

# COMPARISON BETWEEN PROJECT MANAGEMENT AND SOFTWARE PROJECT MANAGEMENT

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**Abstract:** Software project management encompasses the knowledge, techniques and tools necessary to manage the development of software products. Software project management remains different from project management in other more established fields for a number of reasons. Software is “brain product” only, unconstrained by the laws of physics or by the limits of manufacturing processes. In the report discusses topics that managers need to create a plan for software development using effective estimation of size and to execute the plan with attention to productivity and quality.

*In the report they have understand the concept of project management, software project management*

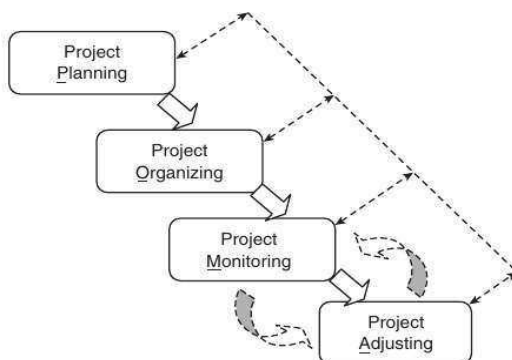
**Keywords:** SOFTWARE, PROJECT MANAGEMENT, SOFTWARE PROJECT MANAGEMENT, PLANNING, ORGANIZING, MONITORING, ADJUSTING

## Introduction

Small and fairly simple software projects need project management. What differs among the various software projects is in the degree of management efforts. A large and complex software project would require some sophisticated project management skills and considerable effort, along with tools to aid the management tasks. The key is to strike a balance between lean project management and excessive project management, never letting it become too meager or too overbearing.

Many software engineering confuse software project management with the software engineering process and development life cycle. Software project management follows a management process to ensure that the appropriate software engineering process is implemented, but it is not itself a software engineering process. Figure 1 depicts the high-level flow of a software project management process and the four major sets of activities (known as POMA) that are involved [2], [4]:

- Project **P**lanning,
- Project **O**rganizing,
- Project **M**onitoring
- Project **A**ddjusting.



**Figure 1** Software project management process

These four activities of POMA may sometimes overlap. Most of the major portions of the activities are performed in sequence, a flow depicted by the large arrows in the figure. Project management ensures that the following goals are met:

- The end results satisfy the customer's need;

- All the desired product/project attributes (quality, security, productivity, cost, etc.) are met;
- Target milestones are met along the way;
- Team members are operating effectively and with high morale;
- Required tools and other resources are available and effectively utilized.

It is important to remember that a project manager cannot do this alone but has to work through the team members to accomplish these management targets.

## Planning

Planning is a natural first phase of any project. The success and failure of the project rides heavily on the results of proper planning. So many software projects tend to rush and minimize this phase citing schedule and cost constraints. Even with a well-planned project, it is not unusual to still see many changes and modifications. Some will use this reason to develop a poor plan or even totally skip planning. Having a well-conceived and documented plan, however, will help facilitate the anticipated modifications that often occur in a software project.

During the early planning phase, the answers to the following questions will contribute to the formulation of a project plan:

- What is the nature of the software project, who is sponsoring the project, and who are the users?
- What are the needed requirements and what are the desired requirements?
- What are the deliverables of the project?
- What are the constraints of the project (schedule, cost, etc.)?
- What are the known risks of the project?

Notice that these are very close to the same questions asked during the requirements gathering and analysis activities. Software engineering's requirements methodologies and process provide the directions on how to perform information gathering and analysis. Project management must ensure that there are qualified resources, proven methodology, and sample time set aside to perform the tasks related to answering these questions. Sometimes customers and users are asked to fund these activities separately; other times the software project organization will sponsor the activities as costs of doing business and fold them into the cost of the total project.

Sophisticated organizations realize the importance of this planning phase and are willing to pay for part of the activities.

Once the basic project requirements are understood, the rest of the project planning activities are much easier to perform and complete. The following activities are the major parts of project planning:

- Ensure that the requirements of the project are accurately understood and specified;
- Estimate the work effort, the schedule, and the needed resources/cost of the project;
- Define and establish measurable goals for the project;
- Determine the project resource allocations of people, process, tools, and facilities;
- Identify and analyze the project risks.

One of the most difficult tasks during this phase is defining realistic and measurable goals. We are used to making grand claims about software products-superior quality, easy to use, easy to maintain. We also like to claim that we have the most efficient and productive team members or most effective methodology. Unless these claims are well defined and measurable, they cannot serve as project goals because there will be no way of monitoring them. As happens in requirements gathering and analysis, a project manager will not be defining these goals alone. It usually is, and should be, a team effort. The success of a project is determined by whether the jointly planned and agreed to goals are achieved. Therefore, the project team members should all understand these goals and measurements. A goal or definition must be measurable so that as we are monitoring the project we can ascertain if the product will achieve the high quality expected.

This goal specification provides us with ways to measure the progress toward the final attainment of a goal. We can quantitatively count the number of total functional requirements, the number of tested functional requirements, the number and severity of problems found during the test, and the number and severity of problems remaining at product release time. With these we can determine whether we have achieved the quality goal.

The goal of meeting project schedule should be stated with more than just a single date. It must be divided into multiple elements that can be measured along the way and the goals need to be quantitatively measurable and monitored throughout the project. Nonmeasurable goals are often said to be nonmanageable.

Another part of planning activities is the identification and analysis of risk items. There are very few projects with no risk. Software projects are fraught with cost overruns and schedule delays. Risk management thus becomes an integral part of software project management, and all risks must be considered during the planning phase. Risk management itself is composed of three major components: identification, prioritization and mitigation

How do we identify risks? Some fertile areas to look for risks include new methodology, requirements new to the group, special skills and resource shortage, aggressive schedule, and tight funding. It is important to consider all possible items that might have a negative impact on the project. Of course, such a list may be huge and impossible to work with, so it will be necessary to prioritize the risks and perhaps decide to consider and track only the high-priority problems. After a prioritized list of risks is agreed on, the planning process must include an activity set to mitigate these prioritized risks and to take some action. Hoping that some external force will magically appear and reduce the risks would be foolishly optimistic. A plan to mitigate these risks must thus be included during the project planning phase.

The activities in a project planning phase all contribute to developing an overall project plan. Depending on the projects, some project plans may be quick and short while others may be very

extensive and lengthy. The content of a project plan [3] must include the following basic items:

- Brief description of the project requirements and deliverables;
- Set of project estimations:
  - ✓ Work effort
  - ✓ Needed resources
  - ✓ Schedule
- Set of project goals to be achieved;
- Set of assumptions and risks.

The plan may be expanded to include a discussion of the problems to be resolved, differentiating between those problems that must be fixed and those that it would be nice to fix. A user and customer profile may be included.

Although it is true that there will always be many unknowns during the planning stage, the more thorough the project planning phase is, the higher the chance that project will be successful. This does not mean that there will be no change to the project or to the plan. Even the best planned project will face some changes as the earlier unknowns become dearer. There will also be some justifiable change of heart as the project progresses. All project managers and project team members should be prepared for such changes.

## Organizing

Once a project plan has been formulated or even before it has been completed, the organizing activities must be initiated. For example, as soon as we have the estimated resources planned, hiring and placement may begin. Table 1 shows how some of the planning and organizing activities may be paired and overlapped.

*Table 1 Planning & Organizing Activities*

Planning	Organizing
Project content & deliverables	
Project tasks & schedule	Set up tracking mechanisms of tasks and schedules
Project resources	Acquire, hire and prepare resources such as people, tools and processes
Project goals & measurement	Establish mechanism to measure and track the goals
Project risks	Establish mechanism to list, track and assign risk mitigation tasks

As soon as a specific planning activity such as risk planning is complete, we can establish the mechanism for tracking and mitigating the risks. The project manager does not need to wait for every planning activity to be finished before starting the organizing phase. The organizing phase requires more than broadband management skills.

Because software development and maintenance projects are more human intensive than most of the projects in other industries, it is vital that the project manager pay special attention to the personnel requirements and ensure that there is an organizational structure built in a timely manner and based on the project plan. Having a great plan and not being able to execute it due to a lack of, or a wrong grouping of, personnel is not always openly acknowledged because issues with people, organizations, and skill sets are often the most uncomfortable and emotional items to discuss.

During the organizing phase, other resources such as tools, education, and methodologies need to be scheduled, and preparations need to be made so that they are available at the correct time. Even though the plan may contain the appropriate financing for the resources, this is the phase when all problems related to procurement or financing of resources are rooted out and resolved.

In addition, all the mechanisms required for monitoring the project need to be defined and set up. In particular, the project goals that will be tracked during the monitoring phase need to be revisited, and all modifications to them should be made at this time.

## **Monitoring**

After the project plan is set and organized, the project still cannot be expected to just coast to a successful completion by itself. No matter how thoroughly the plan is prepared and how carefully the project is organized, the process is never perfect. Inevitably, some part of what was planned and organized will face a change.

There are three main components involved in project monitoring:

- Collection of project information
- Analysis and evaluation of the collected data
- Presentation and communication of the information

The monitoring mechanism must collect relevant information pertaining to the project. The first question is what constitutes relevant information. At a minimum, the planned and stated project goals must be monitored. The second question is how the information will be collected. These two issues should have been addressed during the planning and the organizing phases. Data collection comes in two modes. Some data are gathered through regular and formal project review meetings. In these reviews, preestablished project information must be available and presented without exception. If any exception does occur, it should be viewed as a potential problem and will deserve at least a quick look by the project manager. Other data are collected through informal channels such as management walk around a process of informal socializing that should be a natural part of the manager's behavior. In today's global economy and distributed software development, the collection of data through indirect and informal channels is becoming increasingly difficult in spite of the advances in technology. Direct human contact is a costly proposition for geographically distributed organizations. As a result, many managers will cut on travel expenses and opt to spend on equipment or some other directly visible item. Software project managers need to be especially sensitive to this because the software industry is still a human-intensive business.

The information collected through the regular and formal project review meetings are analyzed in a variety of ways. Most project managers will attempt to perform the analysis themselves. In large and complex projects that involve several organizations and a long time frame, there may need to be a small staff group that performs the data analysis with established techniques such as the following:

- Data trend analysis and control charts
- Data correlation and regression analysis
- Moving averages and data smoothing
- General model building for both interpolating and extrapolating purposes

The collected and analyzed information must be communicated, reported, and acted upon. Otherwise, the entire monitoring process may be construed as nothing more than a superfluous bureaucratic exercise. Information reporting requires different presentation styles and awareness of the fact that the way some information is presented and visualized can certainly sway the receivers of the information. For example, we all love to see the revenue chart showing a curve that goes upward from left to right. The following

are some of the more popular ways to visualize and report this information: Pie charts (to show proportion of different categories), Histogram (to show relative frequencies of different data value range in bar chart form), Pareto diagram (modified histogram – to show data in ascending or descending order), Time chart (to show the values of data through time), Control chart (modified time chart – to show the values of data through time in relationship to acceptable bounds) and Kiviat diagram (to show multiple metrics) [1].

Based on the monitored information, the project manager and the team would then collectively make decisions on whether the observations indicate a need for a change.

## **Adjusting**

Making adjustments is a crucial step in project management because the chance that a project requires no change is very small. If the monitoring process indicates any need for adjustment, then the project management team must take timely actions. The areas that need change may be many and varied. However, the most likely instruments for adjustment that are available to the project management are the following:

- Resources
- Schedule
- Project content

The resources are directly under the control of the project management. For the most part, projects are usually in need of more resources. When more resources are added to the projects, the timing of such additions is very important. Adding human resources to rescue schedules may often result in the reverse effect. New employees may slow down the existing, experienced workers on the project because of the amount of time the experienced people would have to take away from their assigned work to explain and bring the new person on board. Introducing a new tool or a new process at the wrong time can produce the reverse effects of elongating the time and cost.

In contrast, there are times when resources are reduced. An example of human resource addition and reduction that often happens in a software project would be temporary testers who are brought on board to perform well-planned and scripted tests but are released after the testing has been completed. This is a planned increase and decrease of human resources. The more familiar cases are the nonplanned situations where a schedule crunch or an unexpected change in project content forces the project team to consider adjustments in resources. Assuming the schedule crunch means that the schedule must be maintained but other parameters may change and then adding resources is one possible solution and must be seriously considered. There are times when a crucial human resource may drop off from the project. Then the project management team must consider the possibilities of adjusting either the schedule or the project content or both. Doing nothing and just asking the remaining people to bear the brunt may only work once or only for a short period of time. For the most part, the project management team must consider some actions against the schedule or against the project content when there is a resource change.

Another scenario is that a schedule needs to be kept intact or even shortened but lost resources cannot be replaced or added quickly enough. That leaves only the option of a reduction of project content. Reducing project content late in the project cycle, much like adding human resources, is not trivial. A designed and coded functional area that has some level of coupling to other parts of the software cannot easily be taken out without careful consideration of the other interrelated areas. The time and effort spent in reducing the project content in order to keep or shorten a schedule may in fact create additional work and increase the schedule. In the event that more skilled resources can be added very quickly and in time, then that may be a better solution than reducing project content. There are times when customers flatly ask for a schedule reduction

due to increased competition, or when the upper management of a software development organization may request an earlier product release than planned due to unplanned external events. In such cases, a change in schedule will affect and most likely require adjustments to resources or to product content or both. Again, schedule changes are often unplanned and require that an appropriate adjustment is made quickly.

Often there are also changes in project content that occur after the project requirements are set and the project is organized to start. Inevitably, it is the customer or the user who asks for a change or an addition. Sometimes it is just human error or the result of seeing some prototype function and having a better understanding. We have already discussed possible effects of late reduction of the project contents. Additions or changes to project content are also time sensitive. In any case, most of the changes in project content would require an adjustment in either schedule or resources or both.

These three parameters - resources, schedule, and project content, are often the three key factors that project managers focus on during the monitoring and the adjusting phases. Changing one usually affects the other two. Notice that another familiar attribute in software engineering, software quality, has not been brought into the adjustment and trade-off discussion. This is because software quality level, once agreed upon, should be tracked but should rarely be an element offered in the adjustment and trade-offs of the software project. Software engineers and management should be extremely careful not to trade quality for schedule or for other parameters

## ***Summary***

We first introduced the four POMA phases of software project management: (1) planning, (2) organizing, (3) monitoring, and (4) adjusting. POMA is shown to be sequential at the macro level. However, the phases may overlap and may actually iterate among themselves, especially between the monitoring and adjustment phases. The complex and time-consuming planning phase is the key to project success. The monitoring phase is also important, and all projects must be monitored until the end. When necessary, the project manager must take actions and make the appropriate adjustments.

Project monitoring involves the ongoing comparison between what is planned and what is actual. Based on this observation, project managers would have to decide on whether any action, or adjustment, needs to be taken. Earned value management is introduced as a viable technique for monitoring the project effort and project schedule. This process essentially compares the planned or estimated project task efforts against those project task efforts that were actually expended. We have explained the need for setting goals and tracking the goals as part of project management, in order to accomplish those tasks, measurement is needed.

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