EFFECTIVE PROJECT MANAGEMENT TECHNIQUES

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In today’s fast-paced world, organizations that practice sound project management methods have a competitive advantage over those who manage traditionally. Because competition is rapidly becoming time & cost based. That is, if we can get a product or service to market faster than anyone else, you have an edge on your competition. Further, if you can control the costs of your work better than others, you can sell your products or services at lower margins. This paper depicts some of the tools and techniques that can be practiced for effective project management for better control and execution of projects.

Project Management:
In order to understand project management, one must begin with the definition of a project. Quality expert J.M. Juran defines project as: ‘A problem scheduled for solution.’ A project can be considered to be any series of activities and tasks that:

- have a specific objective to be completed within certain specifications.
- have defined start and end dates.
- produces unique service and which can be progressively elaborated as we progress & have funding limits.
- consume human and nonhuman resources (i.e., money, people, equipment)
- are multifunctional (i.e., cut across several functional lines).

Project management is the planning, scheduling, and controlling of project activities to meet project Objectives by the application of acquired skills and techniques. The major objectives that must be met include performance, cost, and time goals, while at the same time we control or maintain the scope of the project at the correct level.

Project Life Cycle
A Typical project life cycle shall have the 5 phases, which is normally called SDLC in software projects and the Figure-1 below depicts the typical resource load required during each phase of the project life cycle.

Areas of Project Management:
The 9 main areas of Project management include Project Integration management, Scope, time, Cost, Quality, Human resources, Procurement, Risk & Communication management.

A project life cycle normally falls in 5 phases, namely Project Initiation, Planning, and Execution, Monitoring & control and Project Closure activities. The interactions between project phases and the 9 management areas are shown below.

Project Manager’s Role
The project manager is responsible for coordinating and integrating activities across multiple, functional lines. The main skills expected out of Project Manager are Negotiation, communication, Organizational planning, Leadership, Influential Team building and Motivational Skills to outline a few.
The integration activities performed by the project manager include:

- Integrating the activities necessary to develop a project plan.
- Integrating the activities necessary to execute the plan.
- Integrating the activities necessary to make changes to the plan.

These integrative responsibilities are shown here where the project manager must convert the inputs (i.e., resources) into outputs of products, services, and ultimately profits. In order to do this, the project manager needs strong communicative and interpersonal skills, must become familiar with the operations of each line organization, and must have knowledge of the technology being used.

![Diagram of Integration Management and Processes](image)

The three main aspects that the project management must track are the Scope, Time and cost, which is known as Triple constraint. Any change in one factor will affect the other two.

Very few projects are ever completed without trade-offs or scope changes on time, cost, and quality. Therefore, success could still occur without exactly hitting this singular point. In this regard, success could be defined as a cube as in the figure-4 above.

If we define performance as: The quality of the work being done; cost: The cost of project work, directly related to the human and physical resources applied; time: The schedule that must be met; scope: The magnitude of the work to be performed.

The four project objectives are related to each other by the following equation:

\[
Cost = f(P, T, S)
\]

As P and S increase, cost generally increases. The relationship between time and cost, however, is not linear. As a rule, cost increases as the time to do the project decreases below a certain optimum time. Studies have shown that if a knowledge worker spends twelve hours of overtime on a job, the actual increase in output is equivalent to that normally obtained in two hours of regular work.

**Work Breakdown Structure to Plan a Project**

The most useful tool for accomplishing these tasks is the Work Breakdown Structure (WBS). The idea behind the WBS is simple: A complicated task is subdivided into several smaller tasks. This process can be continued until the task can no longer be subdivided, at which time you will probably find it easier to estimate how long each small task will take and how much it will cost to perform. A Sample WBS is shown below.

![Sample Work Breakdown Structure](image)
One important question to ask when constructing a WBS is when to stop breaking down the work. The general guideline is that you stop when you reach a point at which you can estimate to the desired degree of accuracy or at which the work will take an amount of time equal to the smallest units you want to schedule.

If, for instance, you want to schedule to the nearest day, break down the work to the point at which each task takes about a day to perform. If you are going to schedule to the nearest hour, then you stop when task durations are in that range.

WBS is a good way to show the scope of a job. Assigning responsibility for tasks is another important use of the WBS.

**Estimating Time Costs & Resources**

Once the work is broken down, we can estimate how long it will take, how much it will cost and how many resources we need.

“Work expands to take the time allowed. An exact estimate is an oxymoron!” (Parkinson’s Law)

Effectiveness of estimation should be ensured by auditing a project at major milestones, with spreads no greater than three months. Beyond that time, memories are not reliable.

**Tools in Project Scheduling**

‘Project management is not just scheduling’. There are tools which are helpful to estimate the time and sequencing the tasks appropriately.

**Critical Path Method: (CPM)**

Critical path is the longest task which is running parallel to others, with zero float and any impact to this shall affect the project delivery dates.

Remember that CP is always the path with the longest duration. In the figure above, path 1-2-3-7-8-9 equals 34 days. Path 1-4-5-6-7-8-9 equals 101 days; therefore the second path is the critical one.

Project manager’s main objective is to observe factors affecting this path and take corrective action as and when it happens to avoid schedule / cost deviations.

**Program Evaluation and Review Technique (PERT)**

PERT is a way to manage the project and forecast the project schedule with a high degree of reliability. PERT and CPM are similar techniques. The difference is CPM uses the most likely duration to determine project duration, while PERT uses what’s called expected value to determine project duration.

The formula to calculate Expected value is as follows:

\[
\text{Expected value} = \frac{\text{Optimistic} + \text{pessimistic} + (4 \times \text{most likely})}{6}.
\]

If we’re given 38 days for the optimistic time, 57 days for the pessimistic, and 45 days for the
most likely. Then the expected value for the Write Programs activity is as follows:

\[
[38 + 57 + (4 \times 45)] / 6 = 45.83.
\]

The standard deviation for our activity is as follows:

\[
\sigma = \frac{\text{O-P}}{6}; (57 - 38) / 6 = 3.17
\]

So we have 68.26% confidence to complete the activity will be completed between 42.66 days and 49 days, which is arrived from Expected value ± \(\sigma\).

And we also have 95.44% (2\(\sigma\)) confidence to complete the activity will be completed between 39.49 days and 52.17 days, which is arrived from Expected value ± 2\(\sigma\). The higher the standard deviation is for an activity, the higher the risk.

**Effective tips on the Network Methods to Manage the Project**

The point of developing a CPM diagram is to use it to manage the project. If this is not done, scheduling is simply a worthless exercise. So here are some pointers that I have found helpful in managing my own jobs:

- Try to stay on schedule. It is always harder to catch up than to stay on target to begin with.
- Keep float in reserve in case of unexpected problems or bad estimates.
- Apply whatever effort is needed to keep critical tasks on schedule. If a task on the critical path can be finished ahead of schedule, do it! Then start the next task.
- Avoid the temptation to perfect everything. Realistically, we will never reach perfection. Keep it simple and avoid Gold Plating.
- Estimates of task durations are made on the basis of the output of particular people.
- No task should be scheduled with duration much greater than four to six weeks. It is a good idea to subdivide it, creating an artificial break if necessary. Then review progress at that point. That will help keep it on target.

- If the people doing the work did not develop the network, explain it to them and teach them the meaning of float.

- Scheduling is done initially on the assumption that we will have the resources we planned on having.

**Duration Compression Techniques**

**Crashing:** It is a compression method that looks at cost and schedule tradeoffs. One of the things you might do to crash the schedule is add resources, from either inside or outside the organization, to the critical path tasks. It wouldn’t help you to add resources to noncritical path tasks as these tasks don’t impact the schedule end date anyway because they have float time. We might also limit or reduce the project requirements. Ask stakeholders if the features or functions are “nice to have” or necessary.

**Fast tracking:** is starting two tasks at the same time that were previously scheduled to start sequentially. Fast tracking can increase project risk and might cause the project team to have to rework tasks. As an example, fast tracking is often performed in object-oriented programming. The programmers might begin writing code on several modules at once, out of sequential order, and prior to the completion of the design phase.

**Reporting Work Complete with Earned Value Analysis**

The difficulty of measuring progress does not justify the conclusion that progress shouldn’t be measured. We cannot have control unless we measure progress.

Many people tend to report that the percent that is complete on an activity is the same as the percent of the time that has elapsed. EV has the ability to combine measurements of scope, schedule, and cost in a single integrated system.
Essential features of any EVM implementation include:

1. A project plan that identifies work to be accomplished,

2. A valuation of planned work, called Planned Value (PV)

3. Pre-defined “earning rules” to quantify the work accomplished, called Earned Value (EV)

In the above figure, EV is above the Planned Value (PV). This means that the project is ahead of schedule. More activities are being completed, and their earned value is being credited faster than planned. AC is higher than the EV; we are spending more money than the earned value of the work that is being completed.

**Verification & Validation**

Verification is often confused with validation. The difference is:

Verification asks the question, “Are we building the product right?”; that is, does the building process conform to its specification.

Validation asks the question, “Are we building the right product?”; that is, is the outcome/final product, doing what the user really requires.

**Cause-and-effect diagram**

Cause-and-effect diagrams show the relationship between the effects of problems and their causes.

This diagram depicts every potential cause and sub cause of a problem and the effect that each proposed solution will have on the problem. This diagram is also called a fishbone diagram, or Ishikawa diagram.

**Pareto Charts**

Vilfredo Pareto is given credit for developing the concept of 80–20 rule. He was an economist who found that typically 80 percent of the wealth of a region was concentrated in 20 percent of the population. This concept describes a number of phenomena that occur in the real world. In terms of quality, it can be said that:

Roughly 80% of the effects come from 20% of the causes.

In other words, if there were one hundred possible things that could be considered to be defects in a process, 20 percent, or twenty of the problems, will account for 80 percent of the cost.

In the above example figure, if we address, the ‘parking difficulty’ issue, we are eliminating good
number of problems. By identifying these twenty items it is possible to expend the energy of the organization where it will do the most good. In quality control, as well as in many areas of project management, it is important that the always limited effort available in the organization be concentrated on the problems where the most benefits will result.

**Design of Experiments**

Now we need to know that design of experiments is an analytical technique that identifies the elements, or variables, that will have the greatest effect on overall project outcomes. This technique is used most often concerning the product of the project but can also be applied to project management processes. This process designs and sets up experiments to determine the ideal solution for a problem using a limited number of sample cases.

**Probability/Impact Matrix**

A probability/impact (PI) matrix is developed to determine if risks should be classified as high, medium, or low risks. This is accomplished by multiplying the risk probability by the risk impact to determine an overall score. The threshold of risk based on high, medium, and low tolerances is determined by comparing the risk score based on the probability level to the PI matrix.

As an example, we have a cost risk event that has a 0.4 probability of occurring and a 0.2 impact on the project cost if it does occur. Therefore, the overall score is as follows:

\[
0.4 \times 0.2 = 0.08
\]

A score of 0.08 for a probability of 0.4 is in the medium threshold, so this risk is assigned a medium value. Again, the values assigned to the risks will determine how Risk Response Planning is carried out for the risks later during the risk planning processes.

**Risk Ranking**

The outputs of this process include overall risk ranking for the project, list of prioritized risks, list of risks for additional analysis and management, and trends in Qualitative Risk Analysis results.

**Risk Quantifying Techniques**

**Interviewing**

Project team members, stakeholders, and subject matter experts are prime candidates for risk interviews. Ask them about their experiences on past projects and about working with the types of technology or processes we will use during the project.

**Sensitivity Analysis**

Sensitivity analysis is a quantitative method of analyzing the potential impact of risk events on the project. Sensitivity analysis can also be used to determine stakeholder risk tolerance levels.

**Decision Tree Analysis**

Decision trees are diagrams that show the sequence of interrelated decisions and the expected results of choosing one alternative over the other. Typically, more than one choice or option is available when you’re faced with a decision or, in this case, potential outcomes from a risk event.

The available choices are depicted in a tree form starting at the left with the risk decision and branching out to the right with possible outcomes. Decision trees are usually used for risk events associated with time or cost.
Expected value is the anticipated impact of the decision. This example shows expected value in dollars. The expected value of the decision is a result of the probability of the risk event multiplied by the impact. Impact is shown in dollars in this example.

The squares represent decisions to be made, and the circles represent the points where risk events may occur. The decision with an expected value of $4200 is the correct decision to make as the resulting outcome has the greatest value.

Simulation

Monte Carlo Analysis is a simulation technique that helps you quantify risks associated with the project as a whole. The identified risks and their potential impacts to the project objectives are examined from the perspective of the whole project. Monte Carlo Analysis is used to determine potential outcomes by simulating the project over and over multiple times.

Risk Response Planning Methods

Avoidance

Risk avoidance involves avoiding the risk altogether or eliminating the cause of the risk event.

• Transference

➢ The idea behind risk transference is to transfer the risk and the consequences of that risk to a third party like taking an insurance policy to cover un-predicted risks.

• Mitigation

➢ Risk mitigation attempts to reduce the impact of the risk event by reducing the probability of risk occurrence. This

• Acceptance

➢ Acceptance means that you won’t make any plans to try to avoid or mitigate the risk.

• Contingency Planning

➢ Contingency planning is a lot like mitigation in that you plan alternatives to deal with the risks should they occur. (For example, perhaps you have identified the departure of a key team member as one of your project risks).

Conclusion:

The project management tools described above if practiced diligently makes all stakeholders, well informed to take apt decisions and implement better.