

# Chapter 2

## Six Sigma Project Management

### 2.1 Project Management

A *project* is a temporary endeavor to achieve some specific objectives in a defined time [10]. A project may vary in size and duration, involving a small group of people or large numbers in different parts of the organization. It is usually unique in content and unlikely to be repeated again in exactly the same way. *Project management* is a dynamic process that utilizes the appropriate resources of the organization in a controlled and structured manner to achieve some clearly defined objectives, identifies as strategic needs conducted within a defined set of constraints. A project involves many processes and each such process progresses with specific objectives (see Chap. 3 for details). A project can be any of the following types:

- *Personal projects*: Preparations for writing a thesis, books, dissertations; student projects; any family functions; conducting an examination; conducting a live show, arranging a tour program, etc.
- *Local projects*: Organization of a public program, organization of a conference or a seminar program, any voluntary projects executed by NGOs and private organizations, etc.
- *Organizational projects*: Construction of buildings or a highway, planning and launching a new product, setting up an automobile plant, establishing a new office, investigating cause and effect of a product's defects, brainstorming a session, organizing an audit check, etc.
- *Projects of national importance*: Launching a vaccination drive, launching a new satellite, introducing a literacy campaign/poverty removal, preparation of annual budget, construction of metro rail/road transports, conducting a national level sporting event, etc.
- *Projects of global importance*: Organizing peace missions, space explorations, environmental sustainability drives, conducting an international level sporting event, etc.

A project is identified through a project identification process. This is the stage where new opportunities and threats emerging in the environment are investigated and suitable proposals that can be adopted by the organization are generated. This is done through the generation of new ideas by the company's think tank. *Brainstorming* is a very effective technique for doing this exercise in a group. Brainstorming may be structured in which each member of the group is asked for his/her idea in a sequential manner. These ideas are then scrutinized for their viability of execution and implementation thereafter.

### *Project characterization*

- Every project involves various processes and these processes are characterized by their inputs and outputs
- The output of the business processes depends on the strategic planning, customer surveys, competitive analysis and benchmarking of the process, etc.
- For the success in projects, it is essential for everyone involved to commit to using a common set of processes and procedures
- This makes the sharing of information considerably easier, particularly when working across different sites, organizations, and countries.

## **2.2 SWOT Analysis**

After having identified the objectives to be achieved through a project, it is generally worthwhile to conduct a strength–weakness–opportunities–threats (SWOT) analysis so that the organization's strengths and weaknesses are highlighted and the opportunities and threats emerging from the environment are viewed in an objective manner. The purpose of this analysis is to be able to generate ideas exploring the emerging opportunities, guarding against the threats while keeping the organization's strengths and weaknesses in mind. The participants of brainstorming may also be made a part of these exercises, so that they become aware of the requirements and limitations of the system they are dealing with. The extent of conformance of the various proposed solutions with the SWOT profile could also be used to evaluate the various ideas after they are proposed during brainstorming. Some of the factors that ought to be considered while doing a SWOT analysis are as follows:

### *Strengths*

- Experience and expertise
- Financial position
- Capital raising capability
- Industrial contacts
- Foreign collaborations

*Weaknesses*

- Lack of experience
- Lack of trained personnel
- Inability to cope with newer technologies
- Inability to raise huge investments
- Inability to forecast market trends

*Opportunities*

- Emerging technologies
- New products with new markets
- New processes with better features
- Special financing schemes
- Government and other incentives

*Threats*

- Competitors
- Poor state of the economy
- Outdated process and technology
- Unprofessional management skills
- New products and services.

Understanding the key customer, market, and operational conditions is input to setting strategic direction. Identifying these components through a SWOT analysis also helps identify the “gaps” in the projects (see also Thompson and Strickland [9]).

## 2.3 Project Phases

We know that every project involves various processes, and these processes are characterized by their inputs and output. In the previous chapter, we have discussed various components and characteristics of a process. The output of the business processes depends on the strategic planning, customer surveys, competitive analysis, benchmarking of the process, etc. For success in projects, it is essential for everyone involved to commit to using a common set of processes and procedures. This makes the sharing of information considerably easier, particularly when working across different sites, organizations, and countries. The process can be broken down into a number of definable phases with decision gates between each of the phases:

- Project conception
- Project definition
- Project planning

- Project launch and execution
- Project closure
- Post-project evaluation.

These activities are often referred to as “key strategies” as they may comprise several actual tasks carried out by more than one person. It is also expected that each phase is carried out sequentially to generate useful data for decision making. Although each phase is treated as discrete with specific work to be completed, this does not signify they are “one-off” activities. In reality, the phases are often revisited during a project. Once a project is initiated, the need to reiterate some or all of the work done in the definition or planning phases is always a possibility as the project moves ahead in the execution phase.

For many organizations, project management is a way of management for change. The idea for project will be created from the knowledge and experience of the organization, customer requirements, and market trend. The climate of project execution depends on the organizational culture, organizational structure, and business strategy. It is essential for senior managers to create and work continuously to sustain the climate for success. Failure to do this will be a disaster for the organization and the people associated with the projects. Collaborative working across the whole structure is a key to project success, as is recognition that assigning an individual to a project team is a dedicated assignment of the whole project.

Projects are an integral component of Six Sigma. Selecting, managing, and completing projects successfully are critical in deploying any systematic business improvement effort, not just Six Sigma. A project should represent a potential breakthrough in the sense that it could result in a major improvement in the product or service. Project impact should be evaluated in terms of its financial benefit to the business, as measured and evaluated by the finance or accounting unit. Obviously, projects with high-potential impact are the most desirable. This financial systems’ integration is standard practice in Six Sigma and should be a part of any DMAIC project, even if the organization as a whole is not currently using Six Sigma [6].

## **2.4 Alignment with the Business Strategy**

Projects and programs are selected only if they support achieving the business strategy and contribute to business growth. A carefully constructed business case is an essential document supporting the decision. Some of the important strategic inputs are as follows:

- Forward planning
- Resource management
- Financial management
- Portfolio management.

In order to start any new project, it is essential to know the commitments and liabilities of the organization in prior. This will decide the future of all ongoing activities and its successes. The selection of projects requires the organization to plan ahead using adequate intelligence gathered from the marketplace and customers. This will help to address the critical areas of potential business growth and lost opportunities. Adequate funding must be available to satisfy the budget of all active projects. Otherwise, the chances of derailment of the projects become certain. It is also important to maintain a visible, authorized list of active projects and those waiting to start, to inform every one of the priorities and relative importance of those on the list. Timescale and completion targets need to be agreed to meet the business and/or customer needs and plan the effective deployment of resources.

## 2.5 Project Stakeholders

The relationship in a project environment can only lead to success when there is a clear definition of ownership at each level in the organization with clearly defined roles and responsibilities. This avoids confusion and clarifies where authority exists to make decisions and avoid unnecessary slippage and delays in projects. According to Young [10], the people associated with a project can be:

- Someone who needs the benefits—the company senior management
- Someone who commits to provide the resources—the line managers
- Someone who is accountable for achieving the benefits—the sponsor
- Someone who is accountable for the project work—the project manager
- Someone who is responsible for the project work—the project team
- Someone who wants to use, influence or is affected by the outcomes—customer, the stakeholders.

Together this, whole group creates an infrastructure that is overlaid on the functional hierarchy, and their behavior collectively can determine the degree of success that is achievable with all projects. The influence of organizational culture has a significant impact on climate of a project. The behavior is strongly influenced by the perceptions people have of the internal climate. Some of the other obvious cultural influences are as follows:

- morale
- mutual trust, support and respect for decisions, openness, and integrity
- risk taking and optimism—recognition of risks and sharing in success
- freedom of action—through accountability, pride, and participation in decision making
- commitment—a sense of belonging, avoiding confusion with clear responsibilities
- collaboration—shared benefits, teamwork and mutual assistance, minimizing stress
- training—opportunities to learn both on and off the job.

Paying specific attention to these influences is important for any ongoing projects. It is not enough to blame the management if the climate is going wrong. Perceptions of the climate are always stronger in the staff than among the management. This, in no way, means that the staff is better than the management, but for a cohesive atmosphere, it is better to ensure each influence is given adequate attention.

## 2.6 Managing the Stakeholders

There are two groups of stakeholders for any publicly traded company [7]. They are company's shareholders or project sponsor and customers. A successful business is one that understands and meets the needs of both the groups. The first group of customers is the company's shareholders. They are mostly focused on the financial aspects of the business including the market share, growth, and profit. The second group is the customers paying for your business services or products. Customers make decisions based on value and quality. All the stakeholders have an open and a closed or hidden agenda about what they expect from the project. These expectations are finalized before scoping the project. This task may not be easy as there will be lots of pressures and influences coming from all the quarters of the project. The project team should have the fortitude to resist such pressures for the larger interest of the company.

Identifying stakeholders is not just part of the project start-up. As many appear later, the leader must review the list at regular intervals. The relative importance of each stakeholder changes with time and through the stages of the project. It is a serious risk to fail to cooperate with or recognize a stakeholder. Set the ground rules at the outset to control the poor stakeholders. The stakeholders are inside and outside the organization. It is a good idea to interact with the sponsors and customers to get involved with the identification of the stakeholders, since some stakeholders impact both. They can come from departments such as finance, sales and marketing, development, production, strategic, and production. They can be consultants, contractors, suppliers, government agencies, public representatives, and supply chain partners.

The involvement of the sponsor throughout the project is an essential success factor for any project as this individual has the authority and power to make decisions about money and the resources—the people that you need to get the work done. The sponsor cannot be effective if the individual has no authority in the organization. The sponsor is accountable for the project and therefore is the appointed guardian of the project on behalf of the organization. An effective sponsor can provide a significant amount of support through:

- Responding rapidly to issues requiring senior management decisions
- Sustaining the agreed priority of the project in the organization
- Ensuring the project stays focused on the organizations strategic needs

- Building a working relationship with the customer
- Influencing the peer-group to provide cross-organization resources and services on time for the project
- Demonstrating concern for success by visible leadership
- Influencing other stakeholders in the approval and sign-off of the phases of the project.

It is the responsibility of the team members to establish a good working relationship with the sponsor to benefit from the above supports. This can be achieved through frequent meeting and discussions held for shorter time in the organization.

## 2.7 A Six Sigma Project

The main objective of a Six Sigma project is to improve quality of the process by reducing variation. There are two approaches for selecting the right project: a model generating *quantitative* data and a model only generating *qualitative* data. A Six Sigma project is considered to be a quantitatively managed project. Some of the important issues need special attention while selecting a Six Sigma project is:

- Will the project maximize profits?
- Will the project maintain the market share?
- Will the project consolidate the market position?
- Will the project open up new markets?
- Will the project maximize profits?
- Will the project maximize utilization of existing resources?
- Will the project boost company's image?
- Will the project increase risk faced by the company?
- Is the project scope within the company's current skills and experience?

Most of the Six Sigma projects are the result of customer needs and expectations, and the projects are selected for their potential impact on business. The value opportunity of projects must be clearly identified and projects must be well aligned with corporate business objectives at all levels. At the highest level, the stockholders, top executives, members of the board of directors, and business analysts who guide investors typically are interested in return on equity, return on invested capital, stock price, dividends, earnings, products and patents, and development of future business leaders. At the business unit or operations level, managers and executives are interested in factory metrics such as yield, cycle time and throughput, cost reduction, safety of employees and customers, efficient use of assets, new product introduction, sales and marketing effectiveness, development of people, and supply chain performance (cost, quality, service). Aligning projects with both business unit goals and corporate-level metrics helps ensure that the best projects are considered for selection. The DMAIC approach is an extremely effective framework for meeting these requirements.

The first types of projects that companies usually undertake are designed to demonstrate the potential success of an overall improvement effort. The projects often focus on the areas of the business that are full of opportunities, but they also tend to be driven by current problems. Issues that are identified by customers or from customer satisfaction (or dissatisfaction) feedback, such as analysis of field failures and customer returns, sometimes are the source of these projects. Hence, project selection is probably the most important part of any business improvement process. Projects should be able to be completed within a reasonable time frame and should have real impact on key business metrics. This means that a lot of thought must go into defining the organization's key business processes, understanding their relationships, and developing appropriate performance measures [6, 8].

The results of any project, (especially, a Six Sigma project) depend on a reliable and quality data. Any data collected contain a mass of information. The problem is to extract that part of it that is relevant to the questions to be answered by the project, in the simplest and most understandable way. This essentially involves checking for pertinent patterns and anomalies in the data. This is the basic role of statistical models: to simplify reality in a reasonable and useful way, a way that you can empirically check with the data. No model is ever "true," but some models are more useful than others for a given data and questions. Irrespective of whether the model constituted by a quantitative or qualitative data, the model can provide:

- a parsimonious description or summary of results, highlighting important features
- a basis for prediction of future observations
- biological or social insight into the processes under study
- a test of a prior theoretical relationship
- comparison of results from different studies
- measures of precision of quantities of interest.

Six Sigma emphasizes the model in terms of  $Y = f(X)$ . It mathematically summarizes the fact that the output from a business process is a function of the decisions made by the process owners. A best model is that which is free of all irregularities and inconsistencies in the data leaving very little chance for assignable causes (man, machine, method, materials, and processes) variation. A general model building involves the following steps:

1. Studying the important descriptive statistics, in order to become familiar with the data
2. Developing a reasonable model from the results of step 1 and from previous knowledge
3. Fitting the model to the data
4. Checking the goodness of fit of the model
5. Going back to step 2, if necessary
6. Using the model to draw appropriate conclusions.

The purpose of modeling is not to get the best fit to the data, but to construct a model that is not only supported by the data but also consistent with previous



knowledge, including earlier empirical research, and that also has a good chance of describing future observations reasonably well. Generally, a probability model and a regression model are sought for describing these types of situations (see Lindsey [4] for details).

### ***2.7.1 Probability Model-Based Project***

It is expected that the main response variable ( $Y$ ) under study should be specified in the protocol. In most cases, it is directly observable, but in some experimental trials, it may be constructed—for example, the difference between the responses at baseline, before the intervention began, and the final response after a certain length of treatment. In statistical models, we consider the response variable to arise at random in a certain sense: That is, we cannot predict in advance exactly what response each respondent will give so that random fluctuations are not reproducible. This variability arises primarily from differences among human beings, in contrast to studies in physics or chemistry where measurements error is predominant.

When the value of a variable is subject to random variation, or when it is the value of a randomly chosen member of a population, then it is called a random variable. A description of the possible values of a random variable and of their corresponding probabilities of occurrence is the probability distribution or the probability model. A probability distribution is a mathematical function that smoothes the histogram of observations in an informative way, while retaining and highlighting the basic shape. A probability distribution is defined for both qualitative and quantitative data. Binomial (for binary responses), Poisson (for counts), geometric, hyper-geometric, etc., are probability models for qualitative and discrete data, and normal, exponential, beta, gamma, uniform, Weibull, lognormal distributions, etc., are the probability models for continuous and quantitative data. Most probability distributions have one or more unknown and unobservable *parameters* (not explanatory variables). Most distributions that have a parameter that indicates the size of the responses, generally the mean and some that have a second parameter related to the shape of the distribution, may be called the variance. Also there are distributions having three parameters, namely location, scale, and shape parameters.

A detailed discussion on various probability models is taken up in different phases of Six Sigma in subsequent chapters. The relevance of such models with respect to the deliverables of DMAIC phases is presented in the respective chapters.

### ***2.7.2 Regression Model-Based Project***

The probability distribution describes the random variability in the response variable. However, in many studies these variables can come with *systematic* changes in the response under certain conditions. They are called the explanatory variables

( $X$ 's). This situation can also be translated into a statistical model by looking at how the probability distribution of the response, or more exactly the parameters in it, change under these conditions. This process may need some general assumptions to be made on the variables in the model. For simplicity, we assume that the mean of the distribution changes with the conditions of interest and variance to remain constant under all conditions. Further by assuming a linear relationship between the response and explanatory variables, the model building becomes an easy job. But in reality, this will not happen every time and hence the necessity of regression model.

The two conditions put together will give the standard (multiple) linear regression model, whereby some function of the mean changes with the conditions:

$$g(\mu_i) = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \dots \quad (2.1)$$

where  $\mu_i$  is the mean for the  $i$ th subject,  $x_{ij}$  is the observation of the  $j$ th explanatory variable for that subject, and  $\beta_j$  is the corresponding unknown parameter, the *regression coefficient*, to be estimated. This model that combines some probability distribution with a linear regression has come to be known as a *generalized linear model*. These and other regression models are discussed in the analyze phase of the DMAIC methodology later.

## 2.8 Quantitative Project Management

A quantitative project management involves:

- Establishing and maintaining the project's quality and process performance objectives
- Identifying suitable sub-processes that compose the project's defined process based on historical stability and capability data found in process performance baselines or models
- Selecting sub-processes within the project's defined process to be statistically managed
- Monitoring the project to determine whether the project's objectives for quality and process performance are being satisfied, and identifying appropriate corrective action
- Selecting measures and analytic techniques to be used in statistically managing selected sub-processes
- Establishing and maintaining an understanding of the variation of selected sub-processes using selected measures and analytic techniques
- Monitoring the performance of selected sub-processes to determine whether they are capable of satisfying their quality and process performance objectives, and identifying corrective action
- Recording statistical and quality management data in the organization's measurement repository.

*Organizational Process Performance:* Process performance is a measure of actual results achieved by following a process. Process performance is characterized by process measures (e.g., effort, cycle time, and defect removal effectiveness) and product measures (e.g., reliability, defect density, capacity, response time, and cost). The common measures for the organization consist of process and product measures that can be used to characterize the actual performance of processes in the organization's individual projects. By analyzing the resulting measurements, a distribution or range of results can be established that characterize the expected performance of the process when used on any individual project. Data mining is one such topic which can be incorporated at this stage to analyze the existing pool of data and segregate for arriving at a process capability trend of the past which would enable us gauge the changes in the future.

*Creating Organizational Baselines:* The expected process performance can be used in establishing the project's quality and process performance objectives and can be used as a baseline against which actual project performance can be compared. This information is used to quantitatively manage the project. Each quantitatively managed project, in turn, provides actual performance results that become a part of baseline data for organizational process assets.

## 2.9 Project Risk Assessment

In project work, any event that could prevent the project realizing the expectations of stakeholders is a *risk*. A risk that happens becomes an issue that must receive prompt attention to maintain the project schedule on time. There are risks to all projects, and *risk management* is a method of managing a project that focuses on identifying and controlling the areas or events that have the potential of creating and causing unwanted changes leading to unwanted results. Because of the complexity of risks, it is impossible to derive a universal process for managing all risks in a project. Three important risks associated with any project are as follows:

- *Business risks*—the viability and context of the project
- *Project risks*—associated with the technical aspects of the work to achieve the required outcomes
- *Process risks*—associated with the project process, procedures, tools and techniques employed to control the project.

All projects inherently contain risk by default. The success depends on how well you manage the risks throughout the project. An efficient project manager should have the potential to identify and evaluate potential risks and the capacity to resolve any issues arising from risks that can happen anytime during the project.

PROBABILITY OF OCCURRENCE	IMPACT ON PROJECT		
	LOW (0.1 – 0.29)	MEDIUM (0.3 – 0.64)	HIGH (0.65 – 1.0)
LOW (0.1 – 0.29)	Low	Medium	High
MEDIUM (0.3 – 0.64)	Medium	High	Unacceptable
HIGH (0.65 – 1.0)	Medium	High	Unacceptable

**Fig. 2.1** Risk ranking matrix

### 2.9.1 Quantifying the Risk

Once a list of risk is derived, work with the team using their experience to decide for each risk: the probability of occurrence and the impact on the project if it does happen. The probability of occurrence can be assessed on a scale of 0–1, where close to zero is considered as low and most unlikely to happen and 1 being very high and essentially to happen. The impact can be calculated as 0.1–0.29 being low—some effect on schedule, little effect on costs; 0.3–0.64 being considered as medium effect—less serious effect on the schedule, some effect on costs and 0.65–1 being high impact—significant effect on the schedule and project costs. Once a set of risks has been assessed for impact and probability of occurrence, one can rank them using a matrix with the parameters of *probability* and *impact* on the project as shown in Fig. 2.1.

The course of action can be initiated as follows:

- *Low risk*—Not expected to have any serious impact on the project. Review regularly for ranking and monitor.
- *Medium risk*—Significant impact on the project with possible impact on other projects. Not expected to affect a project milestone. Review at each project meeting and assess ranking. Monitor regularly to ensure it does not turn into a HIGH risk.
- *High risk*—Major impact on the project schedule and costs. Serious consequent impact on other related projects. Likely to affect a project milestone. Must be monitored regularly and carefully. Review possible mitigation actions you can take to reduce the ranking or minimize the impact.
- *Unacceptable risk*—The project cannot proceed without some immediate actions to reduce this risk ranking to lower the probability of occurrence, either with alternative strategies or making significant decisions about cost, schedule, or scope.

Clearly, any project allowed to proceed with many unacceptable risks is likely to be speculative, with serious potential for failure. By identifying such risks in this process, one can alert the sponsor and management to what you consider may be a safer alternative strategy. Once risks to the project have been identified action plans can be derived. A close monitoring is a key activity toward achieving success. If

risks happen, they become issues that have a time-related cost impact. Unresolved issues do not disappear; they just accumulate and threaten to drown the whole project.

## 2.10 Critical Evaluation of a Project

The critical evaluation of a project is achieved through the analysis of critical path method (CPM) and project (or program) evaluation and review technique (PERT). The fundamental purpose is to enable one to find the shortest possible time in which to complete the project. This is done by the inspection of the *network diagram* or *logic diagram*. Enter the duration on to your notelets (nodes) in the network diagram for each key stage. Begin at the START nodes and trace each possible route or path through the diagram to the FINISH nodes, adding the duration of all the key stages in the path. The path that has the longest duration is the “critical path” of the project and takes the least time to complete the project. All the key stages on the critical path must, by definition, finish on time or the project schedule will slip.

*Example 2.1* Consider a sample project with 14 activities and duration is as follows (Table 2.1):

The PERT method of critical path planning and scheduling is the most commonly used technique for project management control. It is based on representing the activities in a project by boxes (or nodes) that contain essential information calculated about the project. The inter-dependencies between the activities are represented by arrows to show the flow of the project through its various paths in the logic diagram. The PERT diagram is identical to the logic diagram, where each

**Table 2.1** A sample project

Activity	Immediate predecessors	Duration (months)
A	–	2
B	–	6
C	–	4
D	B	3
E	A	6
F	A	8
G	B	3
H	C, D	7
I	C, D	2
J	E	5
K	F, G, H	4
L	F, G, H	3
M	I	13
N	J, K	7

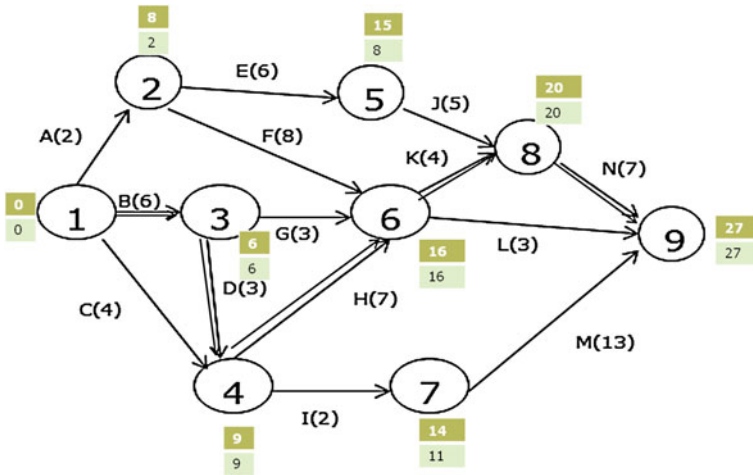


Fig. 2.2 A network diagram

notelet for a key stage representing a node. The analysis of the logic diagram or network diagram is a simple logical process extending the initial calculation you made earlier to locate the critical path (see Fig. 2.2 for the network diagram for the above project). The two steps involved in the critical path calculations are as follows:

1. Adding durations from start to finish—the *forward pass*
2. Subtracting the durations from finish to start—the *backward pass*

The critical path is that which corresponds to the events, where the time to start and finish coincides. For the above project, the critical path is 1–3–4–6–8–9. Notice that CPM is used for deterministic durations (that is, each activity is given a fixed duration), whereas PERT is used for probabilistic durations (that is, each activity is assumed to follow a logical probability distributions). PERT was developed primarily to simplify the planning and scheduling of large and complex projects. It was developed for the US Navy Special Projects Office in 1957 to support the US Navy's Polaris nuclear submarine project [5]. The advantages of PERT are as follows:

- PERT chart explicitly defines and makes visible dependencies (precedence relationships) between the work breakdown structure (WBS) elements
- PERT facilitates identification of the critical path and makes this visible
- PERT facilitates identification of early start, late start, and slack for each activity
- PERT provides for potentially reduced project duration due to better understanding of dependencies leading to improved overlapping of activities and tasks where feasible
- The large amount of project data can be organized and presented in diagram for use in decision making.

See also Kerzner [2] and Klastorin [3] for details.

Since project schedules change on a regular basis, CPM allows continuous monitoring of the schedule, which allows the project manager to track the critical activities, and alerts the project manager to the possibility that non-critical activities may be delayed beyond their total float, thus creating a new critical path and delaying project completion.

In order to allow managers to prioritize activities for the effective management of project completion, and to shorten the planned critical path of a project by pruning critical path activities, one may use the techniques such as *fast tracking* (i.e., performing more activities in parallel), and/or by *crashing* the critical path (i.e., shortening the durations of critical path activities by adding resources). *Crash duration* is a term referring to the shortest possible time for which an activity can be scheduled [1]. It is achieved by shifting more resources toward the completion of that activity, resulting in decreased time spent and often a reduced quality of work, as the premium is set on speed. Crash duration is typically modeled as a linear relationship between cost and activity duration; however, in many cases a convex function or a step function is more applicable.

## 2.11 Role of Computing Technology in Project Management

Computing technology is a valuable aid in project management. Apart from providing computational support in a whole range of network scheduling calculations, it has made possible the generation and distribution of online reports for effective monitoring and control. Since a large number of activities and individuals are involved in a project, keeping everyone up to date and involved is itself a difficult task. This has been made easier through e-mail, the intranet, and the internet. This simplifies the coordination between the head office and multiple sites working on different environments. Moreover, it encourages the practice of green management of infrastructure and environment, which is the need of the hour. With these kinds of easier and cost-effective methods, one can enhance the efficiency of the project and save huge amount of manpower and finances. Plenty of computer softwares are available these days for enabling project management. Two such important softwares are the Microsoft Project and Primavera. The major advantages of such softwares are as follows:

- easy sorting and listing of activities
- easy updating and new listings of project progress over the life cycle
- advanced analysis and reporting can be done automatically
- decision making can be done effectively as per the resources available
- modification and alterations of constraints can be done in accordance with project priority.

## 2.12 Launch and Execution Process

The launch and execution process of a business project involves the following activities:

- Derive the key stage work plans—use WBS, critical path, etc., to decide duration and float
- Establish the milestone schedule—use to resolve the risks and issues
- Create a communication plan to
  - understand current progress of the active tasks
  - identify the problems encountered
  - identify the technical difficulties being encountered
- Decide meetings schedule
- Derive change request process
- Hold launch meeting
- Initiate project execution.

## 2.13 Closure of the Project

Project completion is signified by:

- All finished tasks
- Agreed deliverables completed
- Testing completed
- Training materials prepared
- Equipment installed and operating
- Documentation manuals finished
- Process procedures finished and tested
- Staff training finished.

## 2.14 The Climate for Success

A successful Six Sigma project depends on its climate of success. Success is defined as “attainment” of object, or of wealth, fame, or position. Synonyms of success are victory, accomplishments, achievement, prosperity, attainment, fruition, winning, etc. Success depends on who is measuring the project—sponsor, project manager, project team, resource managers, customers, etc. How each one contribute to success or failure is key to your management of the project.



The climate for success is generally influenced by organizational culture, organizational structure, and business strategy. However, the cultural influences of success depend on the following:

- morale
- mutual trust, support and respect for decisions, openness, and integrity
- risk taking and optimism—recognition of risks and sharing in success
- freedom of action—through accountability, pride, and participation in decision making
- commitment—a sense of belonging, avoiding confusion with clear responsibilities
- collaboration—shared benefits, teamwork and mutual assistance, and minimizing stress
- training—opportunities to learn both on and off the job.

Along with a favorable climate, the sponsor support is also crucial for success project management. They can be achieved through

- Responding rapidly to issues requiring senior management decisions
- Sustaining the agreed priority of the project in the organization
- Ensuring the project stays focused on the organizations strategic needs
- Building a working relationship with the customer
- Influencing the peer-group to provide cross-organization resources and services on time for the project
- Demonstrating concern for success by visible leadership
- Influencing other stakeholders in the approval and sign-off of the phases of the project.

The watch for potential failure is a continuous activity that must be the responsibility of everyone involved not just the project manager. Risk management processes are an essential and integral part of project management and will help reduce the probability of failure. Creating the platinum version of the product or services is ambitious and often more complex.

## **2.15 Relevance for Managers**

Managing a project of various size and volume requires every stakeholder's attention and involvement. This commitment should flow throughout the project period starting from project conception to post-project evaluation. For a Six Sigma project to be relevant, it is essential to have a proper organizational culture, organizational structure, business strategy, and stakeholder confidence. A Six Sigma project is generally classified into two categories: project involving model uncertainties (probability models) and prediction models (regression-based models). These models are generally handy for managers, as they can facilitate both inferential and predictive results.

This chapter also discusses the issues related to risk assessment (project risk, process risk and, business risk), quantifying the risks and propose methods for minimizing the risks. The two important tools for evaluating the project, namely PERT and CPM are also included for a better understanding of the project. These tools are technically sound and support many management issues of project management. The role of computing technology for effective monitoring and control of the project is also included here. In fact, modern day businesses and Six Sigma projects demand the use of computing and information technology in all areas of its implementation.

## Exercise

- 2.1. What is a project? Discuss various types of projects and their characteristics.
- 2.2. What is SWOT analysis?
- 2.3. Distinguish between a qualitative project and quantitative project.
- 2.4. Discuss various project phases associated with a project study.
- 2.5. What are the methods of managing stakeholders in a project? How do they impact the overall success of the project?
- 2.6. Discuss various features and characteristics of a Six Sigma project.
- 2.7. What are the benefits of model-based projects?
- 2.8. What are the characteristics of a quantitative project management?
- 2.9. What are the risks associated with a project? How do they quantify?
- 2.10. Discuss various methods of evaluating a project.
- 2.11. Distinguish between CPM and PERT.
- 2.12. Discuss the role of computing technology in project management.

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