

## Learning Objectives

- To define the concept of a project.
- To explain the Categories of Project.
- To explain the relationship between project Management and line management.
- To describe the system approach to project management.

### 1.1 Concept of a Project

A project idea is a complete documentation of the anticipated project but needs to be implemented yet. The term "idea " means that it is under setting up and processing for implementation.

A full blown project idea consists of following documentation such as ; project feasibility studies (technical, financial, environmental, etc.), detailed drawings/plans & specifications, detailed estimates for project cost, environmental permit, social acceptability of the project and other requirements for fund sourcing.

A project idea has also called project proposal and can only be called "Project" when it is funded and under implementation.

### 1.2 Categories of Project

#### 1.2.1 Construction Projects

The project produces an artifact. The value generated by the project is embedded in the artifact. The artifact may be a complex system with human and mechanical components.

Examples:

- Warship
- Jubilee line extension
- Millennium dome
- Customer call center
- Method guidebook
- IT system

#### 1.2.2 Research Projects

The project produces knowledge. The knowledge may be formally represented as models, patterns or patents. Or the knowledge may be embedded in a working process or artifact.

Examples:

- Business modeling
- Developing a model of the UK economy
- Developing a new species of wheat
- Developing novel approaches to project management.
- Military intelligence/ codebreaking.
- The analysis, testing, QA or evaluation portions of a larger project.

### **1.2.3 Reengineering Projects**

The project produces a desired change in some system or process.

Examples:

- Taking sterling into the Euro
- Renumbering the UK telephone system
- Implementing PRINCE project management practices into a large organization.
- Designing and installing an Intranet.

### **1.2.4 Procurement Projects**

The project produces a business relationship contractually based with a selected supplier for a defined product or service based on a fixed specification and/or a defined specification process

Examples:

- Outsourcing a specific construction or research project
- Outsourcing a complete business function (such as IT).
- Imposing new rules and measures on a regulated industry.

### **1.2.5 Business Implementation Projects**

The project produces an operationally effective process. The value generated by the project is embedded in the process.

Examples:

- Developing a new business process to repackage and exploit existing assets.
- Installing e-commerce

### **1.2.6 Some projects are difficult to classify under this scheme.**

#### **1.2.6.1 National symbolic programs:**

- Putting a man on the moon by the end of the decade.

- Mitterand's Grandes Projects.
- New Labor

#### 1.2.6.2 Large medical programs:

- Creating an artificial heart.
- Mass inoculation programs.

#### 1.2.6.3 Other hybrid or interdisciplinary projects

- Pilot projects
- Moving offices

In most cases, this difficulty arises from an ambiguity about the primary purpose of the project. Are we doing this pilot for its own sake, or merely as an experiment? Are we doing this drug trial to benefit current patients, or to create knowledge that will benefit future patients? What's the real political agenda? Of course, we must be able to handle hybrid projects - but we may need to surface the underlying ambiguity.

#### 1.2.7 Where do we start? How do we know when to stop? When can (should) we evaluate the results?

Each type of project yields different answers to these questions - and this implies that each type of project needs a somewhat different process and management style.

|               | Start                        | Stop                                                     | Evaluate                                                       |
|---------------|------------------------------|----------------------------------------------------------|----------------------------------------------------------------|
| Construction  | With a set of requirements.  | When the artifact is "complete".                         | On delivery of the artifact.                                   |
|               | With a defined solution.     | When the requirements are satisfied.                     | Over the lifetime of the artifact.                             |
| Research      | With a hypothesis.           | When the time runs out.                                  | When the knowledge is confirmed or disconfirmed by later work. |
|               | With a problem.              | When we detect diminishing returns.                      | When the knowledge is used by later work.                      |
| Reengineering | With a problem.              | When we seem to be ahead of the game.                    | At any time.                                                   |
|               | With an opportunity.         | When some higher process changes the game we're playing. |                                                                |
|               | With an (imported) solution. |                                                          |                                                                |

|                         |                             |                                                                                             |                                                                  |
|-------------------------|-----------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Procurement             | With a set of requirements. | We construct a tender document that is “complete”.                                          | Over the lifetime of the contract.                               |
|                         | With a defined solution.    | We sign a contract with the supplier who seems to be ahead at the end of the tender period. | On completion of the contract.                                   |
| Business Implementation | With an opportunity.        | When the process is operational.                                                            | When the process has been running smoothly for a defined period. |
|                         | With a business idea .      | When the process has been running smoothly for a defined period.                            | When the business benefits are starting to become visible.       |
|                         |                             | When the business benefits are starting to become visible.                                  | Over the lifetime of the process.                                |

### 1.3 Project life cycle

A project life is the process of taking a project from idea ion stage through closeout. There are many steps in a project life and, depending on the type of project, some may take significantly longer than others. Typically, there is a project manager that is responsible for the overall success of the project. There are also various functional area experts assigned as Teams which are responsible for ensuring certain aspects of the project are implemented correctly.

The first step in a project life is to identify a need. This initial step defines the project, and what the desired outcome will be. The project manager is assigned and a tentative timeline for project completion is developed. If funding has not been secured, then business justification and funding requests are submitted. There may also be meetings to decide how the project milestones will be measured and who will be responsible for each project life cycle.

The second step in a project life is planned. Though a top level plan was submitted during the initial phase, the detailed milestone and execution plans are defined during the planning stage. Each deliverable is outlined along with an expected completion date. If there are multiple dependencies such as task one must be completed before task two can commence, there is often a Gantt chart developed so all Teams knows who is responsible for what.

The third step in a project life is execution. This is the phase where all of the plans are put into action. Each Team proceeds with his or her required task while the project manager oversees to make sure everyone stays on schedule. The project manager also monitors the milestones with regards to budgets to ensure each milestone is completed on budget. If a particular task is in jeopardy, the project manager will work with the Teams to add additional personnel or money so the entire project can stay on schedule.

The final step in a project life is closed. During this phase, the individual tasks are completed and the entire project is submitted for approval. If the project was something concrete, such as a new product launch or actual construction, closeout also includes delivery of the product to the end customer. Teams are released from their project duties and allowed to go back to their normal jobs and the project manager submits a final report outlining how the team performed with regards to timelines and budgets. Often, the

report will include suggestions on how to improve future projects based on the experiences of the current project so the next project manager will know what did and did not work well.

## **1.4 Definitions of project management**

### **1.4.1 Project**

A project is defined as a “temporary endeavor with a beginning and an end and it must be used to create a unique product, service or result”. Further, it is progressively elaborated. What this definition of a project means is that projects are those activities that cannot go on indefinitely and must have a defined purpose.

**A project is an activity to meet the creation of a unique product or service and thus activities that are undertaken to accomplish routine activities cannot be considered projects.** For instance, if your project is less than three months old and has fewer than 20 people working on it, you may not be working in what is called a project according to the definition of the term.

It has to be remembered that the term temporary does not apply to the result or service that is generated by the project. The project may be finite but not the result. For instance, a project to build a monument would be of fixed duration whereas the result that is the monument may be for an indefinite period in time.

A project is an activity to create something unique. Of course, many of the office buildings that are built are similar in many respects but each individual facility is unique in its own way.

Finally, a project must be progressively elaborated. This means that the project progresses in steps and continues by increments. This also means that the definition of the project is refined at each step and ultimately the purpose of the progress is enunciated. This means that a project is first defined initially and then as the project progresses, the definition is revisited and more clarity is added to the scope of the project as well as the underlying assumptions about the project.

### **1.4.2 What are the basic phases of a project and their purposes ?**

The phases of a project make up the project life cycle. It is convenient for the project managers to divide the project into phases for control and tracking purposes. Each milestone at each stage is then elaborated and tracked for completion. The basic phases of a project are dependent on the kind of project that is being carried out. For instance, a software project may have a requirement, design, build, test, implementation phases whereas a project to build a metro or a building may have different names for each phase.

Thus, the naming of the phases of a project depends on the kind of deliverables that is sought at each phase. For the purpose of definition, the phases may be divided into initial charter, scope statement, plan, baseline, progress, acceptance, approval and handover. This classification is according to the PMBOK. Thus, the phases of a project closely correlate with that of the project cycle.

The purpose of each phase of the project is a set of deliverables that are agreed upon before the project starts. For instance, in a software project, the requirement phase needs to generate the required documents, the design phase the design document etc. The build phase in a project delivers the completed code whereas the test phase is about the completed testing for the deliverables.

Each phase of the project is associated with a certain milestone and the set of deliverables that each phase is expected to deliver is then tracked for compliance and closure. The Project Life Consists of the initiating, executing, controlling and closing processes of the framework as described in the PMBOK. Each of these processes is necessary to ensure that the project stays on track and is completed according to the specifications.

### **1.5 Project Management**

Project Management is the art of managing all the aspects of a project from inception to closure using a scientific and structured methodology. The term project may be used to define any endeavor that is temporary in nature and with a beginning or an end. The project must create something unique whether it is a product, service or result and must be progressively elaborated. As the definition implies, not every task can be considered a project. It would be worthwhile to keep this definition in mind when categorizing projects and studying their role in the success of the organization. With the above definition of the project, one gets a clear idea on what a project is.

Program Management is defined as a department that centralizes the management of projects. What this means is that the PMO or the Project Management Office is a repository of all the projects that are being executed in an organization. Program Management serves the CIO (Chief Information Officer) by providing him or her with regular status updates regarding the progress of all the projects in the company.

The PMO's role is to ensure that the projects are financially viable and to raise an alert whenever there is a possibility or occurrence of a cost overrun. The PMO also keeps tab on the billing and other details that are concerned with the project. Thus, the PMO's function is to oversee the projects coming under its domain and act as a kind of monitoring agency for them. In the current scenario, there is a need for visionary leadership by the CIO's in addition to the technical leadership.

Technical leadership is the ability to spot trends in the technical space and leverage them for the success of the project. This involves choosing the right technology and being able to stay ahead of the curve with respect to new technologies. On the other hand, program visionary leadership is needed to control costs and effectively manage productivity increases and tighter integration of processes. This is relevant in the context of the ongoing economic crisis where the accent is on cutting costs and improving the bottom line.

The role of a project manager is akin to that of a conductor in a symphony. Individually each of the artists knows what has to be done for his or her role. But, there needs to be a person who has the overall "big picture" or the collective vision to make the performance a success. Similarly, the project manager drives the entire project team in pursuit of common goals.

The Project Manager's role is to ensure that the overall objectives of the project are achieved with the participation of each individual member. The project manager is like the Prima Donna and his or her acumen depends on how well he or she can leverage the strengths of the individual members while minimizing the impact of their weaknesses. Program managers take the same view but at a much higher level. Their job is on the overall bottom line for the division or the company and they drive the individual project managers. This is similar to that of a pyramid where the CIO or the program manager sits on the apex and the project manager at the next level, project leads further down and so on.

### **1.6 Rational Approach to Project Management in Organizations**

The evolution of organizational theories from mechanistic to people based ones has influenced the

approaches taken by managers in organizations towards the firm as well as organizing people. While the earlier decades of the 20th century witnessed the rise of the mechanistic of the rational approaches, since the 1970's and particularly in the last decade of the 20th century, there has been a trend towards viewing organizations as interdependent, complex and chaotic. This has led to the adoption of the systems approach of organizations that embraces complexity and uncertainty. However, many managers continue to take the rational approach which views people as building blocks and the organization as a machine leaving little scope for flexibility and adaptability to changes in the external environment (Baecker, 2006, 80). This article considers the reasons for doing so and takes the position that managers would be better served to adopt the systems approach to deal with the challenges of the 21st century.

The rational approach to organizations is appealing to most managers because of the comfort factor in such an approach. It is common for managers to avoid complexity and ambiguity in their working environment and hence taking an approach that has been described as "being purposeful" which enables managers to work towards "specific goals" as the preferred alternative.

Further, the development of organizations in the 20th century has been such that many firms have tight structures with clearly defined hierarchies, command and control bureaucracies. This enables managers to take an approach that is "mechanistic" in nature and which thrives on formalization and standardization (Scott & Davis, 2007, 30). Since this kind of organization structure was the norm across industries and sectors, many managers of the "old school" of management pioneered by Taylor, Weber and others preferred a rational approach which eschews uncertainty and embraces predictability.

To consider examples of organizations that follow these rational approaches in the real world and from a time span of the latter decades of the 20th century to the present, we find that the main difference in the way organizations approach HRM depends on the sector in which they operate and the period in time when they started their operations. To take specific examples, the cases of GM (General Motors) and the United States Government along with the NHS (National Health Service) in the United Kingdom are instances of organizations that practice rational approaches to HRM and this is mainly due to the fact that these organizations have a well defined structure and are tightly coupled with clear boundaries with the environment in which they operate. Hence, these organizations can be said to be practicing a rational approach to HRM that ties in well with their organizational mission and vision.

The rational approach is particularly preferred by managers where there is top down decision making and the "strategic apex" plans the strategies, directs the execution and monitors the implementation. In these organizational structures, strategy is not emergent but rather planned consciously and elaborated in a stepwise manner.

The organizations that have fixed structures and are machine like in their approach to people and processes are places where managers prefer the rational approach to organizations and organizing. Though this approach is now fading away because of the new emergence of organizational forms and where the interaction of the organization and the external environment is characterized by fluidity and uncertainty, there are still many managers who prefer this approach due to the "hangover" of the old school of thought (Boxall & Purcell, 2003, 91).

It must be mentioned that this rational or mechanistic approach served the managers of yesteryears well and the emphasis on the "technical" aspects of management like measuring the deliverables in clearly defined terms, i.e. the output of the machine, plant utilization, efficiency and productivity measured in mechanistic terms all contributed to the success of this approach which continues to deliver even to this day though emerging sectors like the IT (Information Technology) sector and the financial services sector have pioneered the open systems approach (Stern and Barley, 2006, 153).

## **1.7 Importance of Project Management for Organizations**

Project management is the art of managing the project and its deliverables with a view to produce finished products or service. There are many ways in which a project can be carried out and the way in which it is executed is project management.

Project management includes: identifying requirements, establishing clear and achievable objectives, balancing the competing demands of the different stakeholders and ensuring that a commonality of purpose is achieved. It is clear that unless there is a structured and scientific approach to the practice of management, organizations would find themselves adrift in the Ocean called organizational development and hence would be unable to meet the myriad challenges that the modern era throws at them. Hence, the importance of project management to organizations cannot be emphasized more and the succeeding paragraphs provide some reasons why organizations must take the practice of project management seriously.

Without a scientific approach to the task of managing the projects and achieving objectives, it would be very difficult for the organizations to successfully execute the projects within the constraints of time, scope and quality and deliver the required result. In other words, there has to be a framework and a defined way of doing things to ensure that there is a structure to the art of project management.

Thus, project management is about creating structure and managing the project commitments and the delivery of agreed upon results. By using the methods of project management as described in the PMBOK and allied technical journals, organizations can seek to achieve control over the project environment and ensure that the project deliverables are being managed. Managers face what is known as the “triple constraint”. This is the competing demands of time, scope and quality upon the project manager’s list of things to do and how well the project manager manages these constraints goes a long way in determining the success of the project. Without the use of Project Management, managers and organizations would find themselves facing an unpredictable and chaotic environment over which they have little control. Thus, Project Management is both necessary and essential to the success of the project.

Project Management is too big an area to be covered in a few pages and the attempt is to provide concise and lucid definitions of the various terms and terminologies associated with a project. It is important to note that project management provides a framework within which subsequent actions by the organization can be taken and in this way, it is essential for organizations to adopt the framework provided by the practice of project management.

### **1.7.1 Conclusion**

In conclusion, Project Management and the practice of the same have become indispensable to the modern day project manager and they form the basis of much of what is achieved during the course of a project. Thus, the idea of a project being managed professionally lends itself to the ideas and processes laid out for the practitioners of the art of Project Management.

## **1.8 Components of Project Management**

There are several components of project management that encompass the spectrum of project management. Right from the initial setting up of the project to the closure, each phase brings a new set of challenges and components to the art of project management. Specifically, the project manager has to manage the team and take bottom-line responsibility for the deliverables along with managing the

stakeholders of the project.

If we take each of these components individually, **the initial setting up of the project involves establishing procedures and processes for subsequent phases and defining the roles of the Teams**. In organizations that lay emphasis on processes, this phase is crucial to the success of the project. There are many organizations that subscribe to the SEI-CMM guidelines on processes and these organizations take measures to ensure that they are in tune with the guidelines.

### **1.9 Role of the Project Manager**

There has been much debate about what the Project Manager can or cannot do. And the argument is also centered around on whether to take a proactive or a subdued approach towards the issues surrounding the management of the project. The proactive approach favors an interventionist and hands on approach that includes intervening in day to day affairs of the project.

This approach is manifested in the IT industry where the Project Manager is called upon to involve themselves in the technical aspects of the project that would include participating in design, coding and other activities. This phenomenon cannot be said to be restricted to the IT industry alone as there are several instances in the other sectors where the Project Manager has to get their hands dirty, literally and metaphorically.

There are organizations that define the role of the project manager clearly and delineate the roles and responsibilities. This usually happens in Matrix organizations where the structure of the organization is such that there is a lot of emphasis on clarity of the role. Thus, after a review of the literature, it would seem that there is no single answer to the question of whether the project manager has to be at the center of the universe or like a conductor directing the symphony.

### **1.10 Stakeholder Management**

In this section, we look at the specifics of managing the stakeholders of the project. Any project has multiple stakeholders that need to be taken care. A stakeholder is someone who has either invested in the project and derives value from the outcome or a third party who contributes to the success and conversely to the failure of the project.

The first task before the Project Manager is to ensure that the stakeholders are clearly identified and then their roles and responsibilities demarcated and delineated. The task of identifying the stakeholders assumes importance as there should not be any confusion over who is a stakeholder and who is not. For instance, an IT project would have the stakeholders listed right from the systems and the network administrators to the client and the project sponsor. But, there might be other stakeholders like the staffing team who flit in and out of the project phases as and when they are required.

Thus, the need is to establish boundaries and identify the roles of the different stakeholders appropriately. Apart from this, the project manager must make it a point to ensure that stakeholders are categorized according to their importance and relevance to the project and the start of each phase accordingly.

Stakeholder satisfaction should be the bottom-line goal towards which the project managers must work with. Customer satisfaction and customer delight are some of the phrases that are used as an adjunct to good project management and its practice. Customer delight is achieved when one measures up to the needs of the customer and takes appropriate steps to ensure that they are met.

### **1.11 Open Systems Approach to Project Management**

When organizations have “flat” structures and consist of coalitions of people coming together with multiple loyalties, the intersection of the organization with its environment being characterized by shifting boundaries; the informal nature of the work processes makes use of “open” systems approach towards organizations. The point to note here is that external environments both shape and support the structure and the organizations are viewed as systems with interdependent networks of people and projects some of which are tightly coupled but, most are loosely coupled (Scott & Davies, 2007, 63). This has led to a characterization of organizations which behave like “living systems” and hence the real world of human behavior manifests in the way the organizations are run. The psychological and emotional aspects of the people working in such organizations are better served by an open systems approach and hence, it would be advisable for managers in these organizations to take this approach.

Given the recent trend towards viewing people as assets instead of just another factor of production, managers in service sector companies tend to use the open systems approach. The open systems approach lends itself to malleability and a “shape shifting” nature which allows the organizations to “sense” the market and “intuit” the future trends (Malone, 2009).

The “organizations of the future” adopt this approach which relies on dealing with complexity, uncertainty and ambiguity and does not rely on formalized structures alone for decision making and support (Malone, 2009, 93). This approach would be beneficial to managers in all organizations as this lends itself to the complexities of the modern world and the 21st century business landscape which is anything but simple and linear.

Companies like Google and Microsoft can be considered as taking an open systems approach to HRM and have permeable layers in the organizational structure which come together for specific projects whose permanence can be measured in months and at the maximum years. Because of this symbiotic nature of the interactions among their units, these organizations and the managers in these companies often practice the open system or natural approach towards HRM. These organizations view themselves as throbbing and dynamic entities akin to a living organism that favors in symbiotic relationship with its environment and hence the managers in these organizations the open systems approach towards HRM.

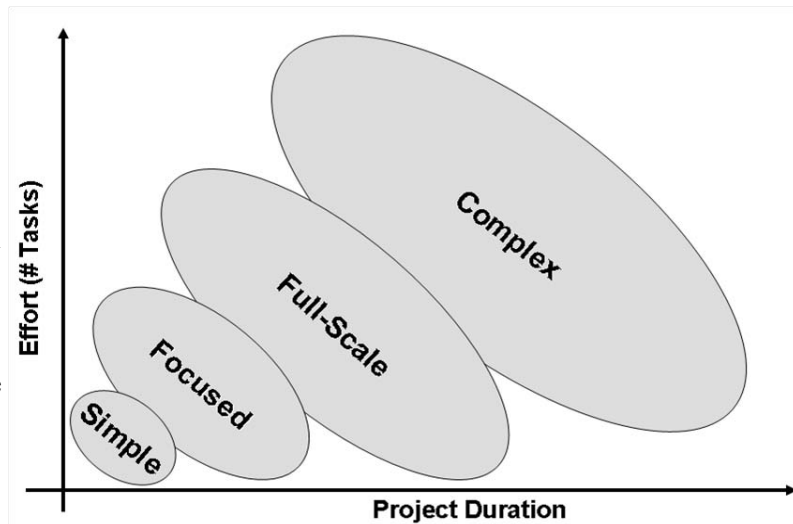
The rational approach to organizations is being outdated and though there are many sectors where the approach serves the purpose, the declining importance of traditional industries like manufacturing in the economies of the West has meant that many managers are adopting the systems view. However, the fact that the bureaucracies of the governments are increasing in size and that many developing countries are still in the phase where the manufacturing sector is the dominant means that the rational approach is unlikely to fade away anytime soon. Whether managers should prefer one over the other would depend on the industry, the organizational structure and the real world imperatives that they face. Considering that management is situational and context dependent there is no one right way to get the job done and hence managers must “intuit” the approach that they need to take.

### **1.12 Complexity of projects**

The Complexity Spectrum considers the project characteristics that drive project integration difficulties. The higher the degree of integration complexity within a project, the higher the level of project risk. Projects with a high degree of integration complexity are likely to require more robust risk management techniques than those with little integration complexity. Some of the project management tools and techniques work well with simple projects but are unable to efficiently handle high degrees of complexity.

Some project management tools and techniques manage complexity very well but are cumbersome and difficult to use on simple projects.

There are many possible ways for assessing integration complexity. In our experience, two factors that are relatively easy to estimate prior to the development of a project plan and provide excellent correlation with complexity are a high level estimate of the project effort and a high-level estimate of the project duration. Neither of these factors needs to be determined with any degree of precision when assessing them for the Project Complexity Spectrum. A



general understanding of the amount of effort, based upon an approximate number of tasks or deliverables is adequate. Also, a general estimate of the project duration will suffice.

The Project Complexity Spectrum differentiates the projects into four categories, Simple, Focused, Full-scale, and Complex. Simple projects are short projects with limited scope and activities. Typically they require about fifteen to twenty tasks or activities in order to complete them. The duration may be from several days to several months. Focused projects are those with a major category of deliverables or business milestone requiring a significant amount of work, however, there is usually only one major category of deliverables or one business function involved. We sometimes refer to these as "100 day projects" since they often take three to four months to complete. Full-scale projects typically require many major deliverables. The integration issues in these projects are significant. The hundreds of activities and deliverables require a high degree of technical integration. These projects usually are six to twenty months in duration. Complex projects include "programs" as defined by the Project Management Institute. They are large, multi-year, multi-deliverable, multi-stakeholder, multi-Team location projects often with multi-million dollar budgets. Given all of these "multi's" it is no wonder that integration is at the forefront of the project management activities on Complex projects.

### 1.12.1 Simple Projects

As stated before, Simple projects are short projects with limited scope and activities. Typically they require about fifteen to twenty tasks or activities in order to complete them. These projects are usually completed by one person or occasionally a small team. Normally there is only one deliverable and one major stakeholder that needs to be kept informed of project progress.

The characteristics of the simple project do not require the use of project management tools that focus on integration complexity. The major project integration risk on Simple projects is that the individual doing

the work becomes distracted by the other aspects of their job, creating errors and delays. The project management tools that often fit best with the Simple project are personal productivity tools. Prioritized tasks lists and network diagrams are excellent tools for planning the project. There is little or no need for internal project integration meetings since the work is usually being done by just one person. The only project reviews needed are periodic pulsing meetings with management or the stakeholder to report progress. These meetings are usually short and conducted informally.

An example of a Simple project would be an individual who is using plans in a "handyman book" to build a deck on the back of his house. He first plans out the steps that must be accomplished, obtains the materials and then builds the deck. The project is likely to be accomplished over several weekends. The Stakeholder reviews are conducted over coffee with their spouse.

### **1.12.2 Focused Projects**

As stated before, Focused projects are those with a major category of deliverables or business milestone requiring a significant amount of work, however, there is usually only one major category of deliverables or one business function involved. Usually there is a small team of individuals who are assigned to this project. There may be multiple stakeholders for this project, but they typically are in agreement on the project charter. The project leader role is not a "full-time" position so the project leader is either one of the Teams with technical responsibilities (for example - the database engineer) or a full-time project manager will be managing several focused projects. The major integration risk on this project is the technical integration of the tasks required to complete the project deliverable(s). Focused projects are often sub-project's within larger more complex projects or programs.

Focused projects require all of the basic elements of project management and they benefit from the use of a standard methodology associated with the type of project (eg. software development, facility construction, Six Sigma). When the organization does not have a standard project management methodology, a "hero" can still often manage this project to success. These projects should have a charter or initiation document, though it is often only one or two pages. The project leader role is part-time and the project leader is usually a technical contributor on some activities within the project. The project leader defines, organizes and staffs the activities with support from stakeholders and management. The project control activities will include appropriate technical reviews (usually only one or two) and regular reviews with stakeholders.

An example of a Focused project is the individual who hires a contractor to build a sunroom addition onto the back of his house. In this case there is a formal bid and proposal process and selection of the contractor. The contractor, who may also be the lead carpenter on the job, commits to a cost and schedule. There are several workers and other subcontractors on the project, including concrete for the foundation, electricians and carpet layers. Also there is a building code permit and inspection. The project takes several months to complete all of the exterior and interior work. There is a project plan and the home owner reviews it with the contractors on a periodic basis. The major risk issues are the technical integration of the activities, such as did the electrician finish roughing in the wiring before the drywall was put up.

### **1.12.3 Full-scale Projects**

As stated earlier, full-scale projects typically require many major deliverables and hundreds of tasks and activities. These projects usually involve many departments within the organization. The projects should be managed by a full-time project leader who is supported by a cross-functional core team which is often located at multiple locations. In addition to the complex technical integration, the cross-functional nature of the work and the multiple locations creates a significant team and organizational integration issues. Also these projects usually have multiple stakeholders with varying objectives, all of which must be integrated into the project plan. Since these projects usually are six to twenty months in duration, they will often be reviewed in at least two annual budgeting cycles. As budgets change and business priorities change, the project will almost always experience at least one point of significant re-direction.

Full-scale projects require effective use of the full complement of project management tools and techniques. The complexity within these projects are such that the project leader is seldom able to "muddle his way through" the project. A standard project management methodology is very beneficial for these projects. The methodology clarifies for the project leader and the core Team is what is required and who has responsibility for the various project deliverables. These projects are often managed in a phase or "tollgate" approach so as to provide appropriate management oversight over the project progress. In my experience, all of the project management processes described in the PMBOK will likely be used on these projects

The focus of the full-time project leader is typically on communication and risk management. They are balancing the triple constraint of scope, schedule and resources (budget). The core Teams are managing the technical activity definition and completion of their portion of the project. The project leader is tracking the issues that inevitably arise and to ensure the issues don't turn into major risks. The project leader is also spending much of his or her time communicating with stakeholders, both to understand whether their requirements are evolving and to inform them of the status of risks and mitigation actions with respect to quality, schedule and budgets.

Continuing with our home construction theme, an example of a Full-Scale project would be the design and construction of a custom home. The home owner would hire a general contractor and an architect. The contractor and architect would develop plans, including budgets and schedules, and identify building sites. Once the owner approves the plan, the contractor and architect begin the permitting process and identify subcontractors. The general contractor is balancing the work of all of the subcontractors, the overall cost and schedule, along with interacting with all of the regulatory agencies. As the construction begins, there are appropriate reviews by the owners and the zoning committee or permitting agencies. Inevitably, the homeowner will want some changes as they see the construction progress. Eventually the home is built, the interior is decorated, the landscaping is installed and the homeowner moves in.

### **1.12.4 Complex Programs**

Complex projects require a full-time program manager and they are best managed by subdividing the work into a portfolio of "Focused" and "Full-Scale" projects. Systems engineering and configuration management become crucial components of the project management tools that are used by the program

manager. The overall program goals and objectives must be allocated to the subprojects and invariably tradeoffs must be made between subprojects in order to achieve the program goals.

The program manager for Complex programs is less likely to be personally using all of the PMBOK practices. He or she is relying on the subproject leaders of the Focused and Full-Scale projects to project manage those subprojects appropriately. The program manager maintains a high level program Work Breakdown Structure that shows the allocation of effort among the subprojects. Also, the program manager maintains a high-level, milestone schedule and the overall program budget. All of these are reviewed and kept current at regularly scheduled program reviews where each subproject presents their status and their major risk issues. The program manager balances the risk between the subprojects and watches for high-level risk trends.

Integration is the focus of everything the program manager is doing. The program manager will have a master schedule that incorporates the major elements of each of the subprojects detailed schedules. The program manager will have the overall program budget, allocated to the subprojects, with a reserve to address unexpected problems within a subproject or areas that are overlooked by each of the subprojects. Also, the program manager will have a program requirements document, usually many pages thick. In addition, the program manager will have created a set of subproject requirement documents. These map the program requirements to the subprojects and the interfaces between each of these are managed closely by the program manager.

Applying the idea for a Complex program to the home construction example that has been used with the other project types leads us to the construction of a large subdivision. The program manager is integrated with all of the construction managers on each house and working with zoning committees. The program manager must ensure that roads and utilities are being installed. They also need to integrate all of these activities so that multiple things are happening at the same time without interfering with each other. For instance, when the road crew is paved, the individuals working on home construction still need to be able to get to their job site. Integration is the key to success so that each house construction project can maintain their schedule and the infrastructure of the subdivision can be installed on time and on budget.

### **1.13 The Relationship Between Project Management And Line Management**

#### **1.13.1 Project Manger and Line Manager Interface**

Project manager and line manager interface refer to the working relationship between project manager and line manager to get project activities accomplished within constraint of limited time, allocated cost and specified quality performance.

The project manager is fully responsible to achieve the project objectives within the parameters (constraints) of time, cost and quality standard.

The project manager needs all types of human and non-human resources like money, manpower, materials, equipment, information and technology etc. for the successful completion of a project through smooth operation of project activities. But project manager does not control the resources directly accepted the project budget. The resources are collected by line managers, they are often called as resource manager. They assign directly to resources to projects. Project mangers control only those

resources which are temporarily loaned by line managers. S/he reminds the line managers that there are also time and cost constraints of the project. This is the starting point for better resource control. Therefore project manager must negotiate with all line managers for pooling require resources on time.

### **1.13.2 Team Management during a Project**

#### **1.13.2.1 Team Selection**

Team selection is a process that involves mapping of skills and strengths of each individual member with that of the role and the job description for which they are being hired or taken into the team. The process should take into account the perceptions of the Team regarding the role for him or her and ensure that it is in line with the expectations from them. Only this would ensure a right “fit” between the individual members and the role for which they are being taken. Further, team selection should not be an ad hoc process and should involve commitment and patience from the project team. The manager has to give enough thought to the selection criterion and how they must be applied to the selection of Teams.

#### **1.13.2.2 Team-Building Strategies**

Team building is a never ending process though more attention must be given to the task early on in the project Lifecycle. The effective team building strategies call for increased co-operation and understanding between the Teams. The objective must to be foster a spirit of mutual reinforcement in the tasks that they perform and that which they accomplish.

The verbal as well as the non-verbal communication must be encouraged and built up with a view to get the team to bond together. Effective team building also requires the Teams to trust each other implicitly and explicitly. This involves a process of building rapport and cueing from each other with regards to doing the tasks together and achieve greater co-operation and build good will among the team.

### **1.13.3 Conflict Management in Diverse Teams**

#### **1.13.3.1 Groups working on the project may have different goals and expectations**

In this case the bottom line expectations for the project must be laid down and the project manager must ensure that the Team's stick to the expectations of the project and learn to subordinate individual goals and aspirations to that of the team goals. Some conflicts reflect the fact that the day-to-day work on projects is usually carried out by many different units of the organization, units that often differ in their objectives and technical judgments. The result is that these units have different expectations about the project, its costs and rewards, its relative importance, and its timing.

#### **1.13.3.2 There is considerable uncertainty about who has the authority to make decisions**

There is nothing like a vacuum to create conflict and hence the project manager must be empowered to take decisions and he or she must be the deciding authority for the project. Uncertainty about who has the authority to make decisions on resource allocation, on administrative procedures, on communication, on technological choices, and on all the other matters affecting the project produces conflict between the PM and the other parties. Conflicts about schedules, intra and inter-project priorities, cost estimates, and staff time tend to fall into this category.

### **1.13.3.3 There are interpersonal conflicts between people who are parties-at-interest in the project**

This is the most common cause of conflict and effective steps must be taken to ensure that team spirit remains intact and the morale of the Team remains high. The minimum requirement is that Team learn to work with each other and for the common project objectives.

## **1.14 Current issues in project management**

Every year organizations spend vast sums on initiatives typically described as 'projects'. Every year, there are numerous examples of poor delivery performance, or disappointment with their outcome.

PMIS has delivered project management training to leading companies across the UK for well over a decade. Throughout this period, we have asked the question 'what goes wrong with projects' at the start of training courses, providing two very interesting results:

- The similarity of the responses to the above question whenever it is asked
- The similarity of the results from across very different industries and environments.

### **1.14.1 The top results, as defined by the participants themselves, are:**

- Unclear goals and objectives
- Lack of alignment to project goals across stakeholders
- non-participative sponsors and stakeholders, or users
- Poor communication of objectives and targets across the team
- Unofficial scope creep
- Poor/ lack of measures or information on project performance
- Unclear responsibilities (can be catastrophic on its own)
- Lack of / poor quality planning / resource planning
- Poor supplier integration / management
- Lack of commitment or team working
- Lack of ownership (relates to many areas)

What is noteworthy is that despite investment in recent years in improved project management 'methods' (or methodologies), the above results have remained much the same. This says something powerful - which PMIS believe is:

- Investing in methods assuming that project teams have the capabilities to use them is at best, optimistic
- The focus of many current PM methods leaves much to be desired - focusing on the 'easy' stuff
- Too many Corporations and individuals are still light on skills to execute project management methods close enough to 'best practice' - in addition, many have thin Corporate Project Governance processes and capability.

**Projects are challenging**, and probably always will be. In business though, we still see lots of examples where organizations sometimes make them much tougher than they need to be. Common examples of this are:

- Limited alignment/ understanding by key Team is to/of the objectives of the project;
- Limited commitment to our awareness of key targets of the project plan;

- Limited understanding of the risks being faced by the project; always been too busy fighting fires rather than doing important tasks such as managing project risks;
- Using very poor methods to present and discuss projects in their early stages;
- Issues or gaps in the project organization and in particular the way responsibilities are defined across the team.

#### 1.14.2 Managing project issues.

Issues come up in all projects. Some projects seem to attract more than others because of complexity, skill sets, and expectations of project sponsors. Knowing this, it is especially important that you manage issues before they manage you.

Issue management is an important part of any project. If you manage issues well, your projects are much more likely to be successful. If your project issues are unmanaged, there is a very high probability that your project will be late, not meet the required scope, or be over budget.

There are 3 important activities for issue management:

1. **Issue tracking** – Because of its importance in providing an early warning to project problems, issue management should be a centerpiece of all of your project team meetings. In this setting, encourage Team to raise issues and capture them in a comprehensive list of issues.
2. **Assigning owners** – Each issue should be assigned an owner. The owner is responsible for clarifying the issue, investigating how to resolve it, and following through to close the issue. In your list of issues, track the name of the owner and any clarifications on what it means to own the selected issue.
3. **Follow-through** – As the project manager, you will need to follow up with issue owners on a periodic basis to obtain status and remind the owners of their responsibilities. For issues that are not severe, you may be able to wait for your team meeting. For those that have a major impact on the project, individual follow up is especially important.

Issues may be tracked in a spreadsheet. A quick glance at the issue list should reveal answers to the following questions:

- What is the issue?
- What is the impact?
- What is the severity?
- When was it documented?
- Who owns the issue?
- What is the current status?
- When was it resolved and closed?
- What was the final outcome?

#### 1.15 System approach to project management

A project, in general terms, entails processes, strategies and resources and that completing it within a target time frame and with its objectives completely realized may prove to be overwhelming for the project manager. Project plans are designed in order to successfully navigate the web of activities involved. Ideally, it will allow a project to trudge on with each phase and stage, culminating in the realization of its targets. However, the world is not perfect and that disruption and distractions occur,

undermining a project's success in varying degrees. Cioffi (2006) found that tasks "typically have nonlinear relationship and that realistically, iterative tasks produce rework, which will increase as fatigue affect productivity and quality". There are numerous other pitfalls, errors, risks and challenges aligned with the substance of Murphy's Law, which prescribes that if things will go wrong, they would go wrong. This is especially true in highly complex and innovative projects.

The idea of systematic approach to project management is an important aspect in addressing this dilemma or to the attempts in designing effective project management with complicated strategies, techniques and methods. This particular approach has gained traction among project managers and experts in recent years with the increasing understanding of project management and its dynamics. The central principle is based on the fact that it considers project management as a complex management process as opposed to the traditional perception that it is merely a set of techniques (Walker, 2006, p. 66). This paper will outline how a systems approach to project management can increase a project's likelihood of achieving its targets and improving on the capability of project managers to control and ensure positive performance and outcome especially in the construction sector.

#### **1.15.1 Project Management**

In order to understand the impact of systems approach, it is important to explain what project management is. This is not difficult because the subject attracts attention from academics and experts, resulting in a comprehensive body of literature investigating this theme. Based on what has been written, it appears that an effective discourse on project management requires an explanation of what the project is, the idea of management and the nature of organizations in general. Organizations, of course, can refer to firms, groups or departments that produce goods or provide services. Andersen (2009) pointed out that this means organizational operation entails the completion of a set of tasks in order to produce or provide (p. 9). These tasks are now the projects and in order to accomplish them, organizations employ management approaches.

According to Andersen, management provides the framework by which work, the organization and its resources are harnessed in order to deliver a composite result (p. 6).

The old project management models were anchored on the principle that projects are made up of parts so the whole is divided like so, to be individually worked on. This old technique also known as the hard system approach compile a set of quantitative techniques in project planning, scheduling and control. But it became apparent that the old model is not sufficient to address the challenges and complexities especially in big projects. Rodrigues and Williams (1998) cited, for instance, how systemic effects cannot be taken into account by such decomposition framework (p. 3). The system dynamics, hence, became the new solution, because it is considered more holistic, focusing on integrating the hard systems with the emergent soft systems, resulting in a more comprehensive approach to project management.

Based on the body of literature, one could conclude that, overall, project management is an initiative, composed of a single or more techniques and approaches to ensure effective and successful project outcome. In the context of systems approach, management is employed not just to organize resources but also to manage tensions, diversity and complexity – variables that inevitably emerge in the process.

#### **1.15.2 Complexities, Cost and Innovation**

Lewis et al., cited several tensions and risks in their argument that project management involve a continuous interplay of preexisting plans and evolving understandings so that conflicts emerging from stability and change are dealt with effectively (p.54) This is echoed in Cioffi's work, which explained how projects are completed according to good planning. His work is devoted to explaining project management in the context of the problems that it needs to address, leading to his position that project management is not only consisted of the set of strategies and methods aimed at completing tasks but also

the mechanisms involved in responding to unforeseen circumstances and risks (p. 290). Take the case of the cost. Besides fragmentation that emerges out of diverse and complex tasks, project managers have to deal with the cost. In a project's life cycle, there is a tendency to run out of control on account of unforeseen variables. For example, there is the case of the recurring and frustrating cycles that typify big projects, requiring collaborations and the involvement of multiple clients. There is also the effect of the increased schedule on workers' morale, the erosion of clients' trust, among other problems (Rodrigues and Williams, p. 2). They can collectively impact schedule and the breadth of the project, leading to cost overruns.

The current trend is to encompass as much style and approaches as possible. It all boiled down to covering as many areas as possible. Laufer (1997) stressed that: In our tough, dynamic, and demanding world, "either/or" approaches are no longer viable... today's challenges of fast change and uncertainty requires "both/and" approaches to thinking and working. Success demands that project leaders adopt both an inward and outward orientation, develop both formal and informal procedures (p.xi).

Furthermore, tensions and problems are not only inevitable but also necessary in the project's life span because it can lead to innovation and competitive advantage as well. For instance in managing a big construction work, it is not uncommon to have multiple decision makers, multiple clients and stakeholders, each asserting their own ideas, agenda and interests. It is easy to understand how this condition could be rife with conflicts. Such nature may involve a particular fluidity that can be problematic and difficult to handle but, when managed well, it becomes a breeding ground for creativity. The old project management approach achieves a certain degree of success in this regard. But the outcome is way better with the systems approach. As the following discourse would outline, the systems approach is an effective model in solving problems, in controlling different and unexpected variables, conflicts, errors and complexities.

### **1.15.3 Systems Approach**

Jelinek and Schoonhoven (1990) prescribed that organizations must stress innovation along with how, "they also require great precision and predictability to enable them to master complex design and production details (p. 56)." This position highlights two important characters of a complex or innovative projects. The first is the complexity in terms of the involved processes. This is naturally a given in large projects involving many stakeholders and huge resources. But this complexity is also considered a necessity that had to be dealt with and must be fostered for the purposes of innovation, efficiency, flexibility and responsiveness. Organizations, in these types of projects, how to cope in order to effectively complete projects and tasks successfully. To this end, they need to exert control over the tensions, risks, errors and other distractions that would consequently emerge in this particular environment in high amount. In order to do all these, organizations have to treat management as a system, which is "a set of interrelated elements that work collectively to achieve some common objectives" (Kohli, 2006, p. 77). This underpins the framework of the systems approach since the model combines things and parts in a logical and interrelated integration so that all elements become a complex and integrated entity (p. 77).

Schwalbe (2010) offered one of the most concise and comprehensive arguments for the systems approach. She stated that it is "a holistic and analytical approach to solving complex problems that includes using a systems philosophy, systems analysis, and systems management (p. 45). In the context of project management, the systems approach is considered to apply when an organization's management: works according to the systems philosophy; when it uses systems analysis in identifying and addressing opportunities, needs and problems; and, when it employs systems management in its operations and its drive to do what is best for the organization.

The systems approach is based on the General Systems Theory developed in the scientific field, which is a theoretical model that supposedly has universal applications. In the context of project management, the theory establishes how the system is characterized by relationships and ensuring that they are integrated. Kohli (2006) explained that:

[It] is concerned with the management of interrelated internal operating systems or subsystems as well as responding to external environmental changes introduced by the organizations of client, stakeholders, (consultants) and others.



*Fig. 1: Sample Systems Approach Model*

Systems approach can also be explained in the context of the contingency theory of the organization. Walker, for instance, explained that an organization is “a function of the task to be carried out and the environment within which it has to be performed. This is aligned with the General Systems Theory in its focus on relationships. For the contingency theory, relationships as well as states are considered as profit motive. Then, systems theory is also supported by resource dependency theory in the sense that it maintains how firms adapt their structures according to external variables. This results to lesser choices, freedom and authority for managers because of their dependency to the environment that provide resources. The systems approach enables managers to effectively manage such dependency so that some semblance of control and authority is achieved. The resource dependency theory also highlights the complexities of the environment where the projects have to operate in. According to Walker, “in circumstances where the indirect and direct environmental influences act in a conflicting manner, the project management process will be required to attempt to resolve the conflict”. The systems approach provides the framework by which managers can accomplish this. The level of control and integration and the nature of the model to welcome pluralities and tensions, ensure that managers can steer projects to its successful completion.

The theories that underpin systems theory, particularly those that focus on relationships, demonstrate and establish how the systems approach to project management can address an asymmetrical or the multifaceted nature of a project. In this respect, Walker outlined as he quoted Scott that:

Relational approaches celebrate the process over structure, becoming over being. What is being processed varies greatly. In some versions it is symbols and words, in others, relationships or contracts, in still others, assets. But in relational approaches if structure exists it is because they are continually being created and recreated.

The lesson learned from these theories and principles is that today, there is a growing trend wherein systems are increasingly being applied to organizations, with high degrees of success. Organizations are becoming complex structures with the constant need for innovation and the emergence of variables such as technology and the changes in the external environment. These underscore the relevance of the systems approach across most project management initiatives today regardless of industries and objectives. This can be demonstrated in the case of the United Kingdom's drive to improve the performance of some of its public sector initiatives.

#### **1.15.4 Systems Approach and Control: The UK Experience**

The systems approach to project management is being employed in the UK's public sector, which is perceived to be drastic failing because of several institutional weaknesses. Gregory (2007) identified some of these such as the erosion of the quality of education, how four of the government's flagship hospitals lost their 3-star status in 2004, with 11 others poised to suffer a similar fate; and, how the majority of the police forces in England and Wales failed to meet the standards set by the Home Office in terms of addressing crime. The issue being raised is that despite measures and initiatives taken in order to address the problems, the trend persists.

Experts have identified that current methods and strategies in achieving better performance are actually preventing the system from being effective. What they accomplish, instead, is impose heavy administrative burden as the focus is diffused into several short term and big events, detracting the system from what it is supposed to do (Gregory, p. 1504). Vestiges of the system approach to project management began to emerge as policymakers began to explore pluralistic perspectives with the identification of severe disorganization, driven by the increase in complexities in each of these initiatives. Commenting on this development, Miller and Skidmore (2004) stated:

[Today], the task for organizational leaders is to make the whole puzzle more visible and therefore less threatening; to find new ways of surfacing and combining the views and aspirations of as many people within their organization as possible.

Recognizing the extent by which projects became complex processes, policymaking began focusing on the control aspect. As the UK embraced the pluralistic perspective of management and of transforming inputs into outputs, the systems approach became the logical model for reform. Gregory outlined this as he contextualized the line of control to the systems approach. He stressed: Control is a key systems idea and systems thinking [that] can help managers come to understand that work is all about changing and managing the interactions between system variables in order to bring about more desirable emergent properties and maximize the performance of the whole rather than the parts.

Gregory highlighted an important characteristic of a complex project in his comment over the UK example. He pointed out that it is ever changing and ever expanding, with interactions facilitated by interrelated variables. Having established the breadth of the initiatives, including the problems and challenges entailed, the government developed a series of standards and measures in order to improve performance.

A specific example of the initiatives pursued to reform the UK public sector is the protocols introduced in construction procurement being implemented by the Office of Government Commerce. These protocols are innovations that result of the principles of the systems model. When Hall and Holt conducted a study of 122 completed construction projects within a two-year period, they found that because of good practices linked to the reforms in project management, public construction procurement has markedly and continuously increased.

A model called payoff function developed by Pich, Loch and De Meyer (2002) confirmed the efficacy of the systems approach to project management by emphasizing that it is more effective in covering not just adequate but also accurate information about states of the world and action effects. States of the world are especially relevant given the fact that it is all about the interactions of actions, variables in a fast changing environment and complications entailed in the fluidity of relationships.

The UK experience highlights the inefficiency of the traditional model of project management. This is evidenced in the manner by which public policy, pursuing innovation as a tool for reform, is increasingly shifting towards models that focus on the performance of the whole system as well as the interactions therein. This is a far cry from the old approaches, which emphasized the performance of the parts. Pich, Loch and de Meyer's model have put the system approach to project management in context by explaining that it assumes two important capabilities. The first is the capability for learning, that when problems are identified and solved, the project managers can effectively modify the strategy. Secondly, there is the capability for "selectionism", which is all about the pursuit of multiple approaches and choosing the best.

#### **1.15.5 Criticism**

Perhaps, the strongest critique of systems approach is its novelty. It is a new framework and project managers may feel uncertain about the lack of empirical evidence that should demonstrate whether the model is, indeed, effective. One can easily arrive at this conclusion after perusing the available literature on the subject.

Then, there is also the issue about whether the emphasis on "human behavior" in project management is actually relevant to construction projects. Construction work includes elements that are distinct and would best be addressed by techniques instead of obsessing with the process. According to Perezgonzalez (2005), safety training, ongoing monitoring, constant auditing and inspections, among other elements make construction projects overly technical and detailed, but predictable, not very complicated and quite rigid as well. The issue is whether there is really a need to shift from the old technique oriented system to a holistic one that would render many activities and measures such as safety part of one system, dependent on others and treated as ever changing.

#### **1.15.6 Conclusion**

There are criticisms of systems approach to project management and those coming from the construction sector particularly have valid concerns. Unfortunately, there is, indeed, a dearth of actual case studies that could provide some insights and concrete evidence that would affirm the theories.

Nonetheless, it is important to remember that the systems approach to project management is an improvement to the evolutionary development of project management and driven by changing patterns in the way organizations operate today. It was specifically designed to address complexity, which is prevailing issue in modern project management. It is an excellent framework for integration. Complex projects entail fragmentation – with the sheer number of participants and resources involved – and a requirement for interdependency at the same time in order for the project's plan and strategies to truly work. Systems approach contains mechanisms that offer project managers a high degree of control because of its focus on the process, on the system as a whole and on human behavior. This aspect leads us

to the reason why it is also good for projects and for managers. The capability of the framework to withstand and control conflicts, tensions, pressures, fluidity and changes, also makes the approach conducive to creativity, which eventually leads to innovation.

## **1.16 Roles and responsibilities of project manager**

### **1.16.1 Role of Project Managers**

It has been said that Project Management is the art of balancing competing demands and determining appropriate interventions whenever necessary. The balancing act is about taking the different stakeholder requirements together and then ensuring that everything falls together for the common purpose of meeting the project deliverables. This then is the bottom-line guideline for project managers: The practice of management for the express purpose of delivering customer delight and stakeholder value.

The contention of this author is that project managers and the art of project management is highly contextual and situation dependant that theory can only point the way and it is up to the individual to make the decisions and tread the path accordingly. Real world scenarios often have a way of surprising the most experienced project manager and hence theory can only help to a point in making decisions that affect real people. Thus, one way of looking at the question is that project managers have to combine the science of project management with the art of people and process management to achieve optimal results. Project Management combines statistics and people skills in equal measure and it is incumbent upon the project manager to plan their strategies accordingly.

There has been much debate about what the Project Manager can or cannot do. And the argument is also centered around on whether to take a proactive or a subdued approach towards the issues surrounding the management of the project. The proactive approach favors an interventionist and hands on approach that includes intervening in day to day affairs of the project. This approach is manifested in the IT industry where the Project Manager is called upon to involve themselves in the technical aspects of the project that would include participating in design, coding and other activities. This phenomenon cannot be said to be restricted to the IT industry alone as there are several instances in the other sectors where the Project Manager has to get their hands dirty, literally and metaphorically.

There are organizations that define the role of the project manager clearly and delineate the roles and responsibilities. This usually happens in Matrix organizations where the structure of the organization is such that there is a lot of emphasis on clarity of the role. Thus, after a review of the literature, it would seem that there is no single answer to the question of whether the project manager has to be at the center of the universe or like a conductor directing the symphony. In conclusion, the question of whether the project managers should behave as Prima Donnas need to be answered as something that is contextual and situation dependant. In the fast paced world of organizations and project management, the central role for a project manager ensures that he or she is always in the middle of the action and the thick of things. Thus, the art of project management requires extraordinary patience and certain thoughtfulness towards the team and stakeholders. Any management devoid of sensitivity and lack of finesse is bound to result in failure.

### **1.16.2 The Importance of Soft Skills for Project Managers**

Project Management is both an art and a science. It is a science because project managers need to estimate

budgets, draw up schedules, and manage costs and earn profits. It is an art because they have to ensure that the team gets along well and the extra edge that contributes to the success of the project is achieved through efficiencies and synergies. In this context, it is very important for project managers to have good soft skills like communication, people management, and personality. **The project manager is like a conductor in an opera who provides the direction to the individual performers in the team.** Hence, he or she has to have exceptional people skills as they are tasked with the objective of carrying the team along with them. Further, project managers need to communicate with different stakeholders including their superiors, the support functions like HR and Admin, and the other interfaces like customers, vendors, and members of other project teams with which their team is interacting. All these aspects call for a superior display of people skills from the project manager. We shall discuss each of these skills in the following sections.

### **1.16.3 Essential Soft Skills for the Project Manager**

#### **1.16.3.1 Exceptional communication abilities**

Since project managers have to interact with the customers, the Teams, and associated stakeholders, he or she has to get the point across without communication gaps. There are many projects where the project managers because of limited communication skills often find themselves unable to articulate the problems and the objectives to the stakeholders. It is an axiom in contemporary organizational behavior theory and practice that the project managers must have excellent written and spoken English skills as he or she has to communicate in writing as well as during an oral speech about the project imperatives and the project objectives. Apart from communication skills, the project managers have to have superior people management skills. Since the project manager is tasked with the duty of ensuring excellent teamwork and team bonding, he or she must provide the leadership by example and leadership of people management from which the Teams can draw inspiration and perform at their full potential. In some multinationals, it is the practice that the people manager is different from the project manager and that this division takes some responsibility of the project manager. However, even in this case, the project manager still has the overall responsibility for teamwork and team cohesion and hence, his or her people skills must be exceptional.

#### **1.16.3.2 People Management and People Enabling**

The other soft skills that the project manager must have concern the conflict resolution, team development, and mentoring skills. Conflicts are inevitable in teams as well as with other stakeholders. Hence, the project manager has to be a skilled negotiator and an astute troubleshooter. Further, the project manager has to inculcate teamwork and team bonding and hence, the team development skills must be exemplary. Apart from this, the project manager has to mentor new recruits and those employees who show high potential and pass on some of the tips and the strategies that made the project manager grow to the present position with the objective that the employees with potential would also grow in a similar manner.

#### **1.16.3.3 Closing Thoughts**

One of the skills that we have touched upon briefly was the customer interfacing skills. Without this skill, project managers might as well find another role for themselves as customer interfacing is one of the key areas of project management. Including the internal stakeholder management, customer interfacing is all about how well the project manager handles customer complaints, proactively prevents customer complaints, and achieves customer delight and customer wow that go beyond customer satisfaction.

#### **1.16.4 Behavioral Models for Project Managers**

There are several models of behavior that the project manager can draw upon his or her work. These include Maslow's need hierarchy theory, Herzberg's Hygiene theory and McGregor's theory X and theory Y as applied to project management. All these behavioral models point to the ability of the project manager to motivate the people in the team towards the common goal of ensuring the success of the project.

Maslow's need hierarchy theory postulates that people do not work for money or security alone. According to this theory, once a person fulfills the basic needs of money and security, he or she tends to seek actualization of their potential and engage in what he called "self-actualization".

Thus, this theory holds that once an individual reaches a certain stage in life or a position, the pay and other benefits matter less to him or her than the quality of the work that they are doing.

When we apply this theory to the real world issues of management, we find that the Project Manager has to ensure that he or she does not concentrate on raising the perks alone to achieve optimal performance from his Teams but also keeps giving challenging work to the Team to fulfill their potential. According to our experience and from talking to seasoned project managers, we have found that most Team takes great pride in their work and hence challenging assignments are one way of motivating them.

Of course, there has been much criticism of this theory in recent years and experts have pointed to several inconsistencies in this theory and application. The most notable example is that of the skyrocketing executive compensation that belies the hypothesis of Maslow's theory. This is one clear instance of the fact that pay matters more than other variables and job satisfaction alone does not motivate people. In my opinion, it is a fact that people tend to get motivated by perks as well as the promise of rewards, monetary and otherwise. So, it is up to the Project Manager to use the notion of reward judiciously without compromising quality or alienating other Team.

If we take a look at a Herzberg's theory of hygiene, the factors that contribute to the success of the individual can be divided into the presence and absence of hygiene factors. The definition is that the presence of good working conditions and salary are things that do not motivate people by themselves. The absence of such factors de-motivates the individual. Thus, the idea here is that hygiene factors are those that do not contribute by their presence but contribute negatively by their absence.

Thus, the project manager cannot be complacent with the fact that he or she has provided optimal working conditions for the Team and expect them to perform at their full potential. The manager also needs to understand that it is his responsibility to take the lead in motivating the Team by holding regular one-one meetings and ensuring that their grievances are heard and accepted.

The Theory X and Theory Y holds that people need to be supervised and told what to do (X) and people would work with little supervision and thus do not need to be told what to do (Y). These are the opposing views of the theory of motivation and behavior. Thus these conflicting and competing views reflect human nature and model the behavior accordingly.

As we discussed, the underlying theory behind the motivation models is the approach that the project manager must take to ensure that the Team and the team as a whole is motivated enough to take action and contribute meaningfully to the project. There is nothing more troublesome than a team that is de-motivated and unable to function cohesively and as a team. Thus, the primary responsibility before the project manager is to ensure a professional approach towards people management.

### 1.16.5 Project Manager Roles and Responsibilities

Project management, as a profession, is both a science and an art, following a systematic process. The Project Manager (PM) needs constant interaction with Stakeholders, which will bring involvement with them as well as complete information to manage the project. In addition, the PM must keep documentation updated in order to have justification for each major action taken for future reference.

Hence, the PM is responsible for accomplishing the project objectives within the constraints of the project (Scope, Time, Resources, and Performance Specifications), following CSUEB Project Management Methodology (CSUEB PMM). The PM responsibilities are listed below, next to each of the phases of the CSUEB methodology:

| CSUEB Project Management Methodology |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| PHASE                                | ROLES                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Project Initiation</b>            | <ul style="list-style-type: none"><li>• Project definition: document high level Project Scope, Timeline and Budget. Obtain Project Sponsor approval and sign-off for the Project Definition</li><li>• Identification of Project Stakeholders, their Roles and Responsibilities</li><li>• Perform Feasibility Studies</li></ul>                                                                                                                                           |
| <b>Planning Strategy</b>             | <ul style="list-style-type: none"><li>• Develop, assess and select the proper strategy for the project, considering Performance, Cost, Time and Scope constraints</li></ul>                                                                                                                                                                                                                                                                                              |
| <b>Implementation Planning</b>       | <ul style="list-style-type: none"><li>• Create a project schedule based on:<ul style="list-style-type: none"><li>◦ Work Breakdown Structure (WBS)</li><li>◦ Work Activities List</li><li>◦ Network Diagram</li><li>◦ Time and Budget Estimates</li></ul></li><li>• Create RACI Matrix Document</li><li>• Develop Communication Plan</li><li>• Risk Management Plan (includes risk identification, monitoring, and response)</li><li>• Develop Procurement Plan</li></ul> |
| <b>Project Execution and Control</b> | <ul style="list-style-type: none"><li>• Conduct Kick-off Meeting</li><li>• Direct and Execute Approved Plan</li><li>• Monitor Project Execution</li><li>• Control and monitor Project Scope, Time, Cost, Quality and Risk</li><li>• Change Management</li><li>• Report on Project Performance</li><li>• Manage Stakeholders Expectations</li><li>• Administer Procurement</li></ul>                                                                                      |
| <b>Project Closure</b>               | <ul style="list-style-type: none"><li>• Gather lessons learned</li><li>• Close procurement</li></ul>                                                                                                                                                                                                                                                                                                                                                                     |

At the organizational level, the PM role must be recognized and granted appropriate authority and accountability. The project sponsor should provide the PM with such authority as stated in the project definition document and reiterated in a kick-off meeting where key stakeholders directly involved in the project should be present. The amount of time Team commits to the project should be negotiated between the PM and the functional managers to whom the Team is directly report. The PM should mitigate issues regarding Team participation in case those arise. Initially, those issues should be discussed directly with the Team and if needed escalated first to the Functional Manager and then to the Project Sponsor.

As a general rule, the PM must be capable of effectively interacting with people. This involves having leadership, communication, negotiation, and team building skills. A successful PM needs to be prepared to resolve conflict and to demonstrate interpersonal communication skills.

There are many groups of people involved in both the project and project management lifecycles.

The **Project Team** is the group responsible for planning and executing the project. It consists of a Project Manager and a variable number of Project Team, who are brought in to deliver their tasks according to the project schedule.

- The **Project Manager** is the person responsible for ensuring that the Project Team completes the project. The Project Manager develops the Project Plan with the team and manages the team's performance of project tasks. It is also the responsibility of the Project Manager to secure acceptance and approval of deliverables from the Project Sponsor and Stakeholders. The Project Manager is responsible for communication, including status reporting, risk management, escalation of issues that cannot be resolved in the team, and, in general, making sure the project is delivered in budget, on schedule, and within scope.
- The Project Team are responsible for executing tasks and producing deliverables as outlined in the Project Plan and directed by the Project Manager, at whatever level of effort or participation has been defined for them.
- On larger projects, some Project Team may serve as Team Leads, providing task and technical leadership, and sometimes maintaining a portion of the project plan.

The **Executive Sponsor** is a manager with demonstrable interest in the outcome of the project who is ultimately responsible for securing spending authority and resources for the project. Ideally, the Executive Sponsor should be the highest-ranking manager possible, in proportion to the project size and scope. The Executive Sponsor acts as a vocal and visible champion, legitimizes the project's goals and objectives, keeps abreast of major project activities, and is the ultimate decision-maker for the project. The Executive Sponsor provides support for the Project Sponsor and/or Project Director and Project Manager and has final approval of all scope changes, and signs off on approvals to proceed to each succeeding project phase. The Executive Sponsor may elect to delegate some of the above responsibilities to the Project Sponsor and/or Project Director.

The **Project Sponsor and/or Project Director** are a manager with demonstrable interest in the outcome of the project who is responsible for securing spending authority and resources for the project. The Project Sponsor acts as a vocal and visible champion, legitimizes the project's goals and objectives, keeps abreast of major project activities, and is a decision-maker for the project. The Project Sponsor will participate in and/or lead project initiation; the development of the Project Charter. He or she will participate in project planning (high level) and the development of the Project Initiation Plan. The Project Sponsor provides support for the Project Manager; assists with major issues, problems, and policy conflicts; remove obstacles; is active in planning the scope; approves scope changes; signs off on major deliverables; and signs off on approvals to proceed to each succeeding project phase. The Project Sponsor

generally chairs the steering committee on large projects. The Project Sponsor may elect to delegate any of the above responsibilities to other personnel either on or outside the Project Team

The **Steering Committee** generally includes management representatives from the key organizations involved in the project oversight and control, and any other key stakeholder groups that have a special interest in the outcome of the project. The Steering Committee acts individually and collectively as a vocal and visible project champion throughout their representative organizations; generally they approve project deliverables, help resolve issues and policy decisions, approve scope changes, and provide direction and guidance to the project. Depending on how the project is organized, the steering committee can be involved in providing resources, assist in securing funding, act as liaisons to executive groups and sponsors, and fill other roles as defined by the project.

**Customers** comprise the business units that identified the need for the product or service the project will develop. Customers can be at all levels of an organization. Since it is frequently not feasible for all the Customers to be directly involved in the project, the following roles are identified:

- **Customer Representatives** are members of the Customer community who are identified and made available to the project for their subject matter expertise. Their responsibility is to accurately represent their business units' needs of the Project Team, and to validate the deliverables that describe the product or service that the project will produce. Customer Representatives are also expected to bring information about the project back to the Customer community. Towards the end of the project, Customer Representatives will test the product or service the project is developing, using and evaluating it while providing feedback to the Project Team.
- **Customer Decision-Makers** are those members of the Customer community who have been designated to make project decisions on behalf of major business units that will use, or will be affected by, the product or service the project will deliver. Customer Decision-Makers are responsible for achieving consensus of their business unit on project issues and outputs, and communicating it to the Project Manager. They attend project meetings as requested by the Project Manager, review and approve process deliverables, and provide subject matter expertise to the Project Team. On some projects they may also serve as Customer Representatives or be part of the Steering Committee.

**Stakeholders** are all those groups, units, individuals, or organizations, internal or external to our organization, which are impacted by, or can impact, the outcomes of the project. This includes the Project Team, Sponsors, Steering Committee, Customers, and Customer co-workers who will be affected by the change in Customer work practices due to the new product or service; Customer managers affected by modified workflows or logistics; Customer correspondents affected by the quantity or quality of newly available information; and other similarly affected groups.

**Key Stakeholders** are a subset of Stakeholders who, if their support were to be withdrawn, would cause the project to fail.

**Vendors** are contracted to provide additional products or services the project will require and are another member of the Project Team.

### *Review Questions*

1. Define the concept of a project?

2. Explain the Categories of Project?
3. Explain the project Lifecycle?
4. Explains the system approach to project management?

#### Discussion Questions

Discuss the Roles and responsibilities of project manager?

#### **Project planning**

- To define the Project plan.
- To explain the process of project planning.
- To explain the network diagrams.
- To describe the Dealing with the uncertainty.

## 2.1 Project planning as a value adding activity

### 2.1.1 Project plan

A **project plan**, according to the Project Management Body of Knowledge, is: "...a formal, approved document used to guide both *project execution* and *project control*. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among *stakeholders*, and document approved scope, cost, and schedule *baselines*. A project plan may be summarized or detailed."

#### 2.1.1.1 PRINCE2 defines:

"...A statement of how and when a project's objectives are to be achieved, by showing the major products, milestones, activities and resources required on the project."

The project manager creates the **project management plan** following input from the project team and key stakeholders. The plan should be agreed and approved by at least the project team and its key stakeholders.

#### 2.1.1.2 Purpose

The objective of a project plan is to define the approach to be used by the Project team to deliver the intended project management scope of the project.

At a minimum, a project plan answers basic questions about the project:

- **Why?** - What is the problem or value proposition addressed by the project? Why is it being sponsored?
- **What?** - What is the work that will be performed on the project? What are the major products/deliverables?
- **Who?** - Who will be involved and what will be their responsibilities within the project? How will they be organized?
- **When?** - What is the project timeline and when will particularly meaningful points, referred to as milestones, be complete?

#### 2.1.1.3 Plan contents

To be a complete project plan according to industry standards such as the PMBOK or PRINCE2, the project plan must also describe the execution, management and control of the project. This information can be provided by referencing other documents that will be produced, such as a Procurement Plan or Construction Plan, or it may be detailed in the project plan itself.

The project plan typically covers topics used in the project execution system and includes the following main aspects:

- Scope Management
- Requirements Management
- Schedule Management
- Financial Management

- Quality Management
- Resource Management
- Stakeholders Management \* New from PMBOK 5
- Communications Management
- Project Change Management
- Risk Management
- Procurement Management

It is good practice and mostly required by large consulting and professional project management firms, to have a formally agreed and version controlled **project management plan** approved in the early stages of the project, and applied throughout the project.

### 2.1.2 Project planning

**Project planning** is part of project management, which relates to the use of schedules such as Gantt charts to plan and subsequently report progress within the project environment.

Initially, the project scope is defined and the appropriate methods for completing the project are determined. Following this step, the durations for the various tasks necessary to complete the work are listed and grouped into a work breakdown structure. Project planning is often used to organize different areas of a project, including project plans, workloads and the management of teams and individuals. The logical dependencies between tasks are defined using an activity network diagram that enables identification of the critical path. Float or slack time in the schedule can be calculated using project management software. Then the necessary resources can be estimated and costs for each activity can be allocated to each resource, giving the total project cost. At this stage, the project schedule may be optimized to achieve the appropriate balance between resource usage and project duration to comply with the project objectives. Once established and agreed, the project schedule becomes what is known as the baseline schedule. Progress will be measured against the baseline schedule throughout the life of the project. Analyzing progress compared to the baseline schedule is known as earned value management.

The inputs of the project planning phase include the project charter and the idea proposal. The outputs of the project planning phase include the project requirements, the project schedule, and the project management plan.

### 2.1.3 Components of a Project Plan

#### 2.1.3.1 Introduction

A project is a success if it meets the objectives of time, cost, technical and business. Project objectives are defined in the preliminary project scope statement. As mentioned above, a project is deemed complete if the project objectives have been met. The objectives should be clear and achievable.

#### 2.1.3.2 Project Objectives

The objectives for this project have been summarized as:

1. **Time**

The project plan must contain the time taken to complete the project end-end from requirements to implementation. A detailed analysis of each stage and the time taken for the same must be outlined upfront and milestones for each stage defined.

2. **Cost**

The cost for completion of the project as defined by the time taken to complete and the technical and business objectives being met is to be defined. All the project objectives are linked to each other and any change in one variable affects the others as well. For e.g. a change in the technical requirements would mean that more time would be required to complete the project and this in turn affects the cost. Thus there are cascading effects on each of the variables.

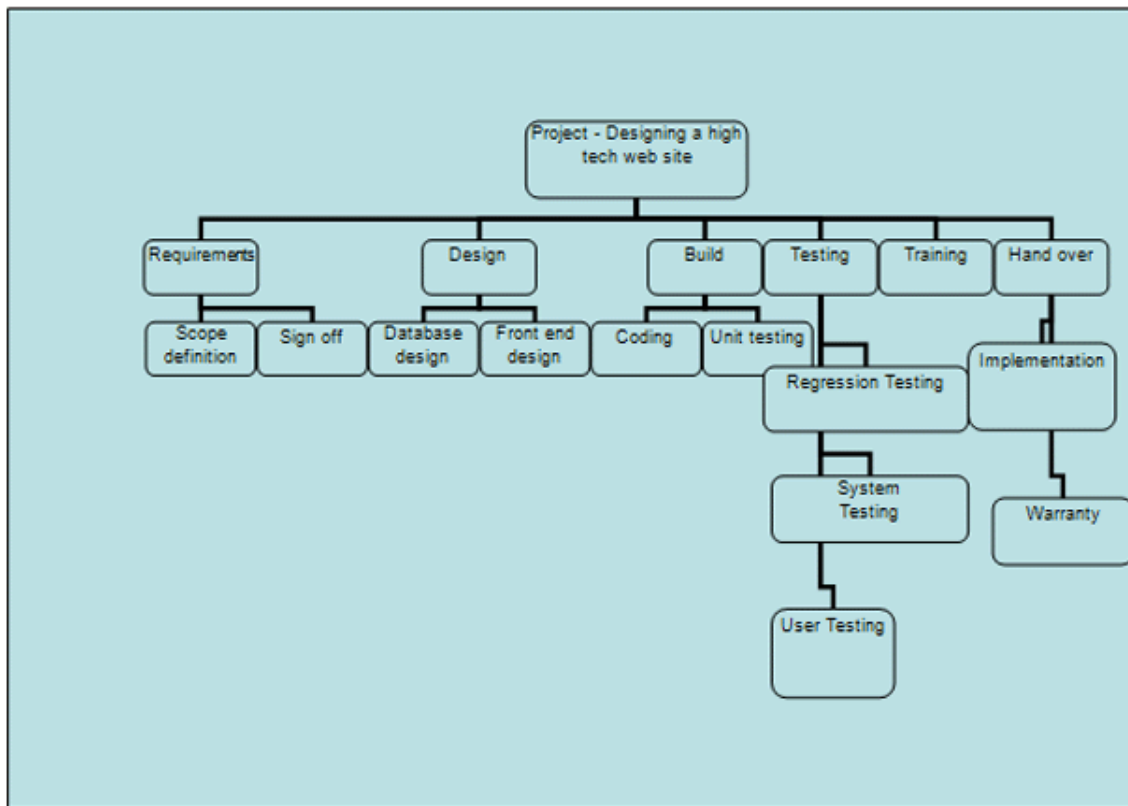
3. **Business**

The business objectives have to be clearly spelt out by your company in terms of the sales generated, the cost benefit analysis of building a website and consequent revenue generation etc.

4. **Technical**

The technical requirements can be stated in terms of the quality of the deliverables and the number of defects found during each of the testing phases and the turnaround time for implementation, etc.

## Work Breakdown Structure



The above chart is a representation of the Work Breakdown Structure (WBS) for the project. It represents a high to medium level summary and it can be refined further. The WBS has been summarized in the organization chart keeping in mind some factors like:

- The WBS is a high level overview that can be broken down into smaller and smaller package of work until the Project Manager achieves the level of granularity that he/she wants. This granularity is to be obtained keeping in mind the realistic scenarios. For e.g. the first level of the WBS described above is the same as the project life cycle, Requirements, Design etc.
- The next levels of the WBS are broken down based on the work packages that are to be assigned to the Team. The packages must be designed in such a way that the deliverables are met.
- In a way, the WBS is the foundation of the project. The time and cost of the project are defined in terms of the work packages and estimated accordingly.

## Responsibility Matrix

| Activity   | Team   |        |        |
|------------|--------|--------|--------|
|            | Team 1 | Team 2 | Team 3 |
| A (design) | P      |        | S      |

|             |   |   |   |
|-------------|---|---|---|
| B (coding)  |   | S | P |
| C (testing) | S | P |   |
|             |   |   |   |

P - Primary responsibility

S - Secondary responsibility

This chart cross reference the WBS created for the project. Each of the work packages created in the WBS is allocated to each of the Team with primary and secondary responsibilities assigned accordingly.

### Project Plan

The project plan consists of the above details as well as the WBS and the responsibility matrix. A detailed project plan needs more elaboration and is a separate activity altogether.

## 2.2 The Project Planning Process

The Planning Cycle brings together all aspects of planning into a coherent, unified process.

By planning within this structure, you will help to ensure that your plans are fully considered, well focused, resilient, practical and cost-effective. You will also ensure that you learn from any mistakes you make, and feed this back into future planning and Decision Making.

Planning using this cycle will help you to plan and manage ongoing projects up to a certain level of complexity – this will depend on the circumstance. For projects involving many people over a long period of time, more formal methodologies and approaches are necessary.

### 2.2.1 How to Use the Tool:

It is best to think of planning as a cycle, not a straight-through process.

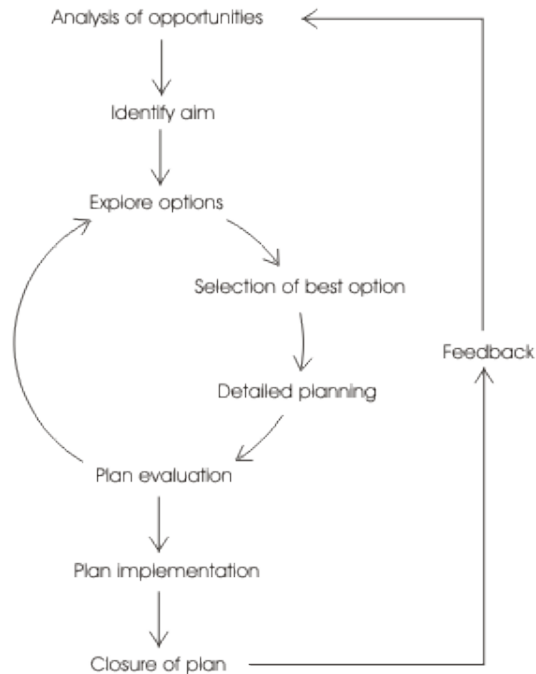
Once you have devised a plan you should evaluate whether it is likely to succeed. This evaluation may be cost or number based, or may use other analytical tools. This analysis may show that your plan may cause unwanted consequences, may cost too much, or may simply not work.

In this case you should cycle back to an earlier stage. Alternatively you may have to abandon the plan altogether – the outcome of the planning process may be that it is best to do nothing!

Finally, you should feedback what you have learned with one plan into the next.

The Planning Cycle is shown in figure 1:

**Figure 1. The Planning Cycle**



The stages in this planning process are explained below:

### **Stage 1. Analysis of Opportunities**

The first thing to do is to spot what needs to be done. You will crystallize this into a formal aim at the next stage in the process.

One approach to this is to examine your current position, and decide how you can improve it. There are a number of techniques that will help you to do this:

- **SWOT Analysis:**  
This is a formal analysis of your strengths and weaknesses, and of the opportunities and threats that you face.
- **Risk Analysis:**  
This helps you to spot project risks, weaknesses in your organization or operation, and identify the risks to which you are exposed. From this you can plan to neutralize some risks.
- **Understanding pressures for change:**  
Alternatively, other people (e.g. clients) may be pressing you to change the way you do things. Alternatively your environment may be changing, and you may need to anticipate or respond to this. Pressures may arise from changes in the economy, new legislation, competition, changes in people's attitudes, new technologies, or changes in government.

A different approach is to use any of a whole range of creativity tools to work out where you can make improvements. These creativity tools culminate in the powerful Simplex process.

## **Stage 2. Identifying the Aim of Your Plan**

Once you have completed a realistic analysis of the opportunities for change, the next step is to decide precisely what the aim of your plan is. Deciding and defining an aim sharpens the focus of your plan, and helps you to avoid wasting effort on irrelevant side issues.

The aim is best expressed in a simple single sentence. This ensures that it is clear and sharp in your mind.

If you are having difficulty in formulating the aim of your plan, ask yourself:

- What do I want the future to be?
- What benefit do I want to give to my customers?
- What returns do I seek?
- What standards am I aiming at?
- What values do I and my organization believe in?

You can present this aim as a 'Vision Statement' or 'Mission Statement'. Vision Statements express the benefit that an organization will provide to its customers. For example, the vision statement for Mind Tools T is: *'To enrich the quality of our customers' lives by providing the tools to help them to think in the most productive and effective way possible'*. While this is wordy, it explains what this site aims to do.

Mission statements give concrete expression to the Vision statement, explaining how it is to be achieved. The mission statement for this site is: *'To provide a well structured, accessible, concise survey of the best and most appropriate mind tools available'*.

## **Stage 3. Exploring Options**

By this stage you should know where you are and what you want to do. The next thing to do is to work out how to do it. The Creativity Tools section of this site explains a wide range of powerful creativity tools that will help you to generate options.

At this stage it is best to spend a little time generating as many options as possible, even though it is tempting just to grasp the first idea that comes to mind. By taking a little time to generate as many ideas as possible you may come up with less obvious but better solutions. Just as likely, you may improve your best ideas with parts of other ideas.

## **Stage 4. Selecting the Best Option**

Once you have explored the options available to you, it is time to decide which one to use. If you have the time and resources available, then you might decide to evaluate all options, carrying out detailed planning, costing, risk assessment, etc. for each. Normally you will not have this luxury.

Two useful tools for selecting the best option are Grid Analysis and Decision Trees. Grid Analysis helps you to decide between different options where you need to consider a number of different factors. Decision Trees help you to think through the likely outcomes of following different courses of action.

## **Stage 5. Detailed Planning**

By the time you start detailed planning, you should have a good picture of where you are, what you want to achieve and the range of options available to you. You may well have selected one of the options as the most likely to yield the best results.

Detailed planning is the process of working out the most efficient and effective way of achieving the aim that you have defined. It is the process of determining who will do what, when, where, how and why, and at what cost.

When drawing up the plan, techniques such as use of Gantt Charts and Critical Path Analysis can be immensely helpful in working out priorities, deadlines and the allocation of resources.

While you are concentrating on the actions that need to be performed, ensure that you also think about the control mechanisms that you will need to monitor performance. These will include the activities such as reporting, quality assurance, cost control, etc. that are needed to spot and correct any deviations from the plan.

A good plan will:

- State the current situation.
- Have a clear aim.
- Use the resources available.
- Detail the tasks to be carried out, whose responsibility they are, and their priorities and deadlines.
- Detail control mechanisms that will alert you to difficulties in achieving the plan.
- Identify risks, and plan for contingencies. This allows you to make a rapid and effective response to crises, perhaps at a time when you are at a low ebb or are confused following a setback.
- Consider transitional arrangements – how will you keep things going while you implement the plan?

## **Stage 6. Evaluation of the Plan and its Impact**

Once you have worked out the details of your plan, the next stage is to review it to decide whether it is worth implementing. Here you must be objective – however much work you have carried out to reach this stage, the plan may still not be worth implementing.

This is frustrating after the hard work of detailed planning. It is, however, much better to find this out now than when you have invested time, resources and personal standing in the success of the plan. Evaluating the plan now gives you the opportunity to either investigate other options that might be more successful, or to accept that no plan is needed or should be carried out.

Depending on the circumstances, the following techniques can be helpful in evaluating a plan:

- PMI (Plus/Minus/Interesting):  
This is a good, simple technique for 'weighing the pros and cons' of a decision. It involves listing the plus points in the plan in one column, the minus points in a second column, and the implications and points of uncertainty of the plan in a third column. Each point can be allocated a positive or negative score.

- **Cost/Benefit Analysis:**  
This is useful for confirming that the plan makes financial sense. This involves adding up all the costs involved with the plan, and comparing them with the expected benefits.
- **Force Field Analysis:**  
Similar to PMI, Force Field Analysis helps you to get a good overall view of all the forces for and against your plan. This allows you to see where you can make adjustments that will make the plan most likely to succeed.
- **Cash Flow Forecasts:**  
Where a decision has mainly financial implications, such as in business and marketing planning, preparation of a Cash Flow Forecast can be extremely useful. It allows you to assess the effect of time on costs and revenue. It also helps in assessing the size of the greatest negative and positive cash flows associated with a plan. When it is set up on a spreadsheet package, a good Cash Flow Forecast also functions as an extremely effective model of the plan. It gives you an easy basis for investigating the effect of varying your assumptions.
- **"6 Thinking Hats":**  
6 Thinking Hats is a very good technique to use to get a rounded view of your plan and its implications. It provides a context within which you can examine a plan rationally, emotionally, optimistically, pessimistically and creatively.

Any analysis of your plan must be tempered by common sense.

If your analysis shows that the plan either will not give sufficient benefit, then either return to an earlier stage in the planning cycle or abandon the process altogether.

### **Stage 7. Implementing Change**

Once you have completed your plan and decided that it will work satisfactorily, it is time to implement it. Your plan will explain how! It should also detail the controls that you will use to monitor the execution of the plan.

### **Stage 8. Closing the Plan**

Once you have achieved a plan, you can close the project. At this point is often worth carrying out an evaluation of the project to see whether there are any lessons that you can learn. This should include an evaluation of your project planning to see if this could be improved.

If you are going to be carrying out many similar projects, it may be worth developing and improving an Aide Memoire. This is a list of headings and points to consider during planning. Using it helps you to ensure that you do not forget the lessons learned in the past.

## **2.3 Managing the planning process**

### **2.3.1 Planning Process Group**

Experienced project managers know that soon after initiating a project, the next set of implementation strategies and skills involves the ability to see both the forest and the trees simultaneously. The Project

Management Body of Knowledge (PMBOK®) Guide sets forth a sequencer, but overlapping set of procedures to follow when looking for a best-practice approach toward orchestrating a complex project

While the first process group (Initiating Process Group) allows a project manager to get a clear view of the entire project landscape, the Planning Process Group provides guidelines for assembling all the layers of details needed to fill in the landscape of the project through one successful phase of completion after another.

In order to keep progress moving according to specified goals and objectives, the PMBOK® puts forth these key elements included in the Planning Process Group:

### **2.3.2 Develop a Project Management Plan**

A Project Management Plan is a detailed report indicating the chain of events that need to happen throughout the project. This includes a timeline and clear communication with stakeholders about how the entire project in all its phases will be “planned, executed, monitored controlled, and closed.”

### **2.3.3 Collect Requirements**

Tailoring client/stakeholder needs with the objectives the project requires may necessitate additional adjusting as the project gets underway. Understanding and documenting all project requirements aids in clarifying expectations.

### **2.3.4 Define Scope**

Producing documentation to define the scope of the project which may reflect any changes is important to maintain stakeholder confidence and client trust.

### **2.3.5 Create Work Breakdown Structure**

Subdividing large projects into more manageable smaller ones allows stake holders to identify on-going progress and allows the project manager to make mid-course adjustments as necessary.

### **2.3.6 Define Activities, Sequence Activities, Estimate Activity Resources, Estimate Activity Durations**

Developing the specific list of actions that will need to be taken to achieve benchmark goals is essential for putting proper teams in place at the right time with the proper resources.

### **2.3.7 Develop Schedule**

Scheduling teams to complete work and setting the progress in place with all the details needed to complete the work objectives takes a great deal of coordination with many project constituents and may involve shifting objectives and phase scheduling.

### **2.3.8 Estimate Costs**

Estimating costs accurately is a skill that comes with increasing practical experience. Coordinating all estimates needed to complete each phase of a project requires a great attention to detail and a well-developed set of multi-tasking skills.

#### **2.3.9 Determine Budget**

Creating accurate budgets mean having the experience to know when to add in allowances for probable weather delays, change orders, or other details gained through experience with similar projects. At every stage of the Planning Process Group documentation is necessary, but in the estimating and budgeting areas, project managers need to be able to understand the details logically to secure quick and trustworthy authorization from related stakeholders.

#### **2.3.10 Plan Quality**

Factors like risk, cost performance baseline, organizational and environmental factors all affect the potential plan quality. Obviously the goal is to assure the highest possible quality. Assessing the details to secure quality throughout each project phase may involve re-adjusting program goals and procedures.

#### **2.3.11 Develop Human Resource Plan**

Having a staffing plan in place that coincides with each phase of the plan and involves all details of creating working teams to support project goals and timeline requirements is imperative.

#### **2.3.12 Plan Communications**

Communication related to changes, progress reports, and budgetary adjustments need to be ongoing so that constituents and stakeholders remain invested in the successful, high-quality outcome of the project. Establishing the expectations around communication supports the positive tone of the project as a whole.

#### **2.3.13 Plan Risk Management, Identify Risks, Perform Qualitative/Quantitative Risk Analysis, Plan Risk Responses**

Accurate risk management procedures can save money and time over the length of any project. Documenting the risk management process for a project supports good communication strategies with stakeholders and clients.

#### **2.3.14 Plan Procurements**

The procurement process involves detailed reports indicating decisions related to costs of items necessary to complete a project and deliver effective results.

Developing the skills and the knowledge necessary to be more cognizant of overall project goals, while at the same time effectively tending to the small, day to day details of a complex project, is at the core of what separates good project managers from the excellent ones.

While much of a top project manager's skill set will come about through years of experience, ongoing education and strong professional networking can leverage increased opportunity and success as well.

### **2.4 Communicating project plans**

Communications planning involves identifying the information and communication needs of the stakeholders. This includes determining what needs to be communicated, to whom, when, with what method and how frequently. This is a very proactive approach. The PMBOK guide often suggests work to be done in a more structured way than many project managers previously thought to do. Hence, the guide emphasizes a structured approach towards the art of project management. Communication is no exception. In order to do it well, one must understand the organization's environment such as culture and standards. One must also take into account the organization's processes and procedures for conducting work and communications, historical records from previous projects, lessons learned and stored information. This means that communications management is the whole process of end-end communication loops that involve feedback and other mechanisms as well.

It is important to realize that communication is not one-sided. During the early part of project planning, the project team would have had a chance to interact with other project stakeholders. This gives the project manager a chance to identify any potential risks and plan to meet with the stakeholders periodically to mitigate the risks. This would mean that a project communication plan has to be drawn up and the appropriate stakeholders identified. Project communications are both internal and external.

The internal communications are within the team and involve the project manager along with the Team. This can take the form of weekly team meetings, status updates and one-one meetings that chart the progress of the individual along with his or her concerns, if any. Internal communications are a good way of ensuring that all Team are in sync with the objectives of the project and that they know what is expected from them.

External communications refer to the processes that have to do with the project manager communicating the status updates to the project sponsors, identifying risks and changes to the bottom line of the project and meeting with the other stakeholders to resolve them to the satisfaction of everyone concerned. This is the external component of the communication process. An effective communication management plan takes into account the needs of the relevant stakeholders along with that of the project team.

Effective project management is the art of striking a balance between competing demands of the different stakeholders and ensuring that the bottom line objectives of the project are **met**. The practice of project management has to do with the way in which the project manager acts in unison along with the Team and delivers the project to the sponsors. The role of the project manager is that of a facilitator as well as an enabler. The facilitator role comes into the picture when the project manager has to balance the competing demands of the sponsors and the stakeholders and enabling role comes into play when the project manager has to motivate his or her Team and make sure that the project objectives are met.

In conclusion, effective project management is all about situational leadership without losing sight of the big picture. This is the bottom line towards which all project managers have to strive and something that the project manager must aspire towards.

## **2.5 Dealing with increased complexity through network diagrams**

Network diagrams are schematic displays of project schedule activities and the interdependencies between these activities. When developed properly, this graphical view of a project's activity conveys critical schedule characteristics required to effectively analyze and adjust schedules – thus resulting in accurate and feasible schedules. This document addresses what should be considered in the development

of a network diagram, how network diagrams are created, and how they may be analyzed to identify necessary corrective actions and ensure optimal schedule definition.

### **2.5.1 Network Diagram Creation**

Network diagrams can be created manually but are also available as project views in project scheduling tools such as Microsoft Project. (See Microsoft Project, View→ More Views → Network Diagram).

#### **2.5.1.1 Inputs:**

- Project Scope Statement – The schedule definition required in the network diagram development must be based on the approved scope documented in the Project Scope Statement. If network diagram and schedule definition does not account for all required deliverables in scope, the resulting network diagram and schedule will not accurately reflect the time necessary to complete the work.
- Work Breakdown Structure (WBS) – The Project Team must include WBS project work in the network diagram to ensure comprehensive reflection of project activities.
- Historical Project Information – The accuracy of network diagram/schedule estimation is strengthened by actual schedule metrics from past projects. Project teams should consider past level of effort and duration for comparable project activities.
- WBS Dictionary – The WBS Dictionary defines task durations, dependencies, predecessor and successor relationships, and resources – all of which need to be defined prior to network diagram creation to ensure that the network diagram accurately reflects the schedule required to successfully complete the project.
- Resource Calendars – The Project Team should develop and utilize a resource calendar that includes holidays and personnel availability. The creation of this calendar prior to network diagram creation will ensure that the schedule accounts for actual working time.

#### **2.5.1.2 Procedure:**

- Consider all inputs and enter all activity definition, sequencing, and duration information into a software tool such as Microsoft Project. If using this tool, ensure all tasks are linked.
- Confirm all tasks are linked with accurate dependencies and with resource names identified for each task.

#### **2.5.1.3 Output:**

- Microsoft Project Plan with task dependencies, predecessors and successors definitions, and resources applied to tasks

### **2.5.2 Schedule Network Analysis**

Schedule network analysis, as defined by the *Project Management Body of Knowledge (PMBOK)*, is a technique used by project managers to analyze schedule information and generate realistic and optimal project schedules. This analysis should be performed upon completion of the draft schedule and network diagram and after each schedule update. Schedule network analysis involves:

- Identifying the schedule impact of task dependencies

- Identifying critical path tasks and understanding the impact of the critical path on the schedule. Software tools such as Microsoft Project automatically display critical path tasks once project information such as tasks, dependencies, and durations are identified in the tools.
- Analyzing the effects of schedule constraints and externally imposed dates.
- Understanding which tasks can experience delays without delaying the overall schedule
- Conducting “what if” analysis of various activity durations (for example, what if the testing activities take twice as long as is currently planned?)
- Assessing resource allocation and leveling to prevent resource over-allocation
- Assessing fast tracking or crashing options to ensure optimal schedule performance

### 2.5.1.3 Analytical Techniques:

*PMBOK* describes the following techniques to perform scheduled network analysis. For more detail regarding analytical techniques, which provide valuable information necessary for effective schedule definition, see *PMBOK*, fourth edition, Section 6.5.2. Most scheduling tools include features that allow utilization of these techniques with minimal effort.

- **Critical Path Method** – The critical path method calculates the longest path of planned activities to the end of the project – the “critical path” – and the earliest and latest date that each activity can start and finish without extending the project. Any activity delay on the critical path impacts the planned project completion date. A network diagram visually conveys the critical path. This visibility into the critical path allows project managers to prioritize activities and take appropriate corrective actions to meet schedule deadlines.

An understanding of the critical path also allows project managers visibility as to which schedule activities are flexible – that is, those activities that are not on the critical path. By looking at a network diagram, project managers can determine when they have a float or slack, which is the amount of time that any given schedule activity can be delayed without causing a delay to the start date of subsequent activities (free float) or to the project completion date (total float). Knowing when a project has float allows a Project Manager to understand what tasks may slip and by how much before they have an impact on the project schedule.

### 2.5.4 Critical Chain Method

The basis for the critical chain method is the same as the basis for the critical path method but with one key difference; the critical chain method accounts for resource limitations. By adding resource limits to the analysis, the result is that critical path is generally longer. The resource-constrained critical path is known as the critical chain. If resources are allocated in the scheduling tool, the network diagram will display the critical chain. Using the critical chain method involves adding duration buffers to project schedules to protect the targeted finish date from slippage. Duration buffers are added to the schedule as non-work schedule activities – one at the end of the critical chain and others at the end of each sequence of tasks that feeds into the critical chain. As a result, “buffer” time is integrated throughout the project schedule to account for duration uncertainty. Later in the project, project teams monitor project progress by reviewing the consumption rate of the buffers.

- **Resource Leveling** – Resource leveling is the process of changing schedule resource allocation to resolve over-allocations or conflicts. Resource leveling is applied to a schedule that has already been analyzed by the critical path method. This technique is used to adjust a project schedule if shared resources are only available at certain times, or in limited quantities, or if a Project Manager wants to maintain resource usage at a constant level. Resource leveling is often used to correct resource over-allocations and will often change the critical path. The network diagram should be recreated after resource leveling to assess the updated critical path.
- **What-If Scenario Analysis** – This analysis examines the schedule impact of various scenarios, such as the delayed delivery of a major deliverable. What-if scenario analysis may include simulation that calculates multiple project durations with different sets of activity assumptions. Multiple network diagrams may be generated to visually convey the impact of varying scenarios. Project managers can use the results of this analysis to determine schedule feasibility under adverse conditions and prepare relevant contingency plans.

#### 2.5.5 Schedule Compression Techniques:

As a result of network diagram analysis, project teams may identify a need to compress the schedule. Schedule compression shortens the project schedule in order to meet schedule deadlines without reducing the project scope. Schedule compression techniques include crashing and fast tracking. If utilized, project teams should recreate and reassess the network diagram to ensure that no new schedule issues have emerged.

- **Crashing** – Crashing involves either adding resources or increasing work hours (overtime, weekends) to shorten the task duration. Shorter task durations typically result in higher task costs, so project teams must determine, prior to crashing, whether the total cost savings are enough to justify the higher costs. Crashing almost always requires cost increases because it usually necessitates new tasks. Crashing is a controversial technique because adding project resources can increase project complexity or risk and may ultimately have a negative impact on the schedule. Crashing does not involve reducing project scope or eliminating project tasks.
- **Fast Tracking** – Fast tracking is a schedule compression technique in which project phases or activities usually conducted sequentially are performed in parallel to reduce the duration. Care must be taken to ensure that parallel work does not create additional work or increase risk. Fast tracking frequently results in increased complexities in task dependencies, so additional project controls must be implemented to ensure ongoing and accurate insight into schedule performance.

## 2.6 Critical Path method

The **critical path method (CPM)** is an algorithm for scheduling a set of project activities. It is an important tool for effective project management.

### 2.6.1 History

The critical path method (CPM) is a project modeling technique developed in the late 1950s by Morgan R. Walker of DuPont and James E. Kelley, Jr. of Remington Rand. Kelley and Walker related their memories of the development of CPM in 1989. Kelley attributed the term "critical path" to the developers

of the Program Evaluation and Review Technique which was developed at about the same time by Booz Allen Hamilton and the U.S. Navy. The precursors of what came to be known as Critical Path were developed and put into practice by DuPont between 1940 and 1943 and contributed to the success of the Manhattan Project.

CPM is commonly used with all forms of projects, including construction, aerospace and defense, software development, research projects, product development, engineering, and plant maintenance, among others. Any project with interdependent activities can apply this method of mathematical analysis. Although the original CPM program and approach is no longer used, the term is generally applied to any approach used to analyze a project network logic diagram.

### **2.6.2 Basic technique**

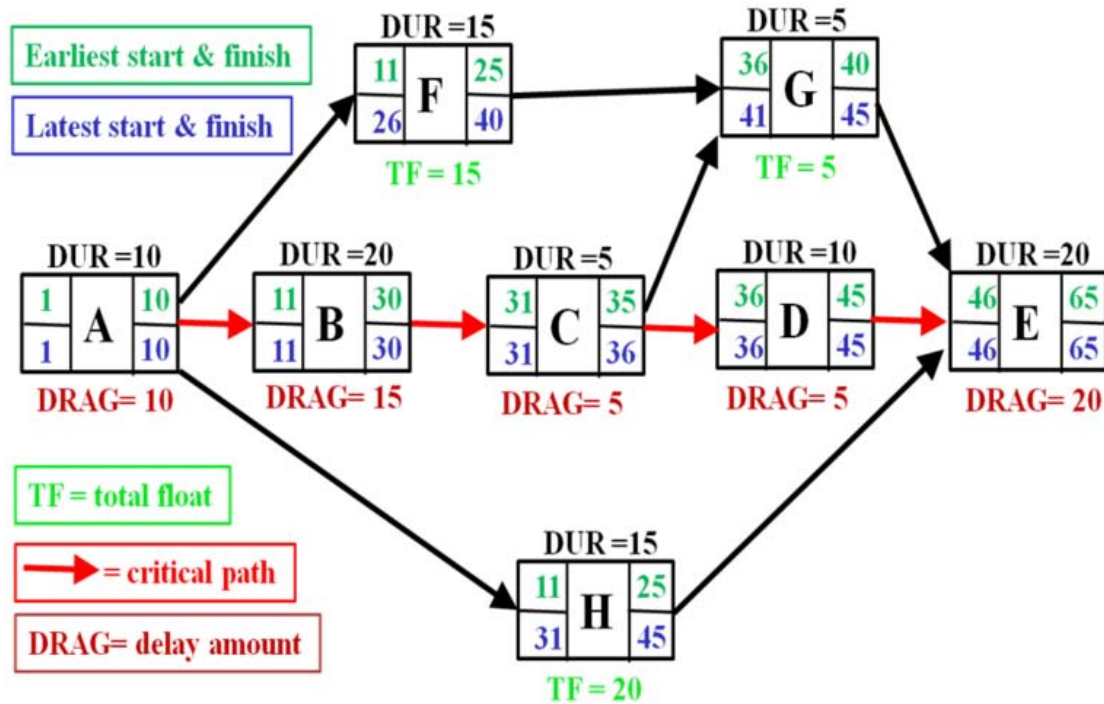
The essential technique for using CPM is to construct a model of the project that includes the following:

1. A list of all activities required to complete the project (typically categorized within a work breakdown structure),
2. The time (duration) that each activity will take to complete,
3. The dependencies between the activities and,
4. Logical end points such as milestones or deliverable items.

Using these values, CPM calculates the longest path of planned activities to logical end points or to the end of the project, and the earliest and latest that each activity can start and finish without making the project longer. This process determines which activities are "critical" (i.e., on the longest path) and which have "total float" (i.e., can be delayed without making the project longer). In project management, a critical path is the sequence of project network activities which add up to the longest overall duration. This determines the shortest time possible to complete the project. Any delay of an activity on the critical path directly impacts the planned project completion date (i.e. there is no float on the critical path). A project can have several, parallel, near critical paths. An additional parallel path through the network with the total durations shorter than the critical path is called a sub-critical or non-critical path.

CPM analysis tools allow a user to select a logical end point in a project and quickly identify its longest series of dependent activities (its longest path). These tools can display the critical path (and near critical path activities if desired) as a cascading waterfall that flows from the project's start (or current status date) to the selected logical end point.

Although the activity-on-arrow diagram ("PERT Chart") is still used in a few places, it has generally been superseded by the activity-on-node diagram, where each activity is shown as a box or node and the arrows represent the logical relationships going from predecessor to successor as shown here in the "Activity-on-node diagram".



Activity-on-node diagram showing critical path schedule, along with total float and critical path drag computations

In this diagram, Activities A, B, C, D, and E comprise the critical or longest path, while Activities F, G, and H are off the critical path with floats of 15 days, 5 days, and 20 days respectively. Whereas activities that are off the critical path have float and are therefore not delaying completion of the project, those on the critical path will usually have critical path drag, i.e., they delay project completion. The drag of a critical path activity can be computed using the following formula:

1. If a critical path activity has nothing in parallel, its drag is equal to its duration. Thus A and E have drags of 10 days and 20 days respectively.
2. If a critical path activity has another activity in parallel, its drag is equal to whichever is less: its duration or the total float of the parallel activity with the least total float. Thus since B and C are both parallel to F (float of 15) and H (float of 20), B has a duration of 20 and drag of 15 (equal to F's float), while C has a duration of only 5 days and thus drag of only 5. Activity D, with a duration of 10 days, is parallel to G (float of 5) and H (float of 20) and therefore its drag is equal to 5, the float of G.

These results, including the drag computations, 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, by "**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).

### 2.6.2 Crash duration

"Crash duration" is a term referring to the shortest possible time for which an activity can be scheduled. It is achieved by shifting more resources towards 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.

### 2.6.3 Expansion

Originally, the critical path method considered only logical dependencies between terminal elements. Since then, it has been expanded to allow for the inclusion of resources related to each activity, through processes called activity-based resource assignments and resource leveling. A resource-leveled schedule may include delays due to resource bottlenecks (i.e., unavailability of a resource at the required time), and may cause a previously shorter path to become the longest or most "resource critical" path. A related idea is called the critical chain, which attempts to protect activity and project durations from unforeseen delays due to resource constraints.

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 addition, the method can easily incorporate the ideas of stochastic predictions, using the Program Evaluation and Review Technique (PERT) and event chain methodology.

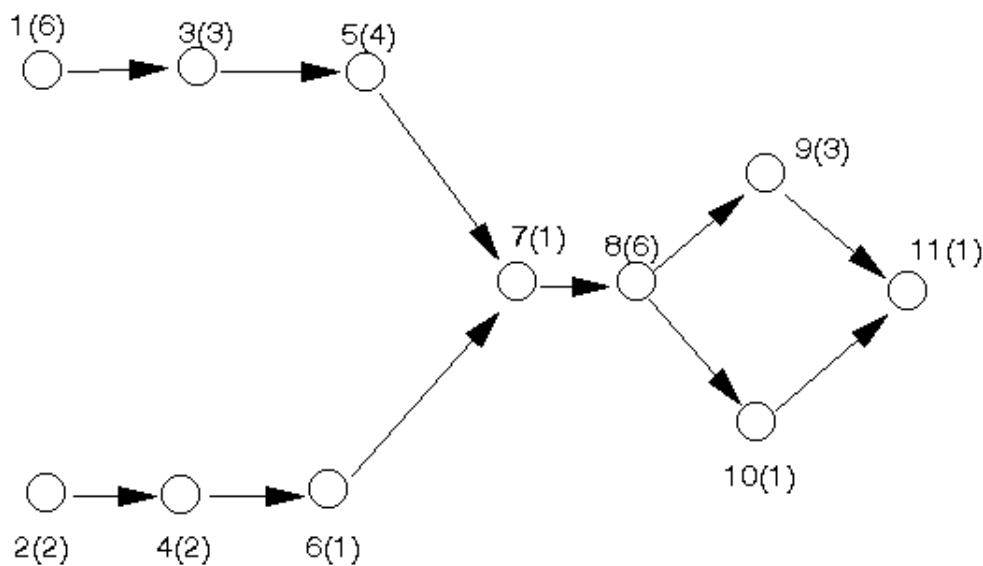
Currently, there are several software solutions available in industry that use the CPM method of scheduling, see list of project management software. The method currently used by most project management software is based on a manual calculation approach developed by Fondahl of Stanford University.

### 2.6.4 Flexibility

A schedule generated using critical path techniques often is not realized precisely, as estimations are used to calculate times: if one mistake is made, the results of the analysis may change. This could cause an upset in the implementation of a project if the estimates are blindly believed, and if changes are not addressed promptly. However, the structure of critical path analysis is such that the variance from the original schedule caused by any change can be measured, and its impact either ameliorated or adjusted for. Indeed, an important element of project postmortem analysis is the As Built Critical Path (ABCP), which analyzes the specific causes and impacts of changes between the planned schedule and eventual schedule as actually implemented.

### 2.6.5 Activity on Nodes diagramming

In the network diagram shown below, for the problem we considered before, each *node* (circle) represents an activity and is labelled with the activity number and the associated completion time (shown in brackets after the activity number).



This network is an *activity on node (AON)* network.

In constructing the network we:

- Draw a node for each activity
- Add an arrow from (activity) node I to (activity) node j if activity I must be finished before activity j can start (an activity I precedes activity j). Note here that all arcs have arrows attached to them (indicating the direction the project is flowing in).

One tip that I find useful in drawing such diagrams is to structure the positioning of the nodes (activities) so that the activities at the start of the project are on the left, the activities at the end of the project at the right, and the project "flows" from left to right in a natural fashion.

Once having drawn the network it is a relatively easy matter to analyze it (using a *dynamic programming* algorithm to find the *critical path*). However we will not consider this algorithm in any detail here but will instead use the computer package to solve the problem.

Note here one key point, the above network diagram assumes that activities not linked by precedence relationships can take place simultaneously (e.g. at the start of the project we could be doing activity 1 at the same time as we are doing activity 2).

Essentially the above diagram is not needed for a computer - a computer can cope very well (indeed better) with just the lists of activities and their precedence relationships we had before. The above diagram is intended for people. Consider what might happen in a large project - perhaps many thousands or tens of thousands of activities and their associated precedence relationships. Do you think it would be possible to list those out without making any errors? Obviously not - so how can we spot errors? Looking at long lists in an attempt to spot errors are just hopeless. With a little practice it becomes easy to look at

diagrams such as that shown above and interpret them and spot errors in the specification of the activities and their associated precedence relationships.

### 2.6.6 Package solution

The problem (as represented by the network diagram) was solved using the package, the input being shown below. Note that we have chosen to enter the problem as a deterministic CPM problem. The various input options shown below will become more familiar to you as we progress.

**Problem Title** Network example

**Number of Activities:** 11

**Time Unit:** week

**Problem Type**

- ☒ Deterministic CPM
- ☐ Probabilistic PERT

**Select CPM Data Field**

- ☒ Normal Time
- ☐ Crash Time
- ☐ Normal Cost
- ☐ Crash Cost
- ☐ Actual Cost
- ☐ Percent Complete

**Data Entry Format**

- ☒ Spreadsheet
- ☐ Graphic Model

**Activity Time Distribution:**

Choose Activity Time Distribution

OK Cancel Help

The numbers entered following the above screen are as below.

| Activity Number | Activity Name | Immediate Predecessor (list number/name, separated by ',') | Normal Time |
|-----------------|---------------|------------------------------------------------------------|-------------|
| 1               | 1             |                                                            | 6           |
| 2               | 2             |                                                            | 2           |
| 3               | 3             | 1                                                          | 3           |
| 4               | 4             | 2                                                          | 2           |
| 5               | 5             | 3                                                          | 4           |
| 6               | 6             | 4                                                          | 1           |
| 7               | 7             | 5,6                                                        | 1           |
| 8               | 8             | 7                                                          | 6           |
| 9               | 9             | 8                                                          | 3           |
| 10              | 10            | 8                                                          | 1           |
| 11              | 11            | 9,10                                                       | 1           |

The output from the package is shown below.

|                        |                  |                     |                  |                   |                    |                 |                  |                  |
|------------------------|------------------|---------------------|------------------|-------------------|--------------------|-----------------|------------------|------------------|
| 01-05-2000<br>11:29:16 | Activity<br>Name | On Critical<br>Path | Activity<br>Time | Earliest<br>Start | Earliest<br>Finish | Latest<br>Start | Latest<br>Finish | Slack<br>(LS-ES) |
| 1                      | 1                | Yes                 | 6                | 0                 | 6                  | 0               | 6                | 0                |
| 2                      | 2                | no                  | 2                | 0                 | 2                  | 8               | 10               | 8                |
| 3                      | 3                | Yes                 | 3                | 6                 | 9                  | 6               | 9                | 0                |
| 4                      | 4                | no                  | 2                | 2                 | 4                  | 10              | 12               | 8                |
| 5                      | 5                | Yes                 | 4                | 9                 | 13                 | 9               | 13               | 0                |
| 6                      | 6                | no                  | 1                | 4                 | 5                  | 12              | 13               | 8                |
| 7                      | 7                | Yes                 | 1                | 13                | 14                 | 13              | 14               | 0                |
| 8                      | 8                | Yes                 | 6                | 14                | 20                 | 14              | 20               | 0                |
| 9                      | 9                | Yes                 | 3                | 20                | 23                 | 20              | 23               | 0                |
| 10                     | 10               | no                  | 1                | 20                | 21                 | 22              | 23               | 2                |
| 11                     | 11               | Yes                 | 1                | 23                | 24                 | 23              | 24               | 0                |
|                        | Project          | Completion          | Time             | =                 | 24                 | weeks           |                  |                  |
|                        | Number of        | Critical            | Path(s)          | =                 | 1                  |                 |                  |                  |

In the output we have a "Project Completion Time" of 24 (weeks). This means that if all the activities take exactly as long as expected the *minimum* time in which we can complete the project (complete all activities whilst obeying the precedence relationships) is 24 weeks.

Note here that we have (implicitly) assumed in calculating this figure of 24 weeks that we have sufficient resources to enable activities to be carried out simultaneously if required (e.g. activities 1 and 2 can be carried out simultaneously). Problems where this assumption does not hold are considered here.

In the column headed "Slack" we have, for each activity in turn, the amount of time that the activity can be delayed *without* altering (increasing) the overall project completion time. If delays occur in two or more activities then we must either analyze the effect on the project by hand, or rerun the problem with new data. Many textbooks also refer to slack by the term "float".

Activities with a slack of zero are called *critical* activities since they must all be completed on time to avoid increasing the overall project completion time. Hence, for this network, activities 1, 3, 5, 7, 8, 9 and 11 are the critical activities.

Note here that 1 3 5 7 8 9 11 constitutes a path in the network diagram from the initial node (node 1) to the final node (node 11). This is no accident because for *any* network there will always be a path of critical activities from the initial node to the final node. Such a path is called the *critical path*.

More strictly the definition of a critical path is a path of activities, each pair of activities on the path directly connected via a precedence relationship (arc), from the start (initial node) to the end (final node) of the project, where the completion times of the activities on the path sum to the overall minimum project completion time. All activities in this path must be critical by definition.

The output also lists, for each activity:

- Earliest start (ES): this is the earliest possible time that an activity can begin. All immediate predecessors must be finished before an activity can start.

- Latest start (LS): this is the latest time that an activity can begin and not delay the completion time of the overall project. If the earliest start and latest start times are the same then the activity is critical.
- Earliest finish (EF): this is the earliest possible time that an activity can be finished (= earliest start time + activity completion time).
- Latest finish (LF): this is the latest time that an activity can be finished and not delay the completion time of the overall project (= latest start time + activity completion time). As with start times, the activity is critical if the earliest finish and latest finish times are the same.
- Slack: this is the difference between the earliest start time and the latest start time (which in turn is equal to the difference between the latest start time and the latest finish time), i.e.  $\text{Slack} = \text{LS} - \text{ES} = \text{LF} - \text{EF}$

Note also:

- There may be more than one critical path - in fact it often makes more sense to talk about critical activities rather than the critical path. For example, suppose in the above network activity 10 took 3 weeks to complete (i.e. the same as activity 9). Then activity 10 would also be critical and we would have multiple critical paths, in fact two critical paths one 1 3 5 7 8 9 11 as before and a new critical path 1 3 5 7 8 10 11.
- The larger the slack the less critical the activity e.g. what would happen to the overall project completion time if the completion time for activity 6 increased by 5?

Be warned that, both in the textbooks and in the literature, there are various different ways of performing network analysis presented - in particular:

- Different definitions of slack
- Different network diagrams (exchanging the role of nodes and arcs) - in fact there are two types of network diagram, activity on node (AON) which we have used above and activity on arc (AOA) which we have not discussed here
- Different notation conventions.

## 2.7 Dealing with the uncertainty

Project schedules are concerned with the future. A project schedule is, in effect, a projection or forecast of how and when the project will be performed. This projection is typically made using the critical path method (CPM), which means that the projected dates are based upon the estimated durations of the various tasks and the logical dependencies between them.

The critical word in the above is “estimated.” The durations that we put into our CPM model are just estimates or predictions. And as Niels Bohr, Yogi Berra, or Samuel Goldwyn (depending on who you ask) once may have pronounced, “Prediction is very difficult, especially about the future.” Everything we think we know about the future is subject to uncertainty, and duration estimates are no exception. The amount of uncertainty varies, depending upon how much the current project resembles previous ones, how much relevant historical data we have, and so on. But we can be certain that there is some uncertainty. Recognition of this fact is essential to creating realistic project plans.

The way we recognize uncertainty about task durations is to replace single-point estimates with a range of possible values. For example, instead of saying a task will take five days, we say it will take somewhere

between three and eight days. Often this will be augmented by giving a “most likely” value, in this case maybe five days.

This two- or three-point estimate may be further refined by specifying the shape of a probability distribution to represent the data. Historically, this has included a subset of the beta distribution sometimes called beta-PERT, though there is no particular reason to favor this. In fact, there is some empirical evidence to suggest that the lognormal distribution is more appropriate.

## **2.8 Program Evaluation and Review Technique**

### **2.8.1 PERT**

Complex projects require a series of activities, some of which must be performed sequentially and others that can be performed in parallel with other activities. This collection of series and parallel tasks can be modeled as a network.

In 1957 the Critical Path Method (CPM) was developed as a network model for project management. CPM is a deterministic method that uses a fixed time estimate for each activity. While CPM is easy to understand and use, it does not consider the time variations that can have a great impact on the completion time of a complex project.

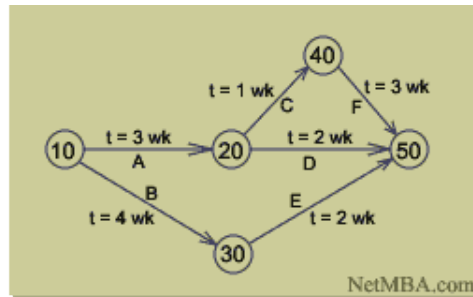
The *Program Evaluation and Review Technique* (PERT) is a network model that allows for randomness in activity completion times. PERT was developed in the late 1950's for the U.S. Navy's Polaris project having thousands of contractors. It has the potential to reduce both the time and cost required to complete a project.

### **2.8.2 The Network Diagram**

In a project, an activity is a task that must be performed and an event is a milestone marking the completion of one or more activities. Before an activity can begin, all of its predecessor activities must be completed. Project network models represent activities and milestones by arcs and nodes. PERT originally was an *activity on arc* network, in which the activities are represented on the lines and milestones on the nodes. Over time, some people began to use PERT as an *activity on node* network. For this discussion, we will use the original form of activity on arc.

The PERT chart may have multiple pages with many sub-tasks. The following is a very simple example of a PERT diagram:

### PERT Chart



The milestones generally are numbered so that the ending node of an activity has a higher number than the beginning node. Incrementing the numbers by 10 allows for new ones to be inserted without modifying the numbering of the entire diagram. The activities in the above diagram are labeled with letters along with the expected time required to complete the activity.

#### 2.8.3 Steps in the PERT Planning Process

PERT planning involves the following steps:

1. Identify the specific activities and milestones.
2. Determine the proper sequence of the activities.
3. Construct a network diagram.
4. Estimate the time required for each activity.
5. Determine the *critical path*.
6. Update the PERT chart as the project progresses.

##### 2.8.3.1 Identify Activities and Milestones

The activities are the tasks required to complete the project. The milestones are the events marking the beginning and the end of one or more activities. It is helpful to list the tasks in a table that in later steps can be expanded to include information on the sequence and duration.

##### 2.8.3.2 Determine Activity Sequence

This step may be combined with the activity identification step since the activity sequence is evident for some tasks. Other tasks may require more analysis to determine the exact order in which they must be performed.

##### 2.8.3.3 Construct the Network Diagram

Using the activity sequence information, a network diagram can be drawn showing the sequence of the serial and parallel activities. For the original activity-on-arc model, the activities are depicted by arrowed lines and milestones are depicted by circles or "bubbles".

If done manually, several drafts may be required to correctly portray the relationships among activities. Software packages simplify this step by automatically converting tabular activity information into a network diagram.

#### 2.8.3.4 Estimate Activity Times

Weeks are a commonly used unit of time for activity completion, but any consistent unit of time can be used.

A distinguishing feature of PERT is its ability to deal with uncertainty in activity completion times. For each activity, the model usually includes three time estimates:

- *Optimistic time* - generally the shortest time in which the activity can be completed. It is common practice to specify optimistic times to be three standard deviations from the mean so that there is approximately a 1% chance that the activity will be completed within the optimistic time.
- *Most likely time* - the completion time having the highest probability. Note that this time is different from the *expected time*.
- *Pessimistic time* - the longest time that an activity might require. Three standard deviations from the mean is commonly used for the pessimistic time.

PERT assumes a beta probability distribution for the time estimates. For a beta distribution, the expected time for each activity can be approximated using the following weighted average:

$$\text{Expected time} = ( \text{Optimistic} + 4 \times \text{Most likely} + \text{Pessimistic} ) / 6$$

This expected time may be displayed on the network diagram.

To calculate the variance for each activity completion time, if three standard deviation times were selected for the optimistic and pessimistic times, then there are six standard deviations between them, so the variance is given by:

$$[ ( \text{Pessimistic} - \text{Optimistic} ) / 6 ]^2$$

#### 2.8.3.5 Determine the Critical Path

The critical path is determined by adding the times for the activities in each sequence and determining the longest path in the project. The critical path determines the total calendar time required for the project. If activities outside the critical path speed up or slow down (within limits), the total project time does not change. The amount of time that a non-critical path activity can be delayed without delaying the project is referred to as *slack time*.

If the critical path is not immediately obvious, it may be helpful to determine the following four quantities for each activity:

- ES - Earliest Start time
- EF - Earliest Finish time
- LS - Latest Start time

- LF - Latest Finish time

These times are calculated using the expected time for the relevant activities. The early start and finish times of each activity are determined by working forward through the network and determining the earliest time at which an activity can start and finish considering its predecessor activities. The latest start and finish times are the latest times that an activity can start and finish without delaying the project. LS and LF are found by working backward through the network. The difference in the latest and earliest finish of each activity is that activity's slack. The critical path then is the path through the network in which none of the activities have slack.

The variance in the project completion time can be calculated by summing the variances in the completion times of the activities on the critical path. Given this variability, one can calculate the probability that the project will be completed by a certain date, assuming a normal probability distribution for the critical path. The normal distribution assumption holds if the number of activities in the path is large enough for the central limit theorem to be applied.

Since the critical path determines the completion date of the project, the project can be accelerated by adding the resources required to decrease the time for the activities on the critical path. Such a shortening of the project sometimes is referred to as *project crashing*.

#### **2.8.3.6 Update as Project Progresses**

Make adjustments in the PERT chart as the project progresses. As the project unfolds, the estimated times can be replaced with actual times. In cases where there are delays, additional resources may be needed to stay on schedule and the PERT chart may be modified to reflect the new situation.

### **2.8.4 Benefits of PERT**

PERT is useful because it provides the following information:

- Expected project completion time.
- Probability of completion before a specified date.
- The critical path activities that directly impact the completion time.
- The activities that have slack time and that can lend resources to critical path activities.
- Activity start and end dates.

### **2.8.5 Limitations**

The following are some of PERT's weaknesses:

- The activity time estimates are somewhat subjective and depend on the judgement. In cases where there is little experience in performing an activity, the numbers may be only a guess. In other cases, if the person or group performing the activity estimates the time there may be bias in the estimate.

- Even if the activity times are well-estimated, PERT assumes a beta distribution of these time estimates, but the actual distribution may be different.
- Even if the beta distribution assumption holds, PERT assumes that the probability distribution of the project completion time is the same as the that of the critical path. Because other paths can become the critical path if their associated activities are delayed, PERT consistently underestimates the expected project completion time.

The underestimation of the project completion time due to alternate paths becoming critical is perhaps the most serious of these issues. To overcome this limitation, Monte Carlo simulations can be performed on the network to eliminate this optimistic bias in the expected project completion time.

## 2.9 Computerized Project Management

**Computerized Project Management** is a means of easily maintaining Project records and communications in a digital format. Computerized project management systems allow for the maintenance of all project documentation in one easily accessed action, with no file cabinets, no big plan files, and with no stacks of paper on the dash of a pickup or thrown in a bottom desk drawer. It can provide the type of organization that will combat many of the causes of dysfunctional Operations that are encountered when executing construction work.

Employing a properly implemented and well-conducted computerized project management system can enhance a company's efforts in much the same way that electronic financial and payroll systems can provide added administrative value. Electronic financial systems and electronic project management systems are both capable of saving time and reducing the effort required to perform many tasks. They both can provide better and more accurate, more accessible records; and, they can also both save money by improving efficiency and by making many administrative tasks easier and less time consuming to perform. They can both actually make money through the savings realized from more effective functioning at all levels of an organization. They reduce record keeping drudgery and errors.

Computerized Project records can be accessible from any location, via any computer (desktop or portable) that can access the Internet. These records can even be accessed via Smart Phones that have Internet access.

Computerized project management systems can provide an electronic record of an entire project, from Invitation to Bid, or Request for Proposal, through Construction, to Project Closeout, incorporating all of the correspondence and documentation generated along the way. The original Plans, Specifications and other Contract Documents can be recorded in the system and referenced at any time from any computer or Smart Phone. A single Drawing, or a full set of Drawings, may be printed upon request at any time. The same ease of access and portability applies to all of the other Contract Documents stored in the system.

All of the familiar construction documents (such as Requests for Information, Submittals, Change Order Requests, Meeting Minutes, Transmittals, and all the rest) can be generated within the computerized system. They automatically link to one another and to additional supporting documents (scanned and uploaded to the system) so that a complete picture of all of the issues and actions that interrelate to the particular subject of any given form are shown and are readily available.

Drawings, Records, Letters, anything in the digital Project record, can be emailed from any Internet access point. Replies can similarly be received via email. Emails or attachments received in that manner can be uploaded to the digital Record almost as soon as they are received.

Paper documents that are generated independently outside of the computerized management system (such as concrete batching plant records, testing service or inspectors records and certificates, sketches, letters, general correspondence, receipts, etc.) can be scanned and electronically archived in the system. Once these documents have been archived, they are then available for linking to Letters, Transmittals, Emails, Meeting Minutes, RFI's, and any other Construction Document generated within the electronic system. It is even possible to "post" instructions and changes directly to archived Drawings as a separate maintainable layer independent of the original Drawings; these "posted" Drawings can, in turn, be electronically forwarded in modified form.

Many companies have considered implementing a computerized project management system, only to conclude, or to assume, that it would be too difficult or too expensive to utilize. The cost requirements for establishing the system and the necessity for designating people to be trained in the use of the system, and then, allowing them the time to actually use it, can all seem to be a daunting resource allocation problem.

#### *Review Questions*

1. Define the Project plan?
2. Explain the process of project planning?
3. Explain the network diagrams?
4. Explain the Dealing with the uncertainty?

#### *Discussion Questions*

Discuss the Computerized Project Management?

## **Project financing and development banks**

### **Learning Objectives**

- To define the Development banking.
- To explain the different types of capital.
- To explain the generation of funds.
- To describe the different types of financing.

### **3.1 Development banking and western world**

Development bank, national or regional financial institution designed to provide medium- and long-term capital for productive investment, often accompanied by technical assistance, in poor countries.

The number of development banks has increased rapidly since the 1950s; they have been encouraged by the International Bank for Reconstruction, Development, and its affiliates. The large regional development banks include the Inter-American Development Bank, established in 1959; the Asian Development Bank, which began operations in 1966; and the African Development Bank, established in 1964. They may make loans for specific national or regional projects to private or public bodies or may operate in conjunction with other financial institutions. One of the main activities of development banks has been the recognition and promotion of private investment opportunities. Although the efforts of the majority of development banks are directed toward the industrial sector, some are also concerned with agriculture.

Development banks may be publicly or privately owned and operated, although governments frequently make substantial contributions to the capital of private banks. The form (share equity or loans) and cost of financing offered by development banks depend on their cost of obtaining capital and they need to show a profit and pay dividends.

Development practices have provoked some controversy. Because development banks tend to be government-run and are not accountable to the taxpayers who fund them, there are few checks and balances preventing the banks from making bad investments. Some international development banks have been blamed for imposing policies that ultimately destabilize the economies of recipient countries. Yet another concern centers on “moral hazard”—that is, the possibility that fiscal irresponsible policies by recipient countries will be effectively rewarded and thereby encouraged by bailout loans. While theoretically a serious concern, the existence of such moral hazard has not been proved.

#### **3.1.1 Development banking in India**

Industrial finance is very much essential for industrial development. No business can reach its full potential of growth and success without adequate finance. Financial requirement is of two types.

##### **3.1.1.1 Short term and long term funds.**

Short term funds are in the form of working capital to meet day to day requirements of business and long term funds help in acquiring fixed assets. All financial institutions in India can be divided into following categories:

**1.) All India Development Banks:** Industrial Development Bank of India (IDBI), Industrial Finance Corporation of India (IFCI), Industrial Credit and Investment Corporation of India (ICICI), State Industrial Development Bank of India (SIDBI), Industrial Investment Bank of India (IIBI).

**2.) Specialized Financial Institutions:** Risk Capital and Technology Finance Corporation Ltd. (RCTC), Technology Development and Information Corporation of India Ltd. (TDICI), Tourism Finance Corporation of India Ltd. (TFCI).

**3.) Investment Institutions:** Unit Trust of India (UTI), Life Insurance Corporation (LIC), General Insurance Corporation (GIC) and its subsidiaries.

**4.) State Level Institutions:** State Financial Corporations (SFC), State Industrial Development Corporation (SIDC).

#### **3.1.1.2 Industrial Finance Corporation of India (IFCI) July 1948**

It was the first all India development bank to be set up in the country. It was set up in 1948 with an object of providing medium and long term credit to industry. On July 1, 1993 it has been converted into a public limited company and now it is known as Industrial Finance Corporation India Ltd.

##### **3.1.1.2.1 The financial resources of IFCI consist following components:**

- a) Capital share
- b) Bonds and debentures
- c) Other borrowings

Initial capital of IFCI was Rs. 5 crore since then it has been increased several times, on March 31, 2000 its capital was 1046 crore.

##### **3.1.1.2.2 Functions of IFCI**

- a) Granting loans and advances both within rupees or foreign currencies payable within 25 years.
- b) Guaranteeing rupee loans.
- c) Underwriting of shares and debentures of industry concern.
- d) Financial assistance to new industrial concern.
- e) Financial assistance for renovation, expansion, modernization or diversification.

##### **3.1.1.2.3 Lending operations of IFCI**

It provides financial assistance to all public sector, the cooperative sector and public sector. The cumulative assistance at the end of March 2000 was Rs 49621 crore.

#### **3.1.1.2.4 Criticism**

- a) IFCI lending operations have encouraged the concentration of wealth and capital
- b) IFCI did a little to remove regional imbalances.
- c) It failed to exercise the necessary control over defaulting borrowers.

**3.1.1.3 State Financial Corporations (SFC) 1951:** IFCI was set up for large and medium enterprise. Therefore the need arises to provide financial help to the small and medium concerns. So SFC act was passed by the parliament on Sep, 1951. The first SFC set up in Punjab was in 1953. There are 18 SFC in the country.

#### **3.1.1.3.1 Functions of SFC**

- a) Granting loans to the industrial concerns for a period not exceeding 20 years.
- b) Guaranteeing rupee loans.
- c) Underwriting of shares and debentures of industry concern.
- d) It also acts as an agent of central and state government, IDBI, IFCI or other financial institutions.

#### **3.1.1.3.2 Criticism**

The working group appointed by RBI found that the performance of various SFC'S were not satisfactory. They have failed to meet the demands of medium and small enterprise and the rate of interest charge by them is also very high.

#### **3.1.1.4 Industrial Credit and Investment Corporation of India (ICICI) JAN 1955**

It is second all India development banks like IDBI, IFCI it is a private sector bank but it's distinguished feature is that it provide underwriting facilities which are generally neglected by other institutions. On April, 1996 SCICI was merged with ICICI.

##### **3.1.1.4.1 The financial resources of ICICI consist following components:**

Initial capital of ICICI was Rs. 149crore in 1971 and in 2000 its capital was 65389 crore.

##### **3.1.1.4.2 Functions of ICICI**

- a) Granting loans and advances both long term and medium term.
- b) Guaranteeing rupee loans.
- c) Underwriting of new issues or securities.

#### **3.1.1.4.3 Lending operations of ICICI**

It provides financial assistance in the form of rupee loan, foreign currency loan, underwriting of shares bonds and debentures and direct subscription to share and debentures.

#### **3.1.1.5 Unit Trust of India (UTI) 1964**

UTI a public sector investment institution was set up in 1964 under the UTI act, 1963. The share capital of UTI was subscribed by IDBI, LIC, SBI and its subsidiaries. Unit trusts are popular due to

i) Diversified portfolio or pooling of risk: an investor cannot avoid his risk if he make direct investment in the shares and debentures of the companies and with small resources he can not have diversified portfolio but by making an investment in the shares of unit trusts risk is avoided as they do not make concentrated investments.

ii) Professional management

iii) These are an open end investment that's why ensuring a high degree of liquidity.

The main aim of setting up UTI is to encourage the saving of the community and use them in productive purposes for the growth of the country's economy.

#### **3.1.1.6 Industrial Development Bank of India (IDBI) July 1964**

Initially it was set up as a wholly owned subsidiary of Reserve Bank of India, in 1976, it was made an autonomous institution and its ownership passed from Reserve Bank of India to the government of India.

##### **3.1.1.6.1 The financial resources of IDBI consist following components:**

a) Share capital

b) Bonds and debentures

c) Borrowings from RBI

d) Deposits from companies

In 2000 its total resources were 72169 crore.

##### **3.1.1.6.2 Functions of IDBI**

a) It provides refinance against the loan granted to industrial concerns by other development banks like SFC, IFCI etc.

b) It plays the role of coordinator at all India level.

c) It also subscribes the share capital and bond issue of IFCI, ICICI, SFC and IIBI.

##### **3.1.1.6.3 Lending operations of IDBI**

It provides financial assistance to all kinds of big, medium as well as small enterprises.

It provides direct financial assistance to industrial enterprise, indirect financial assistance through other financial institutions and also provides financial assistance to the backward areas at concessional rate.

#### **3.1.1.6.4 Criticism**

a) In spite of all its assistance to the backward areas and two small sectors its major beneficiaries are big industrial concerns.

b) It mainly concentrates on providing financial assistance to the promotional and consultancy work has been ignored.

#### **3.1.1.7 State Industrial Development Bank of India (SIDBI) 1990**

With a view to ensure the large flow of financial and non financial assistance to the small scale sector, the government of India announced in the budget a decision to set up SIDBI as a subsidiary of IDBI the SIDBI act was passed by parliament in Oct, 1989 and the bank started its operation from 2 April, 1990.

##### **3.1.1.7.1 The financial resources of SIDBI consist following components:**

Initial capital of SIDBI was Rs. 250 crore since then it has been increased several times.

##### **3.1.1.7.2 Functions of IFCI**

a) Refinance of loans.

b) Discounting and rediscounting of bills.

c) Provide support to small industries.

#### **3.1.1.8 Industrial Investment Bank of India (IIBI) 1971**

In India there are a number of industries due to unemployment government did not want to shut down these units. So the government of India set up an Industrial Reconstruction Corporation of India (IRCI) in 1971 to provide financial assistance to such sick industrial units and to provide technical and managerial assistance if they need.

In 1985, the government converted Industrial Reconstruction Corporation of India (IRCI) into a statutory corporation known as Industrial Reconstruction Bank of India and in 1997 it named as Industrial Investment Bank of India (IIBI) and all the assets and liabilities of IRBI transferred to IIBI.

The above mentioned are the main development banks of India.

## **3.2 Debt-to-equity ratio**

The **debt-to-equity ratio (D/E)** is a financial ratio indicating the relative proportion of shareholders' equity and debt used to finance a company's assets. Closely related to leveraging, the ratio is also known

as **Risk, Gearing or Leverage**. The two components are often taken from the firm's balance sheet or statement of financial position (so-called book value), but the ratio may also be calculated using market values for both, if the company's debt and equity are publicly traded, or using a combination of the book value of debt and market value of equity financing.

### 3.2.1 Usage

Preferred stock can be considered part of debt or equity. Attributing preferred shares to one or the other is partially a subjective decision but will also take into account the specific features of the preferred shares.

When used to calculate a company's financial leverage, the debt usually includes only the Long Term Debt (LTD). Quoted ratios can even exclude the current portion of the LTD. The composition of equity and debt and its influence on the value of the firm is much debated and also described in the Modigliani-Miller theorem.

Financial economists and academic papers will usually refer to all liabilities as debt, and the statement that equity plus liabilities equals assets is therefore an accounting identity (it is, by definition, true). Other definitions of debt to equity may not respect this accounting identity, and should be carefully compared.

### 3.2.2 Formula

In a general sense, the ratio is simply debt divided by equity. However, what is classified as debt can differ depending on the interpretation used. Thus, the ratio can take on a number of forms including:

- Debt / Equity
- Long-term Debt / Equity
- Total Liabilities / Equity

In a basic sense, Total Debt / Equity is a measure of all of a company's future obligations on the balance sheet relative to equity. However, the ratio can be more discerning as to what is actually a borrowing, as opposed to other types of obligations that might exist on the balance sheet under the liabilities section. For example, often only the liability accounts that are actually labelled as "debt" on the balance sheet are used in the numerator, instead of the broader category of "total liabilities". In other words, actual borrowings like bank loans and interest-bearing debt securities are used, as opposed to the broadly inclusive category of total liabilities which, in addition to debt-labelled accounts, can include accrual accounts like unearned revenue and contra accounts like an allowance for bad debts.

Another popular iteration of the ratio is the **long-term-debt-to-equity ratio** which uses only long-term debt in the numerator instead of total debt or total liabilities. Total debt includes both long-term debt and short-term debt which is made up of actual short-term debt that has actual short-term maturities and also the portion of long-term debt that has become short-term in the current period because it is now nearing maturity. This second classification of short-term debt is carved out of long-term debt and is reclassified as a current liability called *current portion of long-term debt* (or a similar name). The remaining long-term debt is used in the numerator of the long-term-debt-to-equity ratio.

A similar ratio is debt-to-capital (D/C), where capital is the sum of debt and equity:

$$D/C = \text{total liabilities} / \text{total capital} = \text{debt} / (\text{debt} + \text{equity})$$

The relationship between D/E and D/C is:

$$D/C = D/(D+E) = D/E / (1 + D/E)$$

The debt-to-total assets (D/A) is defined as

$$D/A = \text{total liabilities} / \text{total assets} = \text{debt} / (\text{debt} + \text{equity} + \text{non-financial liabilities})$$

It is a problematic measure of leverage, because an increase in non-financial liabilities reduces this ratio. Nevertheless, it is in common use.

In the financial industry (particularly banking), a similar idea is equity to total assets (or equity to risk-weighted assets), otherwise known as capital adequacy.

### 3.2.3 Background

On a balance sheet, the formal definition is that debt (liabilities) plus equity equals assets, or any equivalent reformulation. Both the formulas below are therefore identical:

$$A = D + E$$

$$E = A - D \text{ or } D = A - E.$$

Debt to equity can also be reformulated in terms of assets or debt:

$$D/E = D / (A - D) = (A - E) / E.$$

### 3.2.4 Example

General Electric Co.

- Debt / equity: 4.304 (total debt / stockholder equity) (340/79). Note: This is often presented in percentage form, for instance 430.4.
- Other equity / shareholder equity: 7.177 (568,303,000/79,180,000)
- Equity ratio: 12% (shareholder equity / all equity) (79,180,000/647,483,000)

## 3.3 Equity and Preference Share Capital

### 3.3.1 Equity Share Capital

Also known as share capital, equity financing is the strategy of generating funds for company projects by selling a limited amount of stock to investors. The financing may involve issuing shares of common stock or preferred stock. In addition, the shares may be sold to commercial or individual investors, depending on the type of shares involved and the governmental regulations that apply in the nation where the issuer is located. Both large and small business owners make use of this strategy when undertaking new company projects.

Equity financing is a means of raising the capital needed for some sort of company activity, such as the purchase of new equipment or the expansion of company locations or manufacturing facilities. The alternative mode of financing usually involves what is known as debt financing. Debt financing is the process of borrowing money from a lender, and entering into a contract to repay the debt according to specific terms outlined within the loan contract. The choice of which means of financing to use will often depend on the purpose that the business is pursuing, as well as the company's current credit rating.

With the strategy of equity financing, the expectation is that the project funded with the sale of the stock will eventually begin to turn a profit. At that point, the business not only is able to provide dividends to the shareholders who purchased the stock, but also realize profits that help to increase the financial stability of the company overall. In addition, there is no outstanding debt owed to a bank or other lending institution. The end result is that the company has successfully funded the project without going into debt, and without the need to divert existing resources as a means of financing the project during its infancy.

While equity financing is an option that is often ideal for funding new projects, there are situations where looking into debt financing is in the best interests of the company. Should the project be anticipated to yield a return in a very short period of time, the company may find that obtaining loans at competitive interest rates is a better choice. This is especially true if this option makes it possible to launch the project sooner rather than later, and take advantage of favorable market conditions that increase the projected profits significantly. The choice between equity financing and debt financing may also involve considering different outcomes for the project. By considering how the company would be affected if the project fails, as well as considering the fortunes of the company if the project is successful, it is often easier to determine which financing alternative will serve the interests of the business over the long-term.

### **3.3.2 Preference Share Capital**

Also known as preferred shares or preferred stock, *preference shares* are stock options that provide payments to preferred investors before any dividends are paid to holders of common stock issued by the same corporation. In most instances, the amount of this dividend is fixed, as opposed to the variable dividend that is available to investors with common stock. There are several benefits associated with holding these types of shares, although investors with preferred shares do not usually enjoy the same voting privileges as investors with common shares.

Two of the more prominent benefits associated with owning preference shares are the fixed dividend payments and the senior status in the event that the issuing entity should declare bankruptcy. With the fixed amount of the dividend, investors can depend on receiving a specific amount of return on their shares, as long as the company is generating enough profit to comply with the terms within the stock agreement that have to do with the issuing of dividends. Assuming that the company remains financially stable and is able to maintain its market share, this means the payments are regular and easy to predict.

Holders of preference shares also have precedence in the event that the corporation must undergo liquidation. Investors with preferred stock will receive some type of compensation for their shares before any investors with common shares. Depending on the laws that are in force in the area where the business is located, the court of jurisdiction will often determine just how much compensation is received for each of the preference shares. This greater claim on the assets of the company enhances the opportunity to avoid incurring a loss if and when the business fails and its assets must be liquidated in order to settle outstanding debts to lenders and other types of creditors.

While there are benefits to owning preference shares, there are also some drawbacks. Typically, investors holding preferred stock do not participate in votes taken at general meetings. This is in contrast to investors with common shares, who normally do vote at those meetings. In addition, the terms of the fixed dividend payment often require that the business earn a certain level of profit before dividends are issued to shareholders of any type, especially preferred shareholders. This means that a company operating at a deficit may not issue payments to preference investors for an extended amount of time. While investors with preference shares will receive dividends before any payments are tendered to investors with common shares, holding preferred stock does not automatically guarantee that dividends will be issued in all instances.

It is not unusual for companies to issue preference shares that are considered to be convertible. This means that under certain circumstances, the shares may be converted from preferred to common stock option. Depending on the terms related to the issuance of the shares, investors may have the option to request the conversion under certain circumstances. The terms will also allow the issuer to make the conversion should certain events in the marketplace occur that make the change in the best interests of all concerned.

### **3.4 Internal Generation of Funds**

Internal funds are a reference to the type of money that is generated from within a company as opposed to that generated from outside sources. In other words, this type of funding is entirely sourced from the company itself or from its activities pertaining to the realization of that aim. As such, internal funds may be generated by plowing the profit back into further investment, selling some of the company's assets, or aggressively driving toward the realization of more capital.

An example of the application of the idea of internal funds can be seen in the situation where someone wants to start a company. Assuming the person has \$100,000 US Dollars (USD) in the bank and the total cost for establishing the company is \$95,000 USD, he or she could use the \$95,000 USD to establish the company. In this case, the \$95,000 USD serves as a source of internal funds, mainly due to the fact that the owner of the business relied on his or her own internally generated funds to start the company. If the owner did not have this money, he or she would have had to look for other sources of generating the startup funds for the business.

Another application of internal funds is a situation where an already established company is looking for funds with which to expand its production plant. If the company uses funds that it raised by itself without any help from outside investors or lenders, the company would have succeeded in generating internal funds. One of the methods by which the company can do this is by converting its profits into a source of capital. Where this is the case, the owners of the business would have to forfeit any form of a share of the profit, which is one of the drawbacks with this type of method for raising internal funds.

The company could also engage in aggressive strategic marketing of its products or services in order to create more awareness, increase its customer base, and consequently increase its sales. If the company is successful in this endeavor, the money generated from the sales will be used as a source of internal funds. Also, companies with a lot of assets could decide to sell some in order to raise the money they need. This is not the best form of raising funds internally, but it is still a method of raising funds that do not require dependence on outside sources.

### 3.4.1 Internal Finance

Internal finance is money that comes from within a company, rather than from external sources. Companies may use internal finance for investments in lieu of arranging external financing. One advantage to using internal finance for investments is that the company does not incur transaction costs such as origination fees and interest, since the money comes from the inside. Company balance sheets provide information about the amount of money available through internal finance and other financial matters that reflect on a company's financial health.

There are several sources of internal finance. One is depreciation, a tactic that increases cash flow by allowing companies to write down the value of assets over time. Depreciation can be a very powerful accounting tool when it is applied correctly. As assets are depreciated, tax liability decreases, allowing the money to keep funds that it otherwise would have needed to use to pay taxes. This frees up capital for investments and other endeavors.

Retained earnings, also called surplus or undistributed profits, are another source of internal finance. Companies that make payments to shareholders can opt to retain money instead of paying it out to fund investments. This is beneficial for the company in the long term as it increases the possibility for future earnings. Undistributed profits, in other words, do eventually work their way into the hands of shareholders as the company that invests money and increases its profits.

Companies can also raise internal finance by selling off assets for cash. This can include real estate, patents, works of art, and other assets controlled by the company. Sale of assets must be done with care to avoid taking losses or exposing the company to the risk of future losses. Companies in need of cash in a hurry can end up in trouble, as they may be forced to sell assets below market value in order to get cash into company coffers.

When companies are considering new investments, they can weigh available sources of finance to determine which would be most appropriate for a new endeavor. Internal finance can be appealing for certain types of investments, while in other cases, there may be advantages to external financing. Companies that choose to finance through the outside can retain internal funds to cover the company in an emergency, for example. Board members vote on whether or not new investments should be pursued and the type of financing the company should use.

### 3.5 Leasing Financing

A **finance lease** or capital lease is a type of lease. It is a commercial arrangement where:

- The lessee (customer or borrower) will select an asset (equipment, vehicle, software);
- The lessor (finance company) will purchase that asset;
- The lessee will have use of that asset during the lease;
- The lessee will pay a series of rentals or installments for the use of that asset;
- The lessor will recover a large part or all of the cost of the asset plus earn interest from the rentals paid by the lessee;
- The lessee has the option to acquire ownership of the asset (e.g. paying the last rental, or bargain option purchase price);

The finance company is the legal owner of the asset during the duration of the lease.

However the lessee has control over the asset providing them the benefits and risks of (economic) ownership.

### 3.5.1 Treatment in India

A finance lease is the one in which risk and rewards incidental to the ownership of the leased asset is transferred to lessee but not the actual ownership. Thus in case of finance lease we can say that notional ownership is passed to the lessee. Amount Paid As interest During Lease Period is Showed in P/L Dr Side Of Lessee

### 3.4.2 Features

- It's not cancel-able
- The lease may or may not bear the cost of insurance, repair, maintenance etc. Usually the lease has to bear all cost.
- The lease transfer ownership of the asset to the lessee by the end of the lease term
- The lessee has an option to purchase the asset at a price which is expected to be sufficiently lower than the value at the end of the lease period

### 3.4.3 Treatment in the United States

Under US accounting standards, a finance (capital) lease is a lease which meets at least one of the following criteria:

- Ownership of the asset is transferred to the lessee at the end of the lease term;
- The lease contains a bargain purchase option to buy the equipment at less than fair market value;
- The lease term equals or exceeds 75% of the asset's estimated useful life;
- The present value of the lease payments equals or exceeds 90% of the total original cost of the equipment.

Following the GAAP accounting point of view, such a lease is classified as essentially equivalent to a *purchase by the lessee* and is capitalized on the lessee's balance sheet. See Statement of Financial Accounting Standards No. 13 (FAS 13) for more details of classification and accounting.

### 3.4.5 International Financial Reporting Standards

In the over 100 countries that govern accounting using International Financial Reporting Standards, the controlling standard is IAS 17, "Leases". While similar in many respects to FAS 13, IAS 17 avoids the "bright line" tests (specifying an exact percentage as a limit) on the lease term and the present value of the rents. Instead, IAS 17 has the following five tests. If any of these tests are met, the lease is considered a finance lease:

- Ownership of the asset is transferred to the lessee at the end of the lease term;
- The lease contains a bargain purchase option to buy the equipment at less than fair market value;
- The lease term is for the major part of the economic life of the asset even if the title is not transferred;
- At the inception of the lease the present value of the minimum lease payments amounts to at least substantially all of the fair value of the leased asset.

- The leased assets are of a specialized nature such that only the lessee can use them without major modifications being made.

#### **3.4.6 Treatment in Australia**

In Australia the accounting standard pertaining to lease is AASB 117 'Leases'. AASB 117 was released in July 2004. AASB 117 'Leases' applies to accounting for leases other than: (a) leases to explore for or use minerals, oil, natural gas and similar non-regenerative resources; and (b) licensing agreements for such items as motion picture films, video recordings, plays, manuscripts, patents and copyrights.

According to AASB 117, paragraph 4, a lease is: an agreement whereby the lessor conveys to the lessee in return for a payment or series of payments the right to use an asset for an agreed period of time.

A lease is classified as a finance lease if it "transfers substantially all the risks and rewards incidental to ownership of an asset." (AASB 117, p8) There are no strict guidelines as to what constitutes a finance lease, however guidelines are provided within the standard.

#### **3.4.7 Impact on accounting**

- Since a finance lease is capitalized, both assets and liabilities (current and long-term ones) in the balance sheet increase. As a consequence, working capital decreases, but the debt/equity ratio increases, creating additional leverage.
- Finance lease expenses are allocated between interest expense and principal value much like a bond or loan; therefore, in a statement of cash flows, part of the lease payments are reported under operating cash flow but part under financing cash flow. Therefore, operating cash flow increases.
- Under operating lease conditions, lease obligations are not recognized; therefore, leverage ratios are understated and ratios of return (ROE and ROA) are overstated.

#### **3.4.8 The key IFRS criterion is:**

If "substantially all the risks and rewards" of ownership transfer to the lessee then it is a finance lease. If it is not a finance lease then it is an operating lease. The transfer of risk to the lessee may be shown by lease terms such as an option for the lessee to buy the asset at a low price (typically the residual value). At the end of the lease. The nature of the asset (whether it is likely to be used by anyone other than the lessee), the length of the lease term (whether it covers most of the useful life of the asset), and the present value of lease payments (whether they cover the cost of the asset) may also be factors.

IFRS does not provide a rigid set of rules for classifying leases and there will always be borderline cases. It is also still sometimes possible to use leases to make balance sheets look better, provided that the lessee can justify treating them as operating leases.

The classification of large transactions, such as sale and leasebacks of property, may have a significant effect on the accounts and on measures of financial stability such as gearing. However, it is worth remembering that an improvement in financial gearing may be offset by a worsening of operational gearing and vice-versa.

### **3.5 Public sector bonds**

These bonds are medium and long term obligations issued by public sector companies where the Government shareholding is 51% and more. Most of PSU bonds are in the form of promissory notes transferable by endorsement and delivery. No stamp duty or transfer deed was required at the time of transfer of bonds transferable by endorsement.

### **3.5.1 Covered bond**

**Covered bonds** are debt securities backed by cash flows from mortgages or public sector loans. They are similar in many ways to asset-backed securities created in securitization, but covered bond assets remain on the issuer's consolidated balance sheet. However, there exist other variable types where assets come off Balance Sheet.

#### **3.5.1.1 Detailed explanation**

A covered bond is a corporate bond with one important enhancement: recourse to a pool of assets that secures or "covers" the bond if the originator (usually a financial institution) becomes insolvent. These assets act as additional credit cover; they do not have any bearing on the contractual cash flow to the investor, as is the case with Securitized assets. Before the outbreak of the Financial Crisis in 2008, this enhancement typically (although not always) resulted in the bonds being assigned AAA credit ratings. Due to the realization that many of the loans backing these bonds were of a low quality, credit ratings declined sharply. This diminished the demand for all the types of asset backed or covered bonds, contributing to the Global Financial Crisis.

For the investor, one major advantage to a covered bond is that the debt and the underlying asset pool remain on the issuer's financial, and issuers must ensure that the pool consistently backs the covered bond. In the event of default, the investor has recourse to both the pool and the issuer.

Because non-performing loans or prematurely paid debt must be replaced in the pool, the success of the product for the issuer depends on the institution's ability to evaluate the assets in the pool and to rate and price the bond.

#### **3.5.1.2 History**

Covered bonds were created in Prussia in 1769 by Frederick The Great and in Denmark in 1795. Danish covered bond lending emerged after the Great Fire of Copenhagen in 1795, when a quarter of the city burnt to the ground. After the fire, a great need arose for an organized credit market as a large number of new buildings were needed over a short period of time. Today nearly all real estate is financed with covered bonds in Denmark, and Denmark is the 3rd largest issuer in Europe.

In Prussia these Pfandbriefe were sold by the estates of the country and regulated under public law. They were secured by real estate and subsidiary by the issuing estate. In about 1850, the first mortgage banks were allowed to sell Pfandbriefe as a means to refinance mortgage loans. With the mortgage banks law of 1900, the whole German Empire was given a standardized legal foundation for the issuance of Pfandbriefe.

Pfandbriefe are quite common in Germany and Europe and are utilized as a financial instrument with great success. In its more than 200 years of history, there was not even a single case of a defaulted Pfandbrief.

For this reason and due to the security provided by the cover pool, covered bonds were one of the first markets to recover following the global financial crisis of late 2008.

### 3.5.1.3 USA

On 28 July 2008, US Treasury Secretary Henry Paulson announced that, along with four large US banks, the Treasury would attempt to kick-start a market for these securities in the USA, primarily to provide an alternative form of mortgage-backed securities. The guidelines issued specifically address covered bonds backed by pools of eligible mortgages.

The Federal Reserve also announced that it would potentially consider highly rated covered bonds as acceptable collateral for emergency fund requests. Because the United States have already shown a robust market for other securitized debt products, regulators have been promoting the covered bond market strategy.

### 3.5.1.4 New Zealand

On 3 June 2010, Bank of New Zealand announced that it had launched the first covered bond program in Australasia. Covered bonds issued by Bank of New Zealand will be rated 'AAA' by Moody's Investor Service and 'AAA' by Fitch Ratings. No issuers in New Zealand, Australia or surrounding countries have issued covered bonds previously.

## 3.6 Debenture

A **debenture** is a document that either creates a debt or acknowledges it, and it is a debt without collateral. In corporate finance, the term is used for a medium- to long-term debt instrument used by large companies to borrow money. In some countries the term is used interchangeably to **bond, loan stock or not**. A debenture is thus like a certificate of loan or a loan bond evidencing the fact that the company is liable to pay a specified amount with interest and despite the money raised by the debentures becomes a part of the company's capital structure, it does not become share capital. Senior debentures get paid before subordinate debentures, and there are varying rates of risk and payoff for these categories.

Debentures are generally freely transferable by the debenture holder. Debenture holders have no rights to vote in the company's general meetings of shareholders, but they may have separate meetings or votes e.g. On changes to the rights attached to the debentures. The interest paid to them is a charge against profit in the company's financial statements.

### 3.6.1 Attributes

- A movable property.
- Issued by the company in the form of a certificate of indebtedness.
- It generally specifies the date of redemption, repayment of principal and interest on specified dates.
- May or may not create a charge on the assets of the company.
- Corporations often issue bonds of around \$1,000, while government bonds are more likely to be \$5,000.

Debentures gave rise to the idea of the rich "clipping their coupons," which means that a bondholder will present their "coupon" to the bank and receive a payment each quarter (or in whatever period is specified in the agreement).

There are also other features that minimize risk, such as a "sinking fund," which means that the debtor must pay some of the value of the bond after a specified period of time. This decreases risk for the creditors, as a hedge against inflation, bankruptcy, or other risk factors. A sinking fund makes the bond less risky, and therefore gives it a smaller "coupon" (or interest payment). There are also options for "convertibility," which means a creditor may turn their bonds into equity in the company if it does well. Companies also reserve the right to call their bonds, which mean they can call it sooner than the maturity date. Often there is a clause in the contract that allows this; for example, if a bond issuer wishes to rebuy a 30 year bond at the 25th year, they must pay a premium. If a bond is called, it means that less interest is paid out.

Failure to pay a bond effectively means bankruptcy. Bondholders who have not received their interest can throw an offending company into bankruptcy, or seize its assets if that is stipulated in the contract.

### 3.6.2 Security in different jurisdictions

In the United States, debenture refers specifically to an unsecured corporate bond, i.e. A bond that does not have a certain line of income or a piece of property or equipment to guarantee repayment of the principal upon the bond's maturity. Where security is provided for loan stocks or bonds in the US, they are termed 'mortgage bonds'.

However, in the United Kingdom a debenture is usually secured.

In Canada, a debenture refers to a secured loan instrument where security is generally over the debtor's credit, but security is not pledged to specific assets. Like other secured debts, the debenture gives the debtor priority status over unsecured creditors in a bankruptcy; however debt instruments where security is pledged to specific assets (such as a bond) receive a higher priority status in a bankruptcy than do debentures.

In Asia, if repayment is secured by a charge over land, the loan document is called a mortgage; where repayment is secured by a charge against other assets of the company, the document is called a debenture; and where no security is involved, the document is called a note or 'unsecured deposit note'.

### 3.6.3 Convertibility

There are two types of debentures:

1. **Convertible debentures**, which are convertible bonds or bonds that can be converted into equity shares of the issuing company after a predetermined period of time. "Convertibility" is a feature that corporations may add to the bonds they issue to make them more attractive to buyers. In other words, it is a special feature that a corporate bond may carry. As a result of the advantage a buyer gets from the ability to convert, convertible bonds typically have lower interest rates than non-convertible corporate bonds.
2. **Non-convertible debentures**, which are simply regular debentures, cannot be converted into equity shares of the liable company. They are debentures without the convertibility feature

attached to them. As a result, they usually carry higher interest rates than their convertible counterparts.

#### **3.6.4 Debentures are classified into three classes:**

- (a) Debentures payable to a registered holder, and debentures payable to a bearer.
- (b) Secured and unsecured debentures.
- (c) Redeemable and perpetual debentures.

##### **3.6.4.1 Registered debentures and bearer debentures:**

Registered debenture is one which is registered in the name of a holder in the books of the company. It is transferable in the same way as a share. These debentures are not negotiable instruments. Interest on such a debenture is payable to the registered holder or the order of the registered holder.

A company may issue debentures payable to the bearer. These are negotiable instruments and the title to them is, therefore, transferable by mere delivery of the debenture to the transferee. In case of bearer debentures, the company keeps no register of debenture holders in respect of them, but if such debentures are secured they must be entered in respect of them, but if such debentures are secured they must be entered in the register of charges. The coupon is attached to the bearer debenture for payment of interest and must be presented for payment to the company's bankers when the date of payment arrives.

##### **3.6.4.2 Secured and unsecured debentures:**

Debentures issued by a company may be secured or unsecured. Debentures which do not carry any charge on the assets of the company are unsecured or naked debentures. In such a case the debenture-holder is an ordinary unsecured creditor of the company.

When any assets or property of the company are charged in favor of the debenture-holder, the debentures are deemed to be secure. The charges which a company may create on its assets may be:

- i) By way of a specific charge or mortgage on a particular property of the company;
- ii) By way of floating charge;
- iii) By both a specific and a floating charge.

##### **3.6.4.3 Redeemable and perpetual debentures:**

Debentures issued by the company are generally redeemable. A redeemable debenture is one under which the principal money is paid-off to the debenture-holder on the expiry of the fixed term. The company may redeem a certain number of debentures each year or option may be given to the company to redeem all of them by a specified date. Redeemed debentures can be re-issued by the company either by re-issuing the same debentures or by issuing the other debentures in their place.

Perpetual debentures are also known as irredeemable debentures. Such debentures are payable only in the event of a winding up or on some serious default by the company or payable at a remote period- such

as a hundred years after issue. If debentures are issued as irredeemable or perpetual, there would be no time within which the company would be bound to pay them. This does not mean that the company can never pay them off even if it wishes to do so. It only means that the creditors cannot at any time compel the company to redeem them. A perpetual mortgage in the nature of a debenture issued by a company is valid under section 120 of the companies act; through it will be invalid under transfer of property act.

#### 3.6.4.4 Convertible debentures:

In the case of these debentures an option is given to the debenture-holders to convert them into preference or equity shares at a stated rate of exchange after a certain period. Section 81(3) permits the issue of this type of debentures. This section provides for the issue of share to debenture-holders and creditors in exchange for the amount due to them where the terms of the issue of debentures or loans provide for such exchange and such terms are approved both by the special resolution of the company and by the central government.

### 3.7 Working capital

**Working capital** (abbreviated **WC**) is a financial metric which represents operating liquidity available to a business, organization or other entity, including governmental entity. Along with fixed assets such as plant and equipment, working capital is considered a part of operating capital. Net working capital is calculated as current assets minus current liabilities. It is a derivation of working capital, that is commonly used in valuation techniques such as DCFs (Discounted cash flows). If current assets are less than current liabilities, an entity has a **working capital deficiency**, also called a **working capital deficit**.

A company can be endowed with assets and profitability but short of liquidity if its assets cannot readily be converted into cash. Positive working capital is required to ensure that a firm is able to continue its operations and that it has sufficient funds to satisfy both maturing short-term debt and upcoming operational expenses. The management of working capital involves managing inventories, accounts receivable and payable, and cash.

#### 3.7.1 Calculation

*Current assets and current liabilities* include *three accounts* which are of special importance. These accounts represent the areas of the business where managers have the most direct impact:

- accounts receivable (current asset)
- inventory (current assets), and
- accounts payable (current liability)

The current portion of debt (payable within 12 months) is critical, because it represents a short-term claim to current assets and is often secured by long term assets. Common types of short-term debt are bank loans and lines of credit.

An increase in working capital indicates that the business has either increased current assets (that it has increased its receivables, or other current assets) or has decreased current liabilities—for example has paid off some short-term creditors, or a combination of both.

*Implications on M&A:* The common commercial definition of working capital for the purpose of a working capital adjustment in an M&A transaction (i.e. for a working capital adjustment mechanism in a sale and purchase agreement) is equal to:

*Current Assets – Current Liabilities excluding deferred tax assets/liabilities, excess cash, surplus assets and/or deposit balances.*

Cash balance items often attract a one-for-one, purchase-price adjustment.

### 3.7.3 Working capital management

Decisions relating to working capital and short term financing are referred to as *working capital management*. These involve managing the relationship between a firm's short-term assets and its short-term liabilities. The goal of working capital management is to ensure that the firm is able to continue its operations and that it has sufficient cash flow to satisfy both maturing short-term debt and upcoming operational expenses.

A managerial accounting strategy focusing on maintaining efficient levels of both components of working capital, current assets and current liabilities, in respect to each other. Working capital management ensures a company has sufficient cash flow in order to meet its short-term debt obligations and operating expenses.

#### 3.7.3.1 Decision criteria

By definition, working capital management entails short-term decisions—generally, relating to the next one-year period—which are "reversible". These decisions are therefore not taken on the same basis as capital-investment decisions (NPV or related, as above); rather, they will be based on cash flows, or profitability, or both.

- One measure of cash flow is provided by the cash conversion cycle—the net number of days from the outlay of cash for raw material to receiving payment from the customer. As a management tool, this metric makes explicit the inter-relatedness of decisions relating to inventories, accounts receivable and payable, and cash. Because this number effectively corresponds to the time that the firm's cash is tied up in operations and unavailable for other activities, management generally aims at a low net count.
- In this context, the most useful measure of profitability is return on capital (ROC). The result is shown as a percentage, determined by dividing relevant income for the 12 months from capital employed; return on equity (ROE) shows this result for the firm's shareholders. Firm value is enhanced when, and if, the return on capital, which results from working-capital management, exceeds the cost of capital, which results from capital investment decisions as above. ROC measures are therefore useful as a management tool, in that they link short-term policy with long-term decision making.
- Credit policy of the firm: Another factor affecting working capital management is credit policy of the firm. It includes buying of raw material and selling of finished goods either in cash or on credit. This affects the cash conversion cycle.

#### 3.7.3.2 Management of working capital

Guided by the above criteria, management will use a combination of policies and techniques for the management of working capital. The policies aim at managing the *current assets* (generally cash and cash equivalents, inventories and debtors) and the short term financing, such that cash flows and returns are acceptable.

- **Cash management.** Identify the cash balance which allows for the business to meet day to day expenses, but reduces cash holding costs.
- **Inventory management.** Identify the level of inventory which allows for uninterrupted production but reduces the investment in raw materials - and minimizes reordering costs - and hence increases cash flow. Besides this, the lead times in production should be lowered to reduce Work in Process (WIP) and similarly, the Finished Goods should be kept on as low level as possible to avoid over production - see Supply chain management; Just In Time (JIT); Economic order quantity (EOQ); Economic quantity
- **Debtors management.** Identify the appropriate credit policy, i.e. credit terms which will attract customers, such that any impact on cash flows and the cash conversion cycle will be offset by increased revenue and hence Return on Capital (or *vice versa*);
- **Short term financing.** Identify the appropriate source of financing, given the cash conversion cycle: the inventory is ideally financed by credit granted by the supplier; however, it may be necessary to utilize a bank loan (or overdraft), or to "convert debtors to cash" through "factoring".

### 3.7.3.3 Short Term Sources of Working Capital Financing

| Factoring                                                                                                                                                                                                                                                                                        | Instalment Credit                                                                                                                                    | Invoice Discounting                                                                                                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Factoring is a traditional source of short term funding. Factoring facility arrangements tend to be restrictive and entering into a whole-turnover factoring facility can lead to aggressive chasing of outstanding invoices from clients, and a loss of control of a company's credit function. | Instalment credit is a form of finance to pay for goods or services over a period through the payment of principal and interest in regular payments. | Invoice Discounting is a form of asset based finance which enables a business to release cash tied up in an invoice and unlike factoring enables a client to retain control of the administration of its debtors. |
| Income received in advance                                                                                                                                                                                                                                                                       | Advances received from customers                                                                                                                     | Bank Overdraft                                                                                                                                                                                                    |
| Income received in advance is seen as a liability because it is money that does not correlate to that specific accounting or business year but rather for one that is still to come. The income account will then be credited to the income received in advance account and the income received  | A liability account used to record an amount received from a customer before a service has been provided or before goods have been shipped.          | A bank overdraft is when someone is able to spend more than what is actually in their bank account. The overdraft will be limited. A bank overdraft is also a type of loan as the money is technically borrowed.  |

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| in advance will be debited to the income account such as rent.                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Commercial Papers</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Trade Finance</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Letter of Credit</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <p>A commercial paper is an unsecured promissory note. Commercial paper is a money-market security issued by large corporations to get money to meet short term debt obligations e. g. payroll, and is only backed by an issuing bank or corporation's promise to pay the face amount on the maturity date specified in the note. Since it is not backed by collateral, only firms with excellent credit ratings will be able to sell their commercial paper at a reasonable price.</p> | <p>An exporter requires an importer to prepay for goods shipped. The importer naturally wants to reduce risk by asking the exporter to document that the goods have been shipped. The importer's bank assists by providing a letter of credit to the exporter (or the exporter's bank) providing for payment upon presentation of certain documents, such as a bill of lading. The exporter's bank may make a loan to the exporter on the basis of the export contract.</p> | <p>A letter of credit is a document that a financial institution issues to a seller of goods or services which says that the issuer will pay the seller for goods/services the seller delivers to a third-party buyer. The issuer then seeks reimbursement from the buyer or from the buyer's bank. The document is essentially a guarantee to the seller that it will be paid by the issuer of the letter of credit regardless of whether the buyer ultimately fails to pay. In this way, the risk that the buyer will fail to pay is transferred from the seller to the letter of credit's issuer.</p> |

### 3.8 Project financing package

#### 3.8.1 Project finance

**Project finance** is the long-term financing of infrastructure and industrial projects based upon the projected cash flows of the project rather than the balance sheets of its sponsors. Usually, a project financing structure involves a number of equity investors, known as 'sponsors', as well as a 'syndicate' of banks or other lending institutions that provide loans to the operation. They are most commonly non-recourse loans, which are secured by the project assets and paid entirely from project cash flows, rather than from the general assets or creditworthiness of the project sponsors, a decision in part supported by financial modeling. The financing is typically secured by all of the project assets, including the revenue-producing contracts. Project lenders are given a lien on all of these assets and are able to assume control of a project if the project company has difficulties complying with the loan terms.

Generally, a special purpose entity is created for each project, thereby shielding other assets owned by a project sponsor from the detrimental effects of a project failure. As a special purpose entity, the project company has no assets other than the project. Capital contribution commitments by the owners of the project company are sometimes necessary to ensure that the project is financially sound or to assure the lenders of the sponsors' commitment. Project finance is often more complicated than alternative financing methods. Traditionally, project financing has been most commonly used in the extractive (mining), transportation, telecommunications industries as well as sports and entertainment venues.

Risk identification and allocation is a key component of project finance. A project may be subject to a number of technical, environmental, economic and political risks, particularly in developing countries and emerging markets. Financial institutions and project sponsors may conclude that the risks inherent in project development and operation are unacceptable (unfinanceable). "Several long-term contracts such as construction, supply, off-take and concession agreements, along with a variety of joint-ownership structures are used to align incentives and deter opportunistic behavior by any party involved in the project." The patterns of implementation are sometimes referred to as "project delivery methods." The financing of these projects must be distributed among multiple parties, so as to distribute the risk associated with the project while simultaneously ensuring profits for each party involved.

A riskier or more expensive project may require **limited recourse financing** secured by a surety from sponsors. A complex project finance structure may incorporate corporate finance, securitization, options (derivatives), insurance provisions or other types of collateral enhancement to mitigate unallocated risk.

Project finance shares many characteristics with maritime finance and aircraft finance; however, the latter two are more specialized fields within the area of asset finance.

### 3.8.2 History

Limited recourse lending was used to finance maritime voyages in ancient Greece and Rome. Its use in infrastructure projects dates for the development of the Panama Canal, and was widespread in the US oil and gas industry during the early 20th century. However, project finance for high-risk infrastructure schemes originated with the development of the North Sea oil fields in the 1970s and 1980s. Such projects were previously accomplished through utility or government bond issuances, or other traditional corporate finance structures.

Project financing in the developing world peaked around the time of the Asian financial crisis, but the subsequent downturn in industrializing countries was offset by growth in the OECD countries, causing worldwide project financing to peak around 2000. The need for project financing remains high throughout the world as more countries require increasing supplies of public utilities and infrastructure. In recent years, project finance schemes have become increasingly common in the Middle East, some incorporating Islamic finance.

The new project finance structures emerged primarily in response to the opportunity presented by long term power purchase contracts available from utilities and government entities. These long term revenue streams were required by rules implementing PURPA, the Policy resulted in further deregulation of electric generation and, significantly, international privatization following amendments to the Public Utilities Holding Company Act in 1994. The structure has evolved and forms the basis of energy and other projects throughout the world.

### 3.8.3 Parties to a project financing

There are several parties in a project financing depending on the type and the scale of a project. The most usual parties to a project financing are;

1. Project
2. Sponsor
3. Lenders
4. Financial Advisors

5. Technical Advisors
6. Legal Advisors
7. Debt Financiers
8. Equity Investors
9. Regulatory Agencies
10. Multilateral Agencies

#### **3.8.4 Project development**

Project development is the process of preparing a new project for commercial operations. The process can be divided into three distinct phases:

- Pre-bid stage
- Contract negotiation stage
- Money-raising stage

#### **3.8.5 Financial model**

A financial model is constructed by the sponsor as a tool to conduct negotiations with the sponsor and prepare a project appraisal report. It is usually a computer spreadsheet that processes a comprehensive list of input assumptions and provides outputs that reflect the anticipated real life interaction between data and calculated values for a particular project.

Properly designed, the financial model is capable of sensitivity analysis, i.e. calculating new outputs based on a range of data variations.

#### **3.8.6 Contractual framework**

The typical project finance documentation can be reconducted to four main types:

- Shareholder/sponsor documents
- Project documents
- Finance documents
- Other project documents

#### **3.8.7 Engineering, procurement and construction contract**

The most common project finance construction contract is the engineering, procurement and construction (EPC) contract. An EPC contract generally provides for the obligation of the contractor to build and deliver the project facilities on a turnkey basis, i.e., at a certain pre-determined fixed price, by a certain date, in accordance with certain specifications, and with certain performance warranties. The EPC contract is quite complicated in terms of legal issue, therefore the project company and the EPC contractor need sufficient experience and knowledge of the nature of the project to avoid their faults and minimize the risks during contract execution.

An EPC contract differs from a turnkey contract that, under a turnkey contract, all aspects of construction are included from design to engineering, procurement and construction whereas in the EPC contract the

design aspect is not included. Other alternative forms of construction contract are project management approach and alliance contracting. Basic contents of an EPC contract are:

- Description of the project
- Price
- Payment
- Completion date
- Completion guarantee and liquidated damages (LDs):
- Performance guarantee and LDs
- Cap under LDs

### **3.8.8 Operation and maintenance agreement**

An operation and maintenance (O&M) agreement is an agreement between the project company and the operator. The project company delegates the operation, maintenance and often performance management of the project to a reputable operator with expertise in the industry under the terms of the O&M agreement. The operator could be one of the sponsors of the project company or third-party operator. In other cases the project company may carry out by itself the operation and maintenance of the project and may eventually arrange for the technical assistance of an experienced company under a technical assistance agreement. Basic contents of an O&M contract are:

- Definition of the service
- Operator responsibility
- Provision regarding the services rendered
- Liquidated damages
- Fee provisions

### **3.8.9 Concession deed**

An agreement between the project company and a public-sector entity (the contracting authority) is called a concession deed. The concession agreement concedes the use of a government asset (such as a plot of land or river crossing) to the project company for a specified period. A concession deed would be found in most projects which involve government such as in infrastructure projects. The concession agreement may be signed by a national/regional government, a municipality, or a special purpose entity set up by the state to grant the concession. Examples of concession agreements include contracts for the following:

- A toll-road or tunnel for which the concession agreement giving a right to collect tolls/fares from public or where payments are made by the contracting authority based on usage by the public.
- A transportation system (e.g., a railway / metro) for which the public pays fares to a private company)
- Utility projects where payments are made by a municipality or by end-users.
- Ports and airports where payments are usually made by airlines or shipping companies.
- Other public sector projects such as schools, hospitals, government buildings, where payments are made by the contracting authority.

### **3.8.10 Shareholders Agreement**

The shareholders agreement (SHA) is an agreement between the project sponsors to form a special purpose company (SPC) in relation to the project development. This is the most basic of structures held

by the sponsors in a project finance transaction. This is an agreement between the sponsors and deals with:

- Injection of share capital
- Voting requirements
- Resolution of force one
- Dividend policy
- Management of the SPV
- Disposal and pre-emption rights

### **3.8.11 Off-take agreement**

An off-take agreement is an agreement between the project company and the off-taker (the party who is buying the product / service the project produces / delivers). In a project financing the revenue is often contracted (rather to the sold on a merchant basis). The off-take agreement governs mechanism of price and volume which make up revenue. The intention of this agreement is to provide the project company with stable and sufficient revenue to pay its project debt obligation, cover the operating costs and provide certain required return to the sponsors.

The main off-take agreements are:

- Take-or-pay contract: under this contract in the off-taker – on an agreed price basis – is obligated to pay for the product on a regular basis whether or not the off-taker actually takes the product.
- Power purchase agreement: commonly used in power projects in emerging markets. The purchasing entity is usually a government entity.
- Take-and-pay contract: the off-taker only pays for the product taken on an agreed price basis.
- Long-term sales contract: the off-taker agrees to take agreed-upon quantities of the product from the project. The price is however paid based on market prices at the time of purchase or an agreed market index, subject to certain floor (minimum) price. Commonly used in mining, oil and gas, and petrochemical projects where the project company wants to ensure that its product can easily be sold in international markets, but off-takers not willing to take the price risk
- Hedging contract: found in the commodity markets such as in an oilfield project.
- Contract for Differences: the project company sells its product into the market and not to the off-taker or hedging counterpart. If however the market price is below an agreed level, the off-taker pays the difference to the project company, and vice versa if it is above an agreed level.
- Throughput contract: a user of the pipeline agrees to use it to carry not less than a certain volume of product and to pay a minimum price for this.

### **3.8.12 Supply agreement**

A supply agreement is between the project company and the supplier of the required feedstock / fuel.

If a project company has an off-take contract, the supply contract is usually structured to match the general terms of the off-take contract such as the length of the contract, force major provisions, etc. The volume of input supplies required by the project company is usually linked to the project's output. Example under a PPA the power purchaser who does not require power can ask the project to shut down the power plant and continue to pay the capacity payment – in such case the project company needs to ensure its obligations to buy fuel can be reduced in parallel. The degree of commitment by the supplier can vary.

The main supply agreements are:

- Fixed or variable supply: the supplier agrees to provide a fixed quantity of supplies to the project company on an agreed schedule, or a variable supply between an agreed maximum and minimum. The supply may be under a take-or-pay or take-and-pay.
- Output / reserve dedication: the supplier dedicates the entire output from a specific source, e.g., a coal mine, its own plant. However the supplier may have no obligation to produce any output unless agreed otherwise. The supply can also be under a take-or-pay or take-and-pay
- Interruptible supply: some supplies such as gas are offered on a lower-cost interruptible basis – often via a pipeline also supplying other users.
- Tolling contract: the supplier has no commitment to supply at all, and may choose not to do so if the supplies can be used more profitably elsewhere. However the availability charge must be paid to the project company.

### **3.8.13 Loan agreement**

A loan agreement is made between the project company (borrower) and the lenders. Loan agreement governs the relationship between the lenders and the borrowers. It determines the basis on which the loan can be drawn and repaid, and contains the usual provisions found in a corporate loan agreement. It also contains the additional clauses to cover the specific requirements of the project and project documents.

The basic terms of a loan agreement include the following provisions.

- General conditions precedent
- Conditions precedent to each drawdown
- Availability period, during which the borrower is obliged to pay a commitment fee
- Drawdown mechanics
- An interest clause, charged at a margin over base rate
- A repayment clause
- Financial covenants - calculation of key project metrics / ratios and covenants
- Dividend restrictions
- Representations and warranties
- The illegality clause

### **3.8.13 Intercreditor agreement**

Intercreditor agreement is agreed between the main creditors of the project company. This is the agreement between the main creditors in connection with the project financing. The main creditors often enter into the Intercreditor Agreement to govern the common terms and relationships among the lenders in respect of the borrower's obligations.

Intercreditor agreement will specify provisions including the following.

- Common terms
- Order of drawdown
- Cashflow waterfall
- Limitation on the ability of creditors to vary their rights
- Voting rights
- Notification of defaults

- Order of applying the proceeds of debt recovery
- If there is a mezzanine funding component, the terms of subordination and other principles to apply as between the senior debt providers and the mezzanine debt providers.

### **3.8.14 Tripartite deed**

The financiers will usually require that a direct relationship between itself and the counterparty to that contract be established which is achieved through the use of a tripartite deed (sometimes called a consent deed, direct agreement or side agreement). The tripartite deed sets out the circumstances in which the financiers may “step in” under the project contracts in order to remedy any default.

A tripartite deed would normally contain the following provision.

- Acknowledgement of security: confirmation by the contractor or the relevant party that it consents to the financier taking security over the relevant project contracts.
- Notice of default: obligation on the relevant project counterparty to notify the lenders directly of defaults by the project company under the relevant contract.
- Step-in rights and extended periods: to ensure that the lenders will have sufficient notice /period to enable it to remedy any breach by the borrower.
- Receivership: acknowledgement by the relevant party regarding the appointment of a receiver by the lenders under the relevant contract and that the receiver may continue the borrower’s performance under the contract
- Sale of asset: terms and conditions upon which the lenders may transfer the borrower’s entitlements under the relevant contract.

Tripartite deed can give rise to difficult issues for negotiation but is a critical document in project financing.

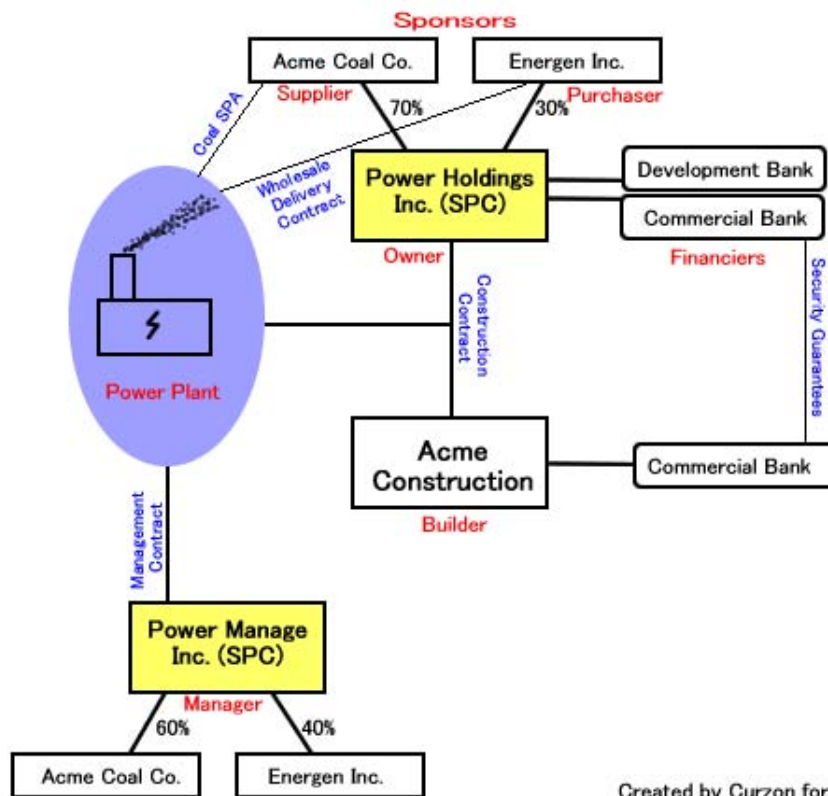
### **3.8.15 Common Terms Agreement**

#### **3.8.15.1 Terms Sheet**

Agreement between the borrower and the lender for the cost, provision and repayment of debt. The term sheet outlines the key terms and conditions of the financing. The term sheet provides the basis for the lead arrangers to complete the credit approval to underwrite the debt, usually by signing the agreed term sheet. Generally the final term sheet is attached to the mandate letter and is used by the lead arrangers to syndicate the debt. The commitment by the lenders is usually subject to further detailed due diligence and negotiation of project agreements and finance documents including the security documents. The next phase in the financing is the negotiation of financial documents and the term sheet will eventually be replaced by the definitive finance documents when the project reaches financial close.

### 3.8.15.2 Basic scheme

#### Typical Structure of a Project Finance Scheme



#### Hypothetical project finance scheme

Acme Coal Co. imports coal. Energen Inc. supplies energy to consumers. The two companies agree to build a power plant to accomplish their respective goals. Typically, the first step would be to sign a memorandum of understanding to set out the intentions of the two parties. This would be followed by an agreement to form a joint venture.

Acme Coal and Energen form an SPC (Special Purpose Corporation) called Power Holdings Inc. and divide the shares between them according to their contributions. Acme Coal, being more established, contributes more capital and takes 70% of the shares. Energen is a smaller company and takes the remaining 30%. The new company has no assets.

Power Holdings then sign a construction contract with Acme Construction to build a power plant. Acme Construction is an affiliate of Acme Coal and the only company with the know-how to construct a power plant in accordance with Acme's delivery specification.

A power plant can cost hundreds of millions of dollars. To pay Acme Construction, Power Holdings receives financing from a development bank and a commercial bank. These banks provide a guarantee to

Acme Construction's financier that the company can pay for the completion of construction. Payment for construction is generally paid as such: 10% up front, 10% midway through construction, 10% shortly before completion, and 70% upon transfer of title to Power Holdings, which becomes the owner of the power plant.

Acme Coal and Energen form Power Manage Inc., another SPC, to manage the facility. The ultimate purpose of the two SPCs (Power Holding and Power Manage) is primarily to protect Acme Coal and Energen. If a disaster happens at the plant, prospective plaintiffs cannot sue Acme Coal or Energen and target their assets because neither company owns or operates the plant.

A Sale and Purchase Agreement (SPA) between Power Manage and Acme Coal supplies raw materials to the power plant. Electricity is then delivered to Energen using a wholesale delivery contract. The cash flow of both Acme Coal and Energen from this transaction will be used to repay the financiers.

### 3.8.15.3 Complicating factors

The above is a simple explanation which does not cover the mining, shipping, and delivery contracts involved in importing the coal (which in itself could be more complex than the financing scheme), nor the contracts for delivering the power to consumers. In developing countries, it is not unusual for one or more government entities to be the primary consumers of the project, undertaking the "last mile distribution" to the consuming population. The relevant purchase agreements between the government agencies and the project may contain clauses guaranteeing a minimum offtake and thereby guarantee a certain level of revenues. In other sectors including road transportation, the government may toll the roads and collect the revenues, while providing a guaranteed annual sum (along with clearly specified upside and downside conditions) to the project. This serves to minimize or eliminate the risks associated with traffic demand for the project investors and the lenders.

Minority owners of a project may wish to use "off-balance-sheet" financing, in which they disclose their participation in the project as an investment, and excludes the debt from financial statements by disclosing it as a footnote related to the investment. In the United States, this eligibility is determined by the Financial Accounting Standards Board. Many projects in developing countries must also be covered with war risk insurance, which covers acts of hostile attack, derelict mines and torpedoes, and civil unrest which are not generally included in "standard" insurance policies. Today, some altered policies that include terrorism are called *Terrorism Insurance* or *Political Risk Insurance*. In many cases, an outside insurer will issue a performance bond to guarantee timely completion of the project by the contractor.

Publicly funded projects may also use additional financing methods such as tax increment financing or Private Finance Initiative (PFI). Such projects are often governed by a Capital Improvement Plan which adds certain auditing capabilities and restrictions to the process.

Project financing in transitional and emerging market countries are particularly risky because of cross-border issues such as political, currency and legal system risks. Therefore, mostly requires active facilitation by the government.

*Review Questions*

1. Define the Development banking?
2. Explain the different types of capital?
3. Explain the generation of funds?
4. Explain the different types of financing?

Discussion Questions

Discuss the Project financing and its different aspects?

## Project implementation

### Learning Objectives

- To define the Project implementation stages.
- To explain the Management techniques for project management.
- To explain the project monitoring.
- To describe the management reporting.

### 4.1 Project implementation – stages

Often a smoothly run project gets a black eye because of problems during implementation. Those problems often crop up because we don't anticipate and plan for the complexity of deploying the solution. For example, you might communicate and plan well for the deployment of a client-server solution, only to discover during implementation that many of your workstations aren't powerful enough to handle the load. This is the type of minor detail that can cause major headaches.

Let's look at the major steps associated with implementation. Note that many of these activities need to be completed ahead of time. You cannot start planning for implementation while you are actually implementing.

1. **Prepare the infrastructure.** Many solutions are implemented in a production environment that is separate and distinct from where the solution was developed and tested. It is important that the characteristics of the production environment be accounted for. This strategy includes a review of hardware, software, communications, etc. In our example above, the potential desktop capacity problem would have been revealed if we had done an evaluation of the production (or real-world) environment. When you are ready for implementation, the production infrastructure needs to be in place.
2. **Coordinate with the organizations involved in implementation.** This may be as simple as communicating to your client community. However, few solutions today can be implemented without involving a number of organizations. For IT solutions, there are usually one or more operations and infrastructure groups that need to be communicated to ahead of time. Many of these groups might actually have a role in getting the solution successfully deployed. Part of the implementation work is to coordinate the work of any other groups that have a role to play. In some cases, developers simply failed to plan ahead and make sure the infrastructure groups were prepared to support the implementation. As a result, the infrastructure groups were forced to drop everything to make the implementation a success.
3. **Implement training.** Many solutions require users to attend training or more informal coaching sessions. This type of training could be completed in advance, but the further out the training is held, the less information will be retained when implementation rolls around. Training that takes place close to the time of implementation should be made part of the actual implementation plan.
4. **Install the production solution.** This is the piece everyone remembers. Your solution needs to be moved from development to test. If the solution is brand new, this might be finished in a leisurely and thoughtful manner over a period of time. If this project involves a major change to a current solution, you may have a lot less flexibility in terms of when the new solution moves to production, since the solution might need to be brought down for a period of time. You have to

make sure all of your production components are implemented successfully, including new hardware, databases, and program code.

5. **Convert the data.** Data conversion, changing data from one format to another, needs to take place once the infrastructure and the solution are implemented.
6. **Perform final verification in production.** You should have prepared to test the production solution to ensure everything is working as you expect. This may involve a combination of development and client personnel. The first check is just to make sure everything is up and appears okay. The second check is to actually push data around in the solution, to make sure that the solution is operating as it should. Depending on the type of solution being implemented, this verification step could be extensive.
7. **Implement new processes and procedures.** Many IT solutions require changes to be made to business processes as well. These changes should be implemented at the same time that the actual solution is deployed.
8. **Monitor the solution.** Usually the project team will spend some period of time monitoring the implemented solution. If there are problems that come up immediately after implementation, the project team should address and fix them.

#### **4.1.1 Elements of a Project Implementation Plan**

1. The most important elements of the borrower's Project Implementation Plan (PIP) are covered in the Staff Appraisal Report. The elements that are essential for achieving the project's objectives are incorporated into the legal documents. Other elements, agreed with the borrower and implementing agencies, are included in the Minutes of Negotiations or incorporated into letters of intent to serve as a convenient performance monitoring system that can be modified during project implementation through a simple exchange of letters.

##### **4.1.1.1 The PIP contains the following elements:**

###### **4.1.1.1.1 The Project**

Summary of project scope and objectives.

- Detailed project description: detailed financial and economic analysis of the project, including a description of assumptions; description of main project risks (internal and external); critical factors that could affect the project's success, and an assessment of the project's sensitivity to them.
- Detailed financing plan.

###### **4.1.1.1.2 Implementation Arrangements**

- Organization responsible for the project.
- Implementation agreement between the borrower and implementation agencies.
- Responsibilities of the implementing agencies and other stakeholders.
- Relationship of the implementing agency with other entities (ministries, project beneficiaries, etc.); participation arrangements.
- Role of the Bank during project implementation.
- Administrative arrangements for project implementation.

###### **4.1.1.1.3 Implementation Plan**

- Time-bound detailed implementation plan for each project component, including technical assistance and training.
- Schedule of procurement actions, including target dates for each step.
- Schedule of disbursements for each project component, detailing expected Bank financing, government counterpart funds, and cofinancing.
- Specific actions required to achieve the project's development impact objectives (including implementation of environmental and social actions specified in any mitigation plans, resettlement plans, and indigenous peoples plans).
- Provision for setting up project accounting and financial management system; agreement on a timetable for appointing auditors to audit the institutions' financial statements (short- and long-form audit, including management letter), project accounts, revolving fund accounts, statements of expenditure, etc.

#### **4.1.1.1.4 Monitoring and Evaluation**

- Key development impact indicators for measuring progress in reaching project development objectives.
- Key progress indicators for monitoring delivery of project inputs and achievement of project outputs.
- Key financial indicators to assess the project's budgetary and financial health.
- Major loan covenants that require special attention.

## **4.2 Bottlenecks in project implementation**

A **bottleneck** is a phenomenon where the performance or capacity of an entire system is limited by a single or limited number of components or resources. The term bottleneck is taken from the 'assets are water' metaphor. As water is poured out of a bottle, the rate of outflow is limited by the width of the conduit of exit—that is, bottleneck. By increasing the width of the bottleneck one can increase the rate at which the water flows out of the neck at different frequencies. Such limiting components of a system are sometimes referred to as **bottleneck points**.

### **4.2.1 Project management**

A **bottleneck** in project management is one process in a chain of processes, such that its limited capacity reduces the capacity of the whole chain.

Related ideas in project management are:

- Critical path method
- Theory of Constraints

And an example is the lack of smelter and refinery supply which cause bottlenecks upstream.

Another example is in a Surface Mount Technology (SMT) Board Assembly Line with several equipments aligned, usually the common sense is driven to set up and shift the bottleneck element

towards the end of the process, inducing the better and faster machines to always keep the PCB supply flowing up, never allowing the slower ones to fully stop, a fact that would be heeded as a deleterious and the significant overall drawback on the process.

#### **4.2.2 Why Bottlenecks Occur**

Some of the most common six sigma implementation bottlenecks arise due to errors in the decision making process, which ultimately leads to higher COPQ (cost of poor quality). The basic characteristic and intensity of these bottlenecks varies, depending on the organization's size and the number of processes it currently employs. The process of identifying bottlenecks is quite complicated as the bottlenecks can occur at any stage of the implementation.

#### **4.2.3 Common Bottlenecks In Small Organizations**

Although Six Sigma is applicable in both large as well as small organizations, the problem is that small organizations often do not have adequate resources to carry out the implementation effectively. By opting for Six Sigma implementation, small companies often expose themselves to several limitations. Lack of adequate resources, both human and financial leads to increased employee dissatisfaction, as they have to work extra hours all throughout the implementation stage. Small organizations may also face difficulties in hiring Six Sigma professionals, who are vital for the success of any implementation.

It is difficult for these organizations to speed up the implementation process, as they have to juggle between meeting existing obligations and overseeing the project implementation at the same time. These limitations can create different types of problems such as the unavailability of the requisite tools and methods that are necessary for effective and timely implementation of the Six Sigma project. The limitations also increase the risk of generating outdated and ineffective solutions aimed at redesigning the product, service or the business process. These limitations can easily prolong the deployment cycle time because chances are high that errors start occurring in the initial deployment stages, which ultimately can trigger a series of multiple errors.

#### **4.2.4 Some Common Bottlenecks Of The Deployment Phase**

Poor project selection is often the root cause of bottlenecks in the deployment phase and can lead to bottlenecks in all stages of the implementation. In the "Define" phase, the organization may fail to clearly define the real objectives of the implementation project, which in turn can create problems during the

actual implementation. In the "Measure" phase, bottlenecks may arise due to lack of proper measurement systems and due to time lost in data collection. In the "Design" phase, problems may arise due to lack of innovative design improvement ideas. In the "Control" phase, bottlenecks may occur due to non-adherence to VOC (voice of the customer), which is vital for the success of any Six Sigma implementation project.

An organization that wants to eliminate bottlenecks should give due consideration to all the above stated factors. This will help in timely implementation, necessary for deriving the benefits of Six Sigma initiatives.

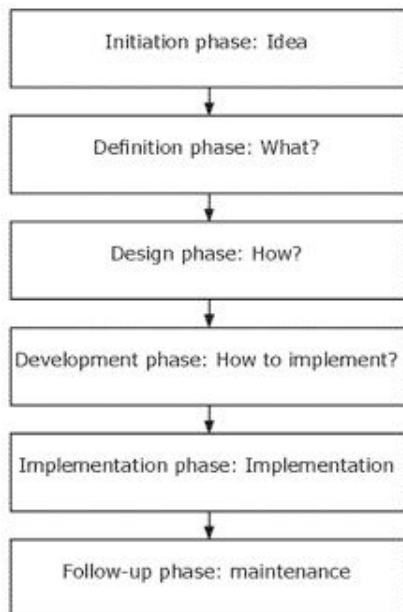
### **4.3 Management techniques for project management**

#### **4.3.1 The six phases of project management**

This chapter provides a sketch of the traditional method of project management. The model that is discussed here forms the basis for all methods of project management. Later chapters go into more depth regarding a model that is particularly appropriate for IT-related projects.

Dividing a project into phases makes it possible to lead it in the best possible direction. Through this organization into phases, the total workload of a project is divided into smaller components, thus making it easier to monitor. The following paragraphs describe a phasing model that has been useful in practice. It includes six phases:

1. Initiation phase
2. Definition phase
3. Design phase
4. Development phase
5. Implementation phase
6. Follow-up phase



#### 4.3.1.1 Initiation phase

The initiation phase is the beginning of the project. In this phase, the idea for the project is explored and elaborated. The goal of this phase is to examine the feasibility of the project. In addition, decisions are made concerning who is to carry out the project, which party (or parties) will be involved and whether the project has an adequate base of support among those who are involved.

In this phase, the current or prospective project leader writes a proposal, which contains a description of the above-mentioned matters. Examples of this type of project proposal include business plans and grant applications. The prospective sponsors of the project evaluate the proposal and, upon approval, provide the necessary financing. The project officially begins at the time of approval.

Questions to be answered in the initiation phase include the following:

- Why this project?
- Is it feasible?
- Who are possible partners in this project?
- What should the results be?
- What are the boundaries of this project (what is outside the scope of the project)?

The ability to say no is an important quality in a project leader. Projects tend to expand once people have become excited about them. The underlying thought is, While we're at it, we might as well. Projects to which people keep adding objectives and projects that keep expanding are nearly certain to go off schedule, and they are unlikely to achieve their original goals.

In the initiation phase, the project partners enter a (temporary) relationship with each other. To prevent the development of false expectations concerning the results of the project, it makes sense to explicitly agree on the type of project that is being started:

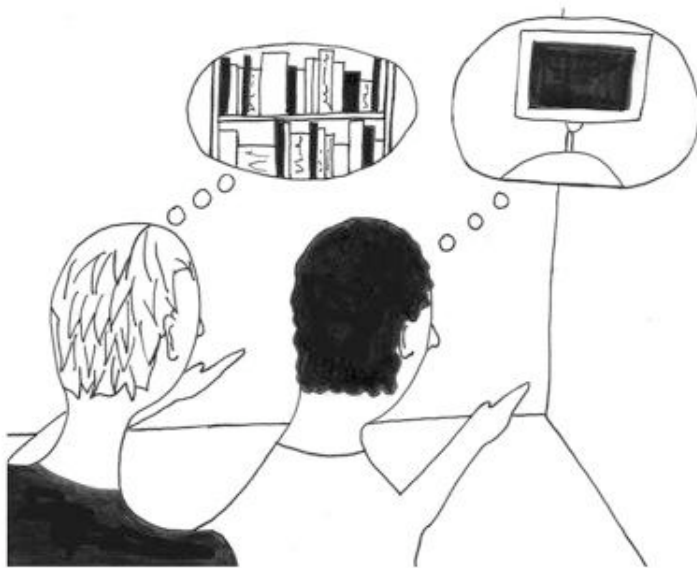
- A research and development project;
- A project that will deliver a prototype or 'proof of idea ';
- A project that will deliver a working product.

The choice for a particular type of project largely determines its results. For example, a research and development project delivers a report that examines the technological feasibility of an application. A project in which a prototype is developed delivers all of the functionality of an application, but they need not be suitable for use in a particular context (e.g. by hundreds of users). A project that delivers a working product must also consider matters of maintenance, instructions and the operational management of the application.

Many misunderstandings and conflicts arise because the parties that are involved in a project are not clear on these matters. Customers may expect a working product, while the members of the project team think they are developing a prototype. A sponsor may think that the project will produce a working piece of software, while the members of the project team must first examine whether the idea itself is technically feasible.

#### **4.3.1.2 Definition phase**

After the project plan (which was developed in the initiation phase) has been approved, the project enters the second phase: the definition phase. In this phase, the requirements that are associated with a project result are specified as clearly as possible. This involves identifying the expectations that all of the involved parties have with regard to the project result. How many files are to be archived? Should the metadata conform to the Data Documentation Initiative format, or will the Dublin Core (DC) format suffice? May files be deposited in their original format, or will only those that conform to the Preferred Standards be accepted? Must the depositor of a dataset ensure that it has been processed adequately in the archive, or is this the responsibility of the archivist? Which guarantees will be made on the results of the project? The list of questions goes on and on.



'After the brain-storming session, all of the members of the "New Archive" project team were in agreement about the desired outcome'.

Figure 2: Expectations of a project

It is important to identify the requirements as early in the process as possible. Wijnen (2004) distinguishes several categories of project requirements that can serve as a memory aid:

- Preconditions
- Functional requirements
- Operational requirements
- Design limitations

Preconditions form the context within which the project must be conducted. Examples include legislation, working-condition regulations and approval requirements. These requirements cannot be influenced from within the project. Functional requirements are requirements that have to do with the quality of the project result (e.g. how energy-efficient must an automobile be or how many rooms must a new building have?). Operational requirements involve the use of the project result. For example, after a software project has been realised, the number of malfunctions that occur must be reduced by ninety percent. Finally, design limitations are requirements that involve the actual realization of the project. For example, the project cannot involve the use of toxic materials or international partners for whom it is unclear whether they use child labor.

During the definition phase of a project that involved developing a web application for a consortium of large organizations, no agreements were made concerning the browser that would be supported by the application. The consortium assumed that it would be Microsoft Explorer, because it was the browser that everyone used. The programmers created the application in Firefox, because they worked with the

browser themselves and because it had a number of functions that were particularly useful during the development. Because most of the websites that are made for Firefox also look good in Explorer, the difference was initially not noticeable. Near the end of the project, however, the customer began to complain that the website didn't look good. The programmers, who had been opening the site in Firefox, did not understand the complaint.

When the problem of the two browsers became clear, the programmers reacted defensively, Can't they just install Firefox? After all, it is free. The organizations, however, were bound to the bureaucratic-minded system administrators who, for some possibly justified reason, refused to install Firefox in addition to Explorer. Even if they had wanted to install it, it would have involved a lengthy process, and there would have been extra costs for the time that the system administrators would have to spend on the task. It was ultimately decided that the application would have to be made suitable for Explorer. That involved considerable extra work, whereby the project ran even more behind schedule than it already had, and it was necessary to negotiate the extra costs. It was later discovered that the various organizations were working with different versions of Microsoft Explorer.

It is very important that all parties that are involved in the project are able to collaborate during the definition phase, particularly the end users who will be using the project result. The fact that end users are often not the ones that order the project perhaps explains why they are often ignored. The client, who pays for the project, is indeed invited to collaborate on the requirements during the definition phase. Nonetheless, the project results benefits when its future users are also invited. As a point of departure, it is helpful to make a habit of organizing meetings with all concerned parties during the definition phase of a project.

During the development of an educational video game, the users (young people) were involved in the project only at a later stage. When the game was nearly completed, a group of young people was asked to test the game. Their initial assessments appeared mild and friendly. When pressed, however, they admitted that they had actually found the game extremely boring and that they would certainly not play it themselves. Had these young people been involved in the project earlier, the game would probably have been a success. As it stands, the game remains nearly unused on an Internet website.

The result of the definition phase is a list of requirements from the various parties who are involved in the project. Every requirement obviously has a reverse side. The more elaborate the project becomes, the more time and money it will cost. In addition, some requirements may conflict with others. New copy machines are supposed to have less environmental impact; they must also meet requirements for fire safety. The fire-safety regulations require the use of flame-retardant materials, which are less environmentally friendly. As this illustration shows, some requirements must be negotiated.

Ultimately, a list of definitive requirements is developed and presented for the approval of the project decision-makers. Once the list has been approved, the design phase can begin. At the close of the definition phase, most of the agreements between the customer and the project team have been established. The list of requirements specifies the guidelines that the project must adhere to. The project team is evaluated according to this list. After the definition phase, therefore, the customer can add no new requirements.

A part of a new exhibit in a museum was comprised of a computer installation, the creation of which had been project-based. Because there had been no definition phase in the project, no clear agreements between the museum and those responsible for building the installation had been made. When the computer for the installation broke down halfway through the exhibit, the museum assumed that it would

be covered by the projects guarantee. The project team had a different opinion. Negotiations between the directors were necessary in order to arrive at an appropriate solution.

#### 4.3.1.3 Design phase

The list of requirements that is developed in the definition phase can be used to make design choices. In the design phase, one or more designs are developed, with which the project result can apparently be achieved. Depending on the subject of the project, the products of the design phase can include dioramas, sketches, flow charts, site trees, HTML screen designs, prototypes, photo impressions and UML schemas. The project supervisors use these designs to choose the definitive design that will be produced in the project. This is followed by the development phase. As in the definition phase, once the design has been chosen, it cannot be changed in a later stage of the project.

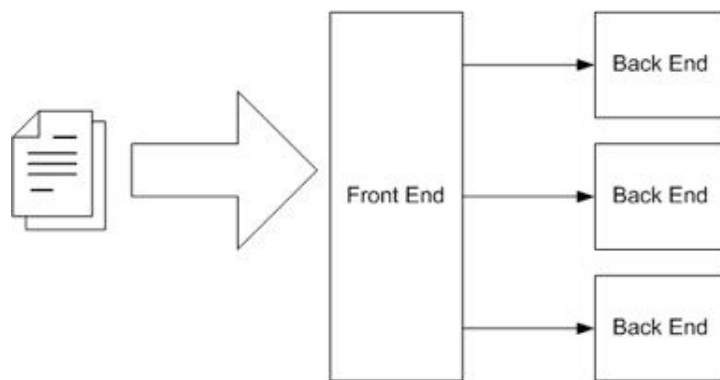


Figure 3: Example: Global design for the DANS Architecture Archive

In a young, very informal company, the design department was run by an artist. The term design department was not accurate in this case; it was more a group of designers who were working together. In addition, everyone was much too busy, including the head of the department.

One project involved producing a number of designs, which were quite important to the success of the project. A young designer on the project team created the designs. Although the head of the design department had ultimate responsibility for the designs, he never attended the meetings of the project team when the designs were to be discussed. The project leader always invited him, and sent him e-mails containing his young colleagues sketches, but the e-mails remained unanswered. The project leader and the young designer erroneously assumed that the department head had approved the designs. The implementation phase began. When the project was nearly finished, the result was presented to the department head, who became furious and demanded that it be completely redone. The budget, however, was almost exhausted.

#### 4.3.1.4 Development phase

During the development phase, everything that will be needed to implement the project is arranged. Potential suppliers or subcontractors are brought in, a schedule is made, materials and tools are ordered, instructions are given to the personnel and so forth. The development phase is complete when implementation is ready to start. All matters must be clear for the parties that will carry out the implementation.

In some projects, particularly smaller ones, a formal development phase is probably not necessary. The important point is that it must be clear what must be done in the implementation phase, by whom and when.

#### **4.3.1.5 Implementation phase**

The project takes shape during the implementation phase. This phase involves the construction of the actual project result. Programmers are occupied with encoding, designers are involved in developing graphic material, contractors are building, the actual reorganization takes place. It is during this phase that the project becomes visible to outsiders, to whom it may appear that the project has just begun. The implementation phase is the doing phase, and it is important to maintain the momentum.

In one project, it had escaped the project teams attention that one of the most important Team was expecting to become a father at any moment and would thereafter be completely unavailable for about a month. When the time came, an external specialist was brought in to take over his work, in order to keep the team from grinding to a halt. Although the team was able to proceed, the external expertise put a considerable dent in the budget.

At the end of the implementation phase, the result is evaluated according to the list of requirements that was created in the definition phase. It is also evaluated according to the designs. For example, tests may be conducted to determine whether the web application does indeed support Explorer 5 and Firefox 1.0 and higher. It may be determined whether the trim on the building has been made according to the agreement, or whether the materials that were used were indeed those that had been specified in the definition phase. This phase is complete when all of the requirements have been met and when the result corresponds to the design.

Those who are involved in a project should keep in mind that it is hardly ever possible to achieve a project result that precisely meets all of the requirements that were originally specified in the definition phase. Unexpected events or advancing insight sometimes requires a project team to deviate from the original list of requirements or other design documents during the implementation of the project. This is a potential source of conflict, particularly if an external customer has ordered the project result. In such cases, the customer can appeal to the agreements that were made during the definition phase.

As a rule, the requirements cannot be changed after the end of the definition phase. This also applies to designs: the design may not be changed after the design phase has been completed. Should this nonetheless be necessary (which does sometimes occur), the project leader should ensure that the changes are discussed with those involved (particularly the decision-makers or customers) as soon as possible. It is also important that the changes that have been chosen are well documented, in order to prevent later misunderstandings. More information about the documentation of the project follows later in this handbook.

#### **4.3.1.6 Follow-up phase**

Although it is extremely important, the follow-up phase is often neglected. During this phase, everything is arranged that is necessary to bring the project to a successful completion. Examples of activities in the follow-up phase include writing handbooks, providing instruction and training for users, setting up a help desk, maintaining the result, evaluating the project itself, writing the project report, holding a party to celebrate the result that has been achieved, transferring to the directors and dismantling the project team.

The central question in the follow-up phase concerns when and where the project ends. Project leaders often joke among themselves that the first ninety percent of a project proceeds quickly and that the final ten percent can take years. The boundaries of the project should be considered in the beginning of a project, so that the project can be closed in the follow-up phase, once it has reached these boundaries.

It is sometimes unclear for those concerned whether the project result is to be a prototype or a working product. This is particularly common in innovative projects in which the outcome is not certain. Customers may expect to receive a product, while the project team assumes that it is building a prototype. Such situations are particularly likely to manifest themselves in the follow-up phase. Consider the case of a software project to test a very new idea .

There was some anxiety concerning whether any results would be produced at all. The project eventually produced good results. The team delivered a piece of software that worked well, at least within the testing context. The customer, who did not know much about IT, thought that he had received a working product. After all, it had worked on his office computer. The software did indeed work, but when it was installed on the computers of fifty employees, the prototype began to have problems, and it was sometimes instable.

Although the programmers would have been able to repair the software, they had no time, as they were already involved in the next project. Furthermore, they had no interest in patching up something that they considered a trial piece. Several months later, when Microsoft released its Service Pack 2 for Windows, the software completely stopped functioning. The customer was angry that the product once again did not work. Because the customer was important, the project leader tried to persuade the programmers to make a few repairs. The programmers were resistant, however, as repairing the bugs would cause too much disruption in their new project. Furthermore, they perceived the software as a prototype. Making it suitable for large-scale use would require changing the entire architectural structure. They wondered if the stream of complaints from the customer would ever stop.

The motto, Think before you act is at the heart of the six-phase model. Each phase has its own work package. Each work package has its own aspects that should be the focus of concentration. It is therefore unnecessary to continue discussing what is to be made during the implementation phase. If all has gone well, this was already determined in the definition phase and the design phase. For a more detailed description of the six-phase model and the task packets for each phase, see Wijnen (2004) and Kor (2002).

## **4.4 Project Appraisal and Management**

### **4.4.1 Projects**

A project is a specific plan or design presented for consideration. UNIDO defines a project as a proposal for an investment to create and or develop certain facilities in order to increase the production of goods/services in a community certain period of time. Burns and Tolbet define the term projects discrete package of investments, policy measures and institutional and other actions designed to achieve a specific development objectives. Projects are a common term used by many flexibly to denote specific action plans. There are projects to develop a new road, new car, new motorbike, marketing plan, construction of buildings, transport and communication etc. A project can be long term or short term, limited or comprehensive, single sector concentrated or multi sector concentrated. While all of these projects have a general goal with macro and micro directives with specific time frame.

#### **4.4.1.1 Project: can be defined thus as**

- \* *A scientifically evolved work plan*
- \* *Devised to achieve a specific objective*
- \* *Within specified time limit*
- \* *Consuming planned resources*

#### **4.4.1.2 Project Questions**

Before the formulation of project problem, many questions to be asked by the project initiators. These questions can be summarized as follows:

- What for: The objectives of the project
- How: The process, and the internal and external resources
- Who: For whom, By whom – Project partners, stakeholders
- When: The time factor
- Where: The location
- What: The activity

#### **4.4.2 Identifying the Project**

The first phase of project management is the concerned with identifying the project to achieve the desired objectives. The initial task coming under project identification is to find out the sources of the project. Agencies like government organizations, international institutions like WHO, World Bank, UNDP, Non Governmental Organisations etc. can be a good source of projects.

#### **4.4.3 Project Need Analysis**

The factors included under project need analysis are the, problem, solutions, beneficiaries and decisions. The problem should exhibit an immediate intervention. The focus should be to identify the beneficiaries. The solutions should be based on the original problem. The decision to take up the project lies on how these three factors problem, solutions and beneficiaries are important to project intervention.

#### **4.4.4 Problem formulation and Statement of the Problem**

The crux of the project lies in the problem formulation process. The project team should have a detailed understanding of the problem, scope, intervention areas and the outcome of the project to be hypothesized. Based on a multi phased understanding and analysis, describe the problem to be addressed and resolved. The macro level objectives and micro level objectives to be separated and should give differential wastages

#### **4.4.5 Project Planning**

Project planning: can be defined as

- \* A scientific and systematic process, in which

\* Logical linkages are clearly established, among

\* Various elements of projects

Successful implementation of the project lies in the effective project plan. Based on the anticipated goals and objectives the project planning to be done. The project plan is the blue print of the project. Effective planning gives proper direction in the implementation of the project and it further helps inadequate monitoring and evaluation. For the implementation of the plan, an activity chart to be prepared. The activity chart consists of all the proposed activities in the implementation process, including the start date, calendar for the entire project, dates of monitoring and evaluation periods, finishing stages, series of outputs, slack time, responsible person to be coordinating the activities etc.

#### **4.4.6 Project Budget**

The project budgeting phase is in the project formulation phase. Two types of budgets are to be made. The prior one is the cost category budget (materials, administration, capital; expenditures etc.) and the later is the activity budget. This project budget is to calculate the cost of each project output. Keep in mind the cash flow of the project, considering the contingencies like, technical shortage, shortage of raw materials, delays in the activity implementation etc. The estimation of the project cost should be made with a fairly realistic sense of financial values. In the multi year projects the inflation rate also to be anticipated in advance.

#### **4.4.7 Feasibility of the Projects**

##### **4.4.7.1 Management Appraisal**

Management appraisal is related to the technical and managerial competence, integrity, knowledge of the project, managerial competence of the promoters etc. The promoters should have the knowledge and ability to plan, implement and operate the entire project effectively. The past record of the promoters is to be appraised to clarify their ability in handling the projects.

##### **4.4.7.2 Technical Feasibility**

Technical feasibility analysis is the systematic gathering and analysis of the data pertaining to the technical inputs required and formation of conclusion there from. The availability of the raw materials, power, sanitary and sewerage services, transportation facility, skilled manpower, engineering facilities, maintenance, local people etc. are coming under technical analysis. This feasibility analysis is very important since its significance lies in planning the exercises, documentation process, risk minimization process and to get approval.

##### **4.4.7.3 Financial feasibility**

One of the very important factors that a project team should meticulously prepare is the financial viability of the entire project. This involves the preparation of cost estimates, means of financing, financial institutions, financial projections, break-even point, ratio analysis etc. The cost of the project includes the land and site development, building, plant and machinery, technical know-how fees, pre-operative expenses, contingency expenses etc. The means of finance include the share capital, term loan, special capital assistance, investment subsidy, margin money loan etc. The financial projections include the profitability estimates, cash flow and projected balance sheet. The ratio analysis will be made on debt

equity ration and current ratio.

#### **4.4.7.4 Commercial Appraisal**

In the commercial appraisal many factors are coming. The scope of the project in market or the beneficiaries, customer friendly process and preferences, future demand of the supply, effectiveness of the selling arrangement, latest information available on all areas, government control measures, etc. The appraisal involves the assessment of the current market scenario, which enables the project to get adequate demand. Estimation, distribution and advertisement scenario also to be here considered into.

#### **4.4.7.5 Economic Appraisal**

How far the project contributes to the development of the sector, industrial development, social development, maximizing the growth of employment, etc. are kept in view while evaluating the economic feasibility of the project.

#### **4.4.7.6 Environmental Analysis**

Environmental appraisal concerns with the impact of environment on the project. The factors include the water, air, land, sound, geographical location etc.

#### **4.4.8 Project Implementation**

This is the period in which all the activities that are planned in the initial phases of the project get materialized through operation. Here the role of the project managers comes into the picture. It is the task of the project managers to schedule the activities one by one and establish functional relationship of the project activities in the fulfillment of the project. The techniques like PERT (Program Evaluation and Review Technique), CPM (Critical Path Method) etc. are the various network techniques the managers make utilize to implement the activities planned in the project considering the cost and time.

#### **4.4.9 Monitoring and Evaluation**

Monitoring is the process of observing progress and resource utilization and anticipating deviations from planned performance. In the monitoring and controlling phase the project managers have to monitor the technical performance, time and cost performance in addition to the organizational performance. Correction, re-planning and cancellation of the activities are the control actions expected from this phase in order to get the expected outcome. The monitoring is periodical by fixing milestones in the project phases.

#### **4.4.10 Evaluation**

The final stage is the evaluation of the project. Upon the conclusion of the project success in attaining the goals, and to determine how future projects could be managed. Here the effectiveness of the degree of the objective achievement, the efficiency of the financial, human, and time resources to be observed. The impact of the project, the major concern of the project, i.e. whether the project reach up to the beneficiaries with quality and quantity is to be measured. Different types of evaluation are there like performance appraisal, work audit, result evaluation, cost benefit evaluation, impact analysis etc. Evaluation is done to ensure the effective utilization of all resources for the accomplishment of the project.

#### **4.4.11 Conclusion**

Here the role of the project manager to be analyzed into. From the idea on stage to the implementation stage and from periodical monitoring to the evaluation stage his role is inevitable. He should show his leadership in managing the relationship, motivating the team, procuring the resources, developing the capabilities, leading all the resources to the accomplishment of the project. The accountability of the project manager's leadership comes only when the Team accepts the ideas and directions of the leader towards the accomplishment of the project. A project manager here should be an effective leader.

#### **4.5 Project Monitoring and Controlling Tools & Techniques**

Monitoring and Controlling a project is the process or activities whereby the project manager tracks, reviews and revises the project activities in order to ensure the project creates the deliverables in accordance with the project objectives. Because of the unique and temporary nature of projects, they require active control. Unlike a process where the same set of activities has been performed repeatedly so that habits and expectations are stable, a project is inherently unstable. The activities are unique to the project or the sequence of activities and resources are only temporarily assigned and associated with the project and are redeployed when the project completes. Habits and patterns are not established before everything changes.

The primary results of the Monitoring and Controlling processes are the project performance reports and implementing project changes. The focus for project management is the analysis of project performance to determine whether a change is needed in the plan for the remaining project activities to achieve the project goals. In my experience, almost every project will require a change to the plan at some point in time. Traditional projects are the most stable projects because the requirements and the activities are clear and well understood. Adaptive and Extreme projects are the least stable. They require very close control and will require numerous changes - if for no other reason the project manager will need to refine the activities of later phases based upon the results of early activities.

Tools and techniques that are used by project managers to conduct the Monitoring and Controlling of a project fall into one of four general categories. The first is the collection of project performance information. Techniques supporting this category are Pulse Meetings, Variance Reports, and Program Reviews. The second category is the analysis of the project performance to determine whether a project change is needed. Techniques that are used in this category are Technical Reviews, Project Forecasting and Problem Solving. The third category is reporting on project performance. Techniques that support this activity include the use of a Project Management Information System, Management Reviews, and

Dashboards. The final category is the management of the project change. The technique I commonly use in this category is the maintenance of a Change Management Log. There are two areas of project management tools and techniques that closely support the Monitoring and Controlling process but are also used more broadly throughout the project Lifecycle. These are important enough to justify their own page.

#### **4.5.1 Project Communication Tools and Techniques**

##### **4.5.1.1 Pulse Meetings**

Pulse meetings are short team status meetings where the project management team is able to gather project performance information about the activities that are underway. These meetings should occur frequently and can either be face-to-face or virtual. Normally they are only a few minutes in duration. During the meeting, the beginning and completion of project activities are reported. In addition, the status of any activities that are underway is communicated to the rest of the project management team. Issues on any of the ongoing activities are identified, however, the issue resolution occurs at a separate meeting with the appropriate individuals present. The issue resolution meeting may immediately follow the Pulse meeting, but it is clearly a separate meeting and those project Team who are not needed for issue resolution do not need to attend. The frequency of the Pulse meeting is determined based upon the status of the project. When in an Extreme mode, the Pulse meeting may be happening several times a day. Projects that are running smoothly may only need to have a Pulse meeting once a week.

##### **4.5.1.2 Variance Reports**

Variance reports are formal reports generated by the PMIS, by the Earned Value Management System, one of the other business management systems - such as the quality control system, or by a project supplier. Variance reports compare what has actually happened on a project against what was expected to have happened on the project. A variance report typically indicates both the absolute value of the difference and a percentage representation of the difference.

The actual performance achieved on a project activity (such as cost or duration) seldom precisely matches the estimated performance set at the time of project planning. The page on Estimating explains why project estimates are seldom precisely accurate. However, since the estimates often aren't accurate, it is imperative for the project management team to identify the variances in order to know what is actually

happening on the project. The variances can uncover both positive and negative project risks.

Project variance reports often are expressed with two references. The first reference is what was supposed to have happened since the last reporting cycle. This is often called the "Current Period" variance. It is an indication of how well the project resources were able to conduct project activities in accordance with the project plan in the recent past. The second reference is what was supposed to have been done on the project since it started. This is often called the "Cumulative" variance. It is an indication of how well the project resources have been able to conduct project activities throughout the project Lifecycle. The cumulative variance will have embedded in it any previous variances - either positive or negative. The current period variance provides a clear representation of what is happening right now on the project. The cumulative variance eliminates the effects of some short term conditions, either good or bad, that affected the project during the most recent reporting period. Both variances provide useful information.

#### **4.5.1.3 Program Reviews**

Program Reviews are meetings with the project Team and sub-project leaders that review the current status of the program as compared to the original program plan. These are most often used on Full-scale and Complex projects. Unlike the Pulse Meetings which focus on day-to-day activities, the Program Reviews focus on the big picture and emphasize the integration between activities and between sub-projects encompassed within the program. The question being asked is whether the program activities and the sub-projects are likely to interfere with each other. In addition, when a company has a supplier who is a major contributor to the program and is performing customized work on this program, We will conduct Program Reviews with the supplier for their portion of the program. Program Reviews are sometimes combined with Management Reviews. This approach is not good. The danger with this approach is that key stakeholders and managers may intimidate some project Team from providing a frank and honest appraisal of the status of program work.

#### **4.5.1.4 Technical Reviews**

Technical Reviews are formal meetings conducted by subject matter experts who are not members of the project team. These are in-depth reviews focused upon a technical aspect of the project. Examples would be Design Reviews, Code Reviews, Security Reviews, or Production Readiness Reviews. The reviewers should perform an in-depth analysis of the project deliverables and activities to determine whether the project work has been accomplished completely and correctly. These reviews will normally generate a list of actions that must be completed. These actions may require additional testing or analysis. In some cases

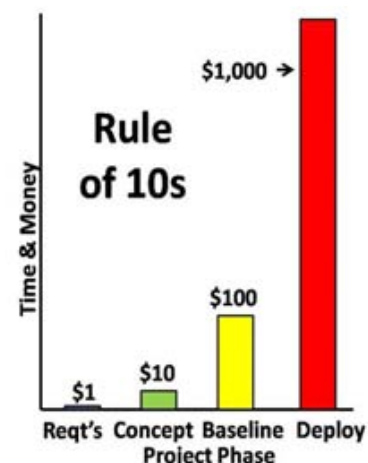
it may even require redesigns of systems, software, processes or products. The results of these reviews are normally reported to senior management at the next Management Review. In many cases, the technical review must be completed before a project can proceed to a tollgate meeting. When the Technical Review is linked to a toll-gate meeting, the action items do not need to be completed prior to the toll-gate. However, any open action item is listed on the risk register and the plan for resolving that action item is included in the project plan for the next phase.

#### 4.5.1.5 Project Forecasting

Project Forecasting consists of taking the project status information and extrapolating the current project performance to the end of the project. Forecasts can be made with respect to project duration, overall project cost, performance/quality level of project deliverables, or any combination of these. A key element in forecasting is to review the risk events that occurred and the remaining risk triggers. A deeper discussion of this is found on the Project Risk Management page. A caution when doing forecasting, ensure you have adequate information to realistically forecast performance. Our personal rule of thumb is that we wait until an activity, phase, or deliverable is at least 25% complete before we try to forecast.

When forecasting project duration, the key is to understand the schedule performance and schedule risk of the activities on the critical path. Those activities will be the ones that drive the project completion date. On a resource constrained project, or a project with unpredictable resource availability, this can be very difficult because the lack of resources causes the critical path to vary. We have not found a good robust tool for forecasting schedule in this condition. It generally comes down to expert judgment and gut feel. When it is vital for the project to complete by a certain date, we often will convert my schedule tracking to a countdown mode where everything is measured in terms of how many days before project completion. Also, we will Pulse the project more frequently in order to quickly assess when we believe we are falling behind. If that sounds like micro-management it is because that is micro-management.

When forecasting total project cost, we prefer to use the forecasting methods that are embedded in the Earned Value Management system. Unfortunately, many organizations do not have the financial systems in place that enable earned value management. When that is the case, we are forced to rely on trend forecasting - which is sometimes called "straight-line" forecasting. Trend forecasting takes the current project spending and extrapolates that rate of spending until the end of the



project. This provides a rough forecast, but it does not take into account the effect that different activities may require resources that spend at different levels. The resources that perform the remaining activities may be higher or lower cost than the preceding resources. Also, it does not take into account that the project may be ahead or behind schedule. If the project is ahead of schedule, the spending done to achieve that condition inflates the extrapolated value of the project final cost. If the project is behind schedule, the lack of spending creates an extrapolated value of total project cost that is too low.

When forecasting the performance or quality of project deliverables, we rely heavily on prototypes and preliminary analysis. When the project does not have these, the risk that the project will not achieve the desired performance or quality established at the time of project planning is higher. If performance is the most important attribute of the project deliverables, then the risk of missing the forecast project duration or cost is much higher. The principle involved is the "Rule of Ten's." According to this principle, the cost to correct a technical issue goes up by a factor of 10 as the project moves from one phase to the next. Therefore it is imperative that performance issues be identified as early as possible.

**Problem Solving** Problem Solving is a very broad topic. There are dozens of approaches to problem solving. Our rule of thumb with respect to this technique is that if you have a process that works for you, use it! We recommend you have an agreement with your project core Team or key project stakeholder concerning the problem solving process that will be used. Will it be team-based or individually driven? Will you use a process that relies on data from past projects or only on data from this project? Once a root cause is determined, how will recovery actions be identified and approved? As we said, there are many problem solving methods and their answer to these questions and others is different. From my standpoint, the most important point is that you have a process to address issues, rather than jumping to conclusions or worse yet, ignoring the problem until it is a crisis.

Problem solving process:

1. Clarify: Clarify the problem. In which part of the project did it occur? Who was involved? When did it happen?
2. Investigate: Investigate the details about what happened. Gather data from both the project activity and the surrounding environment. Determine the root cause(s) of the problem.
3. Evaluate: Evaluate the options to address the problem. Consider the impact on the project objectives

that each potential solution would likely have. What new risks are associated with each potential solution.

4. Choose: Choose among the viable solution/recovery paths. If necessary, coordinate the decision with key stakeholders. This must be done whenever the solution will impact a boundary condition of the project.

5. Implement: Implement the selected solution/recovery path. Modify the project plan with respect to any changes in scope, resources, or the scheduled dates of any activities. Update the risk register.

6. Validate: Validate that the solution/recovery path is achieving the desired results.

#### **4.5.1.6 Project Management Information System**

The PMIS is the set of communicating methods used by the project team to share plans and results of project activities. The PMIS can either be a physical system or an electronic system. Either way, the PMIS is used as the clearing house of information on the project including: project plans, project status, project risks, project changes, project meetings, and any other information that the project management team believes is relevant to the project team.

#### **4.5.1.7 Management Reviews**

Project Management Reviews are formal documented meetings with the project team and key stakeholders that review the current status of the project as compared to the original project plan. Unlike the Pulse Meetings and Program Reviews which are data gathering meetings that focus on understanding the current status of the project, the Management Reviews are with key stakeholders with the emphasis being on whether the project performance is adequate for the project to deliver on the overall project objectives. Often if the project has encountered issues, such as resource constraints or scope creep, the stakeholders conducting the review are able to provide assistance to the project team to overcome these issues.

The format for these reviews is usually set by the stakeholders and addresses the topics that are most important to them. The review may be a formal stand-up meeting, it may be an informal discussion setting, a written report, or an update to an electronic dashboard. Regardless of the method used, these are formal status reporting meetings and need to be treated as such. The project manager should keep an

Action Item list or Stakeholder Issue log for any questions that arise in these reviews. Also minutes from these meetings should be maintained as part of the project record.

Program Name

| ### | Issue | Stakeholder Affected | Resolution Action | Responsible Team Member | Date Assigned | Date Closed | Status |
|-----|-------|----------------------|-------------------|-------------------------|---------------|-------------|--------|
|     |       |                      |                   |                         |               |             |        |

#### 4.5.1.8 Project Dashboards

Dashboards have proliferated as more organizations start to manage projects within the context of a portfolio of projects. A dashboard is a great method for capturing a snapshot of a project and presenting that to stakeholders. Dashboards contain a small subset of project status information that is used as indicators of whether the entire project is on track. The dashboard information is used to make decisions concerning changes to projects or to the project portfolio.

Within a project team, Dashboards were used by project managers to focus the project team on the few key items that would drive project performance. Therefore the current critical path activity is tracked for schedule status, the current activity with the most uncertainty in resource requirements is tracked for cost status, and the most challenging activities are tracked for project performance/quality. This is an excellent use of dashboards, especially when working with a virtual project team.

As more organizations decided to manage their projects as a portfolio of projects, they have recognized the need to have a means of measuring the projects in the portfolio both against each other and with respect to their objectives. The dashboard offers that mechanism as each of the project report on key metrics that are used by the senior management or the Project Management Office to check the status of the

| Project          | Project A | Project B | Project C | Project D | Project E | Project F |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| Charter Approved |           |           |           |           |           |           |
| Plan Approved    |           |           |           |           |           |           |
| Schedule Status  |           |           |           |           |           |           |
| Cost Status      |           |           |           |           |           |           |
| Performance      |           |           |           |           |           |           |
| Completion Date  |           |           |           |           |           |           |

projects. Often the dashboard measures the status through the "Red light - Green light" method. This type of scoring uses colors to indicate project status on the key measures. A "Green light" indicates that everything on the project is going according to plan. A "Yellow light" indicates that there are some problems, but the project team is working the situation and should be able to contain the problem. A "Red light" indicates that the problem is so severe, the project team cannot resolve the problem and achieve the project objectives without help from the stakeholders. The senior management team and PMO use the Dashboard to make resource allocation decisions and to call special Project Management Reviews.

4.5.1.9 Change Management Log

This tool is very straightforward. The need for it increases as the project complexity increases. We can't imagine running a Complex project without one, but I have never used one on a Simple project. The necessity of a Complex project is because these

| Program Name |        |                       |                    |                             |        |
|--------------|--------|-----------------------|--------------------|-----------------------------|--------|
| ###          | Change | Sub-Projects Affected | Sub-Project Impact | Planned Implementation Date | Status |
|              |        |                       |                    |                             |        |

projects are managed as a set of Focused and Full-scale sub-projects. The boundaries between these sub-projects will inevitably need to change as projects progress. Sometimes the changes are due to shifting milestones. Sometimes the changes are the result of activity deliverables that are passed between the projects. In any case, the changes in one sub-project cascades into changes in another sub-project. The Change Management Log tracks the implementation of the change across the sub-projects. It can also track the implementation of the change within a project, especially if the project activities are conducted in multiple locations or if there are multiple phases underway at one time. Using the Change Management Log is similar to using an action item list. Each item is tracked to ensure it has been completed.

4.6 Tools and techniques Project management performance

Project Initiation is the process or activities associated with defining the boundaries of a project, or project phase, and gaining the approval of appropriate stakeholders to begin the work of project planning and project execution. Project initiation is always company-specific. While many of the tools of project planning or project control are standard and universal, the initiating tools must interact with the company's business environment and strategy planning process, and therefore are far less formal or deterministic. The project objectives, which form the basis for project boundaries, are directly related to

the business strategic imperatives. These are different from business to business and they change over time. The stakeholder analysis involved in approving a project is based upon a combination of the business organizational structure and the personalities of the individuals involved.

The Project Management Institute identifies several outputs from the Initiating processes. These are the Project Charter, a Project Stakeholder Register, and a Stakeholder Management Strategy. On small or simple projects I recommend that these all be rolled into one document. On larger more complex projects, I suggest that two deliverables are created during project initiation, a Project Charter and a Stakeholder Register that incorporates the stakeholder strategy decisions. I use a variety of tools and techniques to create these documents, depending upon project complexity and uncertainty. These include: W's, In-Frame/Out-of-Frame, Project Dimensions, Project Requirements Document, Communication Strategy Matrix, and Collaboration Strategy Matrix. The project leader needs to determine which of these tools and techniques are appropriate for their project. Typically only two or three of them are used. The project leader should always follow corporate policies and directives with regard to required tools or techniques. In addition, unique characteristics of the project may require different tools.

#### 4.6.1 Project Charter

The Project Charter documents the basic attributes of the project, essentially the project boundaries. As such it captures the understanding of the project by the project sponsors and senior management at the time they approve the project to go forward into a planning phase. The charter is not an in-depth project plan. It is a high-level document. It describes the expectations of the customers of the project and the senior management for the project results. A charter is normally developed by the portion of the business that is sponsoring the project, not the project team. On small projects the charter may only be a one-page document. On larger projects, the charter may require many pages.

A project team uses the charter document to assist in the planning process. The team attempts to develop a project plan that has a strong potential of achieving the project

objective while staying within the project schedule and budget boundaries found in the charter. An example of a Project Charter format that I have used on small projects with several clients is shown.

|               |  |              |              |
|---------------|--|--------------|--------------|
| Sponsors:     |  | Objective:   |              |
| Proj Ldr:     |  |              |              |
| Milestones:   |  | Major Risks: |              |
|               |  | In-Frame     | Out-of-Frame |
|               |  |              |              |
| Total Budget: |  |              |              |
| Capital \$\$: |  |              |              |

| Stakeholder | "Win" | Communication Strategy | Collaboration Strategy |
|-------------|-------|------------------------|------------------------|
|             |       |                        |                        |

#### 4.6.2 Stakeholder Register

The Stakeholder Register documents the stakeholder planning process. It is often started during the initiating process. However, this is a living document. While created during the initiating process, it is

continuously updated throughout the life of the project. During the project new stakeholders are often identified and the role or interest of stakeholders may change due to changes in business priorities or reorganizations. The Stakeholder Register tracks these changes and guides the project leader in making decisions with respect to stakeholder interaction planning.

A project leader uses the Stakeholder Register to guide elements of the Project Communication Plan. In addition, project risks, reviews and decision meetings are often structured based upon the strategies documented in the Stakeholder Register. Further, the project attributes associated with the stakeholder's "Wins" will inevitably become linked to entries on the Risk Register.

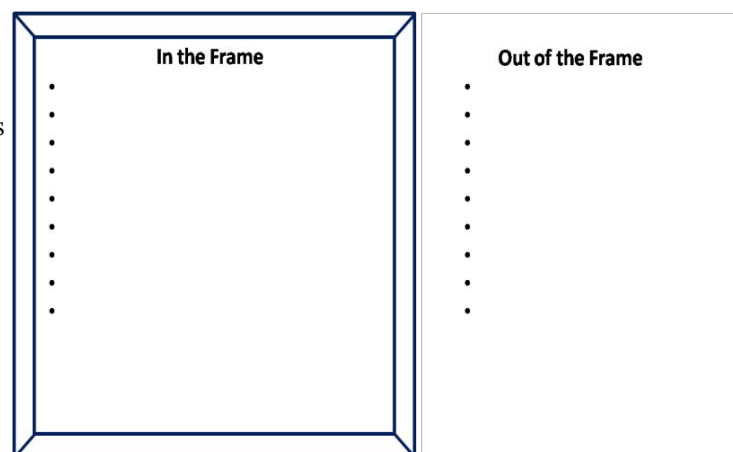
W's

The "W's" are one of the simplest methods for identifying the boundary conditions for a project. This technique is often used with small projects. It consists of discussing with the sponsor the answers to several questions that have a "W" in them. These questions can be asked in any order.

- ☐ "What?" What is the project intended to do or deliver?
- ☐ "Who?" Who is the primary customer and are there any other key stakeholders?
- ☐ "When?" When does the project need to end? When does it need to start?
- ☐ "Where?" Where will the project activity be conducted?
- ☐ "Why?" Why is this project needed? Is it related to a specific business strategy or goal?
- ☐ "How?" How should this project be accomplished? Are there any constraints on the approach, any procedures or regulatory guidance that must be followed, or any financial or resource constraints? (The "w" was on the end of "How")

#### 4.6.3 In-Frame/Out-of-Frame

The "In-Frame/Out-of-Frame" analysis is an excellent technique for clarifying project boundary conditions with stakeholders who are vague or often change their mind. An effective use of this technique at the beginning of a project will significantly decrease the incidents of scope creep. This



technique identifies all of the major elements that are to be accomplished and puts them "In the Frame." It

also lists activities, analysis and work that, though potentially related to the project, is not requested or required by the stakeholders. These items are listed as "Out of the Frame." An important clarification is that the "Out of Frame" items are not items being withheld from the stakeholders, rather there is an agreement with the stakeholders not to expend project time and project money on those items.

The "In-Frame/Out-of-Frame" analysis assists the project team in setting a clear definition of scope. Often there are several possible interpretations of a project requirement. This analysis clarifies the interpretation. This analysis minimizes the likelihood of scope creep because it forces the stakeholder to clarify the boundary of acceptable performance. Many instances of scope creep are due to stakeholders asking for "just one more thing." This analysis defines the limits of what can be done with the available time and money in the project. If at the time of project initiation the "In the Frame" list is more extensive than the desired end date or budget can reasonably be expected to deliver, the discussion with the stakeholder occurs at that time to either limit the project scope or increase time and/or money.

#### 4.6.4 Project Dimensions

Karl Wieggers introduced the idea of categorizing the various project requirements into different "dimensions." These dimensions are related to the criticality of the

| Dimension | Constraint<br><u>No Flexibility</u><br>(state limits) | Driver<br><u>Some Flexibility</u><br>(state goal) | Degree of Freedom or Latitude<br>(state range) | Consequences<br>(of failure) |
|-----------|-------------------------------------------------------|---------------------------------------------------|------------------------------------------------|------------------------------|
| Schedule  |                                                       |                                                   |                                                |                              |
| Features  |                                                       |                                                   |                                                |                              |
| Quality   |                                                       |                                                   |                                                |                              |
| Cost      |                                                       |                                                   |                                                |                              |
| Staffing  |                                                       |                                                   |                                                |                              |

requirements. This tool is useful for larger, more complex projects and programs. When discussing with stakeholders the nature of their requirements, determine how strategically important each requirement is. Some requirements are "Constraints." There is no flexibility with respect to these requirements. If this requirement cannot be met, the project is canceled. Very few requirements are truly in this category. For these requirements, the project plan should be constructed to minimize risk in those areas. The next category of requirements is "Drivers." These requirements are often expressed by stakeholders in terms such as, "As much as ..." or "As soon as ...." These requirements should be optimized to achieve the best overall mix among them. If you have many stakeholders, this may prove to be difficult as some stakeholders will probably need to compromise on their preferred solution or actions in order to accommodate some others. The final category is "Degrees of Freedom." These are items that are not requirements in the minds of any stakeholders, yet are elements of the project that must be accomplished in order to complete the project. Since there are no stakeholder imperatives with respect to these requirements, these are the areas where the project team should be the most creative and takes the most

risk. When completing a Project Dimensions we normally use a spreadsheet to capture the items. There are often more than one hundred items between all of the categories.

4.6.5 Project Requirements Document

A Requirements Document is a formal document that describes all of the requirements for a project. It is most commonly used in government contracting or large commercial construction projects and programs. This document is prepared by the buying organization in order for sellers to fully understand all requirements of a project when they prepare to bid on the project or portions of the project. When a government agency determines that it will source a major project effort, the agency develops the requirements document. The document contains all of the technical and managerial requirements appropriate for the government agency and the type of project work. The document can easily be hundreds of pages in length.

4.6.6 Communication Strategy Matrix

The Communication Strategy Matrix is a tool for determining the communication strategy to be used with each stakeholder. On a small project with one or two stakeholders, the matrix guides the project head to determine the specific communication

| Communication Strategy                                                                                  |                                                                                                                                                                                                                                                                                                                      |                                                                          |                                           |                                                         |                                                     |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------|---------------------------------------------------------|-----------------------------------------------------|
| High<br>Oversight – level to which program boundaries or resources fall within the stakeholders control | <table><tr><td>Keep Satisfied –<br/>Inform With The Method,<br/>Depth &amp; Frequency Desired</td><td>Frequent &amp;<br/>Meaningful<br/>Communication</td></tr><tr><td>Minimum Effort –<br/>Access To Information<br/>To Monitor</td><td>Keep Informed<br/>About Major Issues<br/>&amp; Activities</td></tr></table> | Keep Satisfied –<br>Inform With The Method,<br>Depth & Frequency Desired | Frequent &<br>Meaningful<br>Communication | Minimum Effort –<br>Access To Information<br>To Monitor | Keep Informed<br>About Major Issues<br>& Activities |
| Keep Satisfied –<br>Inform With The Method,<br>Depth & Frequency Desired                                | Frequent &<br>Meaningful<br>Communication                                                                                                                                                                                                                                                                            |                                                                          |                                           |                                                         |                                                     |
| Minimum Effort –<br>Access To Information<br>To Monitor                                                 | Keep Informed<br>About Major Issues<br>& Activities                                                                                                                                                                                                                                                                  |                                                                          |                                           |                                                         |                                                     |
| Low                                                                                                     | Low                      Interest – personal concern<br>regarding program outcomes                      High                                                                                                                                                                                                         |                                                                          |                                           |                                                         |                                                     |

techniques to be used by those stakeholders. On larger projects with many stakeholders, the communication strategy for each stakeholder is a major input used when developing the project communication plan.

Each stakeholder is considered individually. The stakeholder is placed in one of the four quadrants of the matrix. Based upon the quadrant, the communication strategy for that stakeholder is set. One caution with this technique, a stakeholder's oversight or interest may change as the project moves from one phase to another or as business conditions change. Therefore, the stakeholder's position within the matrix should be periodically reviewed and updated.

**4.6.7 Collaboration Strategy Matrix**

The Collaboration Strategy Matrix is a tool for determining the type of collaboration that must be done with each stakeholder. Collaboration in this context implies that the stakeholder must be involved in the activities and decisions of a portion of the project.

On a small project with only one or two stakeholders, the matrix guides the project leader in determining the level of involvement required from the stakeholder. On larger projects with many stakeholders, the collaboration strategy drives decisions on project planning and on project review meetings.

| Collaboration Strategy                                                                             |      |                                                                                                                        |
|----------------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------|
| Planning—<br>ability to<br>affect<br>changes in<br>the detailed<br>program<br>plan or<br>execution | High | Mitigate Concerns –<br>Clearly Address<br>Their Issues Or<br>“Win” In The Plan                                         |
|                                                                                                    | Low  | Minimal Effort –<br>Only Enough To<br>Avoid A Veto                                                                     |
|                                                                                                    |      | Close Collaboration –<br>These Individuals Are<br>Normally Project<br>Team Members                                     |
|                                                                                                    |      | Involve & Secure Interest<br>So That Action Is Not<br>Postponed or Abandoned                                           |
|                                                                                                    |      | Low                      Action – active involvement in the<br>conduct of program activities                      High |

Each stakeholder is considered individually. The stakeholder is placed in one of the four quadrants of the matrix. Based upon the quadrant, the collaboration strategy for that stakeholder is determined. The selected strategy indicates the level of involvement by that stakeholder in decision-making, both during the planning and execution phases of the project. The more stakeholders involved, most project management effort required to manage the relationships and interactions with stakeholders.

**4.6.8 Performance improvement**

Did you know that 70% of projects fail and sponsor organizations continue to needlessly lose their investments when there are techniques, tools and strategies to help them? Improving Project Performance increases your project success by stepping out of the theoretical and into a bold new arena of advanced

practical experiences and lessons in project management. This seven day flagship course is designed to increase your ability to deliver complex projects, allowing you to make a more significant contribution to the future success of your business.

#### **4.6.9 KEY BENEFITS**

- Control of your role in projects
- Enhanced project performance
- Greater self-awareness
- An improved project planning process
- The ability to handle cash flow and understand its importance to you, the team and your organization
- Confidence to manage yourself and others more effectively
- Greater awareness of different contract styles and their advantages and disadvantages
- Positive relationship management.

#### **4.6.10 CORE CONTENT**

- Project Control – implement cost and schedule control
- Planning – tools to ensure deadlines are always met and penalties avoided
- Productivity – identify areas of poor productivity and tackle the issues that cause it
- Personal – learn to build a strong cohesive team who share your vision and understand the role they must play to achieve project success
- Relationships – apply a framework for creating winning stakeholder relationships.

#### **4.6.11 DELEGATE PROFILE**

- All executives involved in projects of any type across a wide range of industries. This program is appropriate regardless of your role in the organization.

### **4.7 Project management environment**

In a matrix environment, key players have critical roles in every project's success. Working in a matrix environment requires that the project manager deal with the styles, interests, and demands of more people who have some degree of control over his project's resources, goals, and objectives than in a functional or projectized structure.

#### **4.7.1 Critical roles in a matrix environment are**

- Project manager
- Project Team:
- Functional managers
- Upper management

#### **4.7.1.1 The project manager**

If you're the project manager, you're responsible for all aspects of the project. Being responsible doesn't mean you have to do the whole project yourself, but you do have to see that every activity is completed satisfactorily.

In this role, the project manager is specifically responsible for the following:

- Determining objectives, schedules, and resource budgets
- Ensuring you have a clear, feasible project plan to reach your performance targets
- Identifying and managing project risks
- Creating and sustaining a well-organized, focused, and committed team
- Selecting or creating your team's operating practices and procedures
- Monitoring performance against plans and dealing with any problems that arise
- Resolving priority, work approach, or interpersonal conflicts
- Identifying and facilitating the resolution of project issues and problems
- Controlling project changes
- Reporting on project activities
- Keeping your clients informed and committed
- Accomplishing the objectives within time and budget targets
- Contributing to your Team's performance appraisals

#### **4.7.1.2 Project Team**

Project Team must satisfy the requests of both their functional managers and their project managers. Team have the following responsibilities:

- Performing tasks in accordance with the highest standards of technical excellence in your field
- Performing assignments on time and within budget
- Maintaining the special skills and knowledge required to do the work well

In addition, you're responsible for working with and supporting your Team's project efforts:

- Considering the effect your actions may have on your Team's tasks
- Identifying situations and problems that may affect Team's tasks
- Keeping your Team informed of your progress, accomplishments, and any problems you encounter

#### **4.7.1.3 Functional managers**

Functional managers are responsible for orchestrating their staff's assignments among different projects. In addition, they provide the necessary resources for their staff to perform their work in accordance with the highest standards of technical excellence.

Specifically, functional managers are responsible for the following:

- Developing or approving plans that specify the type, timing, and amount of resources required to perform tasks in their area of specialty
- Ensuring Team are available to perform their assigned tasks for the promised amount of time

- Providing technical expertise and guidance to help Team solve problems related to their project assignments
- Providing the equipment and facilities needed for a person to do his work
- Helping people maintain their technical skills and knowledge
- Ensuring members of the functional group use consistent methodological approaches on all their projects
- Completing Team s' performance appraisals
- Recognizing performance with salary increases, promotions, and job assignments
- Approving Team s' requests for annual leave, administrative leave, training, and other activities that take time away from the job

#### **4.7.1.4 Upper management**

Upper management creates the organizational environment; oversees the development and use of operating policies, procedures, and practices; and encourages and funds the development of required information systems.

More specifically, upper management is responsible for the following:

- Creating the organizational mission and goals that provide the framework for selecting projects
- Setting policies and procedures for addressing priorities and conflicts
- Creating and maintaining labor and financial information systems
- Providing facilities and equipment to support project work
- Defining the limits of managers' decision-making authority
- Helping to resolve project issues and decisions that can't be handled successfully at lower levels in the organization

#### **4.8 Management reporting**

A significant output of management reporting systems, but by no means their sole output, is a recasting of the firm's overall financial results into profit and loss statements arrayed by, for example:

- Organization (such as division, business unit or department)
- Geographic Region
- Product
- Client Segment
- Individual Client

Financial metrics, such as revenues, expenses and profits, are hardly the sole concern of management reporting systems. They also are used to track a variety of nonfinancial variables that are of concern to management, such as:

- Employee Headcount
- Clients, Households and/or Accounts
- Client Assets in Custody
- Net New Money Deposited or Withdrawn by Clients
- Investment Performance of Client Assets Under Management

Controllers and chief financial officers tend to dedicate a significant amount of their time to designing, implementing, maintaining and adjusting management reporting systems, as well as for monitoring and analyzing their output, and recommending courses of action to line management based on such analysis.

Information technology and management science staff members often are key partners with financial managers in the development and maintenance of management reporting systems. In many cases, however, management reporting systems are constructed and maintained strictly using desktop computing, built in Excel spreadsheets and running on personal computers, rather than programmed in mainframe environments.

In large and small companies alike, the reasons for utilizing desktop computing (often requiring ample amounts of manual data input) generally are twofold. First, the costs of development and maintenance tend to be much lower than with mainframe applications. Second, a desktop computing environment allows for much greater flexibility in changing computational algorithms and reporting formats than does a typical mainframe based application. This is a vital consideration in dynamic business environments where corporate structure, product offerings, business processes, analytical methods and/or reporting requirements are in constant flux, or where management is prone to ask frequent nonstandard or customized questions of its financial analysts.

#### **4.8.1 Applications of Management Reporting**

Management reporting systems frequently are critical tools for evaluating the performance of organizations and managers, and sometimes that of lower level employees as well. The results can be key determinants of compensation, such as the setting of bonus pools. For example, the head and staff of a business unit might have their bonuses driven off the profit that a management reporting system ascribes to that unit. Likewise for a product manager, if the firm has a well developed product profitability measurement system. Also for a marketing manager with responsibility for the development and profitability of a given client segment, if the performance of that segment is measured.

#### **4.8.2 Obstacles to Developing Management Reporting Systems**

A common problem with developing management reporting schemes is that the data necessary to complete the firm's annual report, Form 10-K, Form 10-Q, tax returns and reports to regulatory agencies (among other outside constituencies), may not be detailed enough or in a proper format to conduct the sorts of analyses (some of them mentioned above) that management may need to evaluate the firm and its constituent lines of business, and to adjust its strategic direction. Management reporting is a blanket term for these sorts of analyses that are used internally by management, rather than reported to outside entities (such as the investing public, the tax authorities, and regulatory bodies).

#### **4.8.3 Key Analytical Issues**

The development of management reporting systems often faces hurdles related to key analytical issues, such as:

- Internal transfer pricing methodologies
- The attribution of corporate overheads to individual products or clients
- Disaggregating changes in client assets into the separate impacts of changes in market prices (i.e., investment performance) and of net deposits and withdrawals

In most cases, these analytical challenges are amenable to multiple methods, each of which has drawbacks of its own, and is not demonstrably superior in all situations.

#### **4.8.4 Report designing**

##### **4.8.4.1 A report can be defined as a testimonial or account of some happening**

It is purely based on observation and analysis. A report gives an explanation of any circumstance. In today's corporate world, reports play a crucial role. They are a strong base for planning and control in an organization, i.e., The reports give information which can be utilized by the management team in an organization for making plans and for solving complex issues in the organization.

A report discusses a particular problem in detail. It brings significant and reliable information to the limelight of top management in an organization. Hence, on the basis of such information, the management can make strong decisions. Reports are required for judging the performances of various departments in an organization.

##### **4.8.4.2 An effective report can be written going through the following steps-**

1. Determine the objective of the report, i.e., identify the problem.
2. Collect the required material (facts) for the report.
3. Study and examine the facts gathered.
4. Plan the facts for the report.
5. Prepare an outline for the report, i.e., draft the report.
6. Edit the drafted report.
7. Distribute the draft report to the advisory team and ask for feedback and recommendations.

##### **4.8.4.3 The essentials of good/effective report writing are as follows-**

1. Know your objective, i.e., be focused.
2. Analyze the niche audience, i.e., make an analysis of the target audience, the purpose for which audience requires the report, kind of data audience is looking for in the report, the implications of report reading, etc.
3. Decide the length of the report.
4. Disclose correct and true information in a report.
5. Discuss all sides of the problem reasonably and impartially. Include all relevant facts in a report.
6. Concentrate on the report structure and matter. Pre-decide the report writing style. Use vivid structure of sentences.
7. The report should be neatly presented and should be carefully documented.
8. Highlight and recap the main message in a report.
9. Encourage feedback on the report from the critics. The feedback, if negative, might be useful if properly supported with reasons by the critics. The report can be modified based on such feedback.
10. Use graphs, pie-charts, etc. to show the numerical data records over the years.
11. Decide on the margins on a report. Ideally, the top and the side margins should be the same (minimum 1 inch broad), but the lower/bottom margins can be one and a half times as broad as others.
12. Attempt to generate reader's interest by making appropriate paragraphs, giving bold headings for each paragraph, using bullets wherever required, etc.

## **4.9 Project evaluation**

People perform project evaluations when they want to learn about the effectiveness of their work and how it might be improved. For example, professionals in the manufacturing industry might want to learn about how a new workflow system is affecting their overall productivity. They might measure levels of productivity after implementing new systems and learn where they meet their goals and where they believe they can still benefit from the changes. One of the best tips for project evaluation is to assign a project manager who is responsible for determining how evaluations are performed. A project manager should also be responsible for determining how involved parties make use of a project evaluation to improve their organization.

Before performing a project evaluation, it is important that a manager determines if a formative or summary evaluation is needed. When professionals use formative evaluations, they analyze projects as they progress. They might improve a project as new challenges and opportunities arise. This kind of project evaluation is excellent for making sure that a program is on track and that it is flexible enough to hold up under unforeseen circumstances.

When professionals use a summary project evaluation, on the other hand, the project normally has already been completed. They want to learn if their goals have been achieved. They might also want to study how and why a project was difficult and decide on ways to make future projects smoother and more effective. In most cases, project managers use both kinds of project evaluations.

It is also important to know how a project evaluation is to be presented. Many project managers believe it is best to use several different modes of communication to gain a clearer perspective on a project. For instance, an evaluation might include written text that explains how a project worked and where it could stand to be improved. It can also include photographs or sketches related to a project. Many professionals also choose to use charts that illustrate the relationships between various components of a project.

Many people find that bringing in an outside party is very effective for performing a successful project evaluation. Professionals who work for larger organizations might want to contract with third party consultants to analyze projects and make suggestions for improvements. Individuals who work independently and who have limited budgets might want to find friends or acquaintances who are willing to look over a project and give some feedback. People in organizations with different departments might want to include representatives from other areas in evaluations to give feedback from different perspectives.

### **4.9.1 The Phases of a Project Evaluation**

#### **4.9.1.1 Ex-Ante Evaluation**

Ex-ante evaluation is conducted before the implementation of a project and can include feasibility studies, appraisals, policy assessments and participatory planning activities. This is the first phase of a new project evaluation and starts the activities of the project management cycle. Based on the results of the ex-ante evaluation, a project is implemented, abandoned or reformulated. Performing ex-ante evaluations improves the quality, relevance and comprehensiveness of project design.

#### **4.9.1.2 Midterm Evaluation**

After a project has been designed and implemented, it should be monitored. The first component of monitoring is the midterm evaluation. Midterm evaluations occur at any time during the project to ensure that things are progressing according to plan. A monitoring schedule should be established at the beginning of project implementation. Midterm evaluations are designed to improve the management of the project to stay on course to meet project outcomes.

#### **4.9.1.3 Terminal Evaluation**

Terminal evaluations are the second component of monitoring. They occur toward the end of a project and should be scheduled, like the midterm evaluations. The overall efficiency, budget specifics, output and expected impacts of the project should be reported in the terminal evaluation. The data collected in the terminal evaluation are compared to the benchmarks and indicators outlined in the logic model that is created as a part of the project design.

#### **4.9.1.4 Ex-Post Evaluation**

Ex-post evaluation is the assessment of a project after its completion. The primary focus of ex-post evaluations is the overall lasting impacts of the project. The project management cycle actually starts with the ex-post evaluation of other similar projects, which feeds back into initial project planning. Evaluation is a continuous process and an integral part of project management.

#### **4.9.1.5 Project Monitoring & Evaluation**

Monitoring and evaluation (M&E) are important parts of project management and should be seamlessly integrated into personnel activities. Evaluation is the systematic collection and assessment of information related to the outcomes, operation, or process of a project. Monitoring is a part of evaluation that occurs while a project is being implemented, usually in the form of mid-term and terminal evaluations. M&E improves project effectiveness, efficiency, and increases the probability of reaching project goals.

##### **4.9.1.5.1 Instructions**

Appoint an evaluation facilitator. This person can be someone already a part of your organization or you can hire an outside expert. The evaluation facilitator oversees the evaluation system, assesses personnel and organizational evaluation capacity, helps the organization choose the most appropriate evaluation tools, and guides relevant parties through each component of the evaluation.

Develop a logic model. A logic model links your project's goals to its activities and inputs, ensuring that there are no gaps or leaps in logic. This will become a guiding document for the management of your project and the framework of your evaluation activities. Creating a theory of change is a similar process, but employs a more holistic, big picture approach.

Establish an evaluation schedule. Once you have a good understanding of the parameters of your project through the logic model, you can determine which areas you can measure at which times. Your evaluation schedule should include an ex-ante evaluation (feasibility study) before project launch, monitoring

(midterm and terminal evaluations) during project implementation, and an ex-post evaluation (impact assessment) after the project has been completed.

Choose evaluation tools. Your logic model will help you determine the areas of interest in your evaluation and this will lead you to the appropriate evaluation tools. You can use a "toolbox" evaluation that provides you with worksheets and templates to follow, otherwise you will need to create your own assessment with various quantitative or qualitative approaches, such as empowerment evaluation, or surveys based on your indicators.

Implement evaluations based on your schedule. Again referencing your logic model, decide when it is most appropriate to evaluate certain aspects of your project. For instance, you will want to monitor that your funds are cost effectively rendering your desired outputs in a midterm evaluation, but cannot assess whether or not you reached your final goal until after the project is finished in an ex-post evaluation.

Feed results back into project management improvements. The results of the ex-ante evaluation should be reflected in improvements in project design before implementation. Monitoring data should be incorporated immediately into project management. Ex-post evaluation results should be used in the planning of other similar projects. Establish a system by which evaluation results are reported to relevant parties and integrated into future project management.

#### **4.10 project review**

These activities have many names: Project Reviews, Debriefs, Retrospectives, Post Project Reviews, Mid Project Reviews, Project Audits, Lessons Learned.

Most often called Postmortems on software projects, Project Reviews are examinations of projects or events for the purposes of:

- Reviewing the events that occurred.
- Evaluating not only what happened, but also why those events happened.
- Determining the correct actions to take to improve the results of the next event or project.

Project Reviews can occur at any time during a project and can be used to evaluate the success of both events and projects.

##### **4.10.1 What are the goals of a Project Review?**

- Put into place a set of documented, well-understood procedures and guidelines that are available to all participants prior to the event.
- Make clear to all participants that the process will be positive and blame-free.
- Provide an environment that fosters openness and candor.
- Ensure that lessons learned from Project Reviews are shared widely and have a positive effect on future projects.
- Provide an appropriate balance between the cost of Project Reviews (precious people time) and the return on investment to the team and the organization. This includes the benefit of getting closure, as well as insight into root causes and their effects, and actions taken - real changes in behavior on the part of the organization.
- Provide a flexible set of tools and methods that will allow project teams of all sizes and complexity to analyze significant project events and synthesize the findings into a plan of action for remediation.
- Provide a link from lessons learned to solutions implemented on future projects.

#### **4.10.2 Why do a Project Review? (What are the Benefits?)**

Lessons learned from Project Reviews are useful from many perspectives. The real benefit from Project Reviews is the opportunity to step back and take a deeper look into the system. During the throes of delivery when a problem is observed, the inclination is to fix things quickly without a thorough examination of what is really happening. We call this the ready, fire, aim approach. Sometimes this works. Project Reviews that follow this process allow us to take a deeper look and examine the underlying values, practices, and assumptions that got us in trouble in the first place. We can then precisely craft an appropriate solution and monitor the solution carefully.

##### **4.10.2.1 What's in it for Management?**

- Management benefits by gaining insight into the way that the organization is working.
- It enhances our ability to distinguish between common causes and special causes of variation in the project development process.
- The organization can work collaboratively towards a common understanding of the system.
- It builds common metrics so we can track our efforts across projects.
- It provides an opportunity to exercise fact based management.
- It facilitates the development of a clearer vision of improvement in the system.
- It helps in visualizing what change would look like.

##### **4.10.2.2 What's in it for Teams?**

- Teams learn how roles and responsibilities can be redesigned to enhance product development.
- It provides an historical link through which we can build or accumulate theory and knowledge.
- It provides an opportunity for teams take effective action and have control over the future that increases job satisfaction, morale, and our ability to take joy in work.
- The team can build on their understanding of common assumptions.
- It provides a structured process for developing shared learning and shared meaning.

##### **4.10.2.3 What's in it for Project Managers?**

- Project managers learn how to improve project management methods and infrastructure to enhance productivity and ensure that project goals are met.
- It helps us identify and work towards common, known, related goals.
- It separates the people from the system.
- It provides different points of view and perspectives so we can evaluate our assumptions.
- It enhances our understanding of the current reality.

##### **4.10.2.4 What's in it for Individual Contributors**

- Individual contributors learn how to improve tasks and deliverables to increase effectiveness.
- It increases our understanding of key elements needed to support productive work.
- It helps us see how our actions impede or enhance the success of the project.
- It reveals weakness and strengths in our project documentation and communication methods.
- It provides an opportunity to get closure.

#### **4.10.3 How can we ensure a successful Project Review?**

Project Reviews are not "one size fits all" solutions. As with any business improvement effort, you get what you pay for and it can get expensive. Project reviews are expensive in terms of investment of the time of valuable resources. After projects are shipped and events are over most Team are busy either mopping up after things or are already immersed in the next, already late project.

It takes a lot of energy and enthusiasm to pull off a successful project review. These factors will ensure your success.

##### **4.10.3.1 Ensure that you get the right information.**

- Get the right people to participate.
- Get honest feedback.
- Ask the right, unbiased questions.
- Ask questions in a neutral fashion.
- Ensure that participants can differentiate between objective and subjective project data.

##### **4.10.3.2 Plan carefully.**

- Schedule at a time when the project is still fresh.
- Identify participants that we "can't do without".
- Assign responsibility for data collection.
- Identify the right categories of areas to explore.
- Schedule when conflicts are not a problem.
- Make sure that management makes it clear that this work is important.
- Assign an experienced facilitator to lead the meetings.
- Practice with the tools before the meeting.

#### **4.10.4 How to do a Project Review**

So you've been asked to do a project review for a colleague? You've made it in the eyes of your colleagues, as another project manager considers you a great choice to comment on their project in an objective and constructive way.

However, far from being considered an honor, many project managers find it daunting to be asked to review someone else's project. A project review is like a mini audit, but more informal. What if you miss something and get blamed for it later? What if they don't like what you have to say and it's difficult to work with them in the future? Yes, project reviews can be challenging, but if you are professional and friendly, backing up your comments with evidence, you can be a real help and support to your colleagues. And one day, they will return the favor for you.

#### **4.10.5 Steps for Preparing for Your First Project Review.**

##### **4.10.5.1 Establish what to look for**

What you are looking for on your colleague's project will very much depend on the size of it. If they are running a small project that will be finished in a few months you don't want to spend six weeks investigating every area. If it's a huge project spanning several years, a one-off meeting with the project manager won't be enough to uncover any problems.

You could choose a couple of areas to focus on as long as the project manager agrees. Risk management and the project schedule would be good areas to investigate in detail if you don't have time to look at everything.

While reviews typically aim to uncover problem areas so that you can help your colleague get his or her project back on track, you will also want to spend some time looking at things they are doing well. This is valuable feedback for them, so that they keep on doing those things, and these can be shared with other project managers in the company. That way you all benefit from good practice.

Look out as well for what is not being done. On complex and busy projects it is often the case that certain project management tasks get dropped temporarily while the team catches up. There is the risk that they never get reinstated. This is your opportunity to remind the project manager that they really should go back to doing that activity, or start doing it if they never have in the first place.

#### **4.10.5.2 Get some templates (or make them)**

Your Program or Portfolio Office may have some standard project management templates that you can use for your project review. The document will include questions to ask and a space to record the answers. Or ask around and find out what other project managers have used in the past. You can also search the internet or talk to your mentor – all these options would be faster than designing a document from scratch.

If you really can't find anything, talk to a colleague who has done a project review before. They will know the kinds of things to include in the report and therefore what needs to go in your assessment template. If you have to write your own document, think about what you would like to know if someone was reviewing your project, and write down those questions.

#### **4.10.5.3 Forget about learning the detail**

It's unlikely that your colleague's project will be about the same thing as your current project. They could be managing something with the Marketing team while you are working with IT. They may be working with a local team while you are managing an international project. Each project is different, and you can't be expected to know the technical detail about the project you are reviewing. Luckily, you don't need to.

Look at the generic techniques that are used on all projects – this is where you can add real value, but only if you provide your feedback in a supportive way. Aim of constructive criticism rather than pointing out mistakes and apportioning blame.

#### **4.10.5.4 Meet the project manager**

The next step is to meet the project manager. Share your review template with them so that they know what you will be asking. You can ask them if they have any particular areas that they want you to investigate, and then together check that your review template includes these.

Check if they want you to mainly review the contents of the online project management tool such as the schedule and risk log, or whether they would prefer you to interview the project Team, Or both.

You should also agree how long the review will take, how long you'll need to spend with any project Team (so that the project manager can reorganize their work as required) and what format the feedback will take. Some project managers will prefer a formal report, others may be happy with a short summary document or even an informal chat. Agree how you'll produce your feedback as this will save you a lot of time at the end. There's no point producing a 20-page detailed report if they are only going to read the summary!

#### **4.10.5.5 Review the project**

Next you have to – of course – review the project. Work with the relevant Team and review the documents and materials available online. Go through your list of review questions and be sure to cover off the areas that the project manager specifically wanted your feedback on. How long this step takes depends on the amount of material you have to look through and what you are looking for.

#### **4.10.5.6 Prepare your report**

Prepare your findings in the format that you agreed with the project manager. You could split the report into sections for risk management, the schedule, the budget, team communications or anything else that you have been asked to look at.

Remember to keep your assessment constructive and provide solutions where you have them. For example, if you find that the project schedule isn't being kept up to date, you could recommend that they make better use of the online project management software, or that the project manager adds a diary note to remind the Team to update their tasks on a more regular basis.

It won't help the project manager if you report back that they are doing a truly amazing job. Everyone can improve something, and you've been asked to carry out the review to help the project manager run the project more effectively. If you tell them that they are doing just fine then they will rightly wonder what the point was of spending all that time on the review process. Be balanced with your feedback though; it is not much help pointing out errors in the past that the team can now do nothing about.

#### **4.10.5.7 Share the findings**

Set up a meeting with the project manager to share the findings. Ideally, you should send them a copy of your report in advance so that they have time to review the document and can come to the meeting with comments. Discuss it openly, and then you may choose to issue a revised version of your report incorporating their feedback.

Project reviews are designed to help peers work together to identify areas where they could do better on their projects. A review should pick up areas for improvement without being overly critical or unbalanced. The feedback should be actionable so that the project manager can do something with it. Don't be scared of project reviews, whether you are receiving them or carrying them out. A good review will show you areas where you can improve and potentially pick up problems before they become too difficult to manage, which helps everyone in the long run.

Share your project review templates with the online document storage functionality of ProjectManager.com. This software makes it easy to review other people's project schedules and documentation as they can grant you access with just a couple of clicks.

#### 4.10.6 Importance of Doing a Project Review

One of the key features of anything that qualifies as a project is that it has a definite start and a definite end. In ancient days, the Egyptians and Romans were the champions of project management. Their projects primarily consisted of construction of architectural structures that had no precedence to follow. And almost all of their projects were long haul projects. But still they carried out those projects with acute precision and accuracy.

It would have been simple for them to achieve all that probably because they divided a whole project into many smaller projects and conducted on-going project reviews. Don't you agree?

In software project management too, project managers should allot some time in their project schedules for reviews where they ask the following fundamental but important questions:

- What is the objective of the project?
- Have we allotted the best possible resources?
- Is this the best approach or does anyone have a better solution?
- Do we need to incorporate requirement change?
- Do we need to revise the project plan and schedule?

It is also recommended that the project managers get an "alligator" peer review done to catch any hidden alligators lurking to pounce at the end of a project. To get an alligator review done, it is advised that the project managers find a fellow project manager (reviewer) who can spend a day or two to review the project and is not afraid of giving a brutally honest feedback. It will then be up to the project manager to take a call on his peer's review feedback.

Getting a peer review done can be really helpful. A peer review is usually an unbiased and a fresh perspective which can identify risks that you may have missed out and/or provision for any event that has already occurred but the results of which have not yet surfaced.

Experts advise that any project that is longer than a year should have more than one on-going review.

Post project reviews are more common. It is important for project managers and Team take stock of things that went well and those that created bottlenecks at the end of a project. The project managers must make a list of 'lessons learned' and document it too. Broadly, some of the typical elements of a post project review are:

- To prepare a feedback mechanism for gathering the team's response
- To identify things that went well
- To identify things that struggled and created bottlenecks
- To identify things that met with failure
- To compare requirement specifications with the end result and measure the deviation

Just like the post project review, on-going project reviews are highly recommended so that the same 'lessons learned' can be implemented within the same project to minimize project issues pertaining to:

- Software quality
- Delivery schedule
- Budget
- Deviation from the requirements
- Overall impact on business

So much said and done for the projects which have a definite start and a definite end. But not all software projects may have a start and an end date. Many projects turn into long-term maintenance projects after the development stage is over. Such projects also need reviews at specific intervals so that the Team have a clear picture of what is expected of them at different stages. Reviews will help Team to put in their best performance.

I believe, unless reviews are done often, and ‘lessons learned’ are documented and conveyed properly, the complete process of doing a project review is a waste of efforts. Whereas post project reviews are more common, on-going project reviews should be given high priority too. As Winston Churchill said, “All men make mistakes, but only wise men learn from their mistakes.” So, isn’t it better if the lessons learnt can be implemented earlier for avoiding project issues in a current project?

#### *Review Questions*

1. Define the Project implementation stages?
2. Explain the Management techniques for project management?
3. Explain the project monitoring?
4. Explain the management reporting?

#### *Discussion Questions*

Discuss the project evaluation and its importance ?

## **Project feasibility study**

### Learning Objectives

- To define the feasibility study.
- To explain the Market Feasibility.
- To explain the Technical and Financial Feasibility.
- To describe the Critical Success factors.

### **5.1 Feasibility study**

A **feasibility study** is an evaluation and analysis of the potential of the proposed project which is based on extensive investigation and research to support the process of decision making.

#### **5.1.1 Overview**

Feasibility studies aim to objectively and rationally uncover the strengths and weaknesses of an existing business or proposed venture, opportunities and threats present in the environment, the resources required to carry through, and ultimately the prospects for success. In its simplest terms, the two criteria to judge feasibility are cost required and value to be attained.

As such, a well-designed feasibility study should provide a historical background of the business or project, description of the product or service, accounting statements, details of the operations and management, marketing research and policies, financial data, legal requirements and tax obligations. Generally, feasibility studies precede the technical development and project implementation.

A feasibility study evaluates the project's potential for success; therefore, the perceived objectivity is an important factor in the credibility to be placed on the study by potential investors and lending institutions. It must therefore be conducted with an objective, unbiased approach to provide information upon which decisions can be based.

#### **5.1.2 Feasibility study topics**

##### **5.1.2.1 Common factors**

The acronym TELOS refers to the five areas of feasibility - Technical, Economic, Legal, Operational, and Scheduling.

##### **5.1.2.1.1 Technology and system feasibility**

The assessment is based on an outline design of system requirements, to determine whether the company has the technical expertise to handle completion of the project. When writing a feasibility report, the following should be taken into consideration:

- A brief description of the business to assess more possible factor/s which could affect the study

- The part of the business being examined
- The human and economic factor
- The possible solutions to the problems

At this level, the concern is whether the proposal is both *technically* and *legally* feasible (assuming moderate cost).

#### **5.1.2.1.2 Legal Feasibility**

Determines whether the proposed system conflicts with legal requirements, e.g. a data processing system must comply with the local Data Protection Acts.

#### **5.1.2.1.3 Operational Feasibility**

Operational feasibility is a measure of how well a proposed system solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.

The operational feasibility assessment focuses on the degree to which the proposed development projects fit in with the existing business environment and objectives with regard to the development schedule, delivery date, corporate culture, and existing business processes.

To ensure success, desired operational outcomes must be imparted during design and development. These include such design-dependent parameters such as reliability, maintainability, supportability, usability, producibility, disposability, sustainability, affordability and others. These parameters are required to be considered at the early stages of design if desired operational behaviors are to be realized. A system design and development requires appropriate and timely application of engineering and management efforts to meet the previously mentioned parameters. A system may serve its intended purpose most effectively when its technical and operating characteristics are engineered into the design. Therefore operational feasibility is a critical aspect of systems engineering that needs to be an integral part of the early design phases.

#### **5.1.2.1.4 Economic Feasibility**

The purpose of the economic feasibility assessment is to determine the positive economic benefits to the organization that the proposed system will provide. It includes quantification and identification of all the benefits expected. This assessment typically involves a cost/ benefit analysis.

#### **5.1.2.1.5 Technical Feasibility**

The technical feasibility assessment is focused on gaining an understanding of the present technical resources of the organization and their applicability to the expected needs of the proposed system. It is an evaluation of the hardware and software and how it meets the need of the proposed system

#### **5.1.2.1.6 Schedule Feasibility**

A project will fail if it takes too long to be completed before it is useful. Typically this means estimating how long the system will take to develop, and if it can be completed in a given time period using some

methods like payback period. Schedule feasibility is a measure of how reasonable the project timetable is. Given our technical expertise, are the project deadlines reasonable? Some projects are initiated with specific deadlines. You need to determine whether the deadlines are mandatory or desirable.

#### **5.1.2.1.7 Other feasibility factors**

##### **5.1.2.7.1 Market and real estate feasibility**

Market feasibility studies typically involve testing geographic locations for a real estate development project, and usually involve parcels of real estate land. Developers often conduct market studies to determine the best location within a jurisdiction, and to test alternative land uses for given parcels. Jurisdictions often require developers to complete feasibility studies before they will approve a permit application for retail, commercial, industrial, manufacturing, housing, office or mixed-use project. Market Feasibility takes into account the importance of the business in the selected area.

##### **5.1.2.7.2 Resource feasibility**

This involves questions such as how much time is available to build the new system, when it can be built, whether it interferes with normal business operations, type and amount of resources required, dependencies,

##### **5.1.2.7.3 Financial feasibility**

In case of a new project, financial viability can be judged on the following parameters:

- Total estimated cost of the project
- Financing of the project in terms of its capital structure, debt equity ratio and promoter's share of total cost
- Existing investment by the promoter in any other business
- Projected cash flow and profitability

The financial viability of a project should provide the following information:

- Full details of the assets to be financed and how liquid those assets are.
- Rate of conversion to cash-liquidity (i.e. how easily can the various assets be converted to cash?).
- Project's funding potential and repayment terms.
- Sensitivity in the repayment capability to the following factors:
  - Time delays.
  - Mild slowing of sales.
  - Acute reduction/slowing of sales.
  - Small increase in cost.
  - Large increase in cost.
  - Adverse economic conditions.

## **5.2 Market research study and analysis**

This is one of the most important sections of the feasibility study as it examines the marketability of the product or services and convinces readers that there is a potential market for the product or services. If a significant market for the product or services cannot be established, then there is no project.

Typically, market studies will assess the potential sales of the product, absorption and market capture rates and the project's timing.

The feasibility study outputs the *feasibility study report*, a report detailing the evaluation criteria, the study findings, and the recommendations.

### 5.2.1 Market Feasibility Analysis

A Market Feasibility Analysis determines the likelihood that a proposed land use or development will fulfill the objectives of a particular investor or community. For example, a feasibility study for a proposed housing subdivision should:

- Estimate the demand for housing units in the area;
- Estimate the absorption rate (expected annual sales or new occupancy of a particular type of land use) for the project;
- Discuss legal and other considerations;
- Forecast Cash Flows; and
- Approximate investment returns likely to be produced.

Though it is helpful to have development sites in mind to complete a market feasibility study, it is not necessary. A market study can help a community understand its economic strengths and weaknesses. These studies analyze spending patterns, incomes, leakage (sales revenues leaving the community) and service gaps.

Cities and Counties often see either a gap in services/demand for services or see an opportunity within their community, but need to know whether or not the gap/demand is enough to make a project feasible.

Studies can be done for specific uses like housing, lodging/conference, retail, office/commercial, parking, recreation opportunities, special events, community uses (like museums, theatres, and music venues) as well as for neighborhoods, focus areas or districts such as a downtown feasibility study.

The tools in this toolbox's focus on various types of feasibility studies and how these studies inform the development process.

### 5.2.2 Key Components of a Market Research Feasibility Study

One of the most preferred types of projects that comes our way at Research & Marketing Strategies (RMS) is a market research feasibility study. The request from our client usually pertains to needing research around a new program they want to offer at their institution, a new type of business they want to start in the area or an expansion to their current business. The main objective of a market research feasibility study is to understand the market and determine whether enough demand exists to make the venture successful. Arguably, there isn't another type of market research report that offers more in-depth and thorough analysis than a market research feasibility study report.

Here are five key components to any quality market research feasibility study:

- **Stakeholder In-Depth Interviews (IDIs)** - RMS has found through past studies, beginning the market research by talking with key stakeholders is a perfect starting point. It helps all groups buy

into ownership of the process and support the market research. It also helps the market research team familiarize itself with the project and its goals in a qualitative and open-discussion format. This is a mutually beneficial first step for both parties. These stakeholders can range from key personnel in the organization, outside the organization, those involved in the local economy or any other stakeholders who may offer credible feedback and play a role in your business plans.

- **Demographic Assessment and Trend Analysis-** We've discussed the importance of demographic assessments in a site selection process before on our blog – [click here to read Vance's post](#). This involves secondary research and analyzing the market. This also creates your pool or population that you will use for your demand modeling and estimates. Information is collected for the market with regards to population trends, age, consumer expenditures, education and any other relevant demographic statistics that would impact the feasibility of the project. RMS also uses secondary research to find existing industry trends and ancillary data that is worth noting. This can easily be collected through the Internet with our team of professional Googlers.
- **Quantitative Survey** – This is the portion of the market research project where primary data are collected among end-users. The questions are focused on current usage and predicted usage and understanding the impact the new business idea will have on the market. This is the most integral part of the market research feasibility study and many of the questions asked in the survey will serve as the foundation for the demand model and estimates.
- **Competitive Assessment** - The competitive assessment takes a look at like-competitors in the market area that will impact your new business. RMS creates an expansive profile of each competitor and uses mystery shopping calls and visits to collect the non-publically available information, which isn't available on the website. By analyzing competitors, it also helps our clients understand service or product gaps in which they can market themselves.
- **Demand Model/Estimates with Recommendations** - The final step to a quality market research feasibility study is putting together the first four components and using the findings from each to create a demand model. The demand model will estimate/predict the likelihood and habits of end-users for the new business you are testing. The demand estimates use predictive modeling to offer a rough figure based on the combination of known factors and assumptions. The executive summary also serves as a nice and short snapshot of findings, which works well for upper management if they do not have the time to read through a 100-plus page report. Finally, any good market research firm will be objective in their analysis and provide its client with a "go" or "no go" recommendation.

### 5.3 Technical feasibility

A large part of determining resources have to do with assessing technical feasibility. It considers the technical requirements of the proposed project. The technical requirements are then compared to the technical capability of the organization. The systems project is considered technically feasible if the internal technical capability is sufficient to support the project requirements.

The analyst must find out whether current technical resources can be upgraded or added to in a manner that fulfills the request under consideration. This is where the expertise of system analysts is beneficial, since using their own experience and their contact with vendors they will be able to answer the question of technical feasibility.

The essential questions that help in testing the operational feasibility of a system include the following:

- ☐ Is the project feasible within the limits of current technology?
- ☐ Does the technology exist at all?
- ☐ Is it available within given resource constraints?
- ☐ Is it a practical proposition?
- ☐ Manpower- programmers, testers & debuggers
- ☐ Software and hardware

- ☐ Are the current technical resources sufficient for the new system?
- ☐ Can they be upgraded to provide to provide the level of technology necessary for the new system?
- ☐ Do we possess the necessary technical expertise, and is the schedule reasonable?
- ☐ Can the technology be easily applied to current problems?
- ☐ Does the technology have the capacity to handle the solution?
- ☐ Do we currently possess the necessary technology?

#### 5.4 OPERATIONAL FEASIBILITY

**Operational feasibility is dependent on human resources available for the project and involves projecting whether the system will be used if it is developed and implemented.**

Operational feasibility is a measure of how well a proposed system solves the problems, and takes advantage of the opportunities identified during scope definition and how it satisfies the requirements identified in the requirements analysis phase of system development.

Operational feasibility reviews the willingness of the organization to support the proposed system. This is probably the most difficult of the feasibilities to gauge. In order to determine this feasibility, it is important to understand the management commitment to the proposed project. If the request was initiated by management, it is likely that there is management support and the system will be accepted and used. However, it is also important that the employee base will be accepting of the change.

The essential questions that help in testing the operational feasibility of a system include the following:

- ☐ Does current mode of operation provide adequate throughput and response time?
- ☐ Does current mode provide end users and managers with timely, pertinent, accurate and useful formatted information?
- ☐ Does current mode of operation provide cost-effective information services to the business?
- ☐ Could there be a reduction in cost and or an increase in benefits?
- ☐ Does current mode of operation offer effective controls to protect against fraud and to guarantee accuracy and security of data and information?
- ☐ Does current mode of operation make maximum use of available resources, including people, time, and flow of forms?
- ☐ Does current mode of operation provide reliable services
- ☐ Are the services flexible and expandable?
- ☐ Are the current work practices and procedures adequate to support the new system?
- ☐ If the system is developed, will it be used?
- ☐ Manpower problems
- ☐ Labor objections
- ☐ Manager resistance
- ☐ Organizational conflicts and policies
- ☐ Social acceptability
- ☐ Government regulations
- ☐ Does management support the project?
- ☐ Are the users not happy with current business practices?
- ☐ Will it reduce the time (operation) considerably?
- ☐ Have the users been involved in the planning and development of the project?
- ☐ Will the proposed system really benefit the organization?
- ☐ Does the overall response increase?
- ☐ Will accessibility of information be lost?
- ☐ Will the system affect the customers inconsiderable way?

- ☐ Legal aspects
- ☐ How do the end-users feel about their role in the new system?
- ☐ What end-users or managers may resist or not use the system?
- ☐ How will the working environment of the end-user change?
- ☐ Can or will end-users and management adapt to the change?

## 5.5 ECONOMIC FEASIBILITY

Economic analysis could also be referred to as cost/benefit analysis. It is the most frequently used methods for evaluating the effectiveness of a new system. In economic analysis the procedure is to determine the benefits and savings that are expected from a candidate system and compare them with costs. If benefits outweigh costs, then the decision is made to design and implement the system. An entrepreneur must accurately weigh the cost versus benefits before taking an action.

Possible questions raised in economic analysis are:

- ☐ Is the system cost effective?
- ☐ Do benefits outweigh costs?
- ☐ The cost of doing the full system study
- ☐ The cost of business employee time
- ☐ Estimated cost of hardware
- ☐ Estimated cost of software/software development
- ☐ Is the project possible, given the resource constraints?
- ☐ What are the savings that will result from the system?
- ☐ Cost of employees' time for study
- ☐ Cost of packaged software/software development
- ☐ Selection among alternative financing arrangements (rent/lease/purchase)

The concerned business must be able to see the value of the investment it is pondering before committing to an entire system study. If short-term costs are not overshadowed by long-term gains or produce no immediate reduction in operating costs, then the system is not economically feasible, and the project should not proceed any further. If the expected benefits equal or exceed costs, the system can be judged to be economically feasible. Economic analysis is used for evaluating the effectiveness of the proposed system.

The economic feasibility will review the expected costs to see if they are in-line with the projected budget or if the project has an acceptable return on investment. At this point, the projected costs will only be a rough estimate. The exact costs are not required to determine economic feasibility. It is only required to determine if it is feasible that the project costs will fall within the target budget or return on investment. A rough estimate of the project schedule is required to determine if it would be feasible to complete the systems project within a required timeframe. The required timeframe would need to be set by the organization.

## 5.6 Financial feasibility

Having completed the study of technical feasibility, the entrepreneur should then have sufficient information to determine the costs that are likely to be involved in production. Additionally, the market survey will have supplied information about the sale price that could be achieved in the new product. The entrepreneur is therefore in a position to calculate the expected income and expenditure and hence the gross profit that can be achieved.

### 5.6.1 Start-up costs

When a new fruit and vegetable processing business is started, it is likely that money will be required to buy or convert a building and buy equipment to start production. Additionally, it is necessary to buy a stock of packaging materials and the initial raw materials and ingredients. The *start-up capital* is the amount of money that is needed to buy the facilities and equipment, to register and license the business and get the necessary hygiene certificates.

*Working Capital* includes the costs of raw materials, packaging, staff training, product promotion etc. that have to be made before the business begins to generate income from sales of the product. The requirement for working capital also continues as the business develops and is discussed further under 'Cashflow' below. Fruit and vegetable processing has relatively high requirements for working capital compared to other types of food processing. This is because of the seasonal nature of crop production and the need to buy several month's supply of crops during the season and part process them so that production can continue for a larger part of the year.

### 5.6.2 Income and profit

From the market survey, the estimated market size and share enables the expected sales to be calculated. The *gross profit* (or gross loss) is the difference between the expected income and the total operating costs over the first year, including any loan repayments. Income is therefore calculated as follows:

Income = Selling price per unit x number of units sold

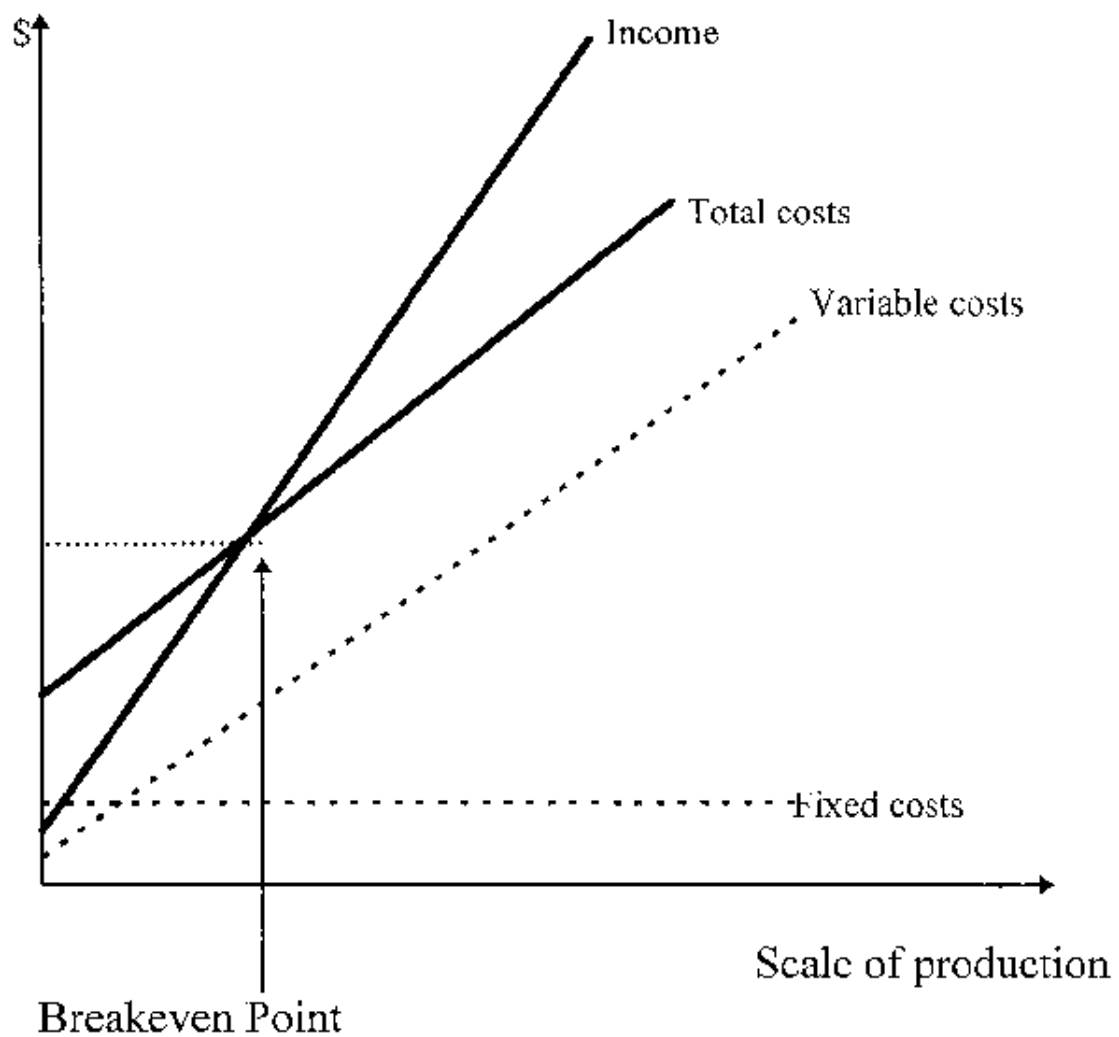
The income clearly depends on both the price of a product and the amount that is sold. When selecting a price for a product, two approaches can be taken: first the price can be based on production costs and it is set to ensure that income exceeds the total costs. This however, does not take account of competitors' prices and to be successful, the new product should be priced at or below the price of other similar products.

The second approach is therefore to set the price to compare favorably with existing products and calculate the likely profit at the planned scale of production.

Unless the new product is to be sold directly from the production unit or through a sales outlet owned by the producer, it is also important to remember the profit that will be expected by retailers. In many countries this profit is normally 10-25% of the value of each pack. In addition, there are distribution costs and perhaps special promotion costs that should also be included. The price that is charged for the product should therefore allow the producer, the distributors and the retailers make an adequate profit. In the example using mango chutney, the income to the producer is the sale price less 10% of retailer's profits (\$4.1 - 10% = \$3.7/kg).

When the production costs and income are compared using the second approach, the operation of the business should be above the *breakeven Point*. Above this point is the minimum level of production that can enable the enterprise to make a profit (Figure 34).

**Figure 34. - Breakeven Point**



Breakeven point can be calculated as follows:

- ☐ calculate the contribution for variable costs per pack
- ☐ subtract the value obtained from the sale price to obtain the 'unit contribution'
- ☐ calculate the total fixed costs per year
- ☐ divide the fixed costs by the unit contribution to obtain the annual production rate that will allow the business to break even

In the example of chutney production, the contribution for variable costs per pack (Table 21) = \$ 15,380/57,600 bags per year = \$ 0.270

The sale price per pack = \$ 3.7/kg/6.61 packs per kg = \$ 0.555 per pack

Unit contribution = sale price - (variable + labor contributions) = 0.555-0.270 = 0.285

Total fixed costs per year = \$ 7262

Breakeven = fixed costs/unit contribution = 7262/0.285 = 25,481 packs per year

When expressed as a % of total production capacity (57,600 bags per year), the breakeven point = (25,481/57,600) x 100 = 44.2%

In other words, the processor must operate at above 44% of the available capacity in order to make a profit. Clearly the higher the figure for the break-even point, the more difficult it is for a process to be profitable.

The annual production costs are calculated in Table 21 as \$22,842. If all products are sold, the annual income is calculated to be \$31,968 (36 kg per day @ \$3.7/kg x 240 days per year). This leaves a gross profit of \$9,126 per year, which after taxes, is available to pay the owner a salary and for re-investment and expansion of the business.

If the feasibility study shows that the scale of production required to meet the expected market share is below the break-even point, the entrepreneur should carefully examine the data to see if production costs can be reduced. If not, there is a question over the wisdom of proceeding further with the proposed business.

It should be noted that entrepreneurs should not automatically consider the gross profit as their own income. The money belongs to the business and they should take a fixed wage, which is recorded as another business expense. A common source of business failure happens when an owner removes cash to pay for a funeral or other family occasions and disrupts the cash flow of the business to a point that it cannot continue trading.

### 5.6.3 Financial planning

If the gross profit indicates that the proposed fruit and vegetable processing business is likely to be successful, it is then necessary to repeat the calculation of monthly gross profit for one to three years. This will then show whether there is sufficient cash available to operate the business without the need for further loans. This is known as a *cash flow forecast*.

**Table 22. - Example of cash flow forecast for chutney manufacture**

| Month                           | J     | F     | M     | A     | M         | J     | J   | A   | S   | O   | N   | D   | Total |
|---------------------------------|-------|-------|-------|-------|-----------|-------|-----|-----|-----|-----|-----|-----|-------|
| Income (\$'000)                 | 0.4   | 0.6   | 1.0   | 1.2   | 1.2 + 2.0 | 1.9   | 2.1 | 2.2 | 2.5 | 2.7 | 2.7 | 2.7 | 22.2  |
| Expenses (\$'000)               | 1.0   | 1.2   | 1.4   | 1.5   | 1.7       | 1.8   | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 1.8 | 19.4  |
| Cumulative Profit/loss (\$'000) | (0.6) | (1.2) | (1.6) | (1.9) | (0.4)     | (0.3) | 0   | 0.4 | 1.1 | 2.0 | 2.9 | 3.9 | 2.8   |

Figures in ( ) indicate a negative cashflow. The second partner's equity of \$2000 was taken in May.

From the data in Table above it can be seen that during the initial start-up period during January and February, production routines were becoming established and as a result, sales were low. The expenditure on supplies of packaging materials and fruit during this time leads to an accumulated negative cash flow of \$1,900 by April. This illustrates one of the benefits of conducting a feasibility study: the losses made over the first few months are planned and can be addressed by taking out a loan or using the owner's equity. This gives both the owner and any lenders the confidence to know that the business is under control and that the negative cash flow will cease, in this case after seven months. Lenders are more willing to provide a loan if they are confident that the finances of the business are planned and managed. This should not be done just at the start of a business but also later on, if sales are expected to fall for a while or if raw material costs rise temporarily (e.g. when the harvest season finishes). A particular problem for all small businesses is the need to order packaging materials in bulk because of minimum order sizes. This expenditure and the need to tie up cash in store packaging can be very damaging to a business cash flow. The entrepreneur should assess the alternatives of paying a higher unit price for small amounts of packaging or suffering a negative cash flow.

A similar forecast is made to show the expected development of the business over three years (not forgetting to take account of the expected actions of competitors). Finally, in assessing the financial feasibility, the data are presented as a *Profit and Loss Statement*, to calculate the net monthly profit before tax over the first three years.

#### **5.6.4 Preparing a business plan**

The advantages of writing down the results of the feasibility study are as follows:

- ☐ The findings can be set out in a clear and logical way, so that potential lenders can understand the business and its likely risks/advantages
- ☐ The document helps the entrepreneur to clarify and focus his/her ideas
- ☐ It is reference material that can be used to plan long term development of the business
- ☐ The plan can be regularly consulted and updated as a guide to the business development
- ☐ Mistakes can be made on paper rather than in the operation of the business
- ☐ When the plan shows that a successful business is possible, it makes the entrepreneur feel more confident about success
- ☐ It helps the entrepreneur to decide how much money is needed and if properly prepared, it gives the loan agency confidence that their money will be repaid.

Most lenders have little understanding of fruit and vegetable processing and the entrepreneur should therefore write the business plan in a simple way, avoiding jargon and technical language as much as possible. If lenders can understand what is involved in the business, they are more likely to approve a loan.

It is important to include as much detail as possible and if necessary do thorough research first. It is also important to look outwards from the business to judge what competitors will do and how the business will develop to become sustainable.

**Introduction:** to summarize what the product is, who is expected to buy it, why the business is a good idea,

**Basic information:** the name and address of the owners, their qualifications and experience,

**The product:** details of the raw materials, the production process, quality assurance, packaging etc. What is special about the product compared to those of competitors,

**The market:** the potential customers, where they are located, the size and value of the market, expected market share, likely expansion (or contraction) of the market, the number and types of competitors, their strengths and weaknesses and their expected reactions to a new product,

**Selling plan:** distribution and sales methods, planned promotion, product cost,

Premises/equipment: where the business will be located, building to be used and services that are needed, steps taken to meet health and hygiene laws, equipment and its cost,

**Finance:** amount required for start-up and initial operation, including profit and loss statement and cash flow forecast for three years, owner's resources that will be used, size of loan required and what it is for, security on the loan,

**Business registration:** steps that have been taken or are planned to register the business with tax authorities, local government and the Department of Health (or equivalent) for hygiene inspection and certification,

**Future plans:** objectives of the business and expectations for the next 3-5 years.

## 5.7 Critical success factor

**Critical success factor (CSF)** is the term for an element that is necessary for an organization or project to achieve its mission. It is a critical factor or activity required for ensuring the success of a company or an organization. The term was initially used in the world of data analysis, and business analysis. For example, a CSF for a successful Information Technology (IT) project is user involvement.

"Critical success factors are those few things that must go well to ensure success for a manager or an organization, and, therefore, they represent those managerial or enterprise areas, that must be given special and continual attention to bring about high performance. CSFs include issues vital to an organization's current operating activities and to its future success."

Critical success factors should not be confused with success *criteria*; those are the outcomes of a project or achievements of an organization that are needed to consider the project a success or to esteem the organization successful. Success criteria are defined by the objectives and may be quantified by KPIs.

### 5.7.1 Idea history

The idea of "success factors" was developed by D. Ronald Daniel of McKinsey & Company in 1961. The process was refined into critical success factors by John F. Rockart between 1979 and 1981. In 1995, James A. Johnson and Michael Friesen applied it to many sector settings, including health care.

Many argue that the success of a business is based on identifying a niche market that will ultimately result in growth, development and profitability.

### 5.7.2 Relation to Key Performance Indicator

Critical Success Factor vs. Key Performance Indicator (KPI):

Critical success factors are elements that are vital for a strategy to be successful. A critical success factor drives the strategy forward, it makes or breaks the success of the strategy, (hence “critical”).

Strategists should ask themselves 'Why would customers choose us?'. The answer is typically a critical success factor.

KPIs, on the other hand, are measures that quantify management objectives, along with a target or threshold, and enable the measurement of strategic performance.

An example:

- KPI = Number of new customers. (Measurable, quantifiable) + Threshold = 10 per week [KPI reached if 10 or more new customers, failed if <10]
- CSF = Installation of a call centre for providing superior customer service (and indirectly, influencing acquiring new customers through customer satisfaction).

## 5.8 Demand forecasting techniques

### 5.8.1 The Importance of Demand Forecasting

Forecasting product demand is crucial to any supplier, manufacturer, or retailer. Forecasts of future demand will determine the quantities that should be purchased, produced, and shipped. Demand forecasts are necessary for the basic operations process, moving from the suppliers' raw materials to finished goods in the customers' hands, takes time. Most firms cannot simply wait for demand to emerge and then react to it. Instead, they must anticipate and plan for future demand so that they can react immediately to customer orders as they occur. In other words, most manufacturers "make to stock" rather than "make to order" – they plan ahead and then deploy inventories of finished goods into field locations. Thus, once a customer order materializes, it can be fulfilled immediately – since most customers are not willing to wait the time it would take to actually process their order throughout the supply chain and make the product based on their order. An order cycle could take weeks or months to go back through part suppliers and sub-assemblies, through manufacture of the product, and through to the eventual shipment of the order to the customer.

Firms that offer rapid delivery to their customers will tend to force all competitors in the market to keep finished good inventories in order to provide faster order cycle times. As a result, virtually every organization involved needs to manufacture or at least order parts based on a forecast of future demand. The ability to accurately forecast demand also affords the firm opportunities to control costs through leveling its production quantities, rationalizing its transportation, and general planning for efficient logistics operations.

In general practice, accurate demand forecasts lead to efficient operations and high levels of customer service, while inaccurate forecasts will inevitably lead to inefficient, high cost operations and/or poor levels of customer service. In many supply chains, the most important action we can take to improve the efficiency and effectiveness of the logistics process is to improve the quality of the demand forecasts.

### **5.8.2 Forecasting Demand in a Logistics System**

Logistics professionals are typically interested in where and when customer demand will materialize. Consider a retailer selling through five superstores in Boston, New York, Detroit, Miami, and Chicago. It is not sufficient to know that the total demand will be 5,000 units per month, or, say, 1,000 units per month per store, on the average. Rather it is important to know, for example, how much the Boston store will sell in a specific month, since specific stores must be supplied with goods at specific times. The requirement might be to forecast the monthly demand for an item at the Boston superstore for the first three months of the next year. Using available historical data, without any further analysis, the best guess of monthly demand in the coming months would probably be the average monthly sales over the last few years. The analytic challenge is to come up with a better forecast than this simple average.

Since the logistics system must satisfy specific demand, in other words what is needed, where and when, accurate forecasts must be generated at the Stock Keeping Unit (SKU) level, by stocking location, and by time period. Thus, the logistics information system must often generate thousands of individual forecasts each week. This suggests that useful forecasting procedures must be fairly "automatic"; that is, the forecasting method should operate without constant manual intervention or analyst input.

Forecasting is a problem that arises in many economic and managerial contexts, and hundreds of forecasting procedures have been developed over the years, for many different purposes, both in and outside of business enterprises. The procedures that we will discuss have proven to be very applicable to the task of forecasting product demand in a logistics system. Other techniques, which can be quite useful for other forecasting problems, have shown themselves to be inappropriate or inadequate to the task of demand forecasting in logistics systems. In many large firms, several organizations are involved in generating forecasts. The marketing department, for example, will generate high-level long-term forecasts of market demand and market share of product families for planning purposes. Marketing will also often develop short-term forecasts to help set sales targets or quotas. There is frequently strong organizational pressure on the logistics group to simply use these forecasts, rather than generating additional demand forecasts within the logistics system. After all, the logic seems to go, these marketing forecasts cost money to develop, and who is in a better position than marketing to assess future demand, and "shouldn't we all be working with the same game plan anyway...?"

In practice, however, most firms have found that the planning and operation of an effective logistics system require the use of accurate, disaggregated demand forecasts. The manufacturing organization may need a forecast of total product demand by week, and the marketing organization may need to know what the demand may be by region of the country and by quarter. The logistics organization needs to store specific SKUs in specific warehouses and to ship them on particular days to specific stores. Thus the logistics system, in contrast, must often generate weekly, or even daily, forecasts at the SKU level of detail for each of hundreds of individual stocking locations, and in most firms, these are generated nowhere else.

An important issue for all forecasts is the "horizon," that is, how far into the future must the forecast project? As a general rule, the farther into the future we look, the more clouded our vision becomes -- long range forecasts will be less accurate than short range forecasts. The answer depends on what the forecast is used for. For planning new manufacturing facilities, for example, we may need to forecast demand many years into the future since the facility will serve the firm for many years. On the other hand, these forecasts can be fairly aggregate since they need not be SKU-specific or broken out by stockage location. For purposes of operating the logistics system, the forecasting horizon need be no longer than the cycle time for the product. For example, a given logistics system might be able to routinely purchase raw materials, ship them to manufacturing Locations, generate finished goods, and then ship the product to its field locations in, say, ninety days. In this case, the forecasts of SKU - level customer demand which can reach ninety days into the future can tell us everything we need to know to direct and control the on-going logistics operation.

It is also important to note that the demand forecasts developed within the logistics system must be generally consistent with planning numbers generated by the production and marketing organizations. If the production department is planning to manufacture two million units, while the marketing department expects to sell four million units, and the logistics forecasts project a total demand of one million units, senior management must reconcile these very different visions of the future.

### **5.8.3 The Nature of Customer Demand**

Most of the procedures in this chapter are intended to deal with the situation where the demand to be forecasted arises from the actions of the firm's customer base. Customers are assumed to be able to order what, where, and when they desire. The firm may be able to influence the amount and timing of customer demand by altering the traditional "marketing mix" variables of product design, pricing, promotion, and distribution. On the other hand, customers remain free agents who react to a complex, competitive marketplace by ordering in ways that are often difficult to understand or predict. The firm's lack of prior knowledge about how the customers will order is the heart of the forecasting problem – it makes the actual demand random.

However, in many other situations where inbound flows of raw materials and component parts must be predicted and controlled, these flows are not rooted in the individual decisions of many customers, but rather are based on a production schedule. Thus, if TDY Inc. Decides to manufacture 1,000 units of a certain model of personal computer during the second week of October, the parts requirements for each unit are known. Given each part supplier's lead-time requirements, the total parts requirement can be determined through a structured analysis of the product's design and manufacturing process. Forecasts of customer demand for the product are not relevant to this analysis. TDY, Inc., may or may not actually sell the 1,000 computers, but that is a different issue altogether. Once they have committed to producing 1,000 units, the inbound logistics system must work towards this production target. The Material Requirements Planning (MRP) technique is often used to handle this kind of demand. This demand for component parts is described as dependent demand (because it is dependent on the production requirement), as contrasted with independent demand, which would arise directly from customer orders or purchases of the finished goods. The MRP technique creates a deterministic demand schedule for component parts, which the material manager or the inbound logistics manager must meet. Typically a detailed MRP process is conducted only for the major components (in this case, motherboards, drives, keyboards, monitors, and so forth). The demand for other parts, such as connectors and memory chips, which are used in many different product lines, is often simply estimated and ordered by using statistical

forecasting methods such as those described in this chapter.

#### **5.8.4 General Approaches to Forecasting**

All firms forecast demand, but it would be difficult to find any two firms that forecast demand in exactly the same way. Over the last few decades, many different forecasting techniques have been developed in a number of different application areas, including engineering and economics. Many such procedures have been applied to the practical problem of forecasting demand in a logistics system, with varying degrees of success. Most commercial software packages that support demand forecasting in a logistics system include dozens of different forecasting algorithms that the analyst can use to generate alternative demand forecasts. While scores of different forecasting techniques exist, almost any forecasting procedure can be broadly classified into one of the following four basic categories based on the fundamental approach towards the forecasting problem that is employed by the technique.

##### **5.8.4.1 Judgmental Approaches.**

The essence of the judgmental approach is to address the forecasting issue by assuming that someone else knows and can tell you the right answer. That is, in a judgment-based technique we gather the knowledge and opinions of people who are in a position to know what demand will be. For example, we might conduct a survey of the customer base to estimate what our sales will be next month.

##### **5.8.4.2 Experimental Approaches**

Another approach to demand forecasting, which is appealing when an item is "new" and when there is no other information upon which to base a forecast, is to conduct a demand experiment on a small group of customers and to extrapolate the results to a larger population. For example, firms will often test a new consumer product in a geographically isolated "test market" to establish its probable market share. This experience is then extrapolated to the national market to plan the new product launch. Experimental approaches are very useful and necessary for new products, but for existing products that have an accumulated historical demand record it seems intuitive that demand forecasts should somehow be based on this demand experience. For most firms (with some very notable exceptions) the large majority of SKUs in the product line have long demand histories.

##### **5.8.4.3 Relational/Causal Approaches**

The assumption behind a causal or relational forecast is that, simply put, there is a reason why people buy our product. If we can understand what that reason (or set of reasons) is, we can use that understanding to develop a demand forecast. For example, if we sell umbrellas at a sidewalk stand, we would probably notice that daily demand is strongly correlated with the weather – we sell more umbrellas when it rains. Once we have established this relationship, a good weather forecast will help us order enough umbrellas to meet the expected demand.

##### **5.8.4.4 "Time Series" Approaches**

A time series procedure is fundamentally different than the first three approaches we have discussed. In a pure time series technique, no judgment or expertise or opinion is sought. We do not look for "causes" or relationships or factors which somehow "drive" demand. We do not test items or experiment with customers. By their nature, time series procedures are applied to demand data that are longitudinal rather than cross-sectional. That is, the demand data represent an experience that is repeated over time rather than across items or locations. The essence of the approach is to recognize (or assume) that demand occurs over time in patterns that repeat themselves, at least approximately. If we can describe these

general patterns or tendencies, without regard to their "causes", we can use this description to form the basis of a forecast.

In one sense, all forecasting procedures involve the analysis of historical experience into patterns and the projection of those patterns into the future in the belief that the future will somehow resemble the past. The differences in the four approaches are in the way this "search for pattern" is conducted. Judgmental approaches rely on the subjective, ad-hoc analyses of external individuals. Experimental tools extrapolate results from small numbers of customers to large populations. Causal methods search for reasons for demand. Time series techniques simply analyze the demand data themselves to identify temporal patterns that emerge and persist.

### **5.8.5 Judgmental Approaches to Forecasting**

By their nature, judgment-based forecasts use subjective and qualitative data to forecast future outcomes. They inherently rely on expert opinion, experience, judgment, intuition, conjecture, and other "soft" data. Such techniques are often used when historical data are not available, as is the case with the introduction of a new product or service, and in forecasting the impact of fundamental changes such as new technologies, environmental changes, cultural changes, legal changes, and so forth. Some of the more common procedures include the following:

#### **5.8.5.1 Surveys**

This is a "bottom up" approach where each individual contributes a piece of what will become the final forecast. For example, we might poll or sample our customer base to estimate demand for a coming period. Alternatively, we might gather estimates from our sales force as to how much each salesperson expects to sell in the next time period. The approach is at least plausible in the sense that we are asking people who are in a position to know something about future demand. On the other hand, in practice there have proven to be serious problems of bias associated with these tools. It can be difficult and expensive to gather data from customers. History also shows that surveys of "intention to purchase" will generally over-estimate actual demand – liking a product is one thing, but actually buying it is often quite another. Sales people may also intentionally (or even unintentionally) exaggerate or underestimate their sales forecasts based on what they believe their supervisors want them to say. If the sales force (or the customer base) believes that their forecasts will determine the level of finished goods inventory that will be available in the next period, they may be sorely tempted to inflate their demand estimates so as to insure good inventory availability. Even if these biases could be eliminated or controlled, another serious problem would probably remain. Sales people might be able to estimate their weekly dollar volume or total unit sales, but they are not likely to be able to develop credible estimates at the SKU level that the logistics system will require. For these reasons it will seldom be the case that these tools will form the basis of a successful demand forecasting procedure in a logistics system.

#### **5.8.5.2 Consensus methods**

As an alternative to the "bottom-up" survey approaches, consensus methods use a small group of individuals to develop general forecasts. In a "Jury of Executive Opinion", for example, a group of executives in the firm would meet and develop through debate and discussion a general forecast of demand. Each individual would presumably contribute insight and understanding based on their view of

the market, the product, the competition, and so forth. Once again, while these executives are undoubtedly experienced, they are hardly disinterested observers, and the opportunity for biased inputs is obvious. A more formal consensus procedure, called "The Delphi Method", has been developed to help control these problems. In this technique, a panel of disinterested technical experts is presented with a questionnaire regarding a forecast. The answers are collected, processed, and re-distributed to the panel, making sure that all information contributed by any panel member is available to all members, but on an anonymous basis. Each expert reflects on the gathering opinion. A second questionnaire is then distributed to the panel, and the process is repeated until a consensus forecast is reached. Consensus methods are usually appropriate only for highly aggregate and usually quite long-range forecasts. Once again, their ability to generate useful SKU level forecasts is questionable, and it is unlikely that this approach will be the basis for a successful demand forecasting procedure in a logistics system.

Judgment-based methods are important in that they are often used to determine an enterprise strategy. They are also used in more mundane decisions, such as determining the quality of a potential vendor by asking for references, and there are many other reasonable applications. It is true that judgment based techniques are an inadequate basis for a demand forecasting system, but this should not be construed to mean that judgment has no role to play in logistics forecasting or that salespeople have no knowledge to bring to the problem. In fact, it is often the case that sales and marketing people have valuable information about sales promotions, new products, competitor activity, and so forth, which should be incorporated into the forecast somehow. Many organizations treat such data as additional information that is used to modify the existing forecast rather than as the baseline data used to create the forecast in the first place.

### **5.8.6 Experimental Approaches to Forecasting**

In the early stages of new product development it is important to get some estimate of the level of potential demand for the product. A variety of market research techniques are used to this end.

***Customer Surveys*** are sometimes conducted over the telephone or on street corners, at shopping malls, and so forth. The new product is displayed or described, and potential customers are asked whether they would be interested in purchasing the item. While this approach can help to isolate attractive or unattractive product features, experience has shown that "intent to purchase" as measured in this way is difficult to translate into a meaningful demand forecast. This falls short of being a true "demand experiment".

***Consumer Panels*** are also used in the early phases of product development. Here a small group of potential customers are brought together in a room where they can use the product and discuss it among themselves. Panel members often pay a nominal amount for their participation. Like surveys, these procedures are more useful for analyzing product attributes than for estimating demand, and they do not constitute true "demand experiments" because no purchases take place.

***Test Marketing*** is often employed after new product development but prior to a full-scale national launch of a new brand or product. The idea is to choose a relatively small, reasonably isolated, yet somehow demographically "typical" market area. In the United States, this is often a medium sized city such as Cincinnati or Buffalo. The total marketing plan for the item, including advertising, promotions, and distribution tactics, is "rolled out" and implemented in the test market, and measurements of product

awareness, market penetration, and market share are made. While these data are used to estimate potential sales to a larger national market, the emphasis here is usually on "fine-tuning" the total marketing plan and insuring that no problems or potential embarrassments have been overlooked. For example, Proctor and Gamble extensively test-marketed its Pringles potato chip product made with the fat substitute Olestra to assure that the product would be broadly acceptable to the market.

**Scanner Panel Data** procedures have recently been developed that permit demand experimentation on existing brands and products. In these procedures, a large set of household customers agrees to participate in an ongoing study of their grocery buying habits. Panel members agree to submit information about the number of individuals in the household, their ages, household income, and so forth. Whenever they buy groceries at a supermarket participating in the research, their household identity is captured along with the identity and the price of every item they purchased. This is straightforward due to the use of UPC codes and optical scanners at checkout. This procedure results in a rich database of observed customer buying behavior. The analyst is in a position to see each purchase in light of the full set of alternatives to the chosen brand that were available in the store at the time of purchase, including all other brands, prices, sizes, discounts, deals, coupon offers, and so on. Statistical models such as discrete choice models can be used to analyze the relationships in the data. The manufacturer and merchandise are now in a position to test a price promotion and estimate its probable effect on brand loyalty and brand switching behavior among customers in general. This approach can develop valuable insight into demand behavior at the customer level, but once again it can be difficult to extend this insight directly into demand forecasts in the logistics system.

### **5.8.7 Relational/Causal Approaches to Forecasting**

Suppose our firm operates retail stores in a dozen major cities, and we now decide to open a new store in a city where we have not operated before. We will need to forecast what the sales at the new store are likely to be. To do this, we could collect historical sales data from all of our existing stores. For each of these stores we could also collect relevant data related to the city's population, average income, the number of competing stores in the area, and other presumably relevant data. These additional data are all referred to as explanatory variables or independent variables in the analysis. The sales data for the stores are considered to be the dependent variable that we are trying to explain or predict.

The basic premise is that if we can find relationships between the explanatory variables (population, income, and so forth) and sales for the existing stores, then these relationships will hold in the new city as well. Thus, by collecting data on the explanatory variables in the target city and applying these relationships, sales in the new store can be estimated. In some sense the posture here is that the explanatory variables "cause" the sales. Mathematical and statistical procedures are used to develop and test these explanatory relationships and to generate forecasts from them. Causal methods include the following:

**Econometric models**, such as discrete choice models and multiple regression. More elaborate systems involving sets of simultaneous regression equations can also be attempted. These advanced models are beyond the scope of this book and are not generally applicable to the task of forecasting demand in a logistics system.

**Input-output models** estimate the flow of goods between markets and industries. These models ensure