

1) Explain the Project Life Cycle in detail.

Answer: -

THE PROJECT LIFE CYCLE

Most projects go through similar stages on the path from origin to completion. We define these stages, shown in Figure 1-3, as the project's *life cycle*. The project is born (its start-up phase) and a manager is selected, the project team and initial resources are assembled, and the work program is organized. Then work gets under way and momentum quickly builds. Progress is made. This continues until the end is in sight. But completing the final tasks seems to take an inordinate amount of time, partly because there are often a number of parts that must come together and partly because team members "drag their feet" for various reasons and avoid the final steps.

The pattern of slow-rapid-slow progress toward the project goal is common. Anyone who has watched the construction of a home or building has observed this phenomenon. For the most part, it is a result of the changing levels of resources used during the successive stages of the life cycle. Figure 1-4 shows project effort, usually in terms of person-hours or resources expended per unit of time (or number of people working on the project) plotted against time, where time is broken up into the several phases of project life. Minimal effort is required at the beginning, when the project concept is being developed and subjected to project selection processes. (Later, we will argue that increasing effort in the early stages of the life cycle will improve the chance of project success.) Normally there is a strong correlation between the life-cycle progress curve of Figure 1-3 and the effort curve of Figure 1-4 because effort usually results in corresponding progress (although not always). Hence the mathematical derivative of the former tends to resemble the latter (Cioffi, 2004). Moreover, since the effort curve is generally nonsymmetrical, the progress curve will in general not be symmetrical either.

Activity increases as planning is completed and the real work of the project gets underway. This rises to a peak and then begins to taper off as the project nears completion, finally

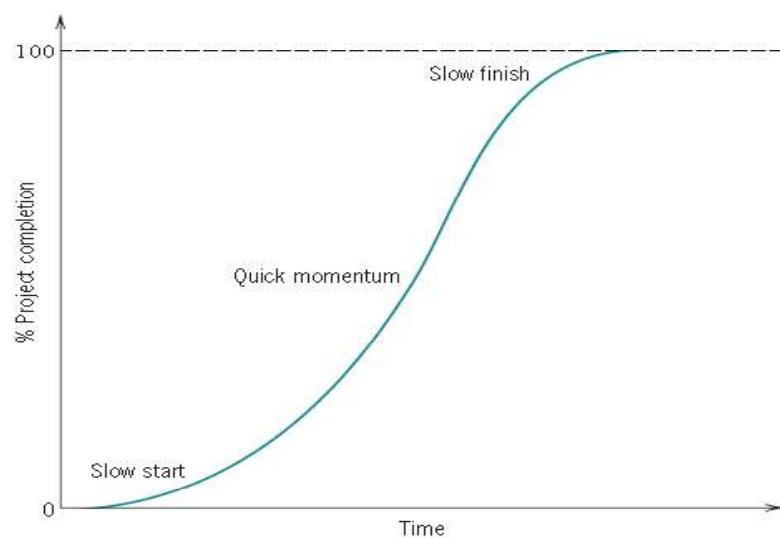


Figure 1-3 The project life cycle.

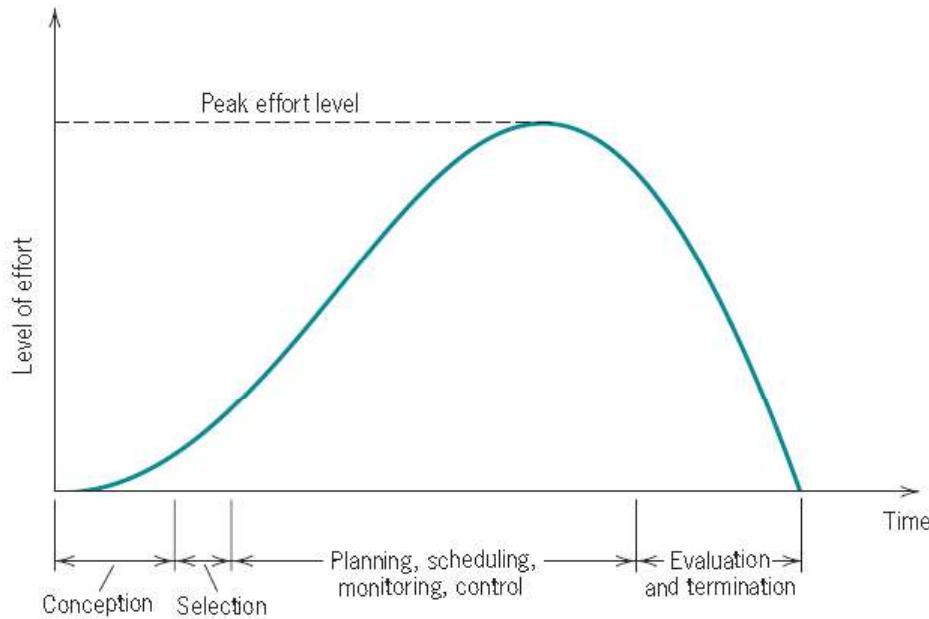


Figure 1-4 Time distribution of project effort.

ceasing when evaluation is complete and the project is terminated. While this rise and fall of effort always occurs, there is no particular pattern that seems to typify all projects, nor any reason for the slowdown at the end of the project to resemble the buildup at its beginning. Some projects end without being dragged out, as is shown in Figure 1-4. Others, however, may be like T. S. Eliot's world, and end "not with a bang but a whimper," gradually slowing down until one is almost surprised to discover that project activity has ceased. In some cases, the effort may never fall to zero because the project team, or at least a cadre group, may be maintained for the next appropriate project that comes along. The new project will then rise, phoenix-like, from the ashes of the old.

The ever-present goals of meeting performance, time, and cost are the major considerations throughout the project's life cycle. It was generally thought that performance took

precedence early in the project's life cycle. This is the time when planners focus on finding the specific methods required to meet the project's performance goals. We refer to these methods as the project's *technology* because they require the application of a science or art.

When the major "how" problems are solved, project workers sometimes become preoccupied with improving performance, often beyond the levels required by the original specifications. This search for better performance delays the schedule and pushes up the costs.

At the same time that the technology of the project is defined, the project schedule is designed and project costs are estimated. Just as it was thought that performance took precedence over schedule and cost early in the life cycle, cost was thought to be of prime importance during the periods of high activity, and then schedule became paramount during the final stages, when the client demanded delivery. This conventional wisdom turns out to be untrue. Recent research indicates that performance and schedule are more important than cost during *all* stages. The reality of time-cost-performance trade-offs will be discussed in greater detail in Chapter 3.

Figure 1-3 presents the conventional view of the project life cycle. There are, however, many projects that have a life cycle quite different from the S-shaped Figure 1-3, conventional wisdom to the contrary. Remember that Figure 1-3 shows “percent project completion” as a function of “time.” The life-cycle function is essentially unchanged if, for the horizontal axis, we use “resources” instead. In effect, the life cycle shows what an economist might call “return on input,” that is, the amount of project completion resulting from inputs of time or resources. While the S-shaped return curve reflects reality on many projects, it is seriously misleading for others.

For example, consider your progress toward getting a degree, which is usually specified, in large part, by the number of credit hours for courses successfully passed. For smooth progress toward the degree, the life-cycle “curve” would probably resemble a staircase, each level portion representing a term of study and the step up representing completion of credit toward the degree. Summer vacation would, of course, be a longer level stair continuing into the fall term. Passing a crucial licensing exam, such as the Certified Public Accountant (CPA), the bar exam for attorneys, or even an electrician’s or plumber’s certification, might appear as a long flat line along the horizontal axis with a spike at the time of passing the exam; of course, the effort curve of Figure 1-4 would look completely different.

Another type of life-cycle curve might be the installation of a new technology consisting of multiple parts, where each independent part resulted in different incremental benefits. In these cases, organizations prefer to install those parts resulting in “the biggest bang for the buck” first, so the resulting life-cycle curve would show great progress at first, and slightly less next, and continual dwindling off as the remaining parts were installed, essentially concave with “decreasing returns to scale,” as the economists call it. And there might even be an “inverse S-curve” representing fast progress at first, a slowdown in the middle, and then speeding up again at the end.

A particularly important alternative life cycle shape can be captured by the analogy of baking a cake. Once the ingredients are mixed, we are instructed to bake the cake in a 350° (F) oven for 35 minutes. At what point in the baking process do we have “cake?” Experienced bakers know that the mixture changes from “goop” (a technical term well known to bakers and cooks) to “cake” quite rapidly in the last few minutes of the baking process. The life cycle of this process looks like the curve shown in Figure 1-5. A number of actual projects have a similar life cycle, for example, some computer software projects, or chemistry and chemical engineering projects. In general, this life cycle often exists for projects in which the output is composed or constructed of several *subunits* (or subroutines) that have little use in and of themselves, but are quite useful when put together. This life-cycle curve would also be typical for projects where a chemical-type reaction occurs that rapidly transforms the output from useless to useful—from goop to cake. Another example is the preparation of the manuscript for the current edition of this book. A great deal of information must be collected, a great deal of rewriting must be done and new materials gathered, but there is no visible result until everything is assembled.

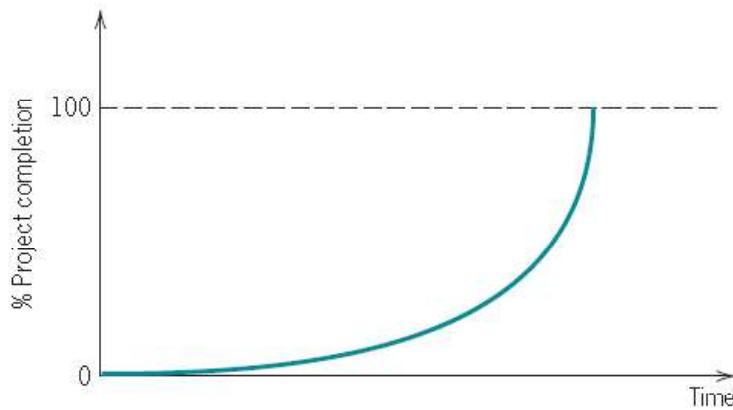


Figure 1-5 Another possible project life cycle.

Figure 1-3 shows that, as the project nears completion, continued inputs of time or resources result in successively smaller increments of completion—diminishing marginal returns. Figure 1-5 shows the opposite. As these projects near completion, additional inputs result in successively larger increments of progress—increasing marginal returns, obviously bounded at 100 percent completion. In Chapter 7, we will see that the distinction between these types of life cycles plays a critical role in developing budgets and schedules for projects. It is not necessary for the PM to estimate the precise shape of the life-cycle curve, but the PM must know which type of project life cycle applies to the project at hand.

There is another comparison between the two types of project life cycles that is instructive. For the S-shaped life cycle in Figure 1-3, percentage of project completion is closely correlated with cost, or the use of resources. In fact, this is the basis for the use of “earned value,” a technique for monitoring project progress that we will describe in more detail in Chapter 10. However, for the exponential progress curve in Figure 1-5, the expenditure of resources has little correlation with progress, at least in terms of final benefit.

Finally, not only does the shape of the project life-cycle curve fail to conform to a neat, single shape—there are also several different ways in which a project life cycle can be *viewed and understood*. We might view the project life cycle as a control system, as a mechanism to control quality, as a way of organizing the management of risk, and as a collection of small projects within larger projects within still larger projects. Each of these views of a project’s life is useful to the project manager. These will be discussed in later chapters.

2) Discuss different attributes, skills and qualities under consideration while selecting a Project Manager.

Answer: -

3.3 SELECTING THE PROJECT MANAGER

Selection of the project manager is one of the two or three most important decisions concerning the project. In this section, we note a few of the many skills the PM should possess in order to have a reasonable chance of success.

The following is a list of some of the most popular attributes, skills, and qualities that have been sought when selecting project managers:

- A strong technical background
- A hard-nosed manager
- A mature individual
- Someone who is currently available
- Someone on good terms with senior executives
- A person who can keep the project team happy
- One who has worked in several different departments
- A person who can walk on (or part) the waters

These reasons for choosing a PM are not so much wrong as they are “not right.” They miss the key criterion. Above all, the best PM is *the one who can get the job done!* As any senior manager knows, hard workers are easy to find. What is rare is the individual whose focus is on the completion of a difficult job, a “closer.” Of all the characteristics desirable in a PM, *this drive to complete the task is the most important.*

If we consider the earlier sections of this chapter, we can conclude that there are four major categories of skills that are required of the PM and serve as the key criteria for selection, given that the candidate has a powerful bias toward task completion. Moreover, it is not sufficient for the PM simply to possess these skills; they must also be perceived by others. The fact and the perception are both important.

Credibility

The PM needs two kinds of credibility. First is *technical credibility*. The PM must be perceived by the client, senior executives, the functional departments, and the project team as possessing sufficient technical knowledge to direct the project. A PM with reasonable technical competence seems to be associated with project success and is seen by project team members to be a “positive” leadership characteristic (Ford et al., 1992; Zimmerer et al., 1998). (We remind the reader that “technical credibility” includes technical knowledge in such arcane fields as accounting, law, psychology, anthropology, religion, history, playwriting, Greek, and a host of other nonhard sciences.) The PM does not need to have a high level of expertise, know more than any individual team members (or all of them), or be able to stand toe-to-toe and intellectually slug it out with experts in the various functional areas. Quite simply, the PM has to have a reasonable understanding of the base technologies on which the project rests, must be able to explain project technology to senior management, and must be able to interpret the technical needs and wants of the client (and senior management) to the project team. Similarly, the PM must be able to hear the problems of the project team and understand them sufficiently to address them, possibly by communicating them to upper management.

Second, the PM must be *administratively credible*. The PM has several key administrative responsibilities that must be performed with apparently effortless skill. One of these responsibilities is to the client and senior management—to keep the project on schedule and within

cost and to make sure that project reports are accurate and timely. This can place the PM in an ethically awkward situation sometimes. Another responsibility is to the project team—to make sure that material, equipment, and labor are available when and where needed. Still another responsibility is to represent the interests of all parties to the project (team, management, functional departments, and client) to one another. The PM is truly the “person in the middle.” Finally, the PM is responsible for making the tough trade-off decisions for the project, and must be perceived as a person who has the mature judgment and courage to do so consistently.

Sensitivity

The preceding pages contain many references to the PM’s need for political sensitivity. There is no point in belaboring the issue further. In addition to a good, working set of political antennae, the PM needs to sense interpersonal conflict on the project team or between team members and outsiders. Successful PMs are not conflict avoiders. Quite the opposite, they sense conflict early, then confront and deal with it before the conflict escalates into interdepartmental and intradepartmental warfare.

The PM must keep project team members “cool.” This is not easy. As with any group of humans, rivalries, jealousies, friendships, and hostilities are sure to exist. The PM must persuade people to cooperate irrespective of personal feelings, to set aside personal likes and dislikes, and to focus on achieving project goals.

Finally, the PM needs a sensitive set of technical sensors. It is common, unfortunately, for otherwise competent and honest team members to try to hide their failures. Individuals who cannot work under stress would be well advised to avoid project organizations. In the pressure-cooker life of the project, failure is particularly threatening. Remember that we staffed the team with people who are task-oriented. Team members with this orientation may not be able to tolerate their own failures (though they are rarely as intolerant of failure in others), and will hide failure rather than admit to it. The PM must be able to sense when things are being “swept under the rug” and are not progressing properly.

Leadership, Ethics, and Management Style

Leadership has been defined (Tannenbaum et al., 1957) as “interpersonal influence, exercised in situations and directed through the communication process, toward the attainment of a specified goal or goals.” Much has been written about how interpersonal influence is generated and the impact of leadership characteristics on team performance. Examples are Jiang et al. (1998); Scott et al. (1998); see also the bibliography.

To all the skills and attributes we have mentioned, add enthusiasm, optimism, energy, tenacity, courage, and personal maturity. It is difficult to explain leadership. We tend to recognize it after the fact, rather than before. We define it anecdotally by saying that this person or that one acted like a leader. The PM should capitalize on people’s strengths, cover their weaknesses, know when to take over and when to “give the team its head,” know when to punish and when to reward, know when to communicate and when to remain silent. Above all, the PM should know how to get others to share commitment to the project. In a word, the PM must be a leader.

Another aspect of leadership that is important in a project manager is a strong sense of ethics. There is a considerable amount of attention to this topic in the news media these days, both good and bad. For instance, protection payments made to terrorists by firms raise serious ethical issues, as does the tobacco industry’s longstanding public denial of the effects of

smoking on human health. Nixon (1987) has identified some ethical missteps that are relatively common in business:

- “wired” bids and contracts (the winner has been predetermined)
- “buy-in” (bidding low with the intent of cutting corners or forcing subsequent contract changes)
- kickbacks
- “covering” for team members (group cohesiveness)
- taking “shortcuts” (to meet deadlines or budgets)
- using marginal (substandard) materials
- compromising on safety
- violating standards
- consultant (e.g., auditors) loyalties (to employer or to client or to public)

A project manager, particularly in the public sector, may easily become embroiled in the ethics concerning such issues as pollution, public safety, industrial plant locations, the use of public lands, and so on. A Code of Ethics for project managers was created at the PMI 1982 symposium on Project Management (Ireland et al., 1982), updated and approved in 1989, again in 1995, and once more in 2006. The 2006 version of the Code resulted from extended discussions and is roughly 8 times the length of earlier versions—including appendices. It is available to anyone at the PMI website, www.PMI.org. The issue is receiving an increasing amount of attention. A humorous column on the subject published several years ago in the PMI’s magazine *PM Network* (Phillips, 1995) elicited several irate letters from readers who seemed unsure about whether or not to take the article seriously (cf. “From Our Readers,” *PM Network*, January 1996).

Anyone seriously considering a career in project management should study the new code. It focuses on behavior that will lead to a high trust level between the PM, project team members, senior management, the client, and other stakeholders. The section entitled “Honesty” should be read, reread, and read once again. We will revisit the subjects of honesty and trust in almost every chapter of this book.

An “ethics audit” has also been recommended for nonprofit organizations (Schaefer et al., 1998), and we would recommend a similar audit for any firm. The extent of this subject is far beyond what we can cover here, but, fortunately, there are a number of excellent books on the topic (Barry, 1979; Blanchard et al., 1988; Pastin, 1986). A concise bibliography on business ethics is included in Robb (1996).

While a great deal has been written about the leadership attributes required or desirable in a project manager, comparatively little has been written about the proper management style for a PM. It has generally been assumed, and we are as guilty as most other writers, that whatever style is good for general managers is also good for project managers. A somewhat informal brand of “participative management” is generally preferred. Of course, each profession (information technology, construction, medicine, research and development in any area of science, ad infinitum) that uses project management is quite certain that its problems are significantly different and more difficult. They argue, therefore, that they require less managerial control.

Shenhar (1998) classifies projects across two dimensions and concludes that management style should be adapted to certain differences in the type of project. His dimensions are: (1) the level of technological uncertainty; and (2) the level of system complexity. As the uncertainty increases from “low tech” to “medium tech” to “high tech” to “very high tech,” the appropriate management style progresses from “firm, rigid, and formal” to “moderately firm” to “moderately flexible” to “highly flexible.” As the system complexity increases from

"assembly" to "system" to "array," the style progresses from "in-house informal" to "formal main/subcontractor relationship" to "remote and highly formal." There are also significant differences in some managerial practices, e.g., the use of project management tools, across the uncertainty and complexity dimensions.

Ability to Handle Stress

Throughout this chapter and elsewhere in this book, we have noted that the life of the project manager is rarely serene. While we know of no scientific research on the issue, casual observation leads us to believe that the basic environment surrounding projects is not fundamentally different from the environment existing in the parent organization within which the projects are being conducted. Life in some organizations is quite hectic and projects in those firms and agencies tend to be equally hectic.

There are numerous factors in life that cause stress and project managers are as subject to them as other humans. There do, however, appear to be four major causes of stress often associated with the management of projects. First, some PMs never develop a reasonably consistent set of procedures and techniques with which to manage their work. Second, many simply have "too much on their plates." Third, some have a high need to achieve that is consistently frustrated. Fourth, the parent organization is in the throes of major change.

This book is primarily devoted to helping the PM deal with the first cause of stress. As for the second cause, we would remind the PM to include him/herself as a "resource" when planning a project. Almost all project management software packages will signal the planner when a project plan calls for a resource to be used beyond its capacity (see Chapters 9 and 10). Such signals, at least, provide PMs with some evidence with which to discuss the work load with the appropriate senior manager.

Concerning the third cause of stress, Slevin (1989) points out that stress results when the demands made on an individual are greater than the person's ability to cope with them, particularly when the person has a high need for achievement. It is axiomatic that senior managers give the toughest projects to their best project managers. It is the toughest projects that are most apt to be beset with unsolvable problems. The cure for such stress is obvious, except to the senior managers who continue the practice.

Finally, in this era of restructuring and downsizing, stress from worry about one's future is a common condition in modern organizations. Dealing with and reducing these stresses as well as the stress resulting from everyday life is beyond the scope of this book as well as the expertise of its authors. Fortunately, any bookstore will have entire sections devoted to the subject of stress and its relief. We refer the reader to such works.

3) Explain the principles and requirement of negotiations.

Answer: -

SOME REQUIREMENTS AND PRINCIPLES OF NEGOTIATION

The word “negotiation” evokes many images: the United States President and Congress on the annual federal budget, the “Uruguay Round” of the GATT talks, a player’s agent and the owner of an NFL team, the buyer and seller of an apartment complex, attorneys for husband and wife in a divorce settlement, union and management working out a collective bargaining agreement, tourist and peddler haggling over a rug in an Ankara market. But as we noted in the introduction to this chapter, none of these images is strictly appropriate for the project manager who must resolve the sorts of conflicts we have considered in the previous section.

The key to understanding the nature of negotiation as it applies to project management is the realization that few of the conflicts arising in projects have to do with *whether* or not a task will be undertaken or a deliverable produced. Instead, they have to do with the precise *design* of the deliverable and/or *how* the design will be achieved, by *whom*, *when*, and at *what cost*. The implication is clear: *The work of the project will be done*. If conflicts between any of the parties to the project escalate to the point where negotiations break down and work comes to a halt, everyone loses. One requirement for the conflict reduction/resolution methods used by the PM is that *they must allow the conflict to be settled without irreparable harm to the project’s objectives*.

A closer consideration of the attorneys negotiating the divorce settlement makes clear a second requirement for the PM negotiating conflicts between parties-at-interest to the project. While the husband and wife (or the rug peddler and tourist) may employ unethical tactics during the negotiation process and, if not found out, profit from them at the expense of the other party, it is much less likely for the attorneys representing the husband and wife to do so—particularly if they practice law in the same community. The lawyers know they will have to negotiate on other matters in the future. Any behavior that breeds mistrust will make future negotiations extremely difficult, perhaps impossible. The rug peddler assumes no further contact with the tourist, so conscience is the sole governor of his or her ethics. A second requirement for the conflict resolution/reduction methods used by the PM is that *they allow (and foster) honesty between the negotiators*.

The conflicting parties-at-interest to a project are not enemies or competitors, but rather allies—members of an alliance with strong common interests. It is a *requirement of all conflicting parties to seek solutions to the conflict that not only satisfy their own individual needs, but also satisfy the needs of other parties to the conflict, as well as the needs of the parent organization*. In the language of negotiation, this is called a “win-win” solution. Negotiating to a win-win solution is the key to conflict resolution in project management.

Fisher et al. (1983, p. 11) have developed a negotiation technique that tends to maintain these three requirements. They call it “principled negotiation,” that is, win-win. The method is straightforward; it is defined by four points.

1. *Separate the people from the problem.* The conflicting parties are often highly emotional. They perceive things differently and feel strongly about the differences. Emotions and objective fact get confused to the point where it is not clear which is which. Conflicting parties tend to attack one another rather than the problem. To minimize the likelihood that the conflict will become strictly interpersonal, the substantive problem should be carefully defined. Then everyone can work on it rather than each other.
2. *Focus on interests, not positions.* Positional bargaining occurs when the PM says to a functional manager: "I need this subassembly by November 15." The functional manager responds: "My group can't possibly start on it this year. We might be able to deliver it by February 1." These are the opening lines in a dialogue that sounds suspiciously like the haggling of the tourist and the rug peddler. A simple "Let's talk about the schedule for this subassembly" would be sufficient to open the discussion. Otherwise each party develops a high level of ego involvement in his or her position and the negotiation never focuses on the real interests and concerns of the conflicting parties—the central issues of the conflict. The exchange deteriorates into a series of positional compromises that do not satisfy either party and leave both feeling that they have lost something important.

In positional negotiation, the "positions" are statements of immediate wants and assume that the environment is static. Consider these positional statements: "I won't pay more than \$250,000 for that property." Or, as above, "We might be able to deliver it by February 1." The first position assumes that the bidder's estimates of future property values are accurate, and the second assumes that the group's current workload (or a shortage of required materials) will not change. When negotiation focuses on interests, the negotiator must determine the underlying concern of the other party. The real concerns or interests of the individuals stating the positions quoted above might be to earn a certain return on the investment in a property, or to not commit to delivery of work if delivery on the due date cannot be guaranteed. Knowledge of the other party's interests allows a negotiator to suggest solutions that satisfy the other party's interests without agreeing with the other's position.

3. *Before trying to reach agreement, invent options for mutual gain.* The parties-in-conflict usually enter negotiations knowing the outcome they would like. As a result, they are blind to other outcomes and are not particularly creative. Nonetheless, as soon as the substantive problems are spelled out, some effort should be devoted to finding a wide variety of possible solutions—or elements thereof—that advance the mutual interests of the conflicting parties. Success at finding options that produce mutual gain positively reinforces win-win negotiations. Cohen (1980) reports on a conflict between a couple in which "he" wanted to go to the mountains and "she" wanted to go to the shore. A creative win-win solution sent them both to Lake Tahoe.
4. *Insist on using objective criteria.* Rather than bargaining on positions, attention should be given to finding standards (e.g., market value, expert opinion, law, company policy) that can be used to determine the quality of an outcome. Doing this tends to make the negotiation less a contest of wills or exercise in stubbornness. If a functional manager wants to use an expensive process to test a part, it is acceptable for the PM to ask if such a process is required to ensure that the parts meet specified quality standards.

Fisher et al. (1983) have had some success with their approach in the Harvard (Graduate School of Business) Negotiation Project. Use of their methods increases the chance of finding win-win solutions.

There are many books on negotiation, some of which are listed in the bibliography of this chapter. Most of these works are oriented toward negotiation between opponents, not an appropriate mindset for the project manager, but all of them contain useful, tactical advice for the project manager. Wall's book (1985) is an excellent academic treatment of the subject. Fisher et al. (1983) is a clear presentation of principled negotiation, and contains much that is relevant

4) State the advantages and disadvantages of Functional, Pure Project and Matrix organizations while implementing the project in these organizations.

Answer: -

There are advantages and disadvantages of using functional elements of the parent organization as the administrative home for a project, if one has chosen an appropriate function. The major advantages are:

- 1.** There is maximum flexibility in the use of staff. If the proper functional division has been chosen as the project's home, the division will be the primary administrative base for individuals with technical expertise in the fields relevant to the project. Experts can be temporarily assigned to the project, make the required contributions, and immediately be reassigned to their normal work.
- 2.** Individual experts can be utilized by many different projects. With the broad base of technical personnel available in the functional divisions, people can be switched back and forth between the different projects with relative ease.
- 3.** Specialists in the division can be grouped to share knowledge and experience. Therefore, the project team has access to whatever technical knowledge resides in the functional group. This depth of knowledge is a potential source of creative, synergistic solutions to technical problems.
- 4.** The functional division also serves as a base of technological continuity when individuals choose to leave the project, and even the parent firm. Perhaps just as important as technological continuity is the procedural, administrative, and overall policy continuity that results when the project is maintained in a specific functional division of the parent firm.
- 5.** Finally, and not the least important, the functional division contains the normal path of advancement for individuals whose expertise is in the functional area. The project may be a source of glory for those who participate in its successful completion, but the functional field is their professional home and the focus of their professional growth and advancement. Just as there are advantages to housing the project in a functional area, there are also

disadvantages:

- 1.** A primary disadvantage of this arrangement is that the client is not the focus of activity and concern. The functional unit has its own work to do, which usually takes precedence over the work of the project, and hence over the interests of the client.
- 2.** The functional division tends to be oriented toward the activities particular to its function. It is not usually problem oriented in the sense that a project should be to be successful.
- 3.** Occasionally in functionally organized projects, no individual is given full responsibility for the project. This failure to pinpoint responsibility usually means that the PM is made accountable for some parts of the project, but another person is made accountable for one or more other parts. Little imagination is required to forecast the lack of coordination and chaos that results.
- 4.** The same reasons that lead to lack of coordinated effort tend to make response to client needs slow and arduous. There are often several layers of management between the project and the client.
- 5.** There is a tendency to sub optimize the project. Project issues that are directly within the interest area of the functional home may be dealt with carefully, but those outside normal interest areas may be given short shrift, if not totally ignored.

6. The motivation of people assigned to the project tends to be weak. The project is not in the mainstream of activity and interest, and some project team members may view service on the project as a professional detour.

7. Such an organizational arrangement does not facilitate a holistic approach to the project. Complex technical projects such as the development of a jet transport aircraft or an emergency room in a hospital simply cannot be well designed unless they are designed as a totality. No matter how good the intentions, no functional division can avoid focusing on its unique areas of interest. Cross-divisional communication and sharing of knowledge is slow and difficult at best.

As with the functional organization, the pure project has its unique advantages and disadvantages.
The former is:

1. The project manager has full line authority over the project. Though the PM must report to a senior executive in the parent organization, there is a complete work force devoted to the project. The PM is like the CEO of a firm that is dedicated to carrying out the project.
2. All members of the project work force are directly responsible to the PM. There are no functional division heads whose permission must be sought or whose advice must be heeded before making technological decisions. The PM is truly the project director.
3. When the project is removed from the functional division, the lines of communication are shortened. The entire functional structure is bypassed, and the PM communicates directly with senior corporate management. The shortened communication lines result in faster communications with fewer failures.
4. When there are several successive projects of a similar kind, the pure project organization can maintain a permanent cadre of experts who develop considerable skill in specific technologies. Indeed, the existence of such skill pools can attract customers to the parent firm. Lockheed's famous "Skunk Works" was such a team of experts who took great pride in their ability to solve difficult engineering problems. The group's name, taken from the Li'l Abner comic strip reflects the group's pride, irreverent attitude, and strong sense of identity.
5. The project team that has a strong and separate identity of its own tends to develop a high level of commitment from its members. Motivation is high and acts to foster the task orientation discussed in Chapter 3.
6. Because authority is centralized, the ability to make swift decisions is greatly enhanced. The entire project organization can react more rapidly to the requirements of the client and the needs of senior management.
7. Unity of command exists. While it is easy to overestimate the value of this organizational principle, there is little doubt that the quality of life for subordinates is enhanced when each subordinate has one, and only one, boss.
8. Pure project organizations are structurally simple and flexible, which makes them relatively easy to understand and to implement.
9. The organizational structure tends to support a holistic approach to the project. A brief explanation of the systems approach was given in Chapter 3, and an example of the problems arising when the systems approach is not used appears in Section 5.3 of this chapter. The dangers of focusing on and optimizing the project's subsystems rather than the total project is often a major cause of technical failure in projects.

While the advantages of the pure project organization make a powerful argument favouring this structure, its disadvantages are also serious:

1. When the parent organization takes on several projects, it is common for each one to be fully staffed. This can lead to considerable duplication of effort in every area from clerical staff to the most sophisticated (and expensive) technological support units. If a project does not require a full-time personnel manager, for example, it must have one nonetheless because personnel managers come in integers, not fractions, and staff is usually not shared across projects.
2. In fact, the need to ensure access to technological knowledge and skills results in an attempt by the PM to stockpile equipment and technical assistance in order to be certain that it will be available when needed. Thus, people with critical technical skills may be hired by the project when they are available rather than

when they are needed. Similarly, they tend to be maintained on the project longer than needed, “just in case.” Disadvantages 1 and 2 combine to make this way of organizing projects very expensive.

3. Removing the project from technical control by a functional department has its advantages, but it also has a serious disadvantage if the project is characterized as “high technology.” Though individuals engaged with projects develop considerable depth in the technology of the project, they tend to fall behind in other areas of their technical expertise. The functional division is a repository of technical lore, but it is not readily accessible to members of the pure project team.
4. Pure project groups seem to foster inconsistency in the way in which policies and procedures are carried out. In the relatively sheltered environment of the project, administrative corner cutting is common and easily justified as a response to the client or to technical exigency. “They don’t understand our problems” becomes an easy excuse for ignoring dicta from headquarters.
5. In pure project organizations, the project takes on a life of its own. Team members form strong attachments to the project and to each other. A disease known as projectitis develops. A strong we-they divisiveness grows, distorting the relationships between project team members and their counterparts in the parent organization. Friendly rivalry may become bitter competition, and political infighting between projects is common.
6. Another symptom of projectitis is the worry about “life after the project ends.” Typically, there is considerable uncertainty about what will happen when the project is completed. Will team members be laid off? Will they be assigned to low-prestige work? Will their technical skills be too rusty to be successfully integrated into other projects? Will our team (that old gang of mine) be broken up?

The **matrix approach** has its own unique **advantages** and **disadvantages**. Its strong points are:

1. The project is the point of emphasis. One individual, the PM, takes responsibility for managing the project, for bringing it in on time, within cost, and to specification. The matrix organization shares this virtue with the pure project organization.
2. Because the project organization is overlaid on the functional divisions, temporarily drawing labour and talent from them, the project has reasonable access to the entire reservoir of technology in all functional divisions. When there are several projects, the talents of the functional divisions are available to all projects, thus sharply reducing the duplication required by the pure project structure.
3. There is less anxiety about what happens when the project is completed than is typical of the pure project organization. Even though team members tend to develop a strong attachment for the project, they also feel close to their functional “home.”
4. Response to client needs is as rapid as in the pure project case, and the matrix organization is just as flexible. Similarly, the matrix organization responds flexibly and rapidly to the demands made by those inside the parent organization. A project nested within an operating firm must adapt to the needs of the parent firm or the project will not survive.
5. With matrix management, the project will have—or have access to—representatives from the administrative units of the parent firm. As a result, consistency with the policies, practices, and procedures of the parent firm tends to be preserved. If nothing else, this consistency with parent firm procedures tends to foster project credibility in the administration of the parent organization, a condition that is commonly undervalued.
6. Where there are several projects simultaneously under way, matrix organization allows a better companywide balance of resources to achieve the several different time/cost/performances targets of the individual projects. This holistic approach to the total organization’s needs allows projects to be staffed and scheduled in order to optimize total system performance rather than to achieve the goals of one project at the expense of others.
7. While pure project and functional organizations represent extremes of the organizational spectrum, matrix organizations cover a wide range in between. We have differentiated between strong and weak matrices in terms of whether the functional units supplied individuals or capacity to projects. Obviously, some functional units might furnish people and others only supply capacity. There is, therefore, a great deal of flexibility in precisely how the project is organized—all within the basic matrix structure—so that it can be adapted to a wide variety of projects and is always subject to the needs, abilities, and desires of the parent organization.

The advantages accruing to the **matrix structure** are potent, but the disadvantages are also, serious. All the following **disadvantages** involve conflict—between the functional and project managers for the most part.

1. In the case of functionally organized projects, there is no doubt that the functional division is the focus of decision-making power. In the pure project case, the PM is the power center of the project. With matrix organizations, the power is more balanced. Often, the balance is delicate. When doubt exists about who is in charge, the work of the project suffers. If the project is successful and highly visible, doubt about who is in charge can foster political infighting for the credit and glory. If the project is a failure, political infighting will be even more brutal to avoid blame.
2. While the ability to balance time, cost, and performance between several projects is an advantage of matrix organizations, that ability has its dark side. The set of projects must be carefully monitored as a set, a tough job. Further, the movement of resources from project

5) Explain the Triple Constraints in Project Management.

Answer: -

Introduction

The project management triangle is used by managers to analyse or understand the difficulties that may arise due to implementing and executing a project. All projects irrespective of their size will have many constraints.

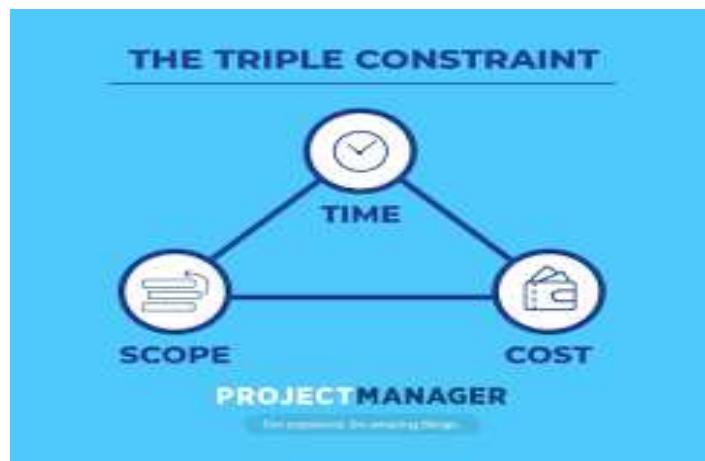
Although there are many such project constraints, these should not be barriers for successful project execution and for the effective decision making.

There are three main interdependent constraints for every project; time, cost and scope. This is also known as Project Management Triangle.

Let's try to understand each of the element of project triangle and then how to face challenges related to each.

The Three Constraints

The three constraints in a project management triangle are time, cost and scope.



1 - Time

A project's activities can either take shorter or longer amount of time to complete. Completion of tasks depends on several factors such as the number of people working on the project, experience, skills, etc.

Time is a crucial factor which is uncontrollable. On the other hand, failure to meet the deadlines in a project can create adverse effects. Most often, the main reason for organizations to fail in terms of time is due to lack of resources.

2 – Cost

It's imperative for both the project manager and the organization to have an estimated cost when undertaking a project. Budgets will ensure that project is developed or implemented below a certain cost.

Sometimes, project managers must allocate additional resources in order to meet the deadlines with a penalty of additional project costs.

3 - Scope

Scope looks at the outcome of the project undertaken. This consists of a list of deliverables, which need to be addressed by the project team.

A successful project manager will know to manage both the scope of the project and any change in scope which impacts time and cost.

Quality

Quality is not a part of the project management triangle, but it is the ultimate objective of every delivery. Hence, the project management triangle represents implies quality.

Many project managers are under the notion that 'high quality comes with high cost', which to some extent is true. By using low quality resources to accomplish project deadlines does not ensure success of the overall project.

Like with the scope, quality will also be an important deliverable for the project.

Six stages of Project Management

A project undergoes six stages during its life cycles, and they are noted below:

Project Definition – This refers to defining the objectives and the factors to be considered to make the project successful. **Project Initiation** - This refers to the resources as well as the planning before the project starts.

Project Planning - Outlines the plan as to how the project should be executed. This is where project management triangle is essential. It looks at the time, cost and scope of the project.

Project Execution - Undertaking work to deliver the outcome of the project.

Project Monitoring & Control - Taking necessary measures, so that the operation of the project runs smoothly.

Project Closure - Acceptance of the deliverables and discontinuing resources that were required to run the project.

Overcoming Challenges to Project Constraints

It is always a requirement to overcome the challenges related to the project triangle during the project execution period. Project managers need to understand that the three constraints outlined in the project management triangle can be adjusted.

The important aspect is to deal with it. The project manager needs to strike a balance between the three constraints so that quality of the project will not be compromised.

To overcome the constraints, the project managers have several methods to keep the project going. Some of these will be based on preventing stakeholders from changing the scope and maintaining limits on both financial and human resources.

A project manager's role is evolved around responsibility. A project manager needs to supervise and control the project from the beginning to the closure.

The following factors will outline a project manager's role:

- The project manager needs to define the project and split the tasks amongst team members. The project manager also needs to obtain key resources and build teamwork.
- The project manager needs to set the objectives required for the project and work towards meeting these objectives.
- The most important activity of a project manager is to keep stakeholders informed on the progress of the project.
- The project manager needs to assess and carefully monitor risks of the project.

Skills Required for a Project Manager

In order to overcome the challenges related to project triangle and meet the project objectives, the project manager needs to have a range of skills, which includes:

Leadership

Managing people

Negotiation

Time management

Effective communication

Planning

Controlling

Conflict resolution

Problem solving

Conclusion

Project management is very often represented on a triangle. A successful project manager needs to keep a balance between the triple constraints so that the quality of the project or outcome is not compromised.

There are many tools and techniques that are available in order to face the challenges related to the three constraints. A good project manager will use appropriate tools in order to execute the project successfully.

6) According to Souder what are the important criteria for selection of the Project Model.

Answer: -

PROJECT SELECTION AND CRITERIA OF CHOICE

Project selection is the process of evaluating proposed projects or groups of projects, and then choosing to implement some set of them so that the objectives of the parent organization will be achieved. This same systematic process can be applied to any area of the organization's business in which choices must be made between competing alternatives. For example, a manufacturing firm can use evaluation/selection techniques to choose which machine to adopt in a part-fabrication process; a TV station can select which of several syndicated comedy shows to rerun in its 7:30 P.M. weekday time-slot; a construction firm can select the best subset of a large group of potential projects on which to bid; or a hospital can find the best mix of psychiatric, orthopedic, obstetric, and other beds for a new wing. Each project will have different costs, benefits, and risks. Rarely are these known with certainty. In the face of such differences, the selection of one project out of a set is a difficult task. Choosing a number of different projects, a *portfolio*, is even more complex.

In the paragraph just above, all firms except the hypothetical construction firm are considering projects that are "inside" the organization; that is, they are for "clients" within the organization funding the projects. The construction firm is considering a set of potential projects to perform for clients outside of the construction firm itself. Whether for inside or outside clients, the projects will use the organization's own resources, and both types of projects are usually dealt with as "competing" for the same pool of resources.

Only rarely will a project manager be involved in the process by which projects are selected for inclusion in the set of projects the parent organization adopts for investment. It is, however, critically important to the success of the PM that he or she fully understands the parent organization's objectives in undertaking a project that the PM is expected to lead. As we will see, most of the decisions that the PM is forced to make will have an impact on the degree to which the project contributes to those objectives the parent organization expected from the project. This is not the last time we will note the importance for the PM to understand why his or her project was selected for investment.

In the following sections, we discuss several techniques that can be used to help senior managers select projects. Project selection is only one of many decisions associated with project management. To deal with all of these problems, we use models. We need such models because they abstract the relevant issues about a problem from the mass of detail in which the problem is embedded—reality is far too complex to deal with in its entirety. The model allows

us to strip away almost all the reality from a problem, leaving only the relevant aspects of the “real” situation for us to deal with. This process of carving away the unwanted reality from the bones of a problem is called *modeling the problem*.

The model represents the problem’s *structure*, its form. We will use many models in this book—graphs, analogies, diagrams, as well as *flow graph* and *network models* to help solve scheduling problems, and *symbolic* (mathematical) models for a number of purposes.

Models may be quite simple to understand, or they may be extremely complex. In general, introducing more reality into a model tends to make the model more difficult to manipulate. If the input data for a model are not known precisely, we often use probabilistic information; that is, the model is said to be *stochastic* rather than *deterministic*. Again, in general, stochastic models are more difficult to manipulate. [Readers who are not familiar with the fundamentals of decision making might find a book such as *The New Science of Management Decisions* (Simon, 1977) useful. Herbert Simon was a pioneer in the science of decision making and a Nobel Prize winner.]

We live in the midst of what has been called the “knowledge explosion.” We frequently hear comments such as “90 percent of all we know about physics has been discovered since Albert Einstein published his original work on special relativity”; and “80 percent of what we know about the human body has been discovered in the past 50 years.” In addition, evidence is cited to show that knowledge is growing exponentially. Such statements emphasize the importance of the *management of change*. To survive, firms should develop strategies for assessing and reassessing the use of their resources. Every allocation of resources is an investment in the future. Because of the complex nature of most strategies, many of these investments are in projects.

The proper choice of investment projects is crucial to the long-run survival of every firm. Daily we witness the results of both good and bad investment choices. In our daily news-

papers we read of Cisco System’s decision to purchase firms that have developed valuable communication network software rather than to develop its own software. We read of Procter and Gamble’s decision to invest heavily in marketing its products on the Internet; or problems faced by school systems when they update student computer labs—should they invest in Microsoft®-based systems or stick with their traditional choice, Apple®. But can such important choices be made rationally? Once made, do they ever change, and if so, how? These questions reflect the need for effective selection models.

Within the limits of their capabilities, such models can be used to increase profits, select investments competing for limited capital resources, or improve the market position of an organization. They can be used for ongoing evaluation as well as initial selection, and thus are a key to the allocation and reallocation of the organization’s scarce resources.

When a firm chooses a project selection model, the following criteria, based on Souder (1973), are most important.

1. *Realism* The model should reflect the reality of the firm’s decision situation, especially the multiple objectives of both the firm and its managers, bearing in mind that without a common measurement system, direct comparison of different projects is impossible. The model should also take into account the realities of the firm’s limitations on facilities, capital, personnel, and so forth, and include factors that reflect project technical and market risks: performance, cost, time, customer rejection, and implementation.
2. *Capability* The model should be sophisticated enough to deal with the relevant factors: multiple time periods, situations both internal and external to the project (e.g., strikes, interest rate changes), and so on.
3. *Flexibility* The model should give valid results within the range of conditions that the firm might experience. It should be easy to modify in response to changes in the firm’s

environment; for example, tax law changes, new technological advancements that alter risk levels, and, above all, organizational goal changes.

4. *Ease of use* The model should be reasonably convenient, not take a long time to execute, and be easy to use and understand. It should not require special interpretation, data that are difficult to acquire, excessive personnel, or unavailable equipment.
5. *Cost* Data-gathering and modeling costs should be low relative to the cost of the project and less than the potential benefits of the project. All costs should be considered, including the costs of data management and of running the model.

We would add the following sixth criterion.

6. *Easy computerization* It should be easy and convenient to gather and store the information in a computer database, and to manipulate data in the model through use of a widely available, standard computer package such as Excel®.

In what follows, we first examine fundamental types of project selection models and the characteristics that make any model more or less acceptable. Next we consider the limitations, strengths, and weaknesses of project selection models, including some suggestions of factors to consider when making a decision about which, if any, of the project selection models to use. We then discuss the problem of selecting projects when significant levels of uncertainty about outcomes, costs, schedules, or technology are present, as well as some ways of managing the risks associated with the uncertainties. Finally, we comment on some special aspects of the information base required for project selection. Then we turn our attention to the selection of a set of projects to help the organization achieve its goals and illustrate this with a technique called the *Project Portfolio Process*. We finish the chapter with a discussion of project proposals.

7) Explain the non-numeric project selection models.

Answer: -

Of the two basic types of selection models (numeric and nonnumeric), nonnumeric models are older and simpler and have only a few subtypes to consider. We examine them first.

The Sacred Cow In this case the project is suggested by a senior and powerful official in the organization. Often the project is initiated with a simple comment such as, "If you have a chance, why don't you look into...," and there follows an undeveloped idea for a new product, for the development of a new market, for the design and adoption of a global data base and information system, or for some other project requiring an investment of the firm's resources. The immediate result of this bland statement is the creation of a "project" to investigate whatever the boss has suggested. The project is "sacred" in the sense that it will be maintained until successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it.

The Operating Necessity If a flood is threatening the plant, a project to build a protective dike does not require much formal evaluation, which is an example of this scenario. XYZ Steel Corporation has used this criterion (and the following criterion also) in evaluating potential projects. If the project is required in order to keep the system operating, the primary question becomes: Is the system worth saving at the estimated cost of the project? If the answer is yes, project costs will be examined to make sure they are kept as low as is consistent with project success, but the project will be funded.

The Competitive Necessity Using this criterion, XYZ Steel undertook a major plant rebuilding project in the late 1960s in its steel-bar-manufacturing facilities near Chicago. It had become apparent to XYZ's management that the company's bar mill needed modernization if the firm was to maintain its competitive position in the Chicago market area. Although the planning process for the project was quite sophisticated, the decision to undertake the project was based on a desire to maintain the company's competitive position in that market.

In a similar manner, many business schools are restructuring their undergraduate and MBA programs to stay competitive with the more forward-looking schools. In large part, this action is driven by declining numbers of tuition-paying students and the need to develop stronger programs to attract them.

Investment in an *operating necessity* project takes precedence over a *competitive necessity* project, but both types of projects may bypass the more careful numeric analysis used for projects deemed to be less urgent or less important to the survival of the firm.

The Product Line Extension In this case, a project to develop and distribute new products would be judged on the degree to which it fits the firm's existing product line, fills a gap, strengthens a weak link, or extends the line in a new, desirable direction. Sometimes careful calculations of profitability are not required. Decision makers can act on their beliefs about what will be the likely impact on the total system performance if the new product is added to the line.

Comparative Benefit Model For this situation, assume that an organization has many projects to consider, perhaps several dozen. Senior management would like to select a subset of the projects that would most benefit the firm, but the projects do not seem to be easily comparable. For example, some projects concern potential new products, some require the conduct of a research and development project for a government agency, some concern changes in production methods, others concern computerization of certain records, and still others cover a variety of subjects not easily categorized (e.g., a proposal to create a daycare center for employees with small children). The organization has no formal method of selecting projects, but members of the Selection Committee think that some projects will benefit the firm more than others, even if they have no precise way to define or measure "benefit."

The concept of comparative benefits, if not a formal model, is widely adopted for selection decisions on all sorts of projects. Most United Way organizations use the concept to make decisions about which of several social programs to fund. Senior management of the funding organization then examines all projects with positive recommendations and attempts to construct a portfolio that best fits the organization's aims and its budget.

Of the several techniques for ordering projects, the Q-Sort (Helin et al., 1974) is one of the most straightforward. First, the projects are divided into three groups—*good*, *fair*, and *poor*—according to their relative merits. If any group has more than eight members, it is subdivided into two categories, such as *fair-plus* and *fair-minus*. When all categories have eight or fewer members, the projects within each category are ordered from best to worst. Again, the order is determined on the basis of relative merit. The rater may use specific criteria to rank each project, or may simply use general overall judgment. (See Figure 2-1 for an example of a Q-Sort.)

The process described may be carried out by one person who is responsible for evaluation and selection, or it may be performed by a committee charged with the responsibility. If a committee handles the task, the individual rankings can be developed anonymously, and the set of anonymous rankings can be examined by the committee itself for consensus. It is common for such rankings to differ somewhat from rater to rater, but they do not often vary strikingly because the individuals chosen for such committees rarely differ widely on what they feel to be appropriate for the parent organization. Projects can then be selected in the order of preference, though they are usually evaluated financially before final selection.

There are other, similar nonnumeric models for accepting or rejecting projects. Although it is easy to dismiss such models as unscientific, they should not be discounted casually. These models are clearly goal-oriented and directly reflect the primary concerns of the organization. The sacred cow model, in particular, has an added feature; sacred cow projects are

8) What is Project Portfolio Process (PPP)? Explain different steps involved in it.

Answer: -

PROJECT PORTFOLIO PROCESS (PPP)

Important inputs to this process are the organization's goals and strategies, and we assume here that the organization has already identified its mission, goals, and strategies—by using some formal analytic method such as SWOT analysis (strengths, weaknesses, opportunities, threats), and that these are well known throughout the organization. If this is not the case, then any attempt to tie the organization's projects to its goals is folly and the PPP will have little value. Deloitte Consulting (McIntyre, 2006) found that only 30 percent of surveyed organizations insisted on knowing the value a project would add to the organization's strategy before granting approval. Symptoms of a misaligned portfolio included:

- Many more projects than management expected
- Inconsistent determination of benefits, including double counting
- Competing projects
- "Interesting" projects that don't contribute to the strategy
- Projects whose costs exceed their benefits
- Projects with much higher risks than others in the portfolio
- Lack of tracking against the plan, at least quarterly If the goals and strategies have been well articulated, however, then the PPP can serve many purposes:
 - To identify proposed projects that are not really projects and should be handled through other processes
 - To prioritize the list of available projects
 - To intentionally limit the number of overall projects being managed so the important projects get the resources and attention they need
 - To identify projects that best fit the organization's goals and strategy
 - To identify projects that support multiple organizational goals and cross-reinforce other important projects
 - To eliminate projects that incur excessive risk and/or cost
 - To eliminate projects that bypassed a formal selection process and may not provide benefits corresponding to their risks and/or costs
 - To keep from overloading the organization's resource availability
 - To balance the resources with the needs
 - To balance short-, medium-, and long-term returns

The PPP attempts to link the organization's projects directly to the goals and strategy of the organization. This occurs not only in the project's initiation and planning phases, but also

throughout the life cycle of the projects as they are managed and eventually brought to completion. Thus, the PPP is also a means for monitoring and controlling the organization's strategic projects. On occasion this will mean shutting down projects prior to their completion because their risks have become excessive, their costs have escalated out of line with their expected benefits, another (or a new) project does a better job of supporting the goals, or any variety of similar reasons. It should be noted that a significant portion of the administration of this process could be managed by the Project Management Office, a concept to be discussed in Chapter 5.

The steps in this process generally follow those described in Longman et al. (1999) and Englund et al. (1999).

Step 1: Establish a Project Council

The main purpose of the project council is to establish and articulate a strategic direction for those projects spanning internal or external boundaries of the organization, such as cross-departmental or joint venture. Thus, senior managers must play a major role in this council. Without the commitment of senior management, the PPP will be incapable of achieving its main objectives. The council will also be responsible for allocating funds to those projects that support the organization's goals and controlling the allocation of resources and skills to the projects.

In addition to senior management, others who should be members of the project council are:

- the project managers of major projects;
- the head of the Project Management Office, if one exists;
- particularly relevant general managers;

- those who can identify key opportunities and risks facing the organization; and
- anyone who can derail the progress of the PPP later in the process.

Step 2: Identify Project Categories and Criteria

In this step, various project categories are identified so the mix of projects funded by the organization will be spread appropriately across those areas making major contributions to the organization's goals. In addition, within each category, criteria are established to discriminate between very good and even better projects. The criteria are also weighted to reflect their relative importance. Identifying separate categories not only facilitates achievement of multiple organizational goals (e.g., long term, short term, internal, external, tactical, strategic) but also keeps projects from competing on inappropriate categories.

The first task in this step is to list the goals of each existing and proposed project: What is the mission, or purpose, of this project? Relating these to the organization's goals and strategies should allow the council to identify a variety of categories that are important to achieving the organization's goals. Some of these were noted above but another way to position some of the projects (particularly product/service development projects) is in terms of their extent of product and process changes.

Wheelwright et al. (1992) have developed a matrix called the aggregate project plan illustrating these changes, as shown in Figure 2-10. Based on the extent of product change and process change, they identified four separate categories of projects:

1. Derivative projects.

These are projects with objectives or deliverables that are only incrementally different in both product and process from existing offerings. They are often meant to replace current offerings or add an extension to current offerings (lower priced version, upscale version).

2. Platform projects.

The planned outputs of these projects represent major departures from existing offerings in terms of either the product/service itself or the process used to make and deliver it, or both. As such, they become "platforms" for the next generation of organizational offerings, such as a new model of automobile or a new type of insurance plan. They thus form the basis for follow-on derivative projects that attempt to extend the platform in various dimensions.

3. Breakthrough projects.

Breakthrough projects typically involve a newer technology than platform projects. It may be a "disruptive" technology that is known to the industry or something proprietary that the organization has been developing over time. Examples here include the use of fibreoptic cables for data transmission, cash-balance pension plans, and hybrid gasoline-electric automobiles.

4. R&D projects.

These projects are "blue-sky," visionary endeavours oriented toward using newly developed technologies, or existing technologies in a new manner. They may also be for acquiring new knowledge or developing new technologies themselves.

The size of the projects plotted on the array indicates the size/resource needs of the project and the shape may indicate another aspect of the project, e.g., internal/external, long/medium/ short term, or whatever aspect needs to be shown. The numbers indicate the order, or time frame, in which the projects are to be (or were) implemented, separated by category, if desired.

The aggregate project plan can be used for many purposes:

- To view the mix of projects within each illustrated aspect (shape)
- To analyse and adjust the mix of projects within each category or aspect
- To assess the resource demands on the organization, indicated by the size, timing, and number of projects shown
- To identify and adjust the gaps in the categories, aspects, sizes, and timing of the projects
- To identify potential career paths for developing project managers, such as team member of a derivative project, then team member of a platform project, manager of a derivative project, member of a breakthrough project, and so on

Next, the council should develop separate criteria and cost ranges for each category that determine those projects that will support the organizational strategy and goals. Example criteria might include alignment with the organization's goals/strategy, riskiness of the project, financial return, probability of success, likelihood of achieving a breakthrough in a critical offering, appeal to a large (or new) market, impact on customer satisfaction, contribution to employee development, knowledge acquisition, and availability of staff/resources. Scales also need to be determined for each criterion to measure how different projects score on each of them. The scales on which these criteria are measured should be challenging so that the scores separate the best projects from those that are merely good. The scales

should also serve as an initial screen, to start the process of winnowing out the weakest

2.7 PROJECT PORTFOLIO PROCESS (PPP)

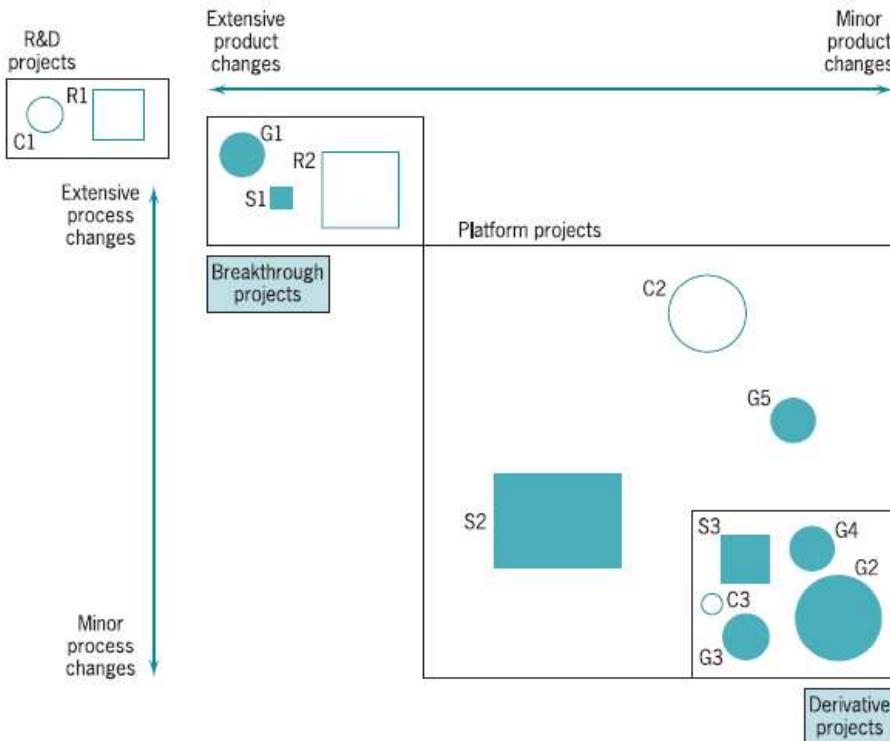


Figure 2-10 An example aggregate project plan.

projects. Thus, they should include limits on their extremes, such as minimum rate of return (if a financial criterion is appropriate), maximum probability of technical failure given proposed budget and schedule, or minimum acceptable potential market share.

Finally, the council needs to set an importance weighting for the various criteria in each category. Note that even if the same criteria apply to multiple categories, their weights might be different. For example, if a firm needs to develop high-level, skilled project managers for their strategic projects, employee development might be more important for breakthrough projects but less important for derivative projects. Also, the weights might change depending on the life cycle stage of the project. For example, early in a project's life, strategic considerations are often most important while in the midpoint of a project, tactical considerations might be more important.

The model we have described above is a “weighted, factor scoring model,” as described earlier. As noted then, there are some standard, well-known tools to help develop the weights, scales, and criteria such as the Delphi method (Dalkey, 1969), the analytic hierarchy process (AHP), (Saaty, 1980), a simplified version of AHP by Frame (1997), and even software such as *Expert Choice*®. For more complex situations, with large numbers of projects and or large councils, the more sophisticated approaches are often more helpful, particularly if used with software that automatically calculates the scores and ranks the projects.

Step 3: Collect Project Data

For each existing and proposed project, assemble the data appropriate to that category’s criteria. Be sure to update the data for ongoing projects and not just use the data from the previous evaluation. For cost data, use “activity-based costs” (see Section 7.1) rather than incremental costs. Challenge and try to verify all data; get other people involved in validating the data, perhaps even customers (e.g., market benefit). Include the timing, both date and duration, for expected benefits and resource needs. Use the project plan, a schedule of project activities, experience, expert opinion, whatever is available to get a good estimate of the data. Then document any assumptions made so that they can be checked in the future as the project progresses. If the project is new, you may want to fund only enough work on the project to verify the assumptions or determine the window-of-opportunity for the proposed product or process, holding off full funding until later. Similarly, identify any projects that can be deferred to a later time period, those that must precede or follow other projects, those that support other projects or should be done in conjunction with them, those that can be outsourced, and other such special aspects of the projects.

Next, use the criteria score limits to screen out the weaker projects: Have costs on existing projects escalated beyond the project's expected benefits? Has the benefit of a project lessened because the organization's goals have changed? Does a competitor's new entry obviate the advantages of a project? Does a new (or old) project dominate an existing or proposed project in terms of its benefits, furtherance of organizational goals, reduced costs? Also, screen *in* any projects that do not require deliberation, such as projects mandated by regulations or laws, projects that are operating or competitive necessities, projects required for environmental or personnel reasons, and so on. The fewer projects that need to be compared and analysed, the easier the work of the council.

Step 4: Assess Resource Availability

Next, assess the availability of both internal and external resources, by type, department, and timing. Note that labour availability should be estimated conservatively, leaving time for vacations, personal needs, illness, holidays, and most important, regular functional (non-project) work. After allowing for all of these things that limit labour availability, add a bit more, perhaps

10 percent, to allow for the well-known fact that human beings need occasional short breaks to rest or meet other human needs. Timing is particularly important, since project resource needs by type typically vary up to 100 percent over the life cycle of projects. Needing a normally plentiful resource at the same moment it is fully utilized elsewhere may doom an otherwise promising project. Eventually, the council will be trying to balance aggregate project resource needs over future periods with resource availabilities, so timing is as important as the amount of maximum demand and availability. This is the major subject of Chapter 9.

Step 5: Reduce the Project and Criteria Set

In this step, multiple screens are employed to try to narrow down the number of competing projects. As noted earlier, the first screen is each project's support of the organization's goals. Other possible screens might be criteria such as:

- Whether the required competence exists in the organization
- Whether there is a market for the offering
- How profitable the offering is likely to be
- How risky the project is
- If there is a potential partner to help with the project
- If the right resources are available at the right times
- If the project is a good technological/knowledge fit with the organization
- If the project uses the organization's strengths, or depends on its weaknesses
- If the project is synergistic with other important projects
- If the project is dominated by another existing or proposed project
- If the project has slipped in its desirability since the last evaluation

One way to evaluate the dominance of some projects over others, and at the same time eliminate non-differentiating criteria, is by comparing the coefficients of variation of each of the criteria across the projects. This technique allows an analyst to maximize the variation within the project set across relevant criteria, eliminating similar projects that are dominated, and identifying criteria that, at least in this evaluation round, do not differentiate among the projects. See Raz (1997) for an example of this approach.

The result of this step may involve cancelling some ongoing projects or replacing them with new, more promising projects. Beware, however, of the tendency to look more favourably upon new, untested concepts than on current projects experiencing the natural problems and hurdles of any promising project.

Step 6: Prioritize the Projects within Categories

Apply the scores and criterion weights to rank the projects within each category. It is acceptable to hold some hard-to-measure criteria out for subjective evaluation, such as riskiness, or development of new knowledge. Subjective evaluations can be translated from verbal to numeric terms easily by the Delphi or other methods and used in the weighted factor scoring model. It should be remembered that such criteria as riskiness are usually composite measures of a set of "risks" in different areas. The same is true of criteria like "development of new knowledge."

When checking the results of this step, however, reconsider the projects in terms of their benefits first and their resource costs second. The former is commonly more difficult to assess, and a reconsideration based on more familiarity with the project profiling process and

other project evaluations may suggest interchanging the priority of neighbouring projects. This could be especially critical around the project cut-off point. Because the projects competing around the cut-off point are typically quite close in benefit/cost scores, there are usually no serious consequences resulting from “errors.” This is, however, an excellent problem on which to use *sensitivity analysis*.

It is also possible currently for the council to summarize the “returns” from the projects to the organization. However, this should be done by category, not for each project individually since different projects are offering different packages of benefits that are not comparable. For example, R & D projects will not have the expected monetary return of derivative projects; yet it would be foolish to eliminate them simply because they do not measure up on this (irrelevant, for this category) criterion.

Step 7: Select the Projects to Be Funded and Held in Reserve

The first task in this step is an important one: determining the mix of projects across the various categories (and aspects, if used) and time periods. Next, be sure to leave some percent (often 10–15 percent) of the organization’s resource capacity free for new opportunities, crises in existing projects, errors in estimates, and so on. Then allocate the categorized projects in rank order to the categories according to the mix desired. It is usually a good practice to include some speculative projects in each category to allow future options, knowledge improvement, additional experience in new areas, and such.

Overall, the focus should be on committing to fewer projects but with enough funding to allow project completion. Document why late projects were delayed and why some, if any, were defunded. One special type of delayed project mentioned earlier is sometimes called an “out-plan” project (in contrast to the selected “in-plan” projects) (Englund et al, 1999). Out-plan projects are those that appear promising but are awaiting further investigation before a final decision is made about their funding, which could occur in the next PPP cycle or sooner, if they warrant the use of some of the 10–15 percent funding holdout.

The result of this step (and most of the project portfolio process) is illustrated in the Plan of Record shown in Figure 2-11. Here, the mix across categories is listed, the priorities and resource needs of each project are given, the timing (schedule) of each project over the PPP cycle (6 months assumed here) is shown (to match resource availability), the out-plan projects, if any, are shown, and the total resource needs and availabilities are listed.

Step 8: Implement the Process

The first task in this final step is to make the results of the PPP widely known, including the documented reasons for project cancellations, deferrals, and non-selection as was mentioned earlier. Top management must now make their commitment to this project portfolio process totally clear by supporting the process and the results. This may require a PPP champion near the top of the organization. As project proposers come to understand the workings and importance of the PPP, their proposals will more closely fit the profile of the kinds of projects the organization wishes to fund. As this happens, it is important to note that the council will have to concern itself with the reliability and accuracy of proposals competing for limited funds.

Senior management must fully fund the selected projects. It is neither appropriate nor ethical for senior management to undermine PPP and the council as well as strategically important projects by playing a game of arbitrarily cutting X percent from project budgets. The council needs to be wary of interpersonal or interdepartmental competition entering the scene at this point also. In some organizations, individuals with their own agenda will

ignore committees and processes (they may be heard to argue that committees never affect anything anyway) until implementation time rolls around, and then they attempt to exercise their political power to undermine the results of others’ long labours. If this does occur, it is indicative of serious organizational problems and the PPP process will fail until the problems are corrected.

Of course, the process will need to be repeated on a regular basis. The council should determine how often this should be, and to some extent it depends on the speed of change in the industry the organization is in. For some industries, quarterly analysis may be best while in slow-moving industries, yearly may be fine.

Finally, the process should be flexible and improved continuously. Instinct may suggest ways that the process may be altered to better match the competitive environment, or to reflect more closely the organization’s goals. The process should be changed when it is found appropriate to do so, including categories, criteria, steps, the order of tasks, and so on.

We offer a final note on this subject of creating and managing a portfolio of projects. In the preceding description of portfolio building it was tacitly assumed that the projects were independent and could be dealt with individually. At times, the projects in a portfolio are not independent. Dickinson et al. (2001) describe a model developed for the Boeing Company that optimizes a portfolio of interdependent product improvement projects. The model includes risk as well as cost/benefit analysis.

<i>Category</i>	<i>Priority</i>	<i>Project</i>	<i>Resources</i>	<i>May</i>	<i>June</i>	<i>July</i>	<i>Aug</i>	<i>Sept</i>	<i>Oct</i>
<i>Derivative</i>									
50% of mix	1	R	500						
	2	K	800						
	3	M	300						
Total			1600						
Available			(1800)						
<i>External</i>									
20% of mix	1	S	500						
	2	V	150						
	out-plan	LT							
Total			650						
Available			(720)						
<i>Strategic</i>									
30% of mix	1	A	600						
	2	W	370						
	out-plan	SB							
Total			970						
Available			(1080)						
<i>Aggregate Total</i>									
Unspent			3220						
10% reserve			380						
Total Available			4000						

Figure 2-11 Plan of Record.

9) What are the four parts of a technical proposal? (four distinct issues that every proposal should deal with)

Answer: -

All proposals should begin with a short summary statement (an “Executive Summary”) covering the fundamental nature of the proposal in *minimally technical language*, as well as the general benefits that are expected. All proposals should be accompanied by a “cover letter.” Roman (1986, pp. 67–68) emphasizes that the cover letter is a key marketing document and is worthy of careful attention. In addition to the Executive Summary and the cover letter, **every proposal should deal with four distinct issues:**

- (1) the nature of the technical problem and how it is to be approached;**
- (2) the plan for implementing the project once it has been accepted;**
- (3) the plan for logistic support and administration of the project; and**
- (4) a description of the group proposing to do the work, plus its experience in similar work.**

The precise way in which the contents of a proposal are organized usually follows the directions found in the TPR or RFP, the stated requirements of a specific potential funder, the traditional form used by the organization issuing the proposal, or, occasionally, the whim of the writer. As is the case with most products, the highest probability of acceptance will occur

when the proposal meets the expectations of the “buyer,” as to form and content. At times there is a tendency to feel that “nontechnical” projects (which usually means projects not concerned with the physical sciences or a physical product) are somehow exempt from the need to describe how the problem will be approached and how the project will be implemented—including details such as milestones, schedules, and budgets. To deal with nontechnical projects casually is folly and casts considerable doubt on the proposer’s ability to deliver on promises. (It is all too common for projects concerned with the development of art, music, drama, and computer software, among other “nontechnical” areas, to be quite vague as to deliverables, deadlines, and costs.) On the other hand, when the proposal is aimed at another division or department of the same parent organization, the technical requirements of the proposal may be greatly relaxed, but the technical approach and implementation plan are still required—even if their form is quite informal.

The Technical Approach

The proposal begins with a general description of the problem to be addressed or project to be undertaken. If the problem is complex, the major subsystems of the problem or project are noted, together with the organization’s approach to each. The presentation is in enough detail that a knowledgeable reader can understand what the proposer intends to do. The general method of resolving critical problems is outlined. If there are several subsystems, the proposed methods for interfacing them are covered.

In addition, any special client requirements are listed along with proposed ways of meeting them. All test and inspection procedures to assure performance, quality, reliability, and compliance with specifications are noted.

The Implementation Plan

The implementation plan for the project contains estimates of the time required, the cost, and the materials used. Each major subsystem of the project is listed along with estimates of its cost. These costs are aggregated for the whole project, and totals are shown for each cost category. Hours of work and quantities of material used are shown (along with the wage rates and unit material costs). A list of all equipment costs is added, as is a list of all overhead and administrative costs.

Depending on the wishes of the parent organization and the needs of the project, project task schedules (e.g., time charts, network diagrams, Gantt charts) are given for each sub-system and for the system. (See Chapter 8 for more about time charts, network diagrams, and Gantt charts.) Personnel, equipment, and resource usages are estimated on a period-by-period basis in order to ensure that resource constraints are not violated. Major milestones are indicated on the time charts. Contingency plans are specifically noted. For any facility that might be critical, load charts are prepared to make sure that the facility will be available when needed.

The Plan for Logistic Support and Administration

The proposal includes a description of the ability of the proposer to supply the routine facilities, equipment, and skills needed during any project. Having the means to furnish artist’s renderings, special signs, meeting rooms, stenographic assistance, reproduction of oversized documents, computer graphics, word processing, video teleconferencing, and many other occasionally required capabilities provides a “touch of class.” Indeed, their

unavailability can be irritating. Attention to detail in all aspects of project planning increases the probability of success for the project and impresses the potential funder.

It is important that the proposal contain a section explaining how the project will be administered. Of interest will be an explanation of how control over subcontractors will be administered, including an explanation of how proper subcontractor performance is to be insured and evaluated. The nature and timing of all progress reports, budgetary reports, audits, and evaluations are covered, together with a description of the final documentation to be prepared for users of the proposed deliverables. Termination procedures are described, clearly indicating the disposition of project personnel, materials, and equipment at project end.

A critical issue, often overlooked, that should be addressed in the administrative section of the proposal is a reasonably detailed description of how *change orders* will be handled and how their costs will be estimated. Change orders are a significant source of friction (and law-suits) between the organization doing the project and the client. The client rarely understands the chaos that can be created in a project by the introduction of a seemingly simple change. To make matters worse, the group proposing the project seems to have a penchant for mis-leading the potential client about the ease with which “minor” changes can be adopted during the process of implementing the project. Control of change orders is covered in Chapter 11.

Past Experience

All proposals are strengthened by including a section that describes the past experience of the proposing group. It contains a list of key project personnel together with their titles and qualifications. For outside clients, a full résumé for each principal should be attached to the proposal. When preparing this and the other sections of a proposal, the proposing group should remember that the basic purpose of the document is to convince a potential funder that the group and the project are worthy of support. The proposal should be written accordingly.

10) What are four stages of team development and growth? What are advantages of effective team?

Answer: -

Forming, Storming, Norming, and Performing Understanding the Stages of Team Formation

You can't expect a new team to perform well when it first comes together.

Forming a team takes time, and members often go through recognizable stages as they change from being a collection of strangers to a united group with common goals. Bruce Tuckman's Forming, Storming, Norming, and Performing model describes these stages. When you understand it, you can help your new team become effective more quickly.

In this article and in the video, below, we'll look at how you can use this model to build a highly productive team.

About the Model

Psychologist Bruce Tuckman first came up with the memorable phrase "forming, storming, norming, and performing" in his 1965 article, "Developmental Sequence in Small Groups." He used it to describe the path that most teams follow on their way to high performance. Later, he added a fifth stage, "adjourning" (which is sometimes known as "mourning").

Let's look at each stage in more detail.

Forming

In this stage, most team members are positive and polite. Some are anxious, as they haven't fully understood what work the team will do. Others are simply excited about the task ahead.

As leader, you play a dominant role at this stage, because team members' roles and responsibilities aren't clear. This stage can last for some time, as people start to work together, and as they make an effort to get to know their new colleagues.

Storming

Next, the team moves into the storming phase, where people start to push against the boundaries established in the forming stage. This is the stage where many teams fail.

Storming often starts where there is a conflict between team members' natural working styles. People may work in different ways for all sorts of reasons but, if differing working styles cause unforeseen problems, they may become frustrated.

Storming can also happen in other situations. For example, team members may challenge your authority, or jockey for position as their roles are clarified. Or, if you haven't defined clearly how the team will work, people may feel overwhelmed by their workload, or they could be uncomfortable with the approach you're using.

Some may question the worth of the team's goal, and they may resist taking on tasks.

Team members who stick with the task at hand may experience stress, particularly as they don't have the support of established processes or strong relationships with their colleagues.

Norming

Gradually, the team moves into the norming stage. This is when people start to resolve their differences, appreciate colleagues' strengths, and respect your authority as a leader.

Now that your team members know one another better, they may socialize together, and they are able to ask one another for help and provide constructive feedback. People develop a stronger commitment to the team goal, and you start to see good progress towards it.

There is often a prolonged overlap between storming and norming, because, as new tasks come up, the team may lapse back into behaviour from the storming stage.

Performing

The team reaches the performing stage, when hard work leads, without friction, to the achievement of the team's goal. The structures and processes that you have set up support this well.

As leader, you can delegate much of your work, and you can concentrate on developing team members.

It feels easy to be part of the team at this stage, and people who join or leave won't disrupt performance.

Adjourning

Many teams will reach this stage eventually. For example, project teams exist for only a fixed period, and even permanent teams may be disbanded through organizational restructuring.

Team members who like routine, or who have developed close working relationships with colleagues, may find this stage difficult, particularly if their future now looks uncertain.

Advantages of effective Team

Teamwork: the act of bringing several individuals together in order to efficiently and effectively complete a project.

Project managers know that cooperation boosts productivity and is beneficial in a team environment. Teamwork is an enabler for the smooth running of projects. It speeds up the achievement of targets and helps project professionals overcome obstacles.

Teamwork ensures that resources are well-managed, and less time is needed to complete a project. Good teamwork can contribute to economising, more successful project outcomes and ultimately higher profits. It also adds to the quality and individuality of projects.

Not convinced that you need to focus on building your team.

Here are some reasons **why teamwork is vital to effective project management.**

1. Promotes Creativity

When people work together, you're creating a better environment for creativity. That happens naturally when there is a lot of brainstorming and sharing ideas.

With each team member contributing unique ideas, you can acquire more effective strategies for completing the project. Your team members have a lot of shared knowledge between them: use it.

2. Encourages Risk-Taking

Working as a team encourages risk-taking. When you shoulder the responsibility yourself, you may be inclined to take fewer risks because the personal and professional consequences of failure.

In a team, you have support from other members in case things fall apart.

Remember, as a professional project manager, good risk management can help you mitigate the risks you take on a project by helping you assess the impact before you go ahead with a particular course of action.

3. Helps Improve Conflict-Resolution Skills

A team is made up of unique individuals. This diversity helps in project success but can also lead to disputes.

Project managers and team leaders should step in to resolve the conflicts, and in most cases, they need not involve the organisation management. You can build your skills in conflict resolution in this way and help others in the team to do the same.

4. Builds Trust

Teamwork requires a healthy relationship that can only be built through trust. Trust is built by relying on each other. Through trust, members feel free to share ideas. You can create a trusting environment in the team that gives them the space to support and encourage each other. An open relationship is built, leading to high productivity.

Trust also increases your confidence in your own abilities as the project manager and helps you build personal credibility.

5. Brings Together Diverse Strengths

Teamwork brings together complementary strengths. You may be good at planning and another team member might be talented in coordinating and creative thinking. Have you done an MBTI assessment with your team or looked at

Belbin's team roles? These would be great tools to give you an insight into the diverse strengths of the people you work with.

When you bring various strengths together – and use them – this can lead to more successful project outcomes. Each member brings their talents to the table.

6. Increases Accountability

There are days when you don't feel like giving it your all when working alone.

Working on a project as a team helps you feel more accountable. It's the informal peer pressure; the feeling that you don't want to let your colleagues down. When you are working with people you respect, you don't want to disappoint them.

7. Teamwork Increases Project Momentum

It's not a surprise that teamwork speeds everything up on a project. You simply couldn't get through the amount of work that is required if you were working by yourself. Plus, you wouldn't have the skills.

When you have the right people on the team, you can fly. Deadlines that seem insurmountable are suddenly achievable with the right people, and the right attitudes.

When you work together, you can take advantage of those time savings to do things right, and to invest time in activities that also help grow your career, like professional development.

Deadlines that seem insurmountable are suddenly achievable with the right people, and the right attitudes.

8. Getting Feedback

When working on a project, you need to get feedback on your progress to know whether you are moving in the right direction. You do this through regular team meetings, conversations with key stakeholders, and your Project Board meetings.

When you work as a team, it's easier to get informal feedback day to day, and to stay more closely connected with the project's customers. There are more of you, so it's easier to listen to a broader group.

As the project manager, ask your team to be on the alert for formal and informal feedback from each other and your clients or customers. Then share with everyone on the team so you can act on it.

9. Finding Solutions to Complex Problems

There are complex problems that are encountered in the progress of a project. You can't resolve issues alone – but you can with the wisdom of your team.

Involve your subject matter experts. Working together as a group leads to the generation of new ideas. Someone might come up with the perfect idea to address the issue you face.

10. Using Everyone's Skills

Teamwork brings different skills to work together on a project. Everyone has something that they can contribute – some useful ability.

Find out what people are good at if you don't know. Then play to their strengths.

Surround yourself with people who complement your personal strengths so that you have all the skill and knowledge bases covered.

11. Builds Leadership Skills

It's common to think that in every teamwork there must be a team leader who ensures that project tasks run smoothly. However, you'll find that in cooperatives, and self-organising agile teams, the role of "leader" is less clearly defined. In some cases, you'll encounter teams where they deliberately shy away from appointing someone in the role of leader.

Everyone can build and use leadership skills in a team environment. You don't have to be the person nominally in charge to step up and demonstrate leadership. You can lead both as a project manager and someone in the project team. Lead your area. Lead your tasks. Provide leadership support to your colleagues when they need you to step up.

Today, leadership is considered far more flexible a skill, and required by so many more job roles.

We say that understanding teamwork is one of the best things that can happen to you as a project manager. If you are working on a project and you want to get it done quickly and effectively, knowing how to get the best out of your team is going to get you there.

What can you do differently to improve the quality of teamwork on your project? How can you bring people together?