The matrix organization

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What Is A Matrix Organization?

A matrix organization is defined as one in which there is dual or multiple managerial accountability and responsibility. However, the term matrix means quite different things to different people and in different industries (1)(5). In a matrix there are usually two chains of command, one along functional lines and the other along project, product, or client lines. Other chains of command such as geographic location are also possible.

The matrix organizational form may vary from one in which the project manager holds a very strong managerial position to one in which he plays only a coordinating role. To illustrate the organizational principles, a matrix will be considered first in which there is a balance of power between the project and functional managers. It must be recognized that such a balanced situation, considered by some authorities to be ideal, probably seldom occurs in practice.

The Two-Boss Matrix

In a balanced matrix organization various people in the organization have two bosses (figure 1). This represents an abandonment of the age-old management concept, “Thou shalt have but one boss above thee.” None of the reporting relationships shown in figure 1 are dotted-line relationships. Solid- and dotted-line relationships have various interpretations depending upon local management custom. However, solid lines normally connect managers with their direct subordinates, the man above being the boss. Dotted lines are usually used to indicate staff relationships or reporting relationships of lesser importance. The project manager in the matrix organization is not a staff man nor does he normally have less authority than the functional managers reporting on the same level. Neither can the relationships shown in figure 1 be simply described by such terms as “he reports to the functional manager only for technical direction,” or “he reports to the project office for budgetary and schedule control.” Such descriptions are inadequate to describe how the matrix organization really works because in reality, not just on paper, the project personnel do have two bosses.

Implicit in the definition of the matrix organization is the recognition that the project is temporary whereas the functional departments are more permanent. Although all organizations are temporary in that they are constantly changing, the matrix is designed to be temporary and a particular organizational structure lasts only for the finite life of the project.

Figure 1. The basic unit of the matrix organization

Why the Matrix?

The matrix developed as a natural evolution of organizational structures in answer to a very definite real-world need. The need was for an organizational form capable of managing the recent very large and very complex programs, projects, and problems, and for managing limited resources. The conventional hierarchical management organization could not cope with the added complexity and the enormous amount of information that had to be processed, and conventional management theory was of little help in solving these new and unique problems.

Most management theorists predicted that the lack of any clear-cut single line of responsibility and authority would result in managerial ineffectiveness. There is no evidence to indicate that multiple authority and role conflict lead to ineffectiveness (16).

The primary reason for adopting the matrix in a large organization can be pinpointed in the fact that functions and skills are fragmented throughout the organizational structure. Individual functional departments have great difficulty in solving very large problems because of a failure to view the total system and a tendency to sub-optimize or solve the problem within their particular discipline. According to an old aerospace cliche, “An engineer attacks *every* problem as if it had an engineering solution.” How few of today’s big civil and social problems have purely technical solutions?

Since it was found to be impractical to fragment the problem and have the various functional organizations work only on their portion of the problem, “microcompanies” were formed (21). This represented the development of the pure project organization. It was very rapidly realized that this alternative was not only very unwieldly but had many disadvantages with respect to efficient functional operations. The matrix was the next logical development.

Growth of the Matrix

As problems and projects have become more complex, the inadequacy of the hierarchical organizational structure became apparent. At the same time, the necessity for designing the organization around the task to be performed was realized. Fortunately, varied but more complex organizational alternatives have become available. The present management philosophy is that there is no “one best way” for all projects to organize. Rather there are many alternatives from which to select a specific project. Among these alternatives are various forms of the matrix.

A formalized matrix form of organization was first developed and documented in the United States aerospace industry where it evolved during the growth of the large, complex projects of the 1950s and 1960s. If a project was very large, it usually became a pure project organization in which all of the functions and resources necessary to accomplish the objectives of the project were put in a single hierarchical organization. This alternative worked very well if the project or program was very large, and if the government customer was similarly organized, and if the customer not only insisted on such an organization but was willing to pay for its added expense.

However, the aerospace industry found that it had many more projects which were not particularly large, but were exceedingly complex, and therefore not conveniently handled within a single discipline. Today, it is rare to find a real-world problem that is unidisciplinary. In addition, top management still felt a strong need to have a single source of information and a single point of responsibility for each project or program. Some form of project management was obviously needed, and not being willing to bear the expense of making each project a little empire of its own, the matrix was a natural evolution in management thinking. The term “matrix” began to be applied to organizations at this time, and as indicated by Davis and Lawrence, “It probably seemed like a fitting term for mathematically trained engineers in that industry to apply to the gridlike structure that was evolving … ” (10).

The Matrix Organization

It has been recognized that the matrix organizational structure has applications far beyond that of project (program or product) management (12). However, in this discussion the matrix will only be considered from the viewpoint of its most highly developed application — that of project management.

The term “matrix project organization” refers to a multidisciplinary team whose members are drawn from various line or functional units of the heirarchical organization. The organization so developed is temporary in nature, since it is built around the project or specific task to be done rather than on organizational functions. The matrix is thus built up as a team of personnel drawn from both the project and the functional or disciplinary organizations. In other words a project organization is superimposed on the conventional functional hierarchical organization.


Simple matrix organization

Figure 2. Simple matrix organization

The matrix in its simplest form is shown diagramatically in figure 2, indicating how the matrix received its name.

The matrix shown in figure 2 represents a general organizational structure. To be more specific, engineering, research, product and construction matrix organizations are shown in figures 3, 4, 5, and 6 respectively.

The matrix is thus a multi-dimensional structure that tries to maximize the strengths and minimize the weaknesses of both the project and the functional structures (25).

Does the Matrix Work?

No specific organizational form can be guaranteed to work at all times, or to improve productive output. However, it can be said that some organizational forms have a better chance of working than others, particularly if they are designed to meet the needs of

project work. As previously indicated, the matrix meets a number of well-defined needs. The principal need is for an organizational structure that can handle the great complexity of a multidisciplinary effort.

Figure 3. An engineering matrix organization

Figure 4. A research matrix organization

If the multidisciplinary need is really there, and if project management is necessary, then the matrix is a viable organizational solution. However, the matrix is a complex organizational form and will not automatically work. The number of things that can go wrong is endless, but the most usual reason for failure of the matrix results from either foot-dragging or downright sabotage on the part of functional management and even by lower level supervision. As indicated in the previous discussion of project management, it is necessary to assure that the matrix will work by thoroughly selling the concept to top management and to all involved functional management. If everyone involved in the matrix is "a believer," and every effort is expended to make it work, the matrix will work and will result in outstanding project accomplishment. As indicated previously, if only takes one uncooperative disciplinary manager dragging his feet to make the whole project fail. However, active, enthusiastic, and aggressive support by top management will counteract even the most recalcitrant functional manager.

Advantages of the Matrix

The matrix organization has many advantages which far outweigh its principal disadvantage of complexity. Among the more universally accepted advantages of the matrix which go beyond the advantages of project management in general are the following (2)(22):

Figure 5. A product industry matrix organization

Figure 6. A construction industry matrix organization

- *Project Objectives Clear* — Project objectives will not only be highly visible through the project office, but will also be balanced with the objectives of the functional organization.
- *Project Integration* — There is a clear and workable mechanism for achieving project integration of subsystems and work packages across functional departmental lines. Coordination across functional lines can easily be achieved.

- *Efficient Use of Resources* — The maximum efficient utilization can be made of scarce company resources. It is the most efficient use of manpower since personnel can be used only part-time if desired, and can be shared between projects. It is the most efficient use of facilities, machinery, equipment, and other resources since these resources can be shared between or among projects. Allocation of scarce resources can be negotiated between project and functional management, or corporate priorities may be established. The matrix is therefore less expensive than an equivalent pure project organization.
- *Information Flow* — Information dissemination should be very effective since there is provision for both horizontal and vertical flow. Horizontal flow provides for project systems information to flow from functional unit to functional unit. Vertical flow provides for detailed disciplinary information to flow from project to project, and to various levels of management. Information of use to other projects is not locked up within a single project.
- *Retention of Disciplinary Teams* — Teams of functional experts and specialists are kept together even though projects come and go. Therefore technology and know-how is not lost when a project is completed. Specialists like to work with other specialists in the same discipline, and they will be better able to continually exchange ideas and information. As a result, when teams of functional specialists work together, a synergistic effect occurs, resulting in increased innovation and productive output, even though individually they may be working on different projects.
- *High Morale* — Morale problems occur less frequently since the worker in the matrix responds first to the morale-building experience of working on a successful project resulting in visible achievements. This will be true whether the achievement is a ballistic missile, an aircraft, a power plant, or the introduction of a new soap into the marketplace. Secondly, worker morale is normally higher when they can work with their fellow specialists. Thirdly, by retaining his functional “home,” the specialist may have a clearer career progression up the functional ladder. On the other hand, if he finds that his talents and interests are multidisciplinary, he can set his career objectives toward the project office.
- *Development of Project Managers* — The matrix is an excellent training ground for prospective project managers since promising candidates can easily be spotted in the multidisciplinary project environment. A common occurrence would be the transfer of a person who had demonstrated the ability to work across functional departmental lines to the project office as an assistant project manager. His career progression would then be to project manager, which is an excellent path leading to top management.

- *Project Shutdown* — In a matrix organization project termination is not the traumatic and painful event that it can be in a pure project organization. It is not uncommon for a large aerospace or construction project to have several thousand people working in a pure project organization. What do you do with several thousand people when the project is completed? Large layoffs are almost unavoidable since only a relatively few people can be relocated unless major buildups in another project are occurring. Matrix projects are normally smaller with fewer people overall involved. In addition, the people are spread across a whole functional organization and each department has only a few people to relocate.

Problems of the Matrix

The matrix organization does have some disadvantages and problems, but they need not be considered insurmountable. Knowing what problems may occur is "half the battle" in overcoming them. The following disadvantages are inherent in the matrix organization:

- *Two Bosses* — The major disadvantage is that the personnel on the project are working for two bosses. In any type of conflict situation a person could easily become "the man in the middle." Further problems of conflict can be caused by project personnel playing one boss against the other.
- *Complexity* — The matrix organization is inherently more complex than either a functional or a pure project organization, since it is the superimposition of one on the other. This complexity shows itself in the following problems:

- *Difficulties in Monitoring and Controlling* — Complexity results from the number of managers and personnel involved and from the number of people that must be kept informed. Fortunately, modern computer techniques have helped to keep this problem under control, but basically it's still a "people" problem.
- *Complex Information Flow* — This is a problem only because there are so many people and organizational units involved. Both the project and functional managers must be certain that they have touched bases with each other for any major decisions in their areas of responsibility.
- *Fast Reaction Difficult* — The project manager is sometimes faced with a problem of achieving fast reaction times, primarily since there are so many people to be consulted. The project manager in the matrix ususally does not have strong vested authority, therefore considerable negotiation is necessary. Project management was primarily conceived to prevent this problem, but it can be a problem if the management system keeps the project manager from making any decisions without consultation with functional and top management. If the matrix is working, the problem won't occur.
- *Conflicting Guidance* — The more complex organization with two lines of authority always increases the possibility of conflicting instructions and guidance.

- *Priorities* — A matrix organization with a number of projects faces real problems with project priorities and resource allocation. Each project manager will obviously consider his project to have the highest priority. Similarly, each functional manager will consider that the allocation of resources and priorities within his department is his own business. As a result, the decisions involving project priorities and often the allocation of resources must be made at a high level. This often puts an undue and unwelcome load on the top executive officer in the matrix. This problem has led to the use of a manager of projects, or a super project manager in some organizations. His principal functions would be to consult with higher levels of management to assure equitable allocation of resources and to periodically reassess project priorities. This effort can be extremely valuable in reducing conflict and anxiety within the matrix.
- *Management Goals* — There is a constant, although often unperceived, struggle in balancing the goals and objectives of project and functional management. A strong project manager may place undue emphasis on time and cost constraints, while a functional manager may concentrate on technical excellence at the expense of schedules. Top management must assure that a careful balance of the goals of both project and functional management is maintained.
- *Potential for Conflict* — As discussed in a later section of this chapter, whenever there are two project managers competing for resources, there is potential for conflict. This conflict may evidence itself primarily as a struggle for power. However, it also may evidence itself by backbiting, foot-dragging and project sabotage. Conflict and competition may also be constructive as an aid to achieving high performance; however, it cannot be allowed to degenerate to personal antagonism and discord. In project work conflict is inevitable; keeping it constructive is the problem in matrix management.
- *Effects of Conflict on Management* — Since conflict and stress are inherent in the matrix organization, considerable attention must be given to the individuals who will function as both project and functional managers. Individuals vary greatly in their ability to function effectively under stress. Conflict, particularly the role conflict typical of the two-boss situation, can produce stress, anxiety, and reduced job satisfaction. Considerable attention must be directed toward assuring that prospective managers have a high tolerance for conflict situations.

Davis and Lawrence have discussed the problems of the matrix which they term matrix pathologies (11). They list and discuss the following problems: power struggles, anarchy, groupitis, collapse during economic crunch, excessive overhead, decision strangulation, sinking, layering, and navel gazing. They indicate that many of these difficulties occur in more conventional organizations, but that the matrix seems somewhat more vulnerable to these particular ailments.

They indicate that power struggles are inevitable in a matrix because it is different from the traditionally structured hierarchy. In the matrix, power struggles are a logical derivative of the ambiguity and shared power that has been built purposefully into the design. Corporations will find it exceedingly difficult to prevent power struggles from developing, but they must prevent them from reaching destructive lengths.

Anarchy is defined as a company quite literally coming apart at the seams during a period of stress. As the authors admit, this is an unlikely occurrence, and the more explicit the organizational agreements are the less likely it is to occur.

Groupitis refers to confusing matrix behavior with group decision making. The matrix does not require that all business decisions be hammered out in group meetings. Group decision making should be done as often as necessary, and as little as possible.

Collapse during economic crunch refers* to the frequently noted fact that matrix organizations seem to blossom during periods of rapid growth and prosperity, and to be buffeted and/or cast away during periods of economic decline. It seems natural that during periods of crisis, top management thinks that the organization needs a firmer hand and reinstitutes the authoritarian structure. “There is no more time for organizational toys and tinkering. The matrix is done in.” Thus the matrix is the readily available scapegoat for other organizational problems such as poor planning and inadequate control.

One of the concerns of organizations first encountering the matrix is that it is too costly since it appears, on the surface, to double up on management by adding another chain of command. It is true that initially overhead costs do rise, but as the matrix matures, these overhead costs decrease and productivity gains appear.

It is suggested that moving into a matrix can lead to the strangulation of the decision process. “Will all bold initiatives be watered down by too many cooks?” Three possible situations can arise: (1) the necessity for constant clearing of all issues with the functional managers, (2) escalation of conflict caused by constant referral of problems up the dual chain of command, and (3) some managers feel that every decision must be a crisp, unilateral decision, therefore they will be very uncomfortable and ineffective in a matrix organization.

Sinking refers to the observation that there seems to be some difficulty in keeping the matrix viable at the corporate or institutional level, and a corresponding tendency for it to sink down to lower levels in the organization where it survives and thrives. This phenomena may be indicative of top management not understanding the matrix or the matrix may just be finding its proper place.

Layering is defined as a phenomena in which matrices within matrices are found. By itself, layering may not be a problem, but it sometimes creates more problems than it solves because the unnecessary complexity may be more of a burden than it is worth.

Navel gazing refers to the tendency to become absorbed in the organization’s internal relations at the expense of the world outside the organization, particularly to clients. This concentration on the internal workings of the organization is most likely to occur in the early phases of a matrix when new behaviors have to be learned.

Making the Matrix Work

After examining the disadvantages and problems of working in a matrix organization, one may view the problems as insurmountable. How then does a company get this complex organizational *form to* function? Its successful operation, like that of any management organization, depends almost entirely on actions and activities of the various people involved. First, top management must give real and immediate support to the matrix, including a clear project charter. This charter should state the purpose of the project and spell out the responsibilities and authority of the project manager. In addition it should indicate to the fullest extent possible his relationships with the functional managers involved in the project.

Functional management must modify much of their managerial thinking and their usual operational procedures and activities in order to make the matrix work. This may mean a considerable change in the way they determine their priorities. It may be a considerable shock to functional management to find that their priorities must change, and that the project comes first. Project management must realize that they get their job accomplished primarily through the process of negotiation, and that they should become negotiation experts. If all major decisions are made with the concurrence of the involved functional managers, the project manager finds himself in a very strong position in insisting that the decision be carried out and that the desired goals be accomplished. In addition, the project personnel must be able to adapt to the two-boss situation which can be a traumatic experience when first encountered.

Who Is the Real Boss?

Whenever the two-boss situation is encountered, the logical question that can be asked is: who is the real boss? Theoretically it should be possible to divide the authority and responsibility more or less equally between the project and functional managers. However, there is no agreement among the experts as to whether a balance of power is necessary or even desirable.

Even if there is a balance of power, the question of who is the real boss may depend on other factors. For instance, the line or discipline manager is usually perceived as the real boss by the employees in a matrix organization. This is a natural situation since the discipline manager represents “home base” — the disciplinary home to which the employee returns after the project is completed. In addition, the disciplinary manager normally carries the most weight when it comes to performance evaluations and promotions. However, there are usually some employees who relate so strongly to the overall project, that they perceive the project manager to be the real boss. So perhaps there is no one real boss, rather there is a continually shifting balance of power (29).

Balance of Power

At the heart of the operation of the matrix is the balance of power. Theoretically, it should be possible to divide the authority and responsibility more or less equally between the project and functional managers, however to do so is difficult and seldom occurs. It has been attempted to clearly delineate the authority and responsibilities of both project and

functional management so as to assure a balance of power. Such a delineation has been presented by one management author (7) who has divided the responsibilities as shown in table 1.

Table 1. Delineation of Responsibilities

Project Manager's Responsibilities

1. What is to be done?
2. When will the task be done?
3. Why will the task be done?
4. How much money is available to do the task?
5. How well has the total project been done?

Functional Manager"s Responsibilities

1. How will the task be done?
2. Where will the task be done?
3. Who will do the task?
4. How well has the functional input been integrated into the project?

Another way of stating the roles is: the project manager is responsible for the overall integration of the total project system and the functional manager is responsible for technical direction in his discipline.

The so-called responsibility chart has been proposed as a useful device in defining jurisdictional areas of management (17)(20). A simplified example of a responsibility chart is show in table 2. Such a chart is probably more meaningful than organization charts or job descriptions, particularly is it is filled in during a meeting of all concerned managers resulting in agreement on the job responsibilities. This process results in potential conflicts being confronted early, before specific problems arise.

 Example of a Responsibility Chart Source: Ref. 17, p. 171

Table 2. Example of a Responsibility Chart Source: Ref. 17, p. 171.

Certainly such a delineation indicates where the major responsibilities lie, but it cannot guarantee a balance of power. In fact, there are many reasons why it is almost impossible to have a truly "equal" balance of power between functional and project management. Not the least of these reasons is the fact that we are dealing with people, and all people, including managers, are different. Managers have differing personalities and differing management styles. Some management styles depend on the persuasive abilities of the manager while others depend on or tend to fall back on strong support from top management. In addition, power is a fluctuating and constantly changing condition that cannot be static even if one so desired (23).

The breakdown of responsibilities shown in table 1 and table 2, although useful in planning and decision making, is highly simplistic. What conscientious, knowledgeable project manager would not get personally involved in "how will the task be done?" His project schedule and "when will the task be done?" responsibilities do not allow him the luxury of sitting back and waiting for functional management to make every technical decision. He must ensure that technical decisions are made on schedule. He then must review the key technical decisions and challenge them if necessary. As project integrator, he has the overriding responsibility for evaluating *every* key project decision to determine how it interfaces with the other project tasks, and with his schedule and budget. The project manager therefore must get involved and influence every project action and as a last resort he always has appeal rights or veto power — for the good of the project. The project manager even gets involved in "who will do the task?" After all, the highest achievers and most innovative personnel in the discipline organizations will be highly sought after, and the project managers will seek to obtain only the very best people for their projects.

On the other hand, what good functional manager will not get deeply involved in the details of "what, when and for how much money?" He has a strong personal interest in these details since his organization has to perform the tasks spelled out in the project schedules and budgets. He must assure that the task is realistically priced and technically feasible. The responsibilities listed in table 1 can therefore only be used as indicators as to where the major responsibilities lie.

Since the project, program or product is usually a very important part of a company's activities, the project manager is a *very* important person. He is the one who puts the company in a position where it can make more profit, or lose money.

Therefore, in terms of the balance of power, it would seem that the project manager would always have the scale of power tipped in his direction, particularly with the firm support of top management. Not necessarily so! In fact, not usually so, at least in a matrix organization. In a pure project organization, there is no question as to who holds the power. But in a matrix organization the functional manager has powerful forces on his side. As previously pointed out, the functional manager is normally perceived by project personnel to be the real boss. This is often inevitable since functional management is part of the unchanging ladder in the management hierarchy and is therefore perceived to be "permanent" by the employees. After all, the functional organization represents "home-base" to which project personnel expect to return after the completion of the project.

Very strong top-management support for the project manager is necessary to get the matrix to work, and even very strong support will not guarantee project success. However, the matrix will not work without it. The project manager must get the job done by every means at his disposal even though he may not be perceived as the real boss. He can always appeal to higher authority, however such actions must be kept to a minimum or top management may view the project manager as ineffective.

The Project/Functional Interface

The secret of the successfully functioning matrix can thus be seen to be not just a pure balance of power, but more a function of the type of interface relationships between the project and individual functional managers. Every project decision and action must be negotiated across this interface. This interface is a natural conflict situation since many of the goals and objectives of project and functional management are different. Depending on the personality and dedication of the respective managers, this interface relationship can be one of smooth-working cooperation or bitter conflict. A domineering personality or power play is not the answer. The overpowering manager may win the local skirmish, but usually manages sooner or later to alienate everyone working on the project. Cooperation and negotiation are the keys to successful decision making across the project/functional interface. Arbitrary and one-sided decisions by either the project or functional manager can only lead to or intensify the potential for conflict. Unfortunately for the project manager, he can accomplish little by himself, and must depend on the cooperation and support of the functional managers. That old definition of successful management — "one who gets things done by working through others" — is essential for successful project management in the matrix organization.

The project manager in a matrix organization has two very important interfaces — with top management and with functional management. A good working relationship with and ready access to top management is essential for resolving big problems and removing obstacles. A good working relationship with functional management will ensure that most problems are resolved at their level and will not have to go to top management. The conventional matrix model (figure 1) does not adequately emphasize these most important relationships. Obviously, neither the project manager nor the functional managers can sit in their offices and give orders. The various managers must be communicating with each other on at least a daily basis, and usually more often. Therefore a more adequate organizational model is shown in figure 7, which shows the managerial relationships as double-ended arrows, indicating that the relationships are two-way streets. Consultation, cooperation, and constant support are particularly necessary on the part of the project and functional managers. These are very important relationships, keys to the success of any matrix organization, and must be carefully nurtured and actively promoted by top management and by both project and functional management.

The difficulties that occur at the project/functional interface are emphasized if the salient differences between the role of the project manager and the traditional functional manager are analyzed. Such an analysis has been made by Cleland (7) and indicated that "while these differences are possibly more theoretical than actual, differences do exist, and they affect the manager's modus operandi and philosophy." Both project and functional management must work to achieve activity harmony in spite of these conflicting objectives and roles. The matrix organization actually is a method of deliberately utilizing conflict to get a better job done. The project team must be more concerned with solving the problem rather than with *who* solves it. Teamwork and problem solving must be emphasized rather than role definition.


The multiple management interfaces

Figure 7. The multiple management interfaces

Achieving a Balance of Power

Achieving a balance of power between project and functional management may in many cases be a desirable goal. Certainly it should be a way of minimizing potential power struggles and unnecessary conflicts. There is no certain way to assure that there is a balance of power, and it is probably seldom really achieved. However, it can be approached by assuming that the project manager has the full support of top management and that he reports at a high enough level in the management hierarchy.

Figure 8. Project management reporting levels

How High Should Project Management Report?

It is not just a question of balance of power, but does the *project* manager have sufficient clout to be effective? For the most part, the project manager's clout is a direct function of the level at which he reports in the hierarchical organization. If he is to be effective, the project manager must be on at least an equal level with the highest level of functional management that he must deal with. As indicated in figure 8, there can be a considerable difference in reporting level depending whether the project is confined to a single department or spreads across the entire company's activities. This optimum reporting level will change during the life of a project as the effort progresses from basic research to the manufacture of a product.

Strong vs. Weak Matrix

In many situations it may not be desirable to have a balance of power. For instance, a project may be so important to the company, or the budget and schedule so tight that top management feels that the project manager must be in a very strong position. Or perhaps the project manager feels that he must tilt the organizational balance of power in his favor to obtain better project performance. For instance, construction management has found from experience that a strong project office is often necessary to achieve good project performance (3). On the other hand, top management may feel that functional management needs more backing. In either case, the balance of power can be tilted in either direction by changing any one or any combination of the following three factors:

- *The administrative relationship.* — The levels at which the project and involved functional managers report, and the backing which they receive from top management.
- *The physical relationship.* — The physical distances between the various people involved in the project
- *The time spent on the project.* — The amount of time spent on the project by the respective managers

These three factors can be used to describe whether the matrix is strong or weak. The strong matrix is one in which the balance of power is definitely on the side of project management. This can be shown by the model in figure 9. A weak matrix has been described by project managers as one in which the balance of power tilts decisively in the direction of line or functional management. Many organizations have thus, for various reasons including the inability to make the two-boss system work, modified the matrix by shifting the balance of power. Galbraith has described the managerial alternatives as a continuum ranging from pure project to functional (figure 10) (13)(17). The matrix falls in the middle of the continuum, and can range from very weak to very strong depending on the relative balance of power.


The balance of power in a strong matrix

Figure 9. The balance of power in a strong matrix

It is easy to see how the administrative relationships can be used to create a strong matrix. The higher the project manager reports in the hierarchical organization, and the more visible support he gets from top management, the more likely it is that the matrix will be strong. The physical relationship would involve actually splitting the project personnel away from their physical reporting relationship with their functional managers. One approach would be to put the entire project team together in the same room, away from their functional bosses. This would seem to be very desirable on the part of most project managers, but would have some disadvantages in regard to utilization of functional facilities and interaction with other functional personnel. The approach of putting all the project personnel together has been described as a tight matrix, whereas the situation of widely-separated project personnel has been described as a loose matrix.


The balance of power in weak and strong matrices

Figure 10. The balance of power in weak and strong matrices

The organizational alternatives have also been described in terms of the percentage of the organizational personnel who are full-time members of the project team (25). In this manner, the various organizational structures can be described as a continuum where the three organizational forms (functional, project, and matrix) are a continuum ranging from functional on one end and pure project on the other (figure 3, chapter 4). In a functional organization, there is no one on the project team, and in a pure project organization, essentially everybody is on the project team. The matrix falls in between, and includes a variety of organizational alternatives ranging from a weak to a strong matrix. A weak matrix is described as having only a part-time coordinator whereas a strong matrix has a project office containing such project functions as systems engineering, cost analysis, scheduling, and planning.

Summary

The matrix organizational structure has had a great influence on project management. The matrix evolved to fill a need for an organization capable of dealing with great project size and complexity. The result was increased organizational complexity. However, it has

greatly added to the versatility and effectiveness of project management. The matrix has permitted project management to be effective not only for very large projects but small projects as well, and has been extremely valuable for solving multidisciplinary problems.

The matrix organizational form is only desirable if there is a real need for its added complexity. Not only is it not for everyone, but it cannot be guaranteed to work. It will only work if the entire organization, from top management to the project personnel, are thoroughly “sold” on the matrix concept. There are many reasons why the matrix will not work, but failure to lay the groundwork and fully prepare the organization is the principle reason for failure. The matrix will function and result in very improved project productivity if top management gives its unwavering support and if functional management and the project personnel accept the matrix as a “way of life” which can only be of great advantage to the company in improving output and profit.