Project Management Organizations Is The Ultimate Resource For Several Network Operations: Case Study Of Construction Project.

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ABSTRACT
Project management is the discipline of planning, organizing, securing and managing resources to bring about the successful completion of specific project goals and objectives. It is sometimes conflated with program management, however technically that is actually a higher level construction. Traditionally, human undertaking projects need to be performed and delivered under these constraints: "scope", "time", and "cost". These three constraints (The Project Management Triangle) are often competing constraints: increased scope usually means increased time and increased cost, a tight time constraint could mean increased costs and reduced scope, and a tight budget could mean increased time and reduced scope. A further refinement of the constraints separates product "quality" or "performance" from scope, and turns quality into a fourth constraint.

The primary challenge of project management therefore is to achieve all of the engineering project goals and objectives while honoring the preconceived typical project constraints. The secondary (and more ambitious) challenge is to optimize the allocation and integration of inputs necessary to meet pre-defined objectives. The management of construction projects hence requires knowledge of modern management as well as an understanding of the design and construction process. This will be aptly portrayed in the case study of this paper.
KEYWORDS: *project management, management development, construction project, case studies.*

I- PREFACE

A project is a temporary endeavor, having a defined beginning and end (usually constrained by date, but can be by funding or deliverables), undertaken to meet unique goals and objectives, usually to bring about beneficial change or added value.
The temporary nature of projects stands in contrast to business as usual (or operations), which are repetitive, permanent or semi-permanent functional work to produce products or services. In practice, the management of these two systems is often found to be quite different, and as such requires the development of distinct technical skills and the adoption of separate management.

Moreover, over the course of any construction project, the work scope may change. Change is a normal and expected part of the construction process. Changes can be the result of necessary design modifications, differing site conditions, material availability, contractor-requested changes, value engineering and impacts from third parties, to name a few. Beyond executing the change in the field, the change normally needs to be documented to show what was actually constructed. Hence, the owner usually requires a final record to show all changes or, more specifically, any change that modifies the tangible portions of the finished work. The record is made on the contract documents – usually, but not necessarily limited to, the design drawings. When changes are introduced to the project, the viability of the project has to be re-assessed.

Furthermore, Construction projects have a specific set of objectives and constraints such as a required time frame for completion. While the relevant technology, institutional arrangements or processes will differ, the management of such projects has much in common with the management of similar types of projects in other specialty or technology domains such as aerospace, pharmaceutical and energy developments. Generally, project management is distinguished from the general management of corporations by the mission-oriented nature of a project. A project organization will generally be terminated when the mission is accomplished.

II- LITERATURE REVIEW OF PROJECT MANAGEMENT

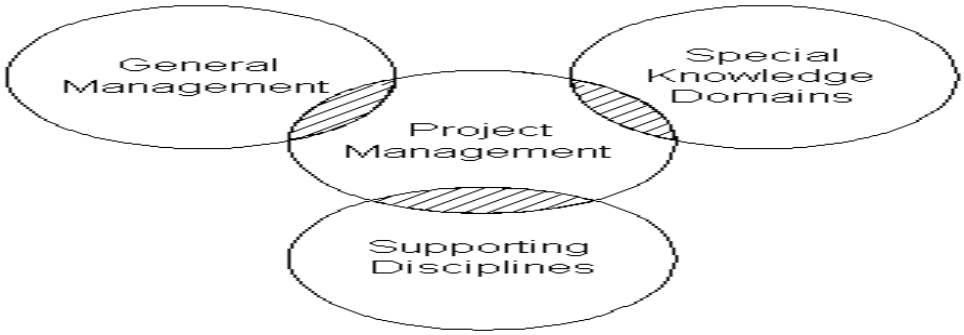
According to the Project Management Institute, the discipline of project management can be defined as follows**:** Project management is the art of directing and coordinating human and material resources throughout the life of a project by using modern management techniques to achieve predetermined objectives of scope, cost, time, quality and participation satisfaction.

By contrast, the general management of business and industrial corporations assumes a broader outlook with greater continuity of operations. Nevertheless, there are sufficient similarities as well as differences between the two so that modern management techniques developed for general management may be adapted for project management.

2.1- The basic ingredients for a construction project framework

The basic ingredients for a project management framework may be represented schematically in *Figure 2-1*. A working knowledge of general management and familiarity with the special knowledge domain related to the project are indispensable. Supporting disciplines such as computer science and decision science may also play an important role. In fact, modern management practices and various special knowledge domains have absorbed various techniques or tools which were once identified only with the supporting disciplines.

Figure 2.1: Basic Ingredients in Project Management



For example, computer-based information systems and decision support systems are now common-place tools for general management. Similarly, many operations research techniques such as linear programming and network analysis are now widely used in many knowledge or application domains. Hence, the depiction in the Figure above reflects only the sources from which the project management framework evolves.

2.2- Project management covers a set of objectives

Specifically, project management in construction encompasses a set of objectives which may be accomplished by implementing a series of operations subject to resource constraints. There are potential conflicts between the stated objectives with regard to scope, cost, time and quality, and the constraints imposed on human material and financial resources. These conflicts should be resolved at the onset of a project by making the necessary tradeoffs or creating new alternatives. Subsequently, the functions of project management for construction generally include the following:

1-Specification of project objectives and plans including delineation of scope, budgeting, scheduling, setting performance requirements, and selecting project participants; **2**-Maximization of efficient resource utilization through procurement of labor, materials and equipment according to the prescribed schedule and plan; **3**-Implementation of various operations through proper coordination and control of planning, design, estimating, contracting and construction in the entire process; **4**-Development of effective communications and mechanisms for resolving conflicts among the various participants.

2.3- Project management knowledge & attention

The Project Management Institute focuses on nine distinct areas requiring project manager knowledge and attention: **1**-Project integration management to ensure that the various project elements are effectively coordinated; **2**-Project scope management to ensure that all the work required (and only the required work) is included; **3**-Project time management to provide an effective project schedule; **4**-Project cost management to identify needed resources and maintain budget control; **5**-Project quality management to ensure functional requirements are met; **6**-Project human resource management to development and effectively employ project personnel; **7**-Project communications management to ensure effective internal and external communications; **8**-Project risk management to analyze and mitigate potential risks. **9**-Finally is the Project procurement management, to obtain necessary resources from external sources.

III- DRIFTS IN MANAGEMENT DEVELOPMENT

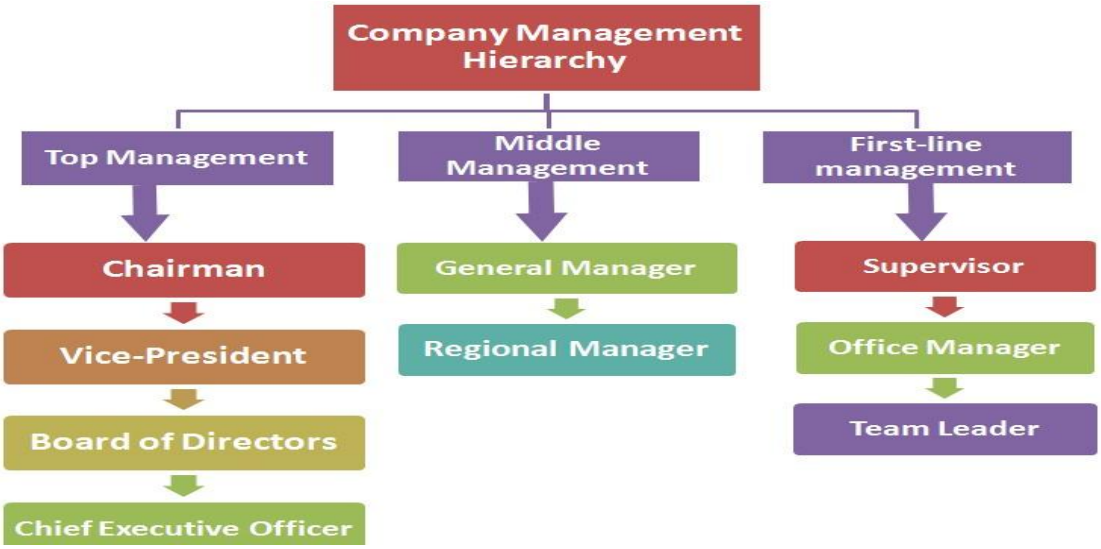
In recent years, major developments in management reflect the acceptance to various degrees of the following elements: **(1)** the management process approach, **(2)** the management science and decision support approach, **(3)** the behavioral science approach for human resource development, and **(4)** sustainable competitive advantage. These four approaches complement each other in current practice, and provide a useful groundwork for project management.

3.1- Management Development

3.1.1- The systematic study of management in an organization

The management process approach emphasizes the systematic study of management by identifying management functions in an organization and then examining each in detail. There is general agreement regarding the functions of planning, organizing and controlling. A major tenet is that by analyzing management along functional lines, a framework can be constructed into which all new management activities can be placed. Thus, the manager's job is regarded as coordinating a process of interrelated functions, which are neither totally random nor rigidly predetermined, but are dynamic as the process evolves. Another tenet is that management principles can be derived from an intellectual analysis of management functions. By dividing the manager's job into functional components, principles based upon each function can be extracted. Hence, management functions can be organized into a hierarchical structure designed to improve operational efficiency, such as the example of the organization for a manufacturing company shown in Figure 3-1. The basic management functions are performed by all managers, regardless of enterprise, activity or hierarchical levels. Finally, the development of a management philosophy results in helping the manager to establish relationships between human and material resources. The outcome of following an established philosophy of operation helps the manager win the support of the subordinates in achieving organizational objectives.

Figure 3-1: Illustrative Hierarchical Structure of Management Functions



3.1.2- Management science & decision support

The management science and decision support approach contributes to the development of a body of quantitative methods designed to aid managers in making complex decisions related to operations and production. In decision support systems, emphasis is placed on providing managers with relevant information. In management science, a great deal of attention is given to defining objectives and constraints, and to constructing mathematical analysis models in solving complex problems of inventory, materials and production control, among others. A topic of major interest in management science is the maximization of

profit, or in the absence of a workable model for the operation of the entire system, the sub-optimization of the operations of its components.

The optimization or sub-optimization is often achieved by the use of operations research techniques, such as linear programming, quadratic programming, graph theory, queuing theory and Monte Carlo simulation. In addition to the increasing use of computers accompanied by the development of sophisticated mathematical models and information systems, management science and decision support systems have played an important role by looking more carefully at problem inputs and relationships and by promoting goal formulation and measurement of performance. Artificial intelligence has also begun to be applied to provide decision support systems for solving ill-structured problems in management.

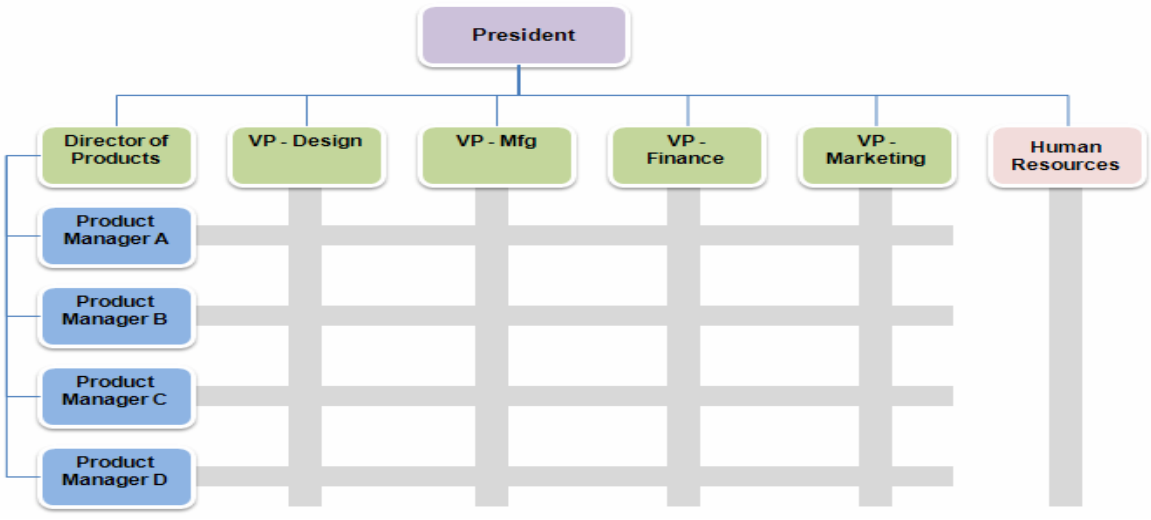
3.2- Organization of Project

3.2.1- Decomposition of Project

The top management of the owner sets the overall policy and selects the appropriate organization to take charge of a proposed project. Its policy will dictate how the project life cycle is divided among organizations and which professionals should be engaged. Decisions by the top management of the owner will also influence the organization to be adopted for project management. In general, there are many ways to decompose a project into stages. The most typical ways are: **1-**Sequential processing whereby the project is divided into separate stages and each stage is carried out successively in sequence. **2-**Parallel processing whereby the project is divided into independent parts such that all stages are carried out simultaneously. **3-** Staggered processing whereby the stages may be overlapping, such as the use of phased design-construct procedures for fast track operation.

It should be pointed out that some decomposition may work out better than others, depending on the circumstances. In any case, the prevalence of decomposition makes the subsequent integration particularly important. The critical issues involved in organization for project management are: **(1)** How many organizations are involved? **(2)**What are the relationships among the organizations? **(3)**When are the various organizations brought into the project?

Figure 3.2.1: A Matrix Organization



3.2.2- Project Implementation

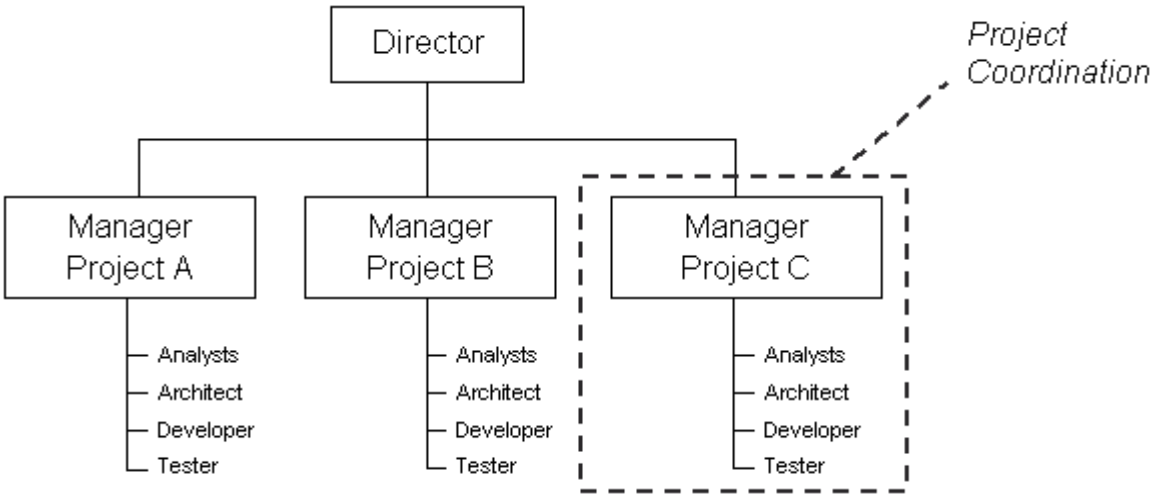
There are two basic approaches to organize for project implementation, even though many variations may exist as a result of different contractual relationships adopted by the owner and builder. These basic approaches are divided along the following lines:

1-Separation of organizations; Numerous organizations serve as consultants or contractors to the owner, with different organizations handling design and construction functions. Typical examples which involve

different degrees of separation are: *Traditional sequence of design and construction; *Professional construction management

2-Integration of organizations; A single or joint venture consisting of a number of organizations with a single command undertakes both design and construction functions. Two extremes may be cited as examples: *Owner-builder operation in which all work will be handled in house by force account. *Turnkey operation in which all work is contracted to a vendor which is responsible for delivering the completed project.

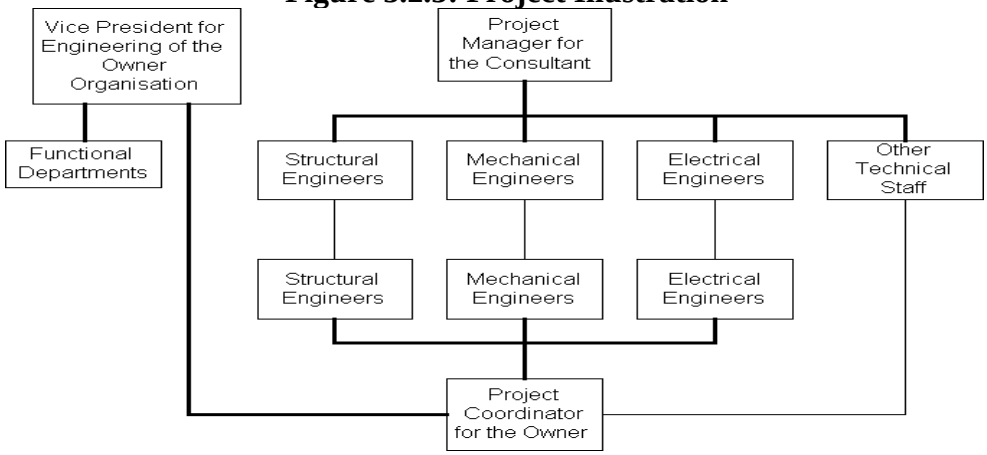
Figure 3.2.2: A Project-Oriented Organization



3.2.3- illustration of organization of project

To illustrate various types of organizations for project management, we shall consider two examples, the first one representing an owner organization while the second one representing the organization of a construction management consultant under the direct supervision of the owner.

Figure 3.2.3: Project Illustration



For Example: Matrix Organization of an Engineering Division

The Engineering Division of an Electric Power and Light Company has functional departments. When small scale projects such as the addition of a transmission tower or a sub-station are authorized, a matrix organization is used to carry out such projects. For example, in the design of a transmission tower, the professional skill of a structural engineer is most important. Consequently, the leader of the project team will be selected from the Structural Engineering Department while the remaining team members are selected from all departments as dictated by the manpower requirements. On the other hand, in the design of a new sub-station, the professional skill of an electrical engineer is most important. Hence, the leader of the project team will be selected from the Electrical Engineering Department.

For Example: Construction Management Consultant Organization

When the same Electric Power and Light Company in the previous example decided to build a new nuclear power plant, it engaged a construction management consultant to take charge of the design and construction completely. However, the company also assigned a project team to coordinate with the construction management consultant.

VI- ILLUSTRATIVE CONSTRUCTION PROJECTS: CASE STUDIES

The initiation and execution of capital projects places demands on the resources of the owner and the professionals and contractors to be engaged by the owner. For very large projects, it may bid up the price of engineering services as well as the costs of materials and equipment and the contract prices of all types. Consequently, such factors should be taken into consideration in determining the timing of a project.

6.1- Setting priorities for projects

A department store planned to expand its operation by acquiring 20 acres of land in the southeast of a metropolitan area which consists of well established suburbs for middle income families. An *architectural/engineering* (A/E) firm was engaged to design a shopping center on the 20-acre plot with the department store as its flagship plus a large number of storefronts for tenants. One year later, the department store owner purchased 2,000 acres of farm land in the northwest outskirts of the same metropolitan area and designated 20 acres of this land for a shopping center. The A/E firm was again engaged to design a shopping center at this new location.

The A/E firm was kept completely in the dark while the assemblage of the 2,000 acres of land in the northwest quietly took place. When the plans and specifications for the southeast shopping center were completed, the owner informed the A/E firm that it would not proceed with the construction of the southeast shopping center for the time being. Instead, the owner urged the A/E firm to produce a new set of similar plans and specifications for the northwest shopping center as soon as possible, even at the sacrifice of cost saving measures. When the plans and specifications for the northwest shopping center were ready, the owner immediately authorized its construction. However, it took another three years before the southeast shopping center was finally built.

The reason behind the change of plan was that the owner discovered the availability of the farm land in the northwest which could be developed into residential real estate properties for upper middle income families. The immediate construction of the northwest shopping center would make the land development parcels more attractive to home buyers. Thus, the owner was able to recoup enough cash flow in three years to construct the southeast shopping center in addition to financing the construction of the northeast shopping center, as well as the land development in its vicinity.

While the owner did not want the construction cost of the northwest shopping center to run wild, it apparently was satisfied with the cost estimate based on the detailed plans of the southeast shopping center. Thus, the owner had a general idea of what the construction cost of the northwest shopping center would be, and did not wish to wait for a more refined cost estimate until the detailed plans for that center were ready. To the owner, the timeliness of completing the construction of the northwest shopping center was far more important than reducing the construction cost in fulfilling its investment objectives.

6.2- Resource constraints for mega projects

A major problem with mega projects is the severe strain placed on the environment, particularly on the resources in the immediate area of a construction project. "Mega" or "macro" projects involve construction of very large facilities such as the Alaska pipeline constructed in the 1970's or the Panama Canal constructed in the 1900's. The limitations in some or all of the basic elements required for the successful completion of a mega project include: *Engineering design professionals to provide sufficient manpower to complete the design within a reasonable time limit. *Construction supervisors with capacity and experience to direct large projects. *The number of construction workers with proper skills to do the work. *The market to supply materials in sufficient quantities and of required quality on time. *The ability of the local infrastructure to support the large number of workers over an extended period of time, including housing, transportation and other services.

To compound the problem, extra-large projects are often constructed in remote environments away from major population centers and subject to severe climate conditions. Consequently, particular features of each extra-large project must be evaluated cautiously.

VII- CONCLUSION

It is amazing how over the course of any construction project, the work scope may change. This Change is normal and it's an expected part of the construction process. Many of the major issues in construction projects require effective interventions by individuals, groups and organizations. The fundamental challenge is to enhance communication among individuals, groups and organizations so that obstacles in the way of improving interpersonal relations may be removed. Some behavior science concepts are helpful in overcoming communication difficulties that block cooperation and coordination. Also, while these symptoms can occur to individuals at any organization, they are compounded if the project team consists of individuals who are put together from different organizations. Invariably, different organizations have different cultures or modes of operation. Individuals from different groups may not have a common loyalty and may prefer to expand their energy in the directions most advantageous to themselves instead of the project team. Therefore, no one should take it for granted that a project team will work together harmoniously just because its members are placed physically together in one location. On the contrary, it must be assumed that good communication can be achieved only through the deliberate effort of the top management of each organization contributing to the joint venture.

Finally, it is very important to summarize the mission entrusted to construction management, highlighted by strategic planning, for the purpose of project management service. The following points will better illustrate: Client total representation; Program planning; Budgeting; Design team management; Time scheduling; Project documents review; Contract administration; On-site contractors coordination; Quantity survey; Quality control; Cost control; Health & safety provisions coordination; Claim analysis; Commissioning.

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