

# **Project Management of Capital Projects: An Overview**

R. Max Wideman, Acres International Limited, Vancouver, BC. Canada

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## **Abstract**

This paper looks at the difficulties of managing modern capital projects and endeavors to reduce the complexities to simpler and more understandable terms. It examines the project environment, defines project management and discusses points of difference from traditional management. A major technique for handling any project, the Work Breakdown Structure, is discussed and rules and guidelines are suggested. The paper concludes with some essentials for success.

## **Introduction**

Significant advances in technology, especially in communications have raised the expectations of most people of the world. I understand that India has a current five year plan (1985 to 1990) which is aimed at providing basic food, health and education for all of her population which will reach one billion persons in the year 2000. This current plan fore-casts government spending to reach over \$140 billion US. Approximately \$18 billion US of this is to be spent on transportation, \$22 billion on social services, \$30 billion US on agriculture and over \$40 billion US on energy projects. This is an ambitious plan indeed, and represents a massive program of project work.

However, severe economic strains have developed in international trade over the last decade, resulting in difficulties in capital markets and with levels of external debt. This has necessitated a serious reappraisal of how projects, especially capital projects are brought to successful completion. This is just as true in the West as it is in the East, the North or the South.

The high cost of money puts a special premium on the time it takes to complete a project and how well it is managed. Delays and poor management may substantially reduce the effective benefits and quality of a project. Not only this, but in forcing a poor project to completion, money and other resources will be drawn away from other vital and needed project opportunities.

Even with good project management, a host of problems usually beset the average capital project. This is especially true in a developing nation, where political, economic, social and physical difficulties impede progress causing serious delays in completion or even failure. In Appendix A to this paper I have listed some of the most common problem areas and situations encountered in overseas project management. The major headings include:

- During Concept Development
- Environmental Conditions
- Market Conditions
- During Planning
- Organizational Difficulties
- During Execution

- Control Difficulties
- Start-up and Operating Difficulties

So after all that bad news, I have some good news. Project management is really very simple. The rest of the bad news is that it is people that make project management difficult!

As projects become larger and more complex, the effective management of them becomes relatively more significant to a successful outcome. How well the project is managed will generally far outweigh how well any of the specific technical roles are performed. Thus, putting in place competent Project Management capability long before putting in place appropriate design, engineering or construction capability is essential.

The difficulty is that on almost all capital projects, there will be a number of people involved who do not really or fully understand the process of bringing a capital project on stream. Without embarrassment, I include owners, sponsors, financiers, bankers, operators, politicians, lawyers, accountants and, I regret to say, even engineers. This is because Project Management is a particular but logical concept of management applied to project-type work.

So let me begin with some definitions, and compare project management to traditional management.

## **Definition**

### ***Project Management***

Unlike the relatively steady state of an on-going enterprise, a project has some distinctive characteristics of its own. Capital undertakings normally have a well defined starting point and a well defined objective which identifies the completion of the work. Further, resources limited in one way or another place constraints on the work to be accomplished, and underline the need for special management control. Hence the need for Project Management. However, let us first agree on what a project is. According to the Project Management Institute, an international organization dedicated to advancing the state-of-the-art in the profession of project management:

### **A project is:**

"Any undertaking with a defined starting point and defined objectives the achievement of which identify completion. In practice most projects depend on finite or limited resources with which the objectives are to be accomplished." (PMI, 1985)

Managing, by the way was well defined as long ago as 1916 by Henri Fayol. He said:

"To manage is to forecast and plan, to organize, to command, to coordinate and to control. To forecast and plan means examining the future and drawing up the plan of action. To organize means to build up the dual structure, material and human, of the undertaking. To command means maintaining activity amongst the personnel. To coordinate means bonding together, unifying and harmonizing all activity and effort. To control means seeing that everything occurs in conformity with established rule and expressed command." (Henri Fayol, Administration Industrielle et Generale, 1916.)

And:

**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 participant satisfaction." (PMI, 1985).

Not everyone is familiar with the word "Scope" by the way. "Scope" means the work content and finished "products" for which the project has been designed. Sometimes scope may be represented by a statement of the results or performance expected, leaving the content details to the designer. Similarly each phase content, or component such as "work package" (which is discussed later) also have associated scopes.

Scope is fully defined by detailing the end products resulting from the project, including quality standards, all activities performed and the resources consumed. A scope statement should be introduced by a brief background to the project, or component, and the general objective.

**Traditional Management**

For emphasis let us take a moment to compare project management with "traditional" management. Traditionally, management has not been concerned with projects but with on-going enterprises. Change is minimal and slow, with sufficient time to adjust, and hence can be thoroughly programmed and slowly integrated. Time is not an immediate concern.

Such on-going enterprises typically have the following characteristics:

- Relatively simple and certain technology;
- Large production quantities per time period;
- Continuous flow of products and/or services with substantial similarity in performed tasks;
- Tasks are repetitive, relationships and responsibilities are clear and the people are functioning in a high stable environment; and
- Roles and responsibilities of all members are well understood; relationships develop and are adjusted over long periods of time.

In such enterprises, management's role has been to maintain the flow of authority and responsibility by ensuring that:

- Established on-going organizations function on a vertical basis;
- A chain of authority exists within the organization from the highest to the lowest rank, through every link in the chain. Hence, an employee receives orders from one superior only.
- Strong superior-subordinate relationships exist to preserve unity of command and to ensure unity of purpose;
- Work progresses within autonomous functional units of the organization;
- Line and staff relationships are clearly defined;
- Functional managers have clearly identified, finite responsibilities; and
- Functional managers establish "staff" relationships where collective action is required.

Unfortunately, this traditional management approach breaks down where projects are concerned. Consequently, new management relationships are then required. These tend to cut across the normal flow of authority and responsibility and to radiate outside the functional unit.

### **Hard and Soft Projects**

Although as engineers we are principally concerned with "capital" or "hard" projects, it is worth noting that the principals I want to describe are equally applicable to both "hard" and "soft" projects, and in fact whether they are large or small.

**Hard Projects** - those in which the final result is a relatively unique tangible product, such as a building, production plant or "utility".

**Soft Projects** - those in which the final result is not in itself a tangible asset. These may include an office relocation, establishing a new administrative system or even launching a new television program. The point is a project is not an on-going activity. Rather, it is an understanding that ends with a specific accomplishment and the product or end result is a distinguishing characteristic.

Thus project management should be applied whenever there is a single, identifiable, overall task which is:

- Complex (that is, requiring reciprocal organizational and technological interdependencies);
- Interdisciplinary (requiring coordination of two or more functional units or departments); and
- Finite (in terms of completion date as well as performance and cost objectives).

### **Typical Capital Project Management Environment**

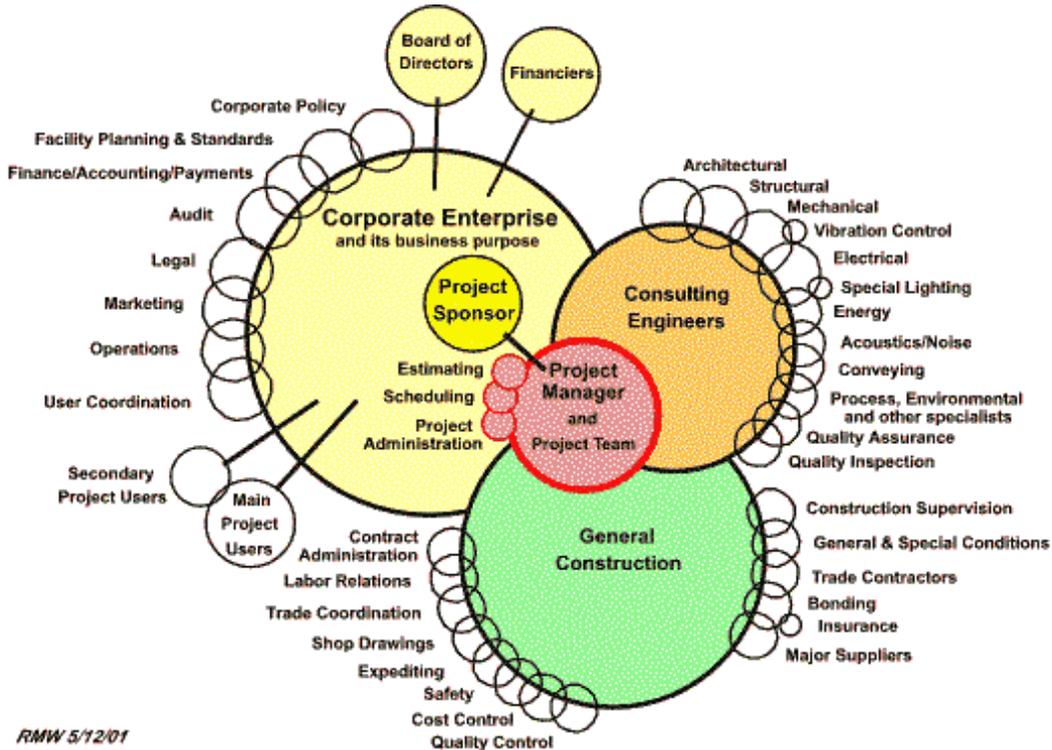
In any capital project, the project group to be managed will consist of consultants, contractors, specialists, the staff of the owner and the project management organization. A typical situation is shown in Figure 1. Each person or unit in the group often has two "bosses", the project manager and his "home" department or firm. This dual reporting relationship is often referred to as a "matrix" structure and accounts for much of the complexity of project management on a large project.

The project manager will be required to direct operational activities such as design, procurement, and construction. He will state his requirements for such management support activities as estimating, scheduling, accounting and forecasting.

In addition, on a larger project, he will require other more specialized services such as financial accounting, payroll, systems development, personnel, legal, public relations and property acquisition. Because they do not normally affect project control decisions, these activities are usually carried out by independent departments or companies, not directly under the project manager's supervision. Nevertheless, if the project manager is to get the quality of information and service that he needs, he must maintain good relationships with all such parties.

The project manager will also be required to report to upper management or the owner on a regular

basis. For this he must render a succinct digest of the available information on progress, forecast, resource requirements, and actions required.



**Figure 1 Project management in a corporate environment**

By comparison, top management's interest will tend to focus on expenditure to date, forecast final cost, and the scheduled commencement of an operating cash flow.

**Project Characteristics**

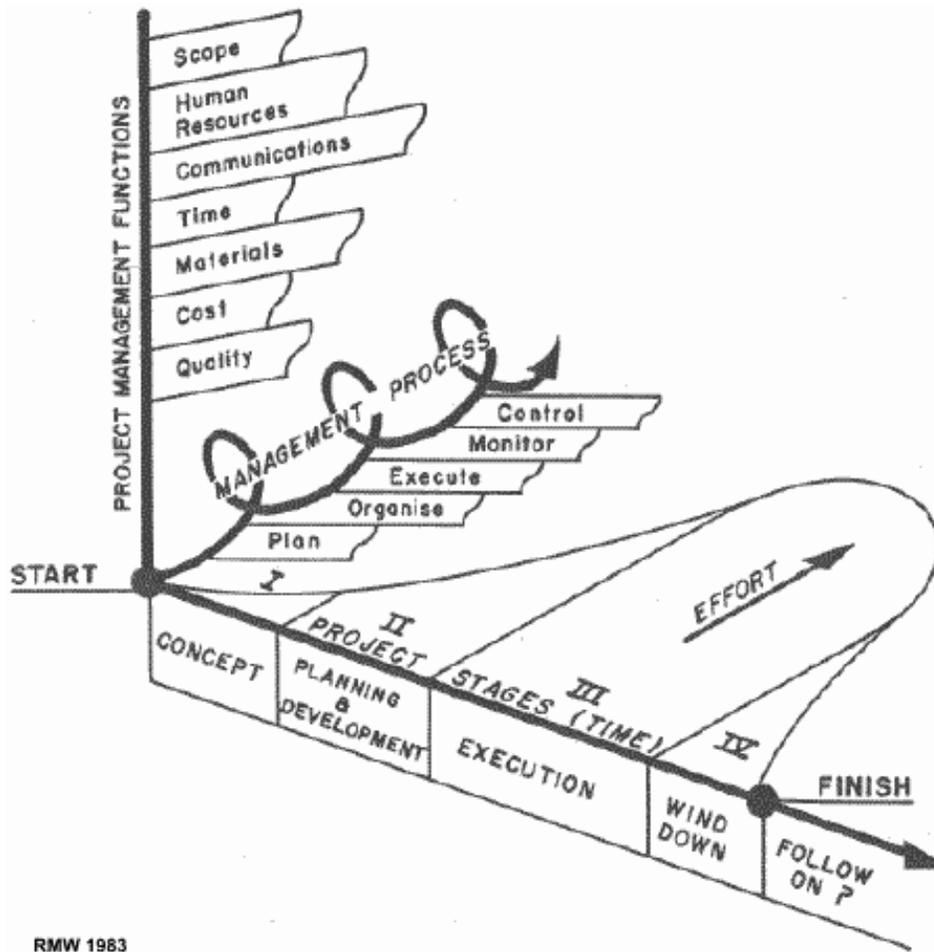
***Function-Process-Time Relationship***

The time, process, and function components of project management form a relationship which may be viewed as three-dimensional. This relationship is shown in Figure 2. The figure shows functions which are to be managed, the processes which are used by management, and their variation in terms of effort required, as the project progresses from beginning to end.

***Project Stages***

There are four distinct project phases or stages which make up the typical project life cycle, namely: Concept; Planning; Execution; and Termination. These phases may be more easily remembered by the letters CDEF standing for:

- **C**onceive
- **D**evelop
- **E**xecute
- **F**inish.



RMW 1983

**Note:** The diagram shows the relationship which makes project management both universally applicable and unique to all project work

**Figure 2 The Function-Process-Time relationship in project management**

Of special significance to project management is the variation in the level of effort required to conduct a project during its life time. This LOE variation, and the activities involved for, say, building a process plant, is shown in Figure 3.

***Project Management Functions***

The management functions involved in a project typically include human and material resources, scope, cost, time, quality, communications and risk management. Each represents a special discipline calling for varying degrees of training, and the requirement for each function depends on the size and nature of the project in question.

A breakdown of these various project management functions, into processes, activities and techniques which may be anticipated within each function is now considered to be part of the Project Management Body of Knowledge. It is available from the Project Management Institute, Box 43, Drexel Hull, Pennsylvania 19026, U.S.A.

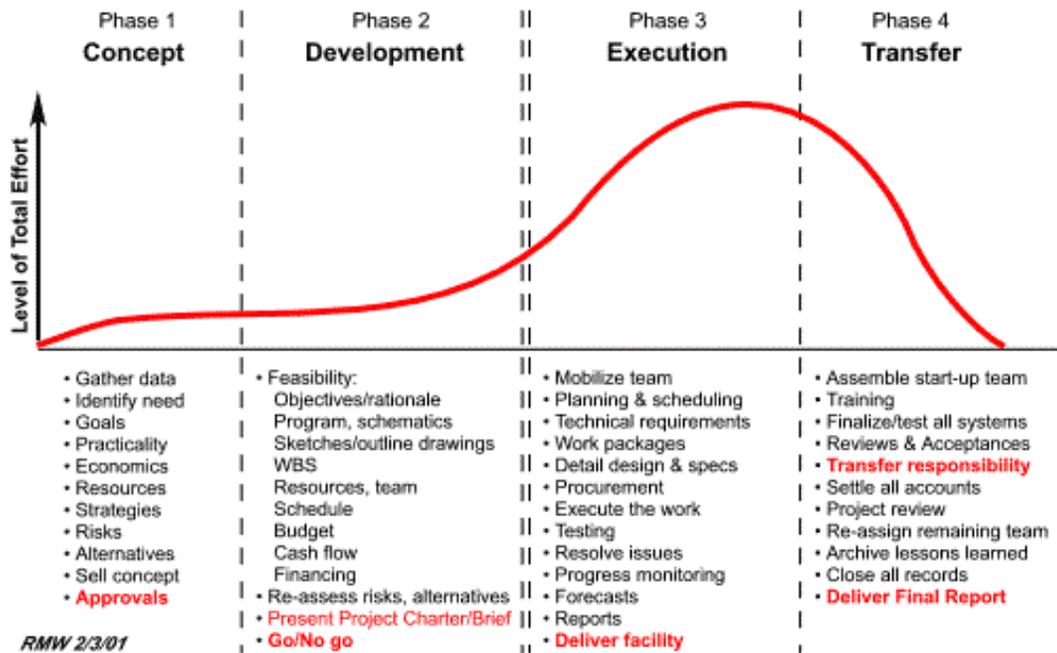


Figure 3 The four basic periods of a typical project life cycle

## Some Basic Concepts of Project Management

### Planning

In developing any project, we must plan the What?, When?, Who?, How?, How well?, and How much? A project can only be executed effectively with a clear definition of the objectives to be achieved, and a plan for achieving those objectives.

Project management also relies heavily on the science of management systems. For example, Decision Analysis (an outgrowth of systems science) is a methodical and logical process for evaluating information, predicting the future, evaluating and comparing alternative courses of action, and selecting the best course to achieve the stated objectives.

### Management by Exception

Once the planning is complete and the objectives have been defined, management of a project should be by exception to the plan. Any other scheme would be chaotic, and usually is! Good management should not have to act during the execution of a project unless there is a deviation from the plan. If those deviations are beyond the project's control, however, then the owner or sponsor's executive management must alter the original objectives.

### Delegation of Authority

Management by exception clearly implies that authority to act during execution of a project must be delegated as much as possible. This must be commensurate with the ability and experience of the project team to make decisions in accordance with the plan. That is why a trained and experienced project manager is so important. A good project manager must recognize, react, and exploit unexpected change to the advantage of the project.

### ***Project Organization***

Because owners investing in capital works can deal more effectively through a single organization, an effective project management organizational structure, complete with appropriate management systems, is essential. Such an organization must assume responsibility for feasibility, scheduling, design, cost control, procurement and delivery. This forces a logical approach and facilitates decision making. Managerial unity can thus be established within an otherwise functional organizational structure, and the Owner can continue to concentrate on his primary business with minimal dilution of effort.

In turn, the Project Manager in charge of such an organization must interpret the Owner's requirements and direct and integrate the work of various specialists in diverse disciplines. He must look at the overall project without being influenced by, say, the specialist's bias or the contractor's profit motive.

Thus, responsibility for conducting the project rests with the Project Manager's team, and this team must be very results oriented. This central group must be similarly capable of delegating and motivating. This is especially important where other functional groups are required to contribute to the project, but whose primary responsibilities rest elsewhere.

Consequently, the Project Management Organization must become a central clearing house for timely project decisions often involving divergent interests. It must pull together such diverse activities as feasibility studies, client changes, etc. As such it is directly involved in managing the participation of parties normally outside its direct control.

Project scope and complexity frequently dictate the need for a formally structured Project Management System. This is necessary to balance design and construction within schedule, cost and quality constraints; to synchronize activities in terms of time, cost and place; and to coordinate human and material resources.

Through such a Project Management Organization, properly set up and efficiently managed, the Owner can achieve effective control of the project from the beginning.

### ***Project Manager's Objectives***

It follows from the foregoing that the Project Manager's personal objectives must be to:

- Attain the willing commitment of people to assigned tasks;
- Achieve the coordination and collaboration of different work groups, responsibility centers, and entire organizations, including those of the owner;
- Achieve cooperation by placing a high premium on reliability and timeliness of information, and by discouraging unnecessary or irrelevant information;
- Steer the project to completion in an orderly and progressive manner;
- Ensure that trade-offs between scope, cost and time are satisfactory and acceptable, and are seen to be so; and
- Perpetuate development of personal and professional skills and the potentialities of project participants.

## Process of Management Control

### *Plan, Organize, Execute, Monitor and Control*

The basic process of management control can easily be remembered by the mnemonic POEM standing for Plan, Organize, Execute, Monitor and Control.

**Plan** - The first step is to plan the project with respect to scope, time and cost. What precisely is to be done? Why? If it is, say, a new plant, what is the purpose and process in the plant? How is the job to be done? Why should the project be done one way rather than another? Indeed, why should it be done at all? Where is it to be built? Who will design and construct it? What resources in terms of materials, manpower, finances and time are required? What risks are involved? What strategies are required to deal with unplanned occurrences?

**Organize** - The second basic step is an extension of the planning process. A careful analysis must be made of the various activities required in planning and executing a project, to provide a closely related project team structure. For every project activity (e.g. programming, estimating, design, planning, procurement, construction) there must be a very clear definition of who is responsible, and who has the authority to execute the activity. That person must have a very clear definition of the scope, cost and time budget for that activity.

**Execute** - The methods by which the Plan is executed or implemented are critical. No project manager (or other member of the project team) will be successful unless he understands the basic needs of human beings, their strengths and weaknesses, mental and social abilities, and how to weld a complex mixture of humans into a dynamic and productive team. The single most important characteristic of a successful project manager is his ability to manage people.

**Monitor and Control** - Continued monitoring, reporting and forecasting must take place during project implementation, and the forecasts compared to the Plan. Deviations must immediately receive management attention, either by reallocation of resources or modifications to the Plan (with the client's approval if his objectives are affected). Without a detailed Plan, there is no basis for comparison, no determination of deviation, and hence no satisfactory basis for corrective action. Clearly then, a successful project management system is one which monitors and responds by a control action as early as possible after an event.

Appendix B illustrates the elements of management control by outlining the general activities which may be expected within each stage of the project management process in various project situations.

### *Elements of Control*

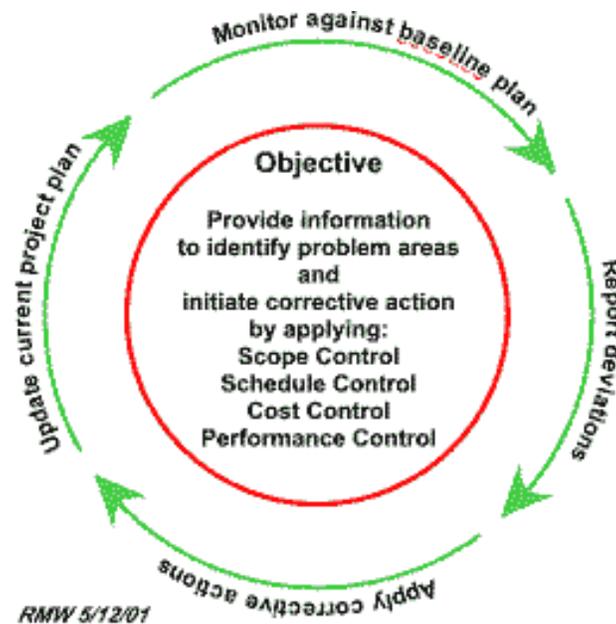
As noted earlier, project management relies heavily on the science of systems. A practical example will help in the understanding of a control system. In a simple machine-to-machine system such as an air conditioner, the input is the electric power and the output is cold air. For this we need three essential control tools:

- A monitoring mechanism, in this case, a thermostat;
- A comparative device, e.g., the thermostat signal with a set point or objective; and
- A preset formula and a means for sending a corrective signal.

The preset formula and corrective signal in its simplest form is on-off. Obviously, other more sophisticated formulae and signals are possible. This can be seen in a man-to-machine system such as an automobile where graduated control is exercised by the gas and brake pedals.

Project Management is a man-to-man system. In this case the input is essentially design information and resources of materials and labor. The output is a completed facility. The processing is done by designers, draftsmen, skilled labor, etc., who transform the raw data through drawings to contracts to construction and finally to project start-up.

Control is exercised through monitoring, reporting and forecasting the output, comparing this to the project objectives and sending corrective signals to the input of data and resources. Thus the output is made to conform closely to the objectives. This cycle is illustrated in Figure 4.



**Figure 4 Elements of the project control cycle**

Modern computers allow us to use a wide variety of control functions using almost any conceivable control formulae.

Actually, the real process is continuous and rather more complex. The cycle of monitoring, comparing and correcting never ceases until a project is completed, see Figure 5.

### ***Characteristics of a Good Management Control System***

A good management control system must:

- facilitate detailed planning;
- be able to measure performance in relation to the plan and quickly report any deviations from the plan;
- be able to communicate planning and performance information to all parties involved; and
- identify objectives and highlight important operations leading to these objectives.

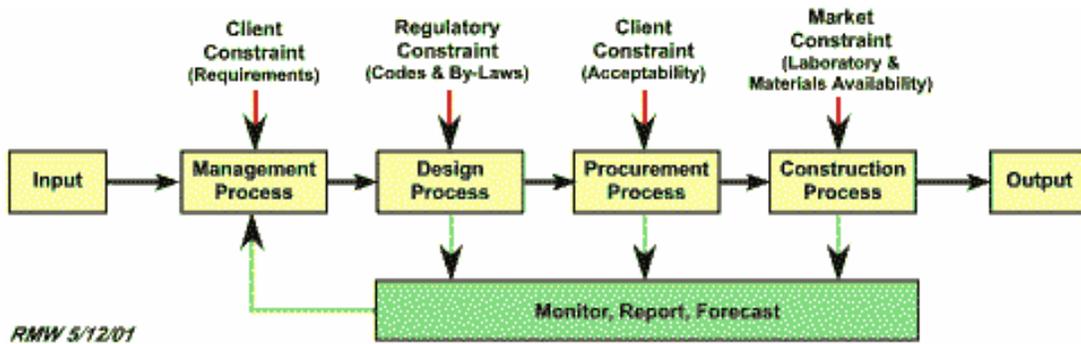


Figure 5 Control system for a construction project

## Work Breakdown

### Work Breakdown Structure

As described earlier, the process of project control requires the establishment of a firm base line for the project. The base line must be defined in terms of scope, cost, time and quality, on a compatible basis. To be successful, the Project Manager must be able to make use of this and all other available information. At any point in time, he must be able to identify problems early to minimize their effects.

Therefore, the scope of the project must be broken down into a suitably coded structure that identifies manageable segments with clearly assigned responsibilities. This is known as a project breakdown, or Work Breakdown Structure (WBS), see Figures 6a, b, and c for a typical example.

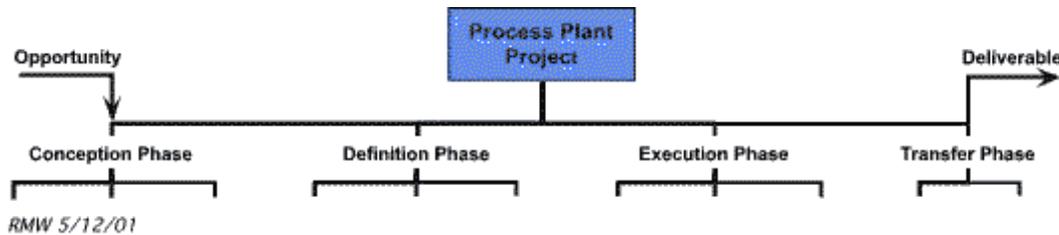


Figure 6a Top level of a process plant project WBS

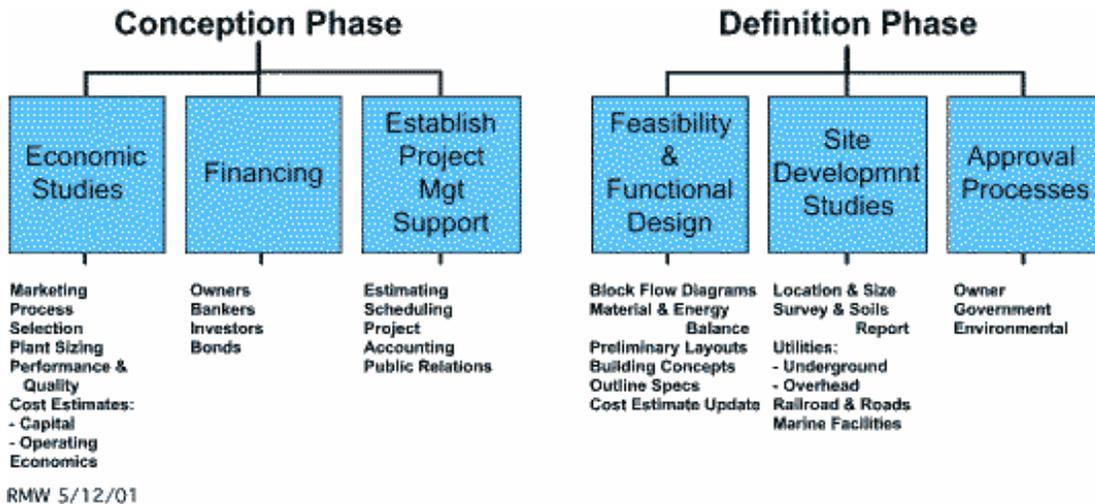
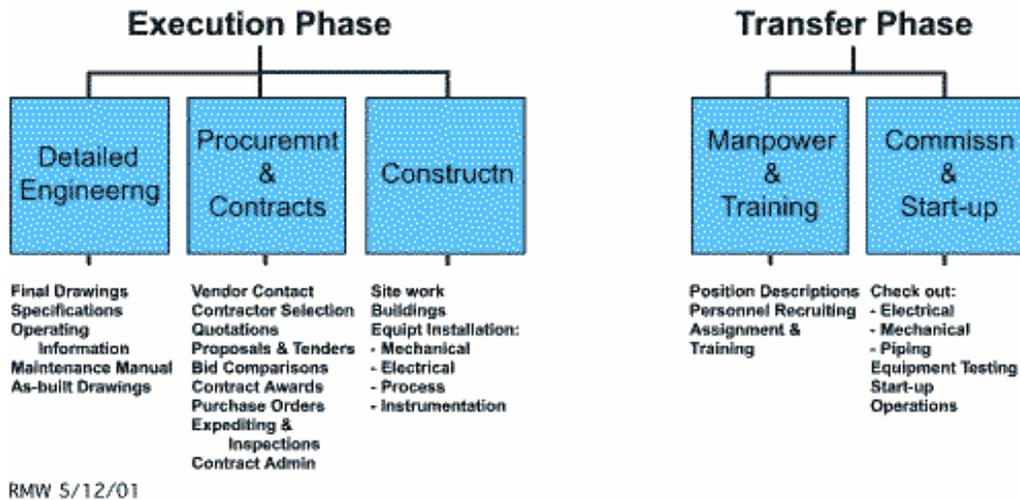


Figure 6b Detailed WBS for the Conception and Definition phases



**Figure 6c Detailed WBS for the Execution and Transfer phases**

**Work Breakdown Structure** - a task-oriented "family tree" of activities, which organizes, defines, and graphically displays the work to be accomplished.

A WBS must:

- Establish an information structure for describing the project's scope;
- Serve as an effective means of communication to integrate the objectives and activities of all the internal and external organizations involved in the project;
- Represent the planning of the project, step by step;
- Separate sequential and parallel activities assigned to different groups who will schedule, measure and control their own performance; and
- Reflect the procurement strategy during the various stages of the project's life cycle.

To be effective this WBS and corresponding coding requires:

- Early implementation;
- Flexibility and expandability;
- Universal application;
- Simplicity; and
- Capability of summation.

### **Work Packages**

The "manageable segments" of the project referred to above, are usually referred to as activity, commitment or Work Packages.

A Work Package describes the work to be performed by a specific organizational unit, and serves as a vehicle for monitoring and reporting on progress, cost and schedule. All work packages fall into one of three different categories:

- Discrete Tasks which have a specific end result or objective. These normally cover 60 to 75 percent of the total work in a project.
- Apportioned-effort Tasks which can be directly related and apportioned to discrete tasks. Examples include quality control or inspection. These tasks are required in support of the discrete tasks, and hence, their schedule and budget can be related to the discrete tasks.

- Level-of-effort Tasks which have performance standards rather than specific end results. These consist mainly of the overhead accounts, e.g., management, administration, liaison, coordination, etc. These tasks are characterized by relatively level, time-phased budgets and are not time-limited as in the case of the discrete tasks.

### ***Essential Work Package Rules***

Note that a work package is a generic term describing the unit at the lowest developed level of the relevant part of the WBS. The distinction is made between the lowest developed level and the lowest possible level, because at any given time not all work packages will be classified at the same level. In other words, ***a work package is not a distinct level in the Work Breakdown Structure.***

To be effective, work packages should be controlled by the following rules.

Rule 1: A work package must represent a unit of work at a level where work is performed.

Rule 2: It must be clearly distinguishable from all other work packages.

Rule 3: It should have scheduled start and completion dates.

Rule 4: It should have a budget.

Rule 5: Its size and duration should be limited to relatively short spans of time.

Rule 6: It must integrate with other work packages and schedules.

Rule 7: It must represent a level at which actual costs can be collected or assigned.

Note, however, that a project should not be broken down to too great an extent. If some work packages are too small, unnecessary administrative effort will be expended in maintaining the information flow. This suggests some additional rules governing work packages:

Rule 8: On small projects the following "test of reasonableness" is suggested: a work package should at least be large enough to constitute a scope of work that could be competitively bid and contracted for by itself.

Rule 9: On large, multi-million dollar projects design work packages should not be less than, say, 300 man-hours and two months in duration.

For construction, a minimum work package value of, say, 0.1 percent is a good rule of thumb.

A number of work packages may be assembled into a ***contract*** package for procurement purposes. Within such a contract, the identity of the individual work packages should be maintained for control purposes. However, to be consistent with the Work Package definition, the following further rule must be applied:

Rule 10: The same work package must not appear in more than one contract. If this is likely to happen, the affected work package should be subdivided, and the respective parts separately defined and coded.

## **Fundamentals for Success**

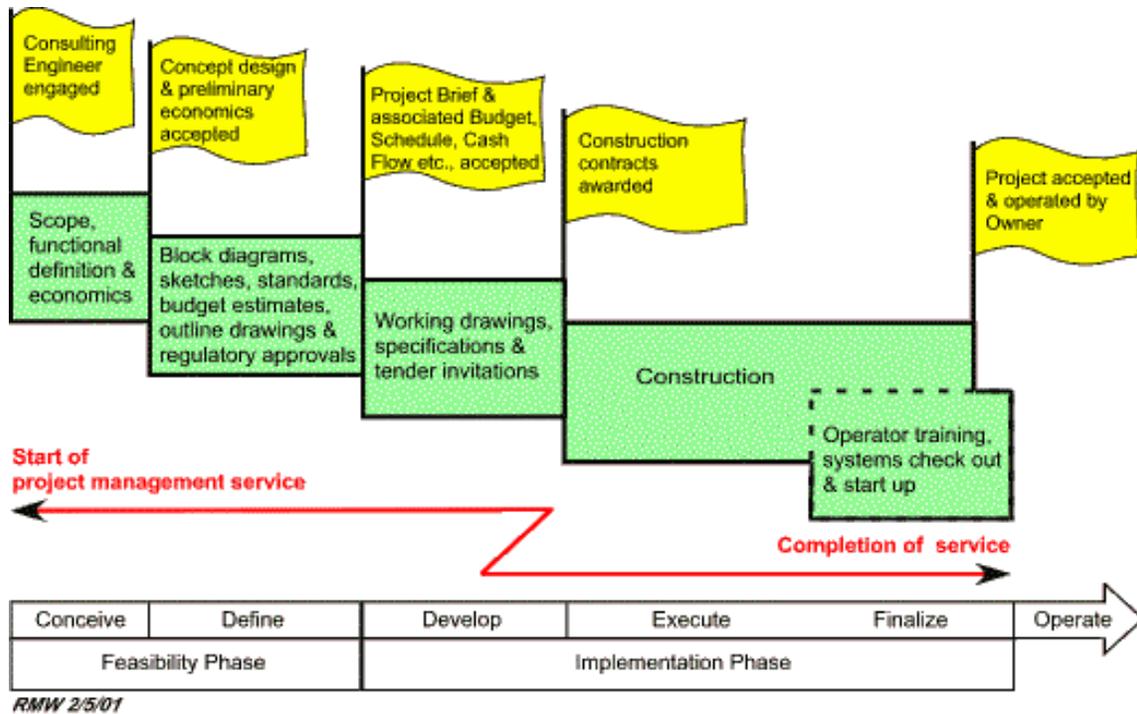
### ***Executive Control Points***

Every project should have "Executive Control Points". These are really like "gates" between phases and major stages of the project that represent major project "milestones". At these gates, the project manager

presents certain predetermined "deliverables" to the project sponsor, top management or "Executive", whoever has the authority to approve further project funding.

For top management, these points provide the opportunity to exercise a high level of control over the shape and timing of the project. Top management can ensure that either the project is developing in a manner consistent with their objectives, or the project can be modified with minimum upset if the objectives have changed. It is also the opportunity for the Executive to inject enthusiasm, excitement and discipline into the project team's work.

Changes and related delays may cost ten or more times as much to implement during construction, compared to the same changes made during the planning stage. Therefore, at the beginning of the project, Executive Control Points should be established at the conclusion of each phase, on a "go" or "no-go" basis for further work as shown by the flags in Figure 7.



**Figure 7 Executive Control points, or "phase gates" in a construction life cycle**

These control points therefore provide the project manager with his mandate to drive the project through to the conclusion of the ensuing stage. It is the project manager's opportunity to ensure that top management is behind him and that he is proceeding in the right direction.

The most important control point in the project life cycle is reached at the conclusion of the "development" stage (see Figure 3). The end of this stage marks the transition of the project from feasibility to implementation. At this point, a project "go" decision must be based on sound and well documented information. This information should be presented in a comprehensive document referred to as the Project Brief. The Project Brief, when approved, becomes the prime source of reference for the implementation phase.

### ***Project Brief***

The Project Brief is the means whereby the owners know precisely what they are getting. A good Project Brief should include:

- Executive summary;
- General statement of business aims and objectives;
- Technical approach;
- Statement of project scope;
- Regulatory approvals and requirements;
- Preliminary design sketches, block diagrams, standards;
- Project team organization;
- Implementation schedule;
- Procurement plan;
- Project estimate and proposed appropriation budget;
- Other resources required from the sponsoring organization (e.g., land, space, staff, etc.);
- Financial statement and economic projections;
- Cash flow projection;
- Justification, alternatives; and
- Areas of uncertainty and risk.

### **Success Prerequisites**

Executive management should insist on the following organizational requirements. While they do not necessarily guarantee success, their absence will certainly make success more difficult to attain.

**Competence** - The project manager and his project management organization must be competent.

**Internal Authority** - The project manager must have the necessary managerial authority within his organization to ensure response to his requirements.

**Commitment Authority** - The project manager should have capability and authority to control the commitment of funds within prescribed limits.

**Project Team** - The project manager should have a say in the assembly of his project team. Functional and discipline personnel assigned to the project must also be competent.

**External Authority** - The project manager must be identified as the authoritative agent in dealing with outside parties, and be the responsible and single *formal* contact with them.

**Involvement in Major Decisions** - No major technical, cost, schedule, or performance decisions should be made without the project manager's participation.

**Senior Management Support** - Senior management must clearly demonstrate support for the project management concept.

## **Summary**

Managing a project is different from managing a production facility, or other established on-going organization. Differences are found in the project life cycle, substantial changes in the level-of-effort required at different periods in the project life cycle and the consequent difficulties of exercising control. Project management is not difficult to understand but depending on the nature and circumstances of the project, success may be difficult to achieve. The key is thorough and early planning to provide the basis for sound execution.

Max Wideman  
1987

## **Appendix A**

### **Overseas Project Management**

#### **Typical Problem Areas and Situations**

##### **A) During Concept Development**

- Project Objectives
- Technology
- Location
- Facility Selection And Design
- Sponsor Sharing
- Capital Cost Estimate, Split and Sourcing
- Management Capability of Prime Borrower

##### **B) Environmental Conditions**

- Impact on Physical Environment
- Impact on Social Fabric
- Impact on Local Industry
- Regulatory Intervention
- National Content
- International Content
- Political Stability

##### **C) Market Conditions**

- Raw Material Supply
- Raw Material Cost
- Energy Requirement & Supply
- Sales Effort, Revenues, Sensitivity to Completion
- Customer/User Rejection
- Purchase Agreement Default
- Lack of Detail in Market Requirements

##### **D) During Planning**

- Inadequate Project Planning
- Inadequate Field Data
- Inadequate Design
- Unfamiliar Industrial Field
- Regulatory Approvals
- Political Approval
- Social Acceptance
- Inadequate Concept Development
- Precipitous Market Pursuit
- Failure to Assess Project Risks

**E) Organizational Difficulties**

- Joint Venture Partner Mismatch
- Untrained Project Management Team
- Inadequate Project Team
- Senior Staff Changes
- Captive or Uncooperative Engineering Team
- Unmotivated Participants
- Limited Local Resources or Skills

**F) During Execution**

- Inadequate Execution Planning
- Precipitous Project Initiation
- Multinational Consortium
- Multinational Engineer/Constructor
- Uncooperative Foreign Participant
- Limited Domestic Experience
- Inadequate Infrastructure
- Failure to Complete Contract
- Lack of Start Up Planning
- Unexpected/Insurmountable Technical Hurdle

**G) Control Difficulties**

- Lack of Communication & Direction
- Lack of Feedback On Progress, Problems & Solutions
- Lack of Commitment to Succeed
- Unrealistic Budget
- Unrealistic Schedule
- Lack of Scope Control
- Lack of Quality Control
- Poor Project Performance

**H) Start-Up And Operating Difficulties**

- Inadequate Operator Training
- Lack of Technology Transfer
- Excessive operating Costs
- Limited Marketing Capability
- Limited Exporter Capability
- Inadequate Commercial Arrangements
- Insufficient Gross Annual Revenue

## **Appendix B**

### **Program/Project Management in Various Management Endeavors**

#### **Project Category Class 1 - Construction; Shipbuilding; Aerospace**

(NB: All using established technology)

##### ***Project Objective***

- Design and construct a physical facility
- Design and build a ship
- Design and manufacture an aerospace product

##### ***Strategy and Plans***

Strategy for:

- Financing
- Contracting
- Technical specifications
- Timing

Plans for:

- Financing
- Schedule
- Technical development
- Contracting
- Sale/transfer

##### ***Organization***

Temporary:

- Coordination of contractors
- Liaison with future users, government, etc.
- Transfer to owner/user/client

Permanent:

- Not applicable to program/project management

##### ***Implementation***

- Coordination of a great number of organizations and individuals to ensure schedule completion
- Control expenditures to avoid overruns

##### ***Control of***

- Technical progress
- Schedule
- Costs
- Revenue

## **Project Category Class 2 – Rural Development**

### ***Project Objective***

- Develop and implement a rural development program

### ***Strategy and Plans***

Strategy for:

- Financing development
- Social development
- Technical approach

Plans for:

- Financing
- Social development
- Technical development
- Implementation

### ***Organization***

Temporary:

- Interface with government, residents, social agencies, etc.

Permanent:

- Post development, social organization to continue to deal with social impacts

### ***Implementation***

- Monitor and ameliorate impact of social and financial disruptions

### ***Control of***

- Technical progress
- Schedule
- Costs
- Funding

## **Project Category Class 3 – Urban Development**

### ***Project Objective***

- Develop and implement an urban development program

### ***Strategy and Plans***

Strategy for:

- Financing development
- Political approval
- Marketing

Plans for:

- Financing
- Political approval
- Construction phasing

- Land acquisition

### ***Organization***

Temporary:

- Planning/design
- Political liaison.
- Construction
- Marketing

Permanent:

- Property management

### ***Implementation***

- Achieve and retain "political" support from elected officials and residents
- Balance construction rate, financing and sales

### ***Control of***

- Funding commitments
- Leasing/selling
- Cash receipts/disbursements
- Construction progress
- Development approvals
- Land purchase

## **Project Category Class 4 - Organizational Change**

### ***Project Objective***

- Achieve a change in structure, staffing, system or style in an organization

### ***Strategy and Plans***

Strategy for:

- Investment
- Timing

Plans for:

- Commitment for key staff
- Organization's units to be included
- Implementation of the change

### ***Organization***

Temporary:

- Core group to interface with all affected groups
- Participatory planning for transition to the new structure

Permanent:

- Assume control after change is complete

### ***Implementation***

- Commitment required from key leaders, followed by all affected persons
- Management of potential conflicts as change occurs

### ***Control of***

- Schedule
- Costs
- Progress and effectiveness of the required organizational change

## **Project Category Class 5 – Performance Turn-around**

### ***Project Objective***

- Within a defined period of time, turn a poor performance situation into a successful one

### ***Strategy and Plans***

Strategy for:

- Capitalizing on existing strengths
- Investment of resources

Plans for:

- Resource investment
- Staff utilization
- Performance schedule and major review milestones

### ***Organization***

Temporary:

- Require a clearly defined charter and control over resources
- Establish the design of the new organizational approach

Permanent:

- Assume operation after the turn-around is complete

### ***Implementation***

- Establish an "esprit-de-corps" among members of the temporary task force
- Ensure the acceptance of the changes by the group in question and the rest of the organization
- Closely track performance with schedule

### ***Control of***

- Financial investment and resulting projected revenue
- Technical performance
- Technical resources and personnel employed
- Key schedule events and milestones

## **Project Category Class 6 – New Venture**

### ***Project Objective***

- Successfully launch a new venture (business, product, etc.)

### ***Strategy and Plans***

Strategy for:

- Financing venture
- Product
- Marketing

Plans for:

- Financing
- Production
- Marketing/sales
- Maintenance

### ***Organization***

Temporary:

- Organizational development
- Liaison with major technical, financial and marketing groups

Permanent:

- Operate venture after startup

### ***Implementation***

- Maintain coordination with support groups
- Transition from development to operation is critical

### ***Control of***

- Technical performance
- Operational preparedness of backup units
- Schedule progress
- Costs
- Revenue projections

## **Project Category Class 7 – Research and Development**

### ***Project Objective***

- Conduct research
- Develop into a marketable product

### ***Strategy and Plans***

Strategy for:

- Investment
- Timing
- Research direction
- Timing

Plans for:

- Staffing
- Investment

- Review points

### ***Organization***

Temporary:

- R&D group maintain linkages with marketing and other support groups

Permanent:

- Not usually applicable in this environment

### ***Implementation***

- Must ensure continuous linkages between R&D functions
- "Go/No-go" decision on development is critical and requires input from other units in organization

### ***Control of***

- Technical progress costs
- Revenue forecasts
- Schedules for each phase
- Linkages between phases