1. What is Industrial Management?

A. Management

Traditionally, the term "management" refers to the activities (and often the group of people) involved in the four general functions: planning, organizing, leading and coordinating of resources. Note that the four functions recur throughout the organization and are highly integrated. Emerging trends in management include assertions that leading is different than managing, and that the nature of how the four functions are carried out must change to accommodate a "new paradigm" in management. This topic in the library helps the reader accomplish broad understanding of management (including traditional and emerging views), and the areas of knowledge and skills required to carry out the major functions of management.

Some writers, teachers and practitioners assert that the above view is rather outmoded and that management needs to focus more on leadership skills, e.g., establishing vision and goals, communicating the vision and goals, and guiding others to accomplish them. They also assert that leadership must be more facilitative, participative and empowering in how visions and goals are established and carried out. Some people assert that this really isn't a change in the management functions, rather it's re-emphasizing certain aspects of management.

What Do Managers Do?

Both of the above interpretations acknowledge the major functions of planning, organizing, leading and coordinating activities -- they put different emphasis and suggest different natures of activities in the following four major functions. They still agree that what managers do is the following:

1. Planning

including identifying goals, objectives, methods, resources needed to carry out methods, responsibilities and dates for completion of tasks. Examples of planning are strategic planning, business planning, project planning, staffing planning, advertising and promotions planning, etc.

2. Organizing resources

to achieve the goals in an optimum fashion. Examples are organizing new departments, human resources, office and file systems, re-organizing businesses, etc.

3. Leading

Including to set direction for the organization, groups and individuals and also influence people to follow that direction. Examples are establishing strategic direction (vision, values, mission and / or goals) and championing methods of organizational performance management to pursue that direction.

4. Controlling, or Coordinating

This occurs with the organization's systems, processes and structures to effectively and efficiently reach goals and objectives. This includes ongoing collection of feedback, and monitoring and adjustment of systems, processes and structures accordingly. Examples include use of financial controls, policies and procedures, performance management processes, measures to avoid risks etc.

Another common view is that "management" is getting things done through others. Yet another view, quite apart from the traditional view, asserts that the job of management is to support employee's efforts to be fully productive members of the organizations and citizens of the community.

To most employees, the term "management" probably means the group of people (executives and other managers) who are primarily responsible for making decisions in the organization. In a nonprofit, the term "management" might refer to all or any of the activities of the board, executive director and/or program directors.

B. Industrial Management

Industrial Management is concerned with the design, improvement, and implementation of integrated systems of people, material, information, equipment, and energy. It draws upon specialized knowledge and skills in the mathematical, physical, and social sciences together with the principles and methods of engineering analysis and design to specify, predict, and evaluate the results to be obtained from such systems.

Industrial Management is also known as Industrial Engineering, Operations Management, Production Engineering, Manufacturing Engineering or Manufacturing Systems Engineering.

While the term originally applied to manufacturing, it has grown to encompass services and other industries as well. Similar fields include operations research, systems engineering, ergonomics and quality engineering. The unicist approach to engineering considers industry as a complex system.

Whereas most engineering disciplines apply skills to very specific areas, industrial engineering is applied in virtually every industry. Examples of where industrial engineering might be used include shortening queues at a theme park, streamlining an operating room, distributing products worldwide, and manufacturing cheaper and more reliable automobiles.

There are a number of things industrial engineers do in their work to make processes more efficient, to make products more manufacturable and consistent in their quality, and to increase productivity.

2. What is Industrial & Management Systems Engineering?

Industrial Engineers figure out how to do things better. They make significant contributions to employers by saving money while making the workplace better for fellow workers. Industrial Engineering is the branch of Engineering most closely related to human resources in that we apply social skills to work with all types of employees, from engineers to salespeople to top management. One of the main focuses of an Industrial Engineer is to improve the working environments of people - not to change the worker, but to change the workplace. We work to make others work better. Writing and presentation skills are very important for us. We measure employee aptitude and motivation to encourage communication, morale, and leadership. We study Japanese management techniques such as kaizen, just-in-time delivery, Taguchi methods, and kanban.

With its diversity, Industrial Engineers appeals to a wide cross section of employers and you will have the opportunity to work in lots of different types of businesses. The most distinctive aspect of industrial engineering is the flexibility that it offers. Whether it's reducing passenger waiting time for a roller coaster ride, scheduling the use of an operating room, developing a plan for distributing a product worldwide, or manufacturing superior automobiles - it's all in a day's work for an industrial engineer.

As an Industrial Engineer, you will:

- Earn an excellent salary
- Work with people - to make things better, faster, safer, and more rewarding
- Help a company save money and stay competitive
- Reap personal and professional satisfaction year after year
- Work with all levels of a business or organization

3. What are Cost Engineering

The AACE International Constitution and Bylaws defines cost engineering and total cost management as follows:

Section 2. The Association is dedicated to the tenets of furthering the concepts of total cost management and cost engineering. Total cost management is the effective application of professional and technical expertise to plan and control resources, costs, profitability and risk. Simply stated, it is a systematic approach to managing cost throughout the life cycle of any enterprise, program, facility, project, product, or service. This is accomplished through the application of cost engineering and cost management principles, proven methodologies, and the latest technology in support of the management process.

Section 3. Total cost management is that area of engineering practice where engineering judgment and experience are used in the application of scientific principles and techniques to problems of business and program planning; cost estimating; economic and financial analysis; cost engineering; program and project management; planning and scheduling; cost and schedule performance measurement, and change control.

A. How is cost and schedule management an "engineering" function?

Most people would agree that "engineers" and engineering (or more generally, the "application of scientific principles and techniques") are most often responsible for creating functional things (or strategic assets as we call them in TCM).

However, engineering has multiple dimensions. The most obvious is the dimension of physical design and the calculation and analysis tasks done to support that design (e.g., design a bridge or develop software). However, beyond the physical dimension of design (e.g., the bridge structure), there are other important dimensions of money, time, and other resources that are invested in the creation of the designed asset.

We refer to these investments collectively as costs. Using the above example, someone must estimate what the bridge might cost, determine the activities needed to design and build it, estimate how long these activities will take, and so on. Furthermore, someone needs to monitor and assess the progress of the bridge design and construction (in relation to the expenditure of money and time) to ensure that the completed bridge meets the owner's and other stakeholder's requirements. Someone must also monitor and assess the cost of operating and maintaining the bridge during its life cycle.

Returning to the AACE International Constitution and Bylaws definition, understanding and managing the cost dimensions requires skills and knowledge in, "business and program planning; cost estimating; economic and financial analysis; cost engineering; program and project management; planning and scheduling; and cost and schedule performance measurement and change control."

No significant asset has ever been built without dealing with these cost dimensions in some way, and the more systematically and professionally these dimensions are addressed, the more successful the asset performance is likely to be. Therefore, cost engineering recognizes that cost is a necessary extension of traditional engineering (and other creative functions such as systems analysis, etc.), and that there is an intimate connection between the physical and cost dimensions of the asset.

B. Do cost engineering practitioners need to have a traditional "engineering" background? "

The skills and knowledge required to deal with costs (e.g., cost estimating, planning and scheduling, etc.) are quite different from those required to deal with the physical design dimension. From that difference, the field of cost engineering was born. Cost engineering practitioners work alongside of and are peers with engineers, software analysts, play producers, architects, and other creative career fields to handle the cost dimension, but they do not necessarily have the same background. Whether they have technical, operations, finance and accounting, or other backgrounds, cost engineering practitioners need to share a common understanding, based on "scientific principles and techniques," with the engineering or other creative career functions.

C. Do cost engineering practitioners all have the same function?

Cost engineering practitioners tend to be:

- specialized in function (e.g., cost estimating, planning and scheduling, etc.);
- focused on either the asset management or project control side of the TCM process; and
- focused on a particular industry (e.g., engineering and construction, manufacturing, information technology, etc.); or asset type (e.g., chemical process, buildings, software, etc.).

They may have titles such as cost estimator, quantity surveyor, parametric analyst, strategic planner, planner/scheduler, value engineer, cost/schedule engineer, claims consultant, project manager, or project control lead.

They may work for the business that owns and operates the asset (emphasis on economics and analysis), or they may work for the contractor that executes the projects (emphasis on planning and control). But, no matter what their job title or business environment, a general knowledge of, and skills in, all areas of cost engineering are required to perform their job effectively.

Cost Center
A cost center is part of an organization that does not produce direct profit and adds to the cost of running a company. Examples of cost centers include research and development departments, marketing departments, help desks and customer service/contact centers.

Although not always demonstrably profitable, a cost center typically adds to revenue indirectly or fulfills some other corporate mandate. Money spent on research and development, for example, may yield innovations that will be profitable in the future. Investments in public relations and customer service may result in more customers and increased customer loyalty.

Because the cost center has a negative impact on profit (at least on the surface) it is a likely target for rollbacks and layoffs when budgets are cut. Operational decisions in a contact center, for example, are typically driven by cost considerations. Financial investments in new equipment, technology and staff are often difficult to justify to management because indirect profitability is hard to translate to bottom-line figures.

Business metrics are sometimes employed to quantify the benefits of a cost center and relate costs and benefits to those of the organization as a whole. In a contact center, for example, metrics such as average handle time, service level and cost per call are used in conjunction with other calculations to justify current or improved funding.

Cost Analysis
The cost analysis application is an intuitive and powerful tool for the cost evaluation of a product or service using batch, continuous, or job processes. The cost analysis generates information on *cost per part, selling price, cost breakdowns, bill of materials, resource usage lists, number of lines required at task and resource level*, etc. Cost versus volume sensitivity and cost versus product variable graphs are easily created.

The cost of a product is determined using production volume (where applicable), manufacturing duration, and numerous other parameters. Each product consists of many **tasks** (also called activities). Each task can include multiple **cost elements** defined as *material, labor, expenditure, tooling, machinery & equipment (M&E), and investment*. The cost elements thus define resource usage. Volume and parametric sensitivity analyses are easily done using the design model as a link to the cost analysis. The cost model provides ease of use, flexibility and power to model almost any process.

The fundamental premise of the cost analysis approach is that one can determine accurate costs by breaking a complex process into *tasks and cost elements that define time-based consumption of resources*.

Cost Element
In activity based costing (which states that products consume activities and activities consume resources), cost of a resource or input consumed by an activity.

Specific function (or a group of functions) which is considered a specific entity for the purpose of estimating, controlling, and reporting costs.

Cost Driver
In activity based costing (which states that products consume activities and activities consume resources) any factor which causes a change in the cost of an activity. An activity can have more than one cost driver attached to it. For example, a production activity may have the following

associated cost-drivers: a machine, machine operator(s), floor space occupied, power consumed, and the quantity of waste and/or rejected output.

Activity Based Costing (ABC)
Cost accounting approach concerned with matching costs with activities (called cost drivers) that cause those costs. It is a more sophisticated kind of absorption-costing and replaces labor based costing system. ABC states that (1) products consume activities, (2) it is the activities (and not the products) that consume resources, (3) activities are the cost drivers, and (4) that activities are not necessarily based on the volume of production. Instead of allocating costs to cost centers (such as manufacturing, marketing, finance), ABC allocates direct and indirect costs to activities such as processing an order, attending to a customer complaint, or setting up a machine. A subset of activity based management (ABM), it enables management to better understand (a) how and where the firm makes a profit, (b) indicates where money is being spent and (c) which areas have the greatest potential for cost reduction. Developed by professors Robert Kaplan and Robin Cooper of Harvard University in late 1980's.

Manufacturing Cost
Definition
Direct material, direct labor, and manufacturing overheads expended in the fabrication, assembly, and testing of an end item.

3. Cost Terminology

a. Fixed Costs
Those unaffected by changes n activity level over a feasible range of operations for the capacity or capability available. Typical fixed cost include insurance and taxes on facilities, general management and administrative salaries, license fees, and interest cost on borrowed capital. Of course, any cost is subject to change, but fixed cost tend to remain constant over a specific range of operating conditions. When large changes in usage of resources occur, or when plant expansion or shutdown is involved, fixed cost will be affected.

b. Variable Costs
Those associated with a operation that vary in total with the quantity of output or other measures of activity level. If you were making an engineering economic analysis of a proposed change to an existing operation, the variable costs would be the primary part of the prospective differences between the present and changed operations as long as the range of activities is not significantly changed. For example, the cost of material and labor used in a product or service are variable costs, because they vary In total with the number of output units, even though the costs per unit stay the same.

c. Incremental Cost (or Incremental Revenue)
The additional cost (revenue) that results from increasing the output of a system by one (or more) units. Incremental cost is often associated with “go-no go” decisions that involve a limited change in output or activity level. For instance, the incremental ost per mile for driving an automobile may be $0.27, but this cost depends on considerations such as total mileage driven during the year (normal operating range), mileage expected for the next major trip, and the age of automobile.

⇒ Various Type of Expenditure
d. Recurring Costs
Those are that are repetitive and occur when an organization produces similar goods or services on a continuing basis. Variable cost are also recurring costs, because they repeat with each unit of output. But recurring costs are not limited to variable costs. A fixed cost that is paid on a repeatable basis is a recurring cost. For example, in an organization providing architectural and engineering services, office space rental, which is fixed cost, is also a recurring cost.

e. Nonrecurring Costs
Those are not repetitive, even though the total expenditure many be cumulative over a relatively short period of time. Typically, nonrecurring cots involve developing or establishing a capability or capacity to operate. For example, the purchase cost for real estate upon which a plant will be built is a nonrecurring cost, is the cost of constructing the plant itself.

f. Direct Costs
Costs hat an be reasonably ,measured and allocated to a specific output or work activity. The labor and material costs directly associated with a product, service, or construction activity are direct costs. For example, the materials needed to make a pair of scissors would be a direct costs.

g. Indirect Costs
Costs that are difficult to attribute or allocate to a specific output or work activity. The term normally refers to types of costs that would involve too much effort to allocate directly to a specific output. In this usage they are costs allocated through a selected formula (such as, proportional to direct labor hours, direct labor dollars, or direct material dollars) to the outputs or work activities. For example, the costs of common tools, general supplies, and equipment maintenance in a plant are treated as indirect costs.

h. Standard Costs
Representative costs per unit of output that are established in advance of actual production or service delivery. They are developed from anticipated direct labor hours, material, and overhead categories (with their established costs per unit). Because total overhead costs are associated with a certain level of production, his is an important condition that should be remembered when dealing with standard cost data. Standard cost play an important role in cost control and other management functions. Some typical uses are he following:

- Estimating future manufacturing costs.
- Measuring operating performance by comparing actual cost per unit with the standard unit cost.
- Preparing bids on products or services requested by customers.
- Establishing the value of work in process and finished inventories.

⇒ Payment Cash
i. **Cash Costs**
A cost that involves payment of cash is called a cash cost and results in a cash flow) to distinguish it from on that does not involve a ash transaction and is reflected in the accounting system as a non-cash cost. Is non-cash is often referred to as a book cost. Cash costs are estimated from he perspective established for the analysis an are the future expenses incurred for the alternatives being analyze.

Book costs are costs that do not involved cash payments, but rather represents the recovery of past expenditures over a fixed period of time. The most common example of book cost is the depreciation charged for the use of assets such as plant and equipment. I engineering economic analysis, only those costs that are cash flows or potential cash flows from defined perspective for the analysis need to be considered. Depreciation, for example, is not a cash flow and is important in an analysis only because it affects income taxes, which are cash flows.

j. Sunk Costs
A sunk cost is one that has occurred in the past and has no relevance to estimates of future costs and revenues related to an alternative course of action. Thus, a sunk cost is common to all alternatives, is not part of the future (prospective) cash flows, and can be disregarded in an engineering economics analysis. For instance, sunk costs are nonrefundable cash outlays, such as earnest money on a house or money spent on a passport. Even though it is sometimes emotionally difficult to do, sunk costs should be ignored, except possibly to the extent that existence assists you to anticipate better what will happen n the future.

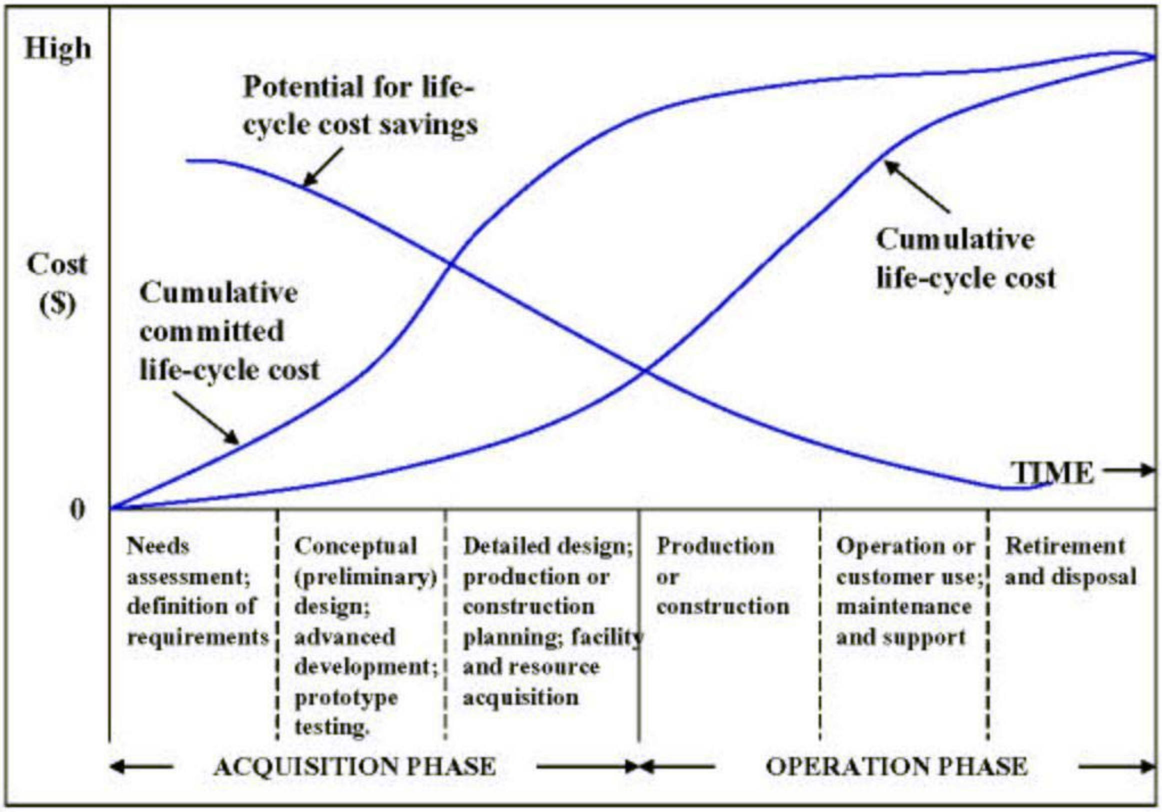
k. Opportunity Cost
An opportunity cost is incurred because of the use of limited resources, such that the opportunity to use those resources to monetary advantage in an alternative use is forgone.

l. Life-Cycle Cost
In engineering practice, the term life-cycle cost is often encountered. This term refers to a summation of all the costs, both recurring and nonrecurring, related to a product, structure, system, or service during its life span. The life cycle begins with identification of the economic need or want

(the requirement) and ends with retirement and disposal activities. It is a time horizon that must be defined in the context of the specification situation – whether its is a highway bridge , a jet engine for commercial aircraft, or an automated flexible manufacturing cell for a factory. The end of the life cycle may be projected on a functional or an economic basis.

The life cycle may be divided into two general time periods: the acquisition phase and he operation phase.

Phases of the Life Cycle and Their Relative Cost



m. Investment Costs
The Investment cost is the capital required for most of the activities in the acquisition phase. In simple cases, such as acquiring specific equipment, an investment cost may be incurred as a single expenditure. On large, complex construction project, however, a series of expenditures over an extended period could be incurred. This cost is also called a capital investment.

n. Working Capital
The term working capital refers to the funds required for current assets (i.e., other than fixed assets such as equipment, facilities, etc.) that are needed for the startup and support of operational activities. For example, products cannot be made or services delivered without having materials available in inventory. Functions such as maintenance cannot be supported without spare parts, tools, trained personnel, and other resources. Also, cash must be available to pay employee salaries and the other expenses of operation. The amount of working capital needed will vary with the project involved, and some or all of the investment in working capital is usually recovered at the end of a project' life.

o. Operation and Maintenance Costs
Operation and maintenance Costs includes many of the recurring annual expense items associated with the operation phase of the life cycle. The direct and indirect costs of operation associated with the five primary resource areas-people, machines, materials, energy, and information-are a major part of the costs in this category.

p. Disposal Costs

Disposal Cost includes those nonrecurring costs of shutting down the operation and the retirement and disposal of assets at the end of the life cycle. Normally, costs associated with personnel, materials, transportation, and one-time special activities can be expected. These costs will be offset in some instances by receipts from the sale of assets with the remaining market value. A classic example of a disposal cost is that associated with cleaning up a site where a chemical processing plant had been located.