

PROJECT MANAGEMENT AND ENGINEERING ISSUES

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ABSTRACT

Starting with some attributes specific to a project manager's work, the paper presents the functions which must be performed by a project leader – planning, organizing, staffing, directing, motivating, leading – and makes a parallelism between the activities of managers and of engineers. The paper also refers to the principles of concurrent engineering, a new approach which replaces conventional sequential engineering in product design, the relationship between projects and other production systems and shows the steps of the transition from engineer to project manager.

KEYWORDS: planning, organizing, staffing, directing, motivating, concurrent engineering

1. INTRODUCTION

Managing a project is a complex and challenging assignment. Because projects are one-of-a-kind endeavors, there is little in the way of experience, normal working relationships or established procedures to guide participants. A project manager may have to coordinate many diverse efforts and activities to achieve the project goals. The project may involve many interrelated activities performed by people from various parts of the organization, assigned to the project for different spans of time.

The project manager has a unique role on the project because he or she must oversee many functional areas, each with its own specialists. The project manager is responsible for organizing, staffing, budgeting, directing, planning and controlling the project.

Project managers have a difficult job. Since projects exist to create a unique product or service, every new project they undertake puts their reputation on line. Even when the projects are similar in size and scope to projects they have worked on in the past, there are still differences between risks, outcomes and project teams.

Every new project has the potential to succeed or fail and every team has the potential to be effective, functioning at the performing

stage, or to be dysfunctional [4].

2. DIFFERENCES BETWEEN MANAGEMENT AND ENGINEERING

A manager, including the project manager, must be able to perform competently the following functions to work effectively through others [5]:

▪ **Planning**

Planning is a process of anticipating problems, analyzing them, estimating their likely impacts and determining actions that will lead to the desired outcomes, objectives, or goals.

Planning means setting short- and long-term goals for the organization and determining how they will be met.

▪ **Organizing**

Organizing means establishing inter-relationships between people and things in such a way, that human and material resources are effectively focused on achieving the goals of the enterprise.

Organizing involves grouping activities and people, defining jobs and responsibilities, specifying the reporting structure and providing policies for coordinating these jobs with each other.

▪ **Staffing**

In organizing, the manager establishes

positions and decides which duties belong to each of them. Staffing involves selecting candidates, setting the compensation and reward structure for each job, training personnel and performing salary administration.

▪ **Directing**

Managers must guide and direct subordinates and resources towards the goals of the enterprise. This involves explaining, providing instructions, pointing out proper directions for the future, clarifying assignments, orienting personnel in the most effective directions and channeling resources.

▪ **Motivating**

Motivating refers to the interpersonal skills to encourage outstanding human performance in others and to instill in them an inner drive to pursue the goals and objectives of the various tasks that may be assigned to them.

Motivating also means realizing in the workforce a commitment for achieving the goals.

▪ **Leading**

Leading includes setting examples for others, encouraging to follow examples with great commitment, establishing a sense of group pride and spirit.

▪ **Controlling**

A continuing responsibility of managers is to check for plan deviations and to take corrective actions.

Controlling involves monitoring achievements and progress, measuring the degree of compliance with the plans, taking actions to realign operations with the plans when a deviation occurs.

Engineering is a science, it is characterized by precision, reproducibility, proven theories and experimentally verifiable results. Management is an art, it is defined by intuition, studied judgments, unique events and one-time occurrences. Engineering involves hands-on contact, an engineer can derive personal satisfaction and gratification in his own physical creations and from the work itself. Managers can influence output and performance only through other people, they must learn to be fulfilled through the achievements of those whom they supervise. Engineering is a world of things, management is a world of people [1, 2].

3. PARALLELISM BETWEEN THE WORK OF MANAGERS AND OF ENGINEERS

The most important attributes of a manager's work are:

- Taking calculated risks, relying on intuition, taking guesses;
- Exercising leadership in making decisions under widely varying conditions, based on

information;

- Solving techno-people problems, on the basis of skills in integrating the talent and behavior of others;
- Working through others and getting things done.

The main characteristics of an engineer's work are:

- Minimizing risks, emphasizing accuracy and mathematical precision;
- Exercising care in applying scientific methods, on the basis of reproducible data;
- Solving technical problems, on the basis of their own individual skills;
- Working largely through their own abilities to get things done.

In contrast to the engineer, the manager achieves satisfaction from directing the work of other people, exercising authority, not technical knowledge, and discovering new ways to do things.

4. CONCURRENT ENGINEERING

Concurrent engineering is an approach which replaces conventional sequential engineering in product design, it is based on the concept that the parallel execution of the most important design components will shorten life cycles and thus reduce the time to market for new products. In an area of time-based competition, this can make the difference between mere survival and material profits [3].

The ability to design and product high-quality products, that satisfy a real need at a competitive price, was, for many years, a sure guarantee for commercial success. With the explosion of electronic and information technology, *time* has become a critical element in the competition. The capacity to reduce the time required to develop new products and bringing them to market is considered by many the next industrial battleground [9].

The basic idea of concurrent engineering is to use project scheduling and resource management techniques in the design process. In a concurrent engineering environment, teams of experts from different disciplines work together to ensure that the design progresses smoothly and that all of the participants share the same, most recent information [6].

Sequential engineering, in which product development starts by one organizational unit, laying out product specifications on customer needs [7], takes longer because all of the design activities are strictly ordered.

Concurrent engineering depends on designing, developing, testing and building prototype parts and subsystems concurrently, not serially, while designing and developing the equipment to fabricate the new product or

system. This means that the team members from various departments make their contribution in parallel.

The first important objective of concurrent engineering is to shorten time from conception to market, so as to be more competitive or responsive to customers' needs.

The basis of concurrent engineering is teamwork, parallel acting, information sharing and constant communication among team members. To be most effective, the team should be multidisciplinary, composed of representatives from each functional area of the organization, the key being cooperation. By performing product, process and support design in parallel, there is a much greater likelihood that misunderstandings and problems of incompatibility will be avoided over the project's life cycle. By reducing the length of the design process, management costs are reduced proportionally. From a marketing point of view, a shorter design process results in the capacity to introduce new models more frequently and to target specific models to specific groups of customers. This strategy leads finally to higher sales and profits because of the higher market share.

It is important to understand that concurrent engineering is risky, the main risks being of organizational and technological nature. Companies, that want to use concurrent engineering, should consider projects with the following characteristics:

- The project can be classified as a new application of known technology;
- The team has experience with the technology;
- The team has received training in quality management and had the opportunity to apply the concepts in its work;
- The goal is a product or a family of products with clearly defined functions.

As mentioned, one of the goals of concurrent engineering is to reduce time that it takes to develop and market new products. Concurrent engineering is a business activity, not just an engineering activity, and market success is a function of a firm's ability to improve all of its tempo factors by integrating concurrent engineering decisions with business decisions [10].

The application of concurrent engineering principles to technology management requires thoughtful planning and oversight. Concurrent engineering has to identify the interdependencies and constraints that exist over the lifecycle of a product and to ensure that the design team is aware of them.

5. RELATIONSHIP BETWEEN PROJECTS AND OTHER PRODUCTION SYSTEMS

Many of the most difficult engineering challenges have been to design, develop and implement new systems of a type and complexity never before attempted. The creation of these systems has required the development of new methods of planning, organizing and controlling events and this is the main characteristic of project management.

A project is an organized endeavor to accomplish a specific nonroutine task. Projects are not repetitive, they are sufficiently large or complex to be recognized and managed as separate undertakings.

Managing a project differs in several ways from the management of a typical organization. The objective of a project team is to accomplish its prescribed mission. The need to manage large, complex projects constrained by tight schedules and budgets has motivated the development of methodologies different from those used to manage a typical enterprise.

Operations and production management contains three important classes of systems [8]:

1. Systems designed for mass production;
2. Systems designed for lot production;
3. Systems for undertaking nonrepetitive projects common to construction and new product development.

Mass production systems are typically designed around the specific processes used to assemble a product or to perform a service. Their orientation is fixed and their applications are limited. Resources and facilities are composed of special-purpose equipment, designed to perform the operations required by the product or the service in an efficient way. These systems are capital intensive and very efficient in processing of large quantities of specific products or services, for which relatively little management and control are necessary.

The systems for lot production are used when several products or services are processed in the same facility. Because the resources used in such systems have to be set up when the production switches from one product to another, jobs are typically scheduled. Flexibility is achieved by using general-purpose resources that can be adjusted to handle different processes. The complexity of operations planning, scheduling and control is greater than in mass production systems because each product has its own sequence of operations. Resources are frequently grouped together on the basis of the type of processes that they perform. In the lot production systems it is important to pay attention to material

handling needs because each product has its specific set of operations.

The systems which are subject to very low demand (no more than a few units) are substantially different from the first two mentioned. Because of the nonrepetitive nature of these systems, past experience may be of limited value. In this environment, extensive management is required to plan, monitor and control the activities and project management is a direct outgrowth of these efforts.

The borderlines between mass production, lot production and project-oriented systems are difficult to define.

6. FINAL COMMENTS

To be successful in their activity, project managers should possess some attributes, skills and qualities:

- Having a strong technical background;
- Being good managers;
- Being mature individuals;
- Being currently available;
- Being persons who have worked in several different departments.

The drive to complete the task is the most important characteristic desirable in project management.

Engineers are often propelled into project management out of economic considerations or a desire to take more responsibility. When an engineer enters project management, new perspectives must be acquired and new motivations must be found. Engineers must learn to enjoy leadership challenges, detailed planning, helping others, taking risks, making decisions, working through others and using the organization. In contrast to the engineer, the project manager achieves satisfaction from directing the work of other people, exercising authority, not technical knowledge, and discovering new ways to do things.

Experience indicates that the following

critical skills are the ones that engineers find most troublesome to acquire [3]

- Learning to trust others;
- Learning how to work through others;
- Learning how to take satisfaction in the work of others.

To become successful project managers, engineers must usually develop new talents, acquire new values and change their point of view. This takes time, on-the-job and off-the-job training and careful planning.

Using the principles of the concurrent engineering approach, time management and management of human resources and maintaining the professional skills at a high level, engineers could become competent project managers.

REFERENCES

- [1] **Badaway, M.K., Trystram, D.**, *Developing Managerial Skills in Engineers and Scientists*, John Wiley & Sons, New York, 1995.
- [2] **Eisner, H.**, *Essentials of Project and System Engineering Management*, Second Edition, John Wiley & Sons, New York, 1995.
- [3] **Fleisher, M., Liker, J.**, *Concurrent Engineering Effectiveness*, Hanser Gardner Publications, Cincinnati, OH, 1997.
- [4] **Heldman, K.**, *Project Management Jump Start*, SYBEX Inc., USA, 2003.
- [5] **Huidan, L.**, *Engineering versus Management*, Bulletin of the "Transilvania" University of Brasov, vol. 12(47), New Series, 2005.
- [6] **Huidan, L.**, *Concurrent Engineering and Time Management in Product Design*, Proceedings of the International Conference TEHNONAV, Constanta, 2006
- [7] **Salomone, A.**, *What Every Engineer Should Know about Concurrent Engineering*, Marcel Dekker, New York, 1995.
- [8] **Shtub, A., Bard, J.F., Globerson, S.**, *Project Management. Processes, Methodologies and Economics*, Second Edition, Pearson Prentice Hall, New York, 2005.
- [9] **Smith, P., Reinertsen, D.G.**, *Developing Products in Half the Time*, John Wiley, New York, 1998.
- [10] **Ulrich, K., Eppinger, S.**, *Product Design and Development*, McGraw-Hill, New York, 2000.