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Maintenance Organization

Ahmed E. Haroun and Salih O. Duffuaa

1.1 Introduction

Organizing is the process of arranging resources (people, materials, technology etc.) together to achieve the organization’s strategies and goals. The way in which the various parts of an organization are formally arranged is referred to as the organization structure. It is a system involving the interaction of inputs and outputs. It is characterized by task assignments, workflow, reporting relationships, and communication channels that link together the work of diverse individuals and groups. Any structure must allocate tasks through a division of labor and facilitate the coordination of the performance results. Nevertheless, we have to admit that there is no one best structure that meets the needs of all circumstances. Organization structures should be viewed as dynamic entities that continuously evolve to respond to changes in technology, processes and environment, (Daft, 1989 and Schermerhorn, 2007).

Frederick W. Taylor introduced the concept of scientific management (time study and division of labor), while Frank and Lilian Gilbreth founded the concept of modern motion study techniques. The contributions of Taylor and the Gilbreths are considered as the basis for modern organization management Until the middle of the twentieth century maintenance has been carried out in an unplanned reactive way and for a long time it has lagged behind other areas of industrial management in the application of formal techniques and/or information technology. With realization of the impact of poor maintenance on enterprises’ profitability, many managers are revising the organization of maintenance and have developed new approaches that foster effective maintenance organization.

Maintenance cost can be a significant factor in an organization’s profitability. In manufacturing, maintenance cost could consume 2–10% of the company’s revenue and may reach up to 24% in the transport industry (Chelson, Payne and Reavill, 2005). So, contemporary management considers maintenance as an integral function in achieving productive operations and high-quality products, while maintaining satisfactory equipment and machines reliability as demanded by

However, there is no universally accepted methodology for designing maintenance systems, i.e., no fully structured approach leading to an optimal maintenance system (i.e., organizational structure with a defined hierarchy of authority and span of control; defined maintenance procedures and policies, etc.). Identical product organizations, but different in technology advancement and production size, may apply different maintenance systems and the different systems may run successfully. So, maintenance systems are designed using experience and judgment supported by a number of formal decision tools and techniques. Nevertheless, two vital considerations should be considered: strategy that decides on which level within the plant to perform maintenance, and hence outlining a structure that will support the maintenance; planning that handles day-to-day decisions on what maintenance tasks to perform and providing the resources to undertake these tasks.

The maintenance organizing function can be viewed as one of the basic and integral parts of the maintenance management function (MMF). The MMF consists of planning, organizing, implementing and controlling maintenance activities. The management organizes, provides resources (personnel, capital, assets, material and hardware, etc.) and leads to performing tasks and accomplishing targets. Figure 1.1 shows the role organizing plays in the management process. Once the plans are created, the management’s task is to ensure that they are carried out in an effective and efficient manner. Having a clear mission, strategy, and objectives facilitated by a corporate culture, organizing starts the process of implementation by clarifying job and working relations (chain of command, span of control, delegation of authority, etc.).

In designing the maintenance organization there are important determinants that must be considered. The determinants include the capacity of maintenance, centralization vs decentralization and in-house maintenance vs outsourcing. A number of criteria can be used to design the maintenance organization. The criteria include clear roles and responsibilities, effective span of control, facilitation of good supervision and effective reporting, and minimization of costs.

Maintenance managers must have the capabilities to create a division of labor for maintenance tasks to be performed and then coordinate results to achieve a common purpose. Solving performance problems and capitalizing on opportunities could be attained through selection of the right persons, with the appropriate capabilities, supported by continuous training and good incentive schemes, in order to achieve organization success in terms of performance effectiveness and efficiency.

This chapter covers the organizational structure of maintenance activities. Section 1.2 describes the organization objectives and the responsibilities of maintenance, followed by the determinants of a maintenance organization in Section 1.3. Section 1.4 outlines the design of maintenance organization and Section 1.5 presents basic models for organization. The description of function of material and spare parts management is given in Section 1.6, and Section 1.7 outlines the process of establishing authority. The role of the quality of leadership and supervision is presented in Section 1.8 followed by the role of incentives in
Section 1.9. Sections 1.10 and 1.11 present education and training, and management and labor relations, respectively. A summary of the chapter is provided in Section 1.12.

1.2 Maintenance Organization Objectives and Responsibility

A maintenance organization and its position in the plant/whole organization is heavily impacted by the following elements or factors:

- Type of business, e.g., whether it is high tech, labor intensive, production or service;
- Objectives: may include profit maximization, increasing market share and other social objectives;
- Size and structure of the organization;
- Culture of the organization; and
- Range of responsibility assigned to maintenance.

![Figure 1.1. Maintenance organizing as a function of the management process](image)

Organizations seek one or several of the following objectives: profit maximization, specific quality level of service or products, minimizing costs, safe and clean environment, or human resource development. It is clear that all of these
objectives are heavily impacted by maintenance and therefore the objectives of maintenance must be aligned with the objectives of the organization.

The principal responsibility of maintenance is to provide a service to enable an organization to achieve its objectives. The specific responsibilities vary from one organization to another; however they generally include the following according to Duffuaa et al. (1998):

1. Keeping assets and equipment in good condition, well configured and safe to perform their intended functions;
2. Perform all maintenance activities including preventive, predictive; corrective, overhauls, design modification and emergency maintenance in an efficient and effective manner;
3. Conserve and control the use of spare parts and material;
4. Commission new plants and plant expansions; and
5. Operate utilities and conserve energy.

The above responsibilities and objectives impact the organization structure for maintenance as will be shown in the coming sections.

1.3 Determinants of a Maintenance Organization

The maintenance organization’s structure is determined after planning the maintenance capacity. The maintenance capacity is heavily influenced by the level of centralization or decentralization adopted. In this section the main issues that must be addressed when forming the maintenance organization’s structure are presented. The issues are: capacity planning, centralization vs decentralization and in-house vs outsourcing.

1.3.1 Maintenance Capacity Planning

Maintenance capacity planning determines the required resources for maintenance including the required crafts, administration, equipment, tools and space to execute the maintenance load efficiently and meet the objectives of the maintenance department. Critical aspects of maintenance capacity are the numbers and skills of craftsmen required to execute the maintenance load. It is difficult to determine the exact number of various types of craftsmen, since the maintenance load is uncertain. Therefore accurate forecasts for the future maintenance work demand are essential for determining the maintenance capacity. In order to have better utilization of manpower, organizations tend to reduce the number of available craftsmen below their expected need. This is likely to result in a backlog of uncompleted maintenance work. This backlog can also be cleared when the maintenance load is less than the capacity. Making long run estimations is one of the areas in maintenance capacity planning that is both critical and not well developed in practice. Techniques for maintenance forecasting and capacity planning are presented in a separate chapter in this handbook.
1.3.2 Centralization vs Decentralization

The decision to organize maintenance in a centralized, decentralized or a hybrid form depends to a greater extent on the organization is philosophy, maintenance load, size of the plant and skills of craftsmen. The advantages of centralization are:

1. Provides more flexibility and improves utilization of resources such highly skilled crafts and special equipment and therefore results in more efficiency;
2. Allows more efficient line supervision;
3. Allows more effective on the job training; and
4. Permits the purchasing of modern equipment.

However it has the following disadvantages:

1. Less utilization of crafts since more time is required for getting to and from jobs;
2. Supervision of crafts becomes more difficult and as such less maintenance control is achieved;
3. Less specialization on complex hardware is achieved since different persons work on the same hardware; and
4. More costs of transportation are incurred due to remoteness of some of the maintenance work.

In a decentralized maintenance organization, departments are assigned to specific areas or units. This tends to reduce the flexibility of the maintenance system as a whole. The range of skills available becomes reduced and manpower utilization is usually less efficient than in a centralized maintenance. In some cases a compromise solution that combines centralization and decentralization is better. This type of hybrid is called a cascade system. The cascade system organizes maintenance in areas and what ever exceeds the capacity of each area is challenged to a centralized unit. In this fashion the advantages of both systems may be reaped. For more on the advantages and disadvantages of centralization and decentralization see Duffuaa et al. (1998) and Niebel (1994).

1.3.3 In-house vs Outsourcing

At this level management considers the sources for building the maintenance capacity. The main sources or options available are in-house by direct hiring, outsourcing, or a combination of in-house and outsourcing. The criteria for selecting sources for building and maintaining maintenance capacity include strategic considerations, technological and economic factors. The following are criteria that can be employed to select among sources for maintenance capacity:

1. Availability and dependability of the source on a long term basis;
2. Capability of the source to achieve the objectives set for maintenance by the organization and its ability to carry out the maintenance tasks;
3. Short term and long term costs;
4. Organizational secrecy in some cases may be subjected to leakage;
5. Long term impact on maintenance personnel expertise; and
6. Special agreement by manufacturer or regulatory bodies that set certain specifications for maintenance and environmental emissions.

Examples of maintenance tasks which could be outsourced are:

1. Work for which the skill of specialists is required on a routine basis and which is readily available in the market on a competitive basis, e.g.,
   - Installation and periodic inspection and repair of automatic fire sprinkler systems;
   - Inspection and repair of air conditioning systems;
   - Inspection and repair of heating systems; and
   - Inspection and repair of main frame computers etc.

2. When it is cheaper than recruiting your own staff and accessible at a short notice of time.

The issues and criteria presented in the above section may help organizations in designing or re-designing their maintenance organization.

1.4 Design of the Maintenance Organization

A maintenance organization is subjected to frequent changes due to uncertainty and desire for excellence in maintenance. Maintenance and plant managers are always swinging from supporters of centralized maintenance to decentralized ones, and back again. The result of this frequent change is the creation of responsibility channels and direction of the new organization’s accomplishments vs the accomplishments of the former structure. So, the craftsmen have to adjust to the new roles. To establish a maintenance organization an objective method that caters for factors that influence the effectiveness of the organization is needed. Competencies and continuous improvement should be the driving considerations behind an organization’s design and re-design.

1.4.1 Current Criteria for Organizational Change

Many organizations were re-designed to fix a perceived problem. This approach in many cases may raise more issues than solve the specific problem (Bradley, 2002). Among the reasons to change a specific maintenance organization’s design are:

1. Dissatisfaction with maintenance performance by the organization or plant management;
2. A desire for increased accountability;
3. A desire to minimize manufacturing costs, so maintenance resources are moved to report to a production supervisor, thereby eliminating the (perceived) need for the maintenance supervisor;
4. Many plant managers are frustrated that maintenance seems slow paced, that is, every job requires excessive time to get done. Maintenance people fail to understand the business of manufacturing, and don’t seem to be part of the team. This failure results in decentralization or distribution of maintenance resources between production units; and
5. Maintenance costs seem to rise remarkably, so more and more contractors are brought in for larger jobs that used to get done in-house.

1.4.2 Criteria to Assess Organizational Effectiveness

Rather than designing the organization to solve a specific problem, it is more important to establish a set of criteria to identify an effective organization. The following could be considered as the most important criteria:

1. Roles and responsibilities are clearly defined and assigned;
2. The organization puts maintenance in the right place in the organization;
3. Flow of information is both from top-down and bottom-up;
4. Span of control is effective and supported with well trained personal;
5. Maintenance work is effectively controlled;
6. Continuous improvement is built in the structure;
7. Maintenance costs are minimized; and
8. Motivation and organization culture.

1.5 Basic Types of Organizational Models

To provide consistently the capabilities listed above we have to consider three types of organizational designs.

- **Entralized maintenance.** All crafts and related maintenance functions report to a central maintenance manager as depicted in Figure 1.2. The strengths of this structure are: allows economies of scale; enables in-depth skill development; and enables departments (i.e., a maintenance department) to accomplish their functional goals (not the overall organizational goals). This structure is best suited for small to medium-size organizations. The weaknesses of this structure are: it has slow response time to environmental changes; may cause delays in decision making and hence longer response time; leads to poor horizontal coordination among departments and involves a restricted view of organizational goals.

- **Decentralized maintenance.** All crafts and maintenance craft support staff report to operations or area maintenance as described in Figure 1.3. The strengths of this structure are that it allows the organization to achieve adaptability and coordination in production units and efficiency in a
centralized overhaul group and it facilitates effective coordination both within and between maintenance and other departments. The weaknesses of this structure are that it has potential for excessive administrative overheads and may lead to conflict between departments.

- Matrix structure, a form of a hybrid structure. Crafts are allocated in some proportion to production units or area maintenance and to a central maintenance function that supports the whole plant or organization as depicted in Figure 1.4. The strengths of this matrix structure are: it allows the organization to achieve coordination necessary to meet dual demands from the environment and flexible sharing of human resources. The weaknesses of this structure are: it causes maintenance employees to experience dual authority which can be frustrating and confusing; it is time consuming and requires frequent meetings and conflict resolution sessions. To remedy the weaknesses of this structure a management with good interpersonal skills and extensive training is required.

![Figure 1.2. Centralized (functional) organizational structure](image)

### 1.6 Material and Spare Parts Management

The responsibility of this unit is to ensure the availability of material and spare parts in the right quality and quantity at the right time at the minimum cost. In large or medium size organizations this unit may be independent of the maintenance organization; however in many circumstances it is part of maintenance. It is a service that supports the maintenance programs. Its effectiveness depends to a large extent on the standards maintained within the stores system. The duties of a material and spare parts unit include:
**Figure 1.3.** Functionally de-centralized organizational structure of maintenance in a textile factory
Figure 1.4. Matrix (de-centralized) organizational structures
1. Develop in coordination with maintenance effective stocking polices to minimize ordering, holding and shortages costs;
2. Coordinate effectively with suppliers to maximize organization benefits;
3. Keep good inward, receiving, and safe keeping of all supplies;
4. Issue materials and supplies;
5. Maintain and update records; and
6. Keep the stores orderly and clean.

1.7 Establishment of Authority and Reporting

Overall administrative control usually rests with the maintenance department, with its head reporting to top management. This responsibility may be delegated within the maintenance establishment. The relationships and responsibility of each maintenance division/section must be clearly specified together with the reporting channels. Each job title must have a job description prescribing the qualifications and the experience needed for the job, in addition to the reporting channels for the job.

1.8 Quality of Leadership and Supervision

The organization, procedures, and practices instituted to regulate the maintenance activities and demands in an industrial undertaking are not in themselves a guarantee of satisfactory results. The senior executive and his staff must influence the whole functional activity. Maintenance performance can never rise above the quality of its leadership and supervision. From good leadership stems the teamwork which is the essence of success in any enterprise. Talent and ability must be recognized and fostered; good work must be noticed and commended; and carelessness must be exposed and addressed.

1.9 Incentives

The varied nature of the maintenance tasks, and differing needs and conditions arising, together with the influence of production activity, are not attuned to the adoption of incentive systems of payment. There are, however, some directions in which incentives applications can be usefully considered. One obvious case is that of repetitive work. The forward planning of maintenance work can sometimes lead to an incentive payment arrangement, based on the completion of known tasks in a given period, but care must be taken to ensure that the required standards of work are not compromised. In some case, maintenance incentives can be included in output bonus schemes, by arranging that continuity of production, and attainment of targets, provides rewards to both production and maintenance personnel.
1.10 Education and Training

Nowadays it is also recognized that the employers should not only select and place personnel, but should promote schemes and provide facilities for their further education and training, so as to increase individual proficiency, and provide recruits for the supervisory and senior grades. For senior staff, refresher courses comprise lectures on specific aspects of their work; they also encourage the interchange of ideas and discussion.

The further education of technical grades, craft workers, and apprentices is usually achieved through joint schemes, sponsored by employers in conjunction with the local education authority. Employees should be encouraged to take advantage of these schemes, to improve proficiency and promotion prospects.

A normal trade background is often inadequate to cope with the continuing developments in technology. The increasing complexity and importance of maintenance engineering warrants a marked increase in training of machine operators and maintenance craftsmen through formal school courses, reinforced by informed instruction by experienced supervisors.

The organization must have a well defined training program for each employee. The following provides guidelines for developing and assessing the effectiveness of the training program:

- Evaluate current personnel performance;
- Assess training need analysis;
- Design the training program;
- Implement the program; and
- Evaluate the program effectiveness.

The evaluation is done either through a certification program or by assessing the ability to achieve desired performance by persons who have taken a particular training program.

The implementation of the above five steps provides the organization with a framework to motivate personnel and improve performance.

1.11 Management and Labor Relations

The success of an undertaking depends significantly on the care taken to form a community of well-informed, keen, and lively people working harmoniously together. Participation creates satisfaction and the necessary team spirit. In modern industry, quality of work life (QWL) programs have been applied with considerable success, in the form of management conferences, work councils, quality circles, and joint conferences identified with the activities. The joint activities help the organization more fully achieve its purposes.
1.12 Summary

This chapter considered organizing as one of the four functions of management. It is the process of arranging resources (people, materials, technology, etc.) together to achieve the organization’s strategies and goals. Maintenance organization structure is the way various part of the maintenance organization is formed including defining responsibilities and roles of units and individuals. A set of criteria are provided to assess and design organization structures and the main issues to be addressed are outlined. The issues include centralization, decentralization and outsourcing. The chapter describes three types of organization structures. In addition, several functions that could support maintenance organization such as material and spare management, training and the management of labor relations are presented.

References