PLANNING AND SCHEDULING IN MAINTENANCE

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Abstract: The planning and scheduling are two processes with important effects in maintenance processes. The paper presents some important issues of this.

Key words: planning, scheduling, maintenance

Planning and scheduling are two of decision-making processes that are used in manufacturing and service industries on a regular basis. These forms of decision-making play an important role in procurement and production, in transportation and distribution, and in information processing and communication. The planning and scheduling functions in a company are based on mathematical techniques and heuristic methods to allocate limited resources to the activities that have to be done. This allocation of resources has to be done in such a way that the company optimizes its objectives and achieves its goals. Resources may be machines, materials and specialized work-team in industrial factories. Another example of resources is the knowledge in some special field. Activities may be operations in a workshop, stages in a mechanical project, or computer programs that have to be executed. Each activity may have a priority level, an earliest possible starting time and a due date. Objectives can take many different forms, such as minimizing the time to complete all activities, minimizing the number of activities that are completed after the committed due dates, and so on.

Planning and scheduling in either a manufacturing or a service organization must interact with the other functions of industrial organisation. These interactions are typically system-dependent and may differ substantially from one setting to another; they often take place within a computer network. For this reason is not so easy to apply the examples from one factory to another. Sometime if only one of influence factors are different is not possible to apply the model.

The purpose of scheduling is to provide a “roadmap” that represents how and when the project will deliver the products defined in the project scope and by the project team. The dynamic nature of a project’s execution is best served by a tool that allows for modeling of the plan and analysis due to the impact of progress and unforeseen developments.
1.1. Planning and Scheduling in Manufacturing. One of the most important field where planning and scheduling have a important position is manufacturing of machines. Orders that are released in a manufacturing setting have to be translated into jobs with associated due dates. These jobs often have to be processed on the machines in a work center in a given order or sequence. The processing of jobs may sometimes be delayed if certain machines are busy. Pre-emption’s may occur when high priority jobs are released which have to be processed at once. Unexpected events on the shop floor, such as machine breakdowns or longer-than-expected processing times, also have to be taken into account, since they may have a major impact on the schedules.

![Diagram of the information flow in a manufacturing system](image_url)

Figure 1. Diagram of the information flow in a manufacturing system

Developing, in such an environment, a detailed schedule of the tasks to be performed helps maintain efficiency and control of operations. The shop floor is not the only part of the organization that impacts the scheduling process. The scheduling process also interacts with the production planning process, which handles medium- to long-term planning for the entire organization. This process intends to optimize the firm’s overall product mix and long-term resource allocation based on inventory levels, demand forecasts and resource requirements. Decisions made at this higher planning level may impact the more detailed scheduling process directly.
In manufacturing, planning and scheduling has to interact with other decision making functions in the plant. One popular system that is widely used is the Material Requirements Planning (MRP) system. After a schedule has been set up it is necessary that all the raw materials and resources are available at specified times. The ready dates of the jobs have to be determined by the production planning and scheduling system in conjunction with the MRP system. MRP systems are normally fairly elaborate. Each job has a Bill Of Materials (BOM) itemizing the parts required for production. The MRP system keeps track of the inventory of each part. Furthermore, it determines the timing of the purchases of each one of the materials. In doing so, it uses techniques such as lot sizing and lot scheduling that are similar to those used in planning and scheduling systems. There are many commercial MRP software packages available. As a result, many manufacturing facilities rely on MRP systems. In the cases where the facility does not have a planning or scheduling system, the MRP system may be used for production planning purposes. However, in a complex setting it is not easy for an MRP system to do the detailed planning and scheduling satisfactorily. Modern factories often employ elaborate manufacturing information systems involving a computer network and various databases. Local area networks of personal computers, workstations and data entry terminals are connected to a central server, and may be used either to retrieve data from the various databases or to enter new data. Planning and scheduling is usually done on one of these personal computers or workstations. Terminals at key locations may often be connected to the scheduling computer in order to give departments access to current scheduling information. These departments, in turn, may provide the scheduling system with relevant information, such as changes in job status, machine status, or inventory levels. Companies nowadays rely often on elaborate Enterprise Resource Planning (ERP) systems, that control and coordinate the information in all its divisions and sometimes also at its suppliers and customers. Decision support systems of various different types may be linked to such an ERP system, enabling the company to do long range planning, medium term planning as well as short term scheduling.

1.2. Planning and Scheduling in Services. Describing a generic service organization and its planning and scheduling systems is not as easy as describing a generic manufacturing system. The planning and scheduling functions in a service organization may often face many different problems. They may have to deal with the reservation of resources (e.g., machines, workers, workshops or other resources), the allocation, assignment, and scheduling of equipment (e.g., planes) or the allocation and scheduling of the workforce (e.g., the assignment of shifts in call centers). The algorithms tend to be completely different from those used in manufacturing settings. Planning and scheduling in a service environment also have to interact with other decision making functions, usually within elaborate information systems, much in the same way as the scheduling function in a manufacturing setting. These
Information systems typically rely on extensive databases that contain all the relevant information regarding the availability of resources as well as the characteristics of current and potential customers.

**Figure 2** The information flow in a scheduling of maintenance of systems.

A planning and scheduling system may interact with a forecasting module; it may also interact with a yield management module (which is a type of module that is not very common in manufacturing settings). On the other hand, in a service environment there is usually no MRP system.

**REFERENCES**