PERIODICA POLYTECHNICA SER. HUM. and SOC. SCI. VOL. 1, NO. 2, PP. 117-123 (1993)

MULTI-PROJECT MANAGEMENT DECISION CHART FOR SOLVING THE SCHEDULING PROBLEM

M. AL-FTISE

Department of Industrial Management and Economics
Technical University of Budapest
H-1242 Budapest, P. O. Box 429

Received: May 20, 1993

Abstract

Due to the complexity of sequencing and scheduling of multiple projects, companies always search for a method that is optimal or near optimal, comprehensive, and easy to implement. Project managers are responsible for carrying out those projects successfully within their completion times . The MMDC helps those decision makers to make the right and fast decisions. It contains several decision points. This article contains several sections, covering the areas of application, definition of the multi-project scheduling problem, summary of the existing solutions, and the description of the MMDC.

Keywords: multi-project scheduling, decision chart, application areas.

Introduction

Projects are defined to be a collection of activities that must be undertaken, normally with discrete time, financial and technical performance goals. Project Managers are responsible for integrating these factors and performance. There is a new trend in organization of firms and companies called as management by projects. Project oriented companies carry out small and large, internal and external unique and repetitive projects to cope with new challenges and potential in a dynamic business's environment. In order to treat increasing business complexity, companies use projects as organizational form to perform unique and complex tasks.

Areas of Application

There are four basic outputs or areas of work under which virtually every type of productive activity can be categorized:

(1) Projects,
(2) Products,
(3) Processes and
(4) Services

Each specific productive activity uses specialized skills, equipment, techniques, and knowledge that is unique to that field of endeavour. Our main concern here is projects. Projects are multidisciplinary activities frequently advancing the state-of-the-art technological knowledge. *Table 1*, see [4] shows several categories of projects. Glancing at the table one can find different types of projects ranging from aerospace projects to water and waste treatment. Range of projects is wide, and managing projects require the project manager to be skilful both in management and the area he is working in.

Table 1

Aerospace projects
Airport construction
Building construction: homes commercial centres and entertainment facilities, and laboratories
Dams and hydroelectric plants
Highway and bridge construction
Military weapons system
Nuclear power plants
Research and development projects
Transportation system (mass transit)
Urban renewal
Utility distribution / collection system
Water and waste treatment facilities and many others

In the application area, one can find many problems under the title of multi-project scheduling problem either in construction, production or service fields. All types of work in those areas can be regarded as projects, all they fall under the definition of project. In construction systems the multi project scheduling problem can be seen very clearly. An example would be a housing contractor who does not wish to risk doubling capacity in the form of a second construction crew so that two houses could be built concurrently. The problem therefore is due to the constraints of limited resources (renewable and non renewable ones).

Definition of the Problem

Suppose a company is engaged in building several houses. Every house is considered to be an independent project (with different ready times and different due-dates). The project manager (construction manager) should find a good way for:

1. Sequencing the projects according to one of the priority rules.
2. Scheduling the projects by assigning their processing times, their critical paths and the milestone events as well as their delivery dates.

From the above we can understand the complication of this problem especially when the company signs another contract for the same type of work.

Existing Solutions

Many optimal solutions have been proposed to such a problem. But, unfortunately, these proposed solutions fall short when it comes to applying them to practical situations. On the other hand, heuristic solutions are preferred in practical cases, even though they only bring us to feasible solutions or near optimal ones. But so many of them managers find it hard to choose between the available alternatives. There are studies evaluating these rules, but even now situations govern what rule we can use. The area of production systems is very wide and covers big range of industrial and consumer needs [4, 5, 7, 8]. There are two production modes; it depends upon the company policy of handling projects.

Static Production Mode

This mode accepts certain demands and then works until finishing everything at hand. This means the system will not accept any other request before completing its present project [3, 6].

Dynamic Production Mode

The second mode leaves the door open for other requests, and expects several projects to join the queue. This mode is the real time mode, and considered to be the realistic one. Managing the dynamic mode seems to be more complicated because of the disturbances that are made by the new coming project. Thus, planning and scheduling will become uncertain. Therefore, we must use the forecasting techniques to predict what will happen in the future; how much of resources we need and how much of allowance time we should plan for ... etc [1, 2].

Multi-project Management Decision Chart (MMDC)

In practice project managers found themselves in front of collection of different methods to solve scheduling problems and allocation of resources. We propose a new decision chart under the title 'Multi-project Management Decision Chart' (MMDC). See *Fig. 1*.

This MMDC contains eight decision points. Every point has more than one alternatives. The chart is an outline to the company, it explains the steps needed to manage a multi-project from the birth of the project up to the end. It shows how to make the major decisions concerning sequencing, scheduling and allocation of resources. Also it is handling unexpected situations like incoming of new projects and the interruptions that may happen and cause a delay in promised due dates. It represents an information system for all the managers who are in contact with projects. The input of the all data must be done by all people working in the system

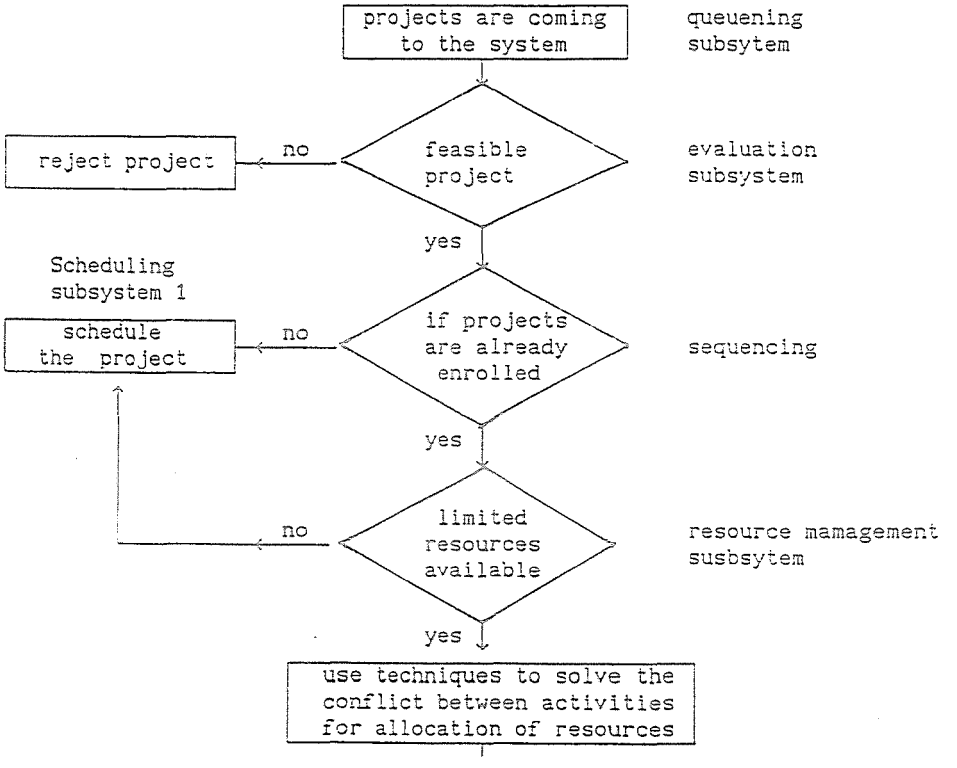

Fig. 1. Multi-project Management Decision Chart (MMDC)

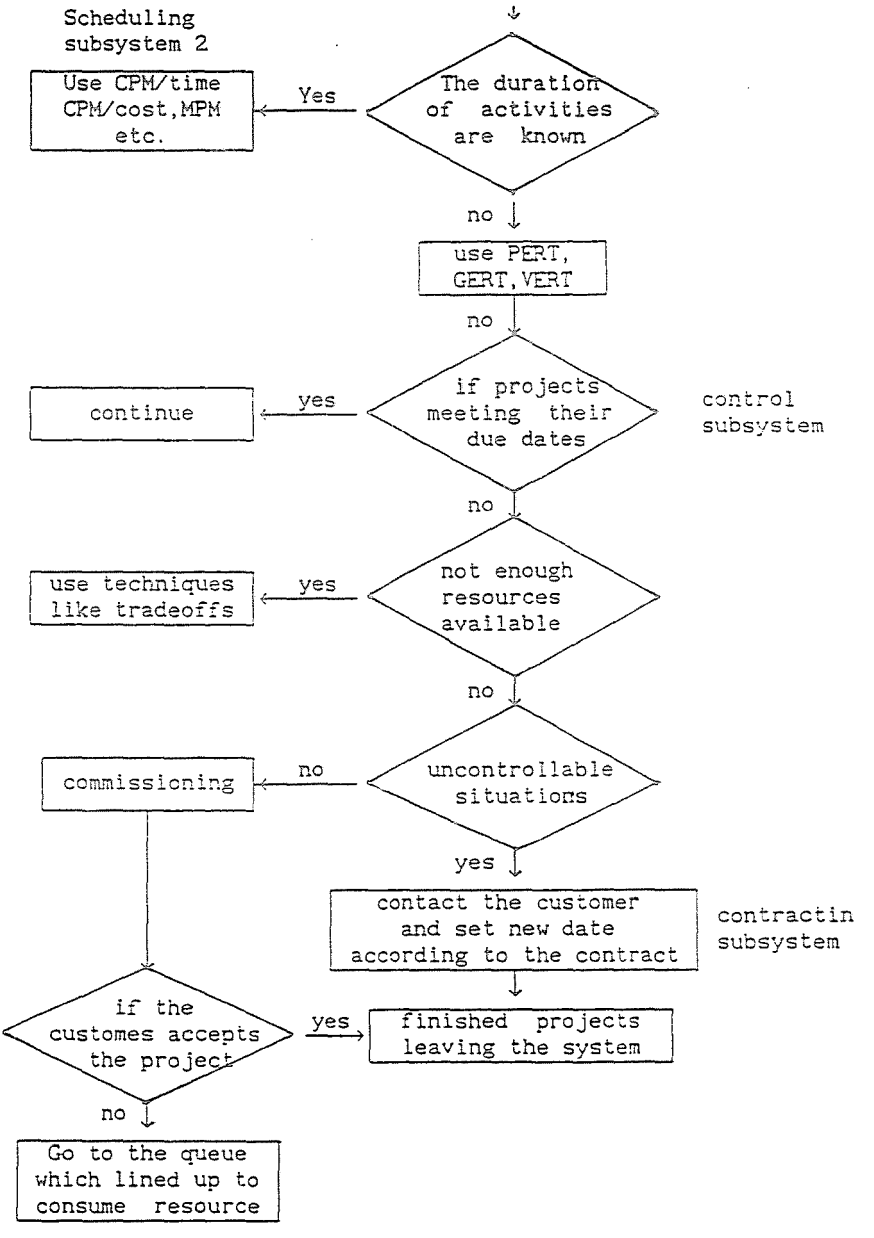

Fig. 1. continuation

in order to provide the good communications between the management levels. The availability of information makes the decision easier and gives a higher probability for success. The MMDC approach is termed 'integration'. Integration is the key to effective project management. An integrated system is essential for effective decision making. It also provides a project or even company-wide communication medium: this is (or should be) consistent in each area of application. The day-to-day work of collecting time sheet data, or details of material deliveries is a part of the project and an essential element of the integrated system. The ability to incorporate such detailed information means that the process of managing the project is based on real information directly available to the project team. This information should be available not just in its detailed form, but 'rolled-up' and summarized in the appropriate form for the task at hand. The scope and complexity of an integrated system vary considerably. The fundamental element in controlling a project is decision making. In order to make decisions reasonable and rational, a number of conditions must be met. Information relevant to the problem in hand must be first isolated. When organizing the activities of a large firm or an institute, it is very important to take into consideration that the different projects may interact each other, and that the corresponding resource capacities are limited and expensive. In this paper a new complex decision chart is presented for general usage which may help the organizers much in the optimal or near optimal solution process of the above mentioned task.

Symbols Used in the Chart

CPM: Critical Path Method; PERT: Project Evaluation and Review Technique; GERT: Graphical Evaluation and Review Technique; VERT: Venture Evaluation and Review Technique.

Conclusion

The concept behind the MMDC is to control the scheduling of many projects at the same time, and it is an integration tool of all project scheduling techniques.

It should be noted that the concept of assigning due dates to incoming projects and then sequencing the activities of the project for meeting these due dates is the total system approach to multi-project scheduling problem. Projects which are in the system and also coming to the system should be sequenced toward their due dates by proper timely allocation of scarce resources. Development of a multi-project scheduling system is based on a

method for setting realistic and accurate due dates on time job sequencing and resource allocation.

Acknowledgement

The author wishes to acknowledge the guidance of Professors C. Tánczos, Z. Baross, A. Bakó and J. Kocsis.

References

1. AL-FTISE, M.– HUJTER, M.: Egy multi-project ütemezési probléma számítógépes algoritmusa [in Hungarian] (A Computer Algorithm for a Multi-project Scheduling Problem), Abstract, In *'Előadáskivonatok', 20th Conference on Operations Research*, Esztergom-Kertváros, Hungary, October 7–9 (1991) p. 22.
2. AL-FTISE, M.: A Mathematical Programming Model to Solve a Multi-project Scheduling Problem, manuscript.
3. BAKÓ, A.: Heruistic and Optimization Modells for Solving the PMS, Proceedings of the PMS, 1989, 57-67.
4. AHUJA, H. N. — WALSH, M. A.: Successful Methods in Cost Engineering. John Wiley & Sons, Inc. 1983.
5. MODER, J. J. — PHILLIPS, C. C. — DAVIS, E. W.: Project Management with CPM and Precedence Diagramming. Van Nostrand Reinhold, New York, 1970.
6. MOSHMAN, J. – JOHNSON, J. – LARSEN, M.: RAMPS Technique for Resource Allocation and Multi-project Scheduling. *Proceedings of the Spring Joint Computer Conference*, 1963. pp. 17–27.
7. HAUPT, R.: A Survey of Priority Rule-based Scheduling. OR Spectrum 11 (1989) pp. 3–16.
8. DANIELS, R. J: Resource Allocation and Multi-project Scheduling, in: Advances in Project Scheduling, R. Slowinski and J. Weglarz, eds. Elsevier Science Publisher B. V., Amsterdam, 1989, pp. 87–111.