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The Study of Multi-Project Resource Management Method Suitable for Research Institutes from Application Perspective

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Abstract

At present, most research institutes are facing the situation of undertaking multiple projects simultaneously, and many projects are very difficult, short-period and high-risked. The resource and schedule conflicts among different projects occur frequently. To solve those problems, advanced multi-project management methods must be introduced. In this paper, multi-project management method based on Critical Chain Method (CCM) is systematically studied, and a multi-project resource management method suitable for research institutes is put forward, including detailed steps and points for attention. At last, the method is applied to the institute the first author working for and the result is very exciting. It can solve the resource conflicts among different projects effectively and promote the utilization ratios of limited resources. It can also shorten the research periods of multiple projects and reduce the schedule risks of multiple projects.

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1. Introduction

With the steady growth of the China's investments in science and technology, the number of projects undertaken by each research institute is increasing greatly, and most research institutes are facing the situation of undertaking multiple projects simultaneously. In particular, engineering research institutes such as the first author working for

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always undertaken a large number of engineering research projects. Those projects are generally heavy, difficult, short-period and high-risked. The problems of lacking resources and planning conflicts often occur. Under multi-project circumstance, it is urgent to optimize the management mode of research projects and adopt advanced management methods to make sure the limited resources are reasonably and effectively allocated and to increase their utilization ratios.

Resource management is one of the most difficult aspects of multi-project management, which includes multi-project resource planning, allocation, balance, and coordination, and so on. As we all known, the resource management of single project supposes its resource requirements are fully met[1], and it doesn't concern about the resource requirements of other projects. The multi-project resource management is completely different. It is responsible for solving the resource conflicts among different projects and achieving optimal allocation of limited resources[1].

For a long time, the research institute the first author working for adopts traditional management mode that focuses mainly on planning management using empirical method. The project managers usually come from research departments with strong technical backgrounds. The methods for planning management and resource management are empirical and lack effective means to analyze the condition of resources and to allocate resources scientifically. With the number of research projects largely increases, the difficulty of management continues to increase. The management model needs to be more delicacy, scientific, professional.

In this paper, the multi-project planning management and resource management methods based on Critical Chain Method (CCM) are systematically studied. It also puts forward a detailed multi-project resource management method suitable for research institutes with relatively good operability. It can identify multi-project resource bottlenecks simply and exactly, and solve resource conflicts among multiple projects effectively, and achieve the optimal allocation and balance of limited resources finally. It can also shorten the research periods of multiple projects and reduce the schedule risks of multiple projects.

2. Principle of Critical Chain Method

The common limitation of classical Critical Path Method (CPM) and Program Evaluation and Review Technique (PERT) is that the resource constraints are not fully considered, and their operability in multi-project management is very poor[2]. Israeli physicist Goldratt successfully applied the theory of constraints (TOC) to project management, creatively put forward a project management method based on critical chain [2, 3].

The Critical Chain Method supposes that the utilization of project's resources is impossible to maintain a balance and not all resources are in shortage [3]. Actually, there are only partial resources that are insufficient. We call them bottleneck resources. By identifying the resource bottlenecks and seeking the optimal resource allocation scheme, we can achieve the overall optimization of the project's schedule and resource arrangement. The basic idea of Critical Chain Method is that a project's completion time depends on its critical chain, which is composed of its bottleneck processes or work packages [2, 3]. In order to shorten the research period of a project, we should pay close attention to the critical chain of the project, ensure the bottleneck resources on the critical chain and compress the period of bottleneck processes.

The Critical Chain Method not only considers the technical constraints among different processes, but also considers the resource constraints [4]. In addition, the method can digest the uncertainty of work packages' periods by setting a variety of time buffers [2, 3]. There are three kinds of time buffers. The first buffer is Feeding Buffer (FB), set at the confluence of the non-critical chain and critical chain to ensure that the related processes on non-critical chain have been finished before the process on critical chain begins. The second buffer is Resource Buffer (RB), set before each process on critical chain to ensure the resources required to the process is ready before it begins. The third buffer is Project Buffer (PB), set at the end of critical chain to avoid the delay caused by compressing the period of bottleneck processes.

The longest critical chain is the critical chain of multiple projects after resource balance. For multiple research projects, in addition to pay attention to the critical chain of multiple projects, it is also important to pay attention to the critical chain of each project. The set of critical chains of multiple projects is known as critical chain bundle [4].

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