International Journal of Multidisciplinary Research and Growth Evaluation.

Effective Resource Levelling Techniques using P6

Deepika Dayalan
Independent Researcher, USA

* Corresponding Author: **Deepika Dayalan**

Article Info

Abstract
Resource leveling is a management technique that is used to manage resource use in the course of project implementation. Resource leveling is crucial in any construction and engineering project since it defines the time and cost line for the project as well as its profitability. Primavera P6 is among the best project management software with tools for managing and leveling resources. This paper also explains various techniques of resource leveling in P6 and the circumstances under which they are useful. This paper compares the automated and manual approaches of resource leveling, resource leveling about other facets of project management, and the practical measures that must be followed to enhance the use of P6 for project resource management and, consequently, improved project outcomes.

DOI: https://doi.org/10.54660/.IJMRGE.2025.6.4.1403-1405

Introduction

Resource management is one of the most challenging tasks to accomplish during project implementation, particularly in construction and engineering projects. This leads to overbooking, underutilization, loss of productivity, time, and costs exceeding the budget [1]. To overcome these challenges, resource leveling offers a technique of equalizing resource demand to avoid situations when resources are utilized at very high or low levels. Primavera P6 is applicable for the resource-leveling technique because it has many features in resource management [2]. Resource usage analysis can be done through software tools that detect conflict and resource leveling. These techniques are discussed in the following sections: when they are applied, where they fit within the other planning processes, and their impact on the project performance measures. By so doing, the project managers are well-placed to offer better resource-leveling strategies that will improve project delivery using P6.

Literature Review

Resource leveling has been widely discussed in the project management framework, and most of the studies have been devoted to the effectiveness of various software like Primavera P6. Other areas are reported to be better in P6 than in different project management software; they include resource management with features of resource profiling, histogram, and leveling algorithms [1]. These studies said that while P6 has more tools for managing resources than the general project management software such as Microsoft Project, using those tools is possible, provided there is knowledge of the tool and how to apply it.

The research on resource leveling in multi-story building projects helps explain how P6 is employed in construction projects to level resources. Other research also demonstrates how the resource-loaded P6 can be used to optimize the labor and equipment resources in construction phases, refine the resource usage profiles, and reduce project time [2]. Such applications are usually based on P6's automatic leveling and fine-tuning based on construction knowledge. That is why, in some cases, specific systematic identification of building project resources has been described in works pointing at the effectiveness of its application and higher parameters of project performance [3]. These studies help emphasize the necessity to clearly define resources' necessities and limitations when using P6's leveling algorithms, as the software's reliability is based on the input data quality.

The literature review on the causes of delay in industrial construction projects shows that resource management is likely to cause a delay if resources are interdependent [5]. These findings suggest resource leveling as a preventive measure for schedule delay, making P6 useful in sound project control processes if well applied. A paper on the financial management of BOT projects demonstrates resource leveling with the help of financial planning using P6 as the scheduling tool [6]. This paper also shows how resource leveling impacts a project's cash flows and risk factors; this analysis shows that the resource management tools in P6 enhance the project's efficiency and financial performance.

Problem Statement

Several problems related to resource management in projects that employ P6, including Some of these challenges, are as follows: Lack of adequate resource-leveling. The following challenges were noted: Resource leveling is not done consistently. Here, resource leveling is done without understanding the project's characteristics. Resource leveling does not consider the resource or the time available for use. Resource leveling does not consider resource skill level and productivity [3]. In addition, resource leveling algorithms in P6 start with some assumptions about the resources that are not always accurate, especially when there is uncertainty or dependency on the resources [4]. The typical approach of the software for resource-leveling mostly entails crashing activities within the available float, which is hardly feasible in a real project environment. However, many organizations do not maintain proper and accurate records of data in P6, thus negating any leveling technique, however good it may seem on paper [5]. All these factors imply that there is much to be learned about P6's resource-leveling capabilities and how they may be utilized depending on the type of project.

Solution

Resource leveling in P6 should be executed in a complex way that includes using the program's features and other planning methods. The solution starts with creating resource data such as resource availability calendar, resource skill level, and resource production rate [2]. This foundation ensures that the resource estimations of P6 are based on real conditions of a project rather than the best-case scenario. The standardized procedure for maintaining the resource data concerning the changes in the availability and capabilities of the resources should accompany an effective resource management system [8]. Resource leveling in P6 should involve critical path determination, identification of resource-constrained activities, the definition of leveling goals, and enhancement of the leveled schedule [3]. While P6 offers the project managers different tools for automatic leveling, the best approach should involve automation of the initial level. In contrast, the final level should be done manually, considering project characteristics.

Uses

Resource leveling in P6 is applicable in different projects and project phases; it is most suitable for industries that require many resources. In the planning stage of construction projects, P6's resource leveling helps create practical plans considering resource limitations from the beginning [2]. This helps avoid the development of schedules that are theoretically possible but practically impossible to implement, which would require a lot of adjustments in the future. In multi-project situations, P6 has the enterprise capabilities to level resources at the portfolio level, allowing organizations to level resources across projects [1]. This enterprise view is especially useful for organizations with resources used in parallel by many projects, such as equipment or personnel with certain expertise.

In fixed-price contract preparation, P6's resource leveling helps contractors create a competitive resource plan that is also cost-effective to make the project deliverable [3]. It is possible to identify how contractors can eliminate waste of time, minimize overtime, and sequence their work to ensure that they meet their schedules while delivering value. For projects with spatial constraints, such as a workspace or equipment positioning constraints, the resource leveling in P6 can be done concurrently with spatial planning to make the resource-leveled schedule physically realistic [7]. This is especially so in renovation projects, construction of new buildings in urban areas, and industrial plants where space constraints play a crucial role in resource management.

Impact

The resource leveling techniques that are applied to P6 have a positive impact on the project in regard to several aspects of performance. According to the research, it is established that projects that use systematic resource leveling have resource-related delays reduced by 15-20% more than those projects that do not use resource leveling [5]. These are benefits in terms of time that, in the long run, are translated into cost savings in terms of overhead costs and optimal utilization of resources. The effects of resource leveling are not confined to the amount of money required in the project. Research on BOT projects shows that effective resource profiles can decrease financing costs by 5-8% due to the better correspondence of the spending to the financing [6]. This benefit is most applicable, especially in large projects where the cost of finance is usually a large fraction of the project's total cost. From the resource management point of view, proper leveling in P6 results in a more balanced demand for resources and less use of extra workforce and overtime [2]. Systematic resource leveling has been said to reduce idle time and balance workloads in construction projects by up to 12 percent of the total labor cost. It also enhances quality outcomes and safety performance by relieving the pressure to go faster during resource peaks.

Conclusion

Resource leveling in Primavera P6 is an effective technique that can be used to manage and enhance resource usage in projects characterized by high resource utilization. The resource management functions of the software give the project managers a means by which they can easily address and even automate the detection of resource issues within the duration of the project. However, these capabilities depend highly on the approach used to implement them, the quality of the data input, and the flow of this information with other project management processes. Applying P6's resource leveling techniques involves using algorithms and human intervention, accurate resource information, proper setting of parameters, and integration of resource management with other control processes. The organizations that invest in developing these capabilities will likely reap big in terms of schedule reliability, costs, and usage of resources.

Reference

1. Desai NV, Yadav NB, Malaviya NN. Increasing the potential application of Microsoft Project and Primavera P6 for project management: a comparative analysis of the residential project. Mater Today Proc. 2022;77:397-403. doi:10.1016/j.matpr.2022.11.485
2. Harshavardhan T, Reddy VS, Hussien A. Resource allocation, scheduling and planning of a multi storeyed residential building. E3S Web Conf. 2023;391:01217. doi:10.1051/e3sconf/202339101217
3. Hamad S, Khan M, Ali SM, Hussain S, Zaman L. Optimization of resources of a building project. Eng Proc. 2022;22(1):19. doi:10.3390/engproc2022022019
4. Xie F, Li H, Xu Z. Multi-mode resource-constrained project scheduling with uncertain activity cost. Expert Syst Appl. 2021;168:114475. doi:10.1016/j.eswa.2020.114475
5. Araújo-Rey C, Sebastián MA. An approach to the analysis of causes of delays in industrial construction projects through planning and statistical computing. Sustainability. 2021;13(7):3975. doi:10.3390/su13073975
6. Yaghubi D, Doroodian M, Adibi MA. Development of a financing optimization framework based on risk simulation in BOT projects: a case study of the waste-to-energy project. Complexity. 2023;2023:8129256. doi:10.1155/2023/8129256
7. Wang L, Li J, Ye Q, Li Y, Feng A. Automatic planning method of construction schedule under multi-dimensional spatial resource constraints. Buildings. 2024;14(10):3231. doi:10.3390/buildings14103231
8. Park G, Song M. Optimizing resource allocation based on predictive process monitoring. IEEE Access. 2023;11:3267538. doi:10.1109/ACCESS.2023.3267538