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A Review: Scheduling and Management of Sand Excavation Quarry

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ABSTRACT:

The main conclusions from the project scheduling literature review are summarized in this abstract. The paper describes how the resource-constrained project scheduling problem has received a lot of attention, which has prompted researchers to develop heuristic and accurate scheduling strategies to reduce makespan. Numerous extensions have been suggested in recognition of this traditional model's shortcomings in reflecting requirements found in the real world. The essay warns against the deceptive use of cost as a proxy for measuring schedule performance and attributes the underutilization of schedule monitoring and management to the dominance of the Earned Value Management System (EVMS) and its derivatives. The research highlights the need for a more sophisticated strategy. Furthermore, the analysis highlights a nearly three-decade-long interest in automating construction schedules, with researchers examining various artificial intelligence and optimization methods to create a "better" construction plan. Given the intricacies of project management in the real world, this synthesis promotes a more flexible and integrated approach to project scheduling.

Keywords: Project scheduling, resource-constrained, real-world requirements, schedule monitoring,

1. Introduction

One of the main ways to meet the growing demand for this essential building material is by extracting sand from quarries. Buildings, infrastructure, and other civil engineering projects all depend on sand, a basic ingredient in concrete and other construction materials. Its adaptability and widespread use in the building sector highlight how crucial effective sand extraction techniques are.

The need for sand is greater than it has ever been due to the world's growing urbanization and extensive infrastructure development. This increase is being driven by developing economies and expanding cities, which require large amounts of sand to support construction projects ranging from roads to residential complexes. Because of this, it is now essential to remove sand in an effective and sustainable manner in order to fulfill the expanding demands of these dynamic development landscapes.

Sand is a key element in the building and infrastructure industries, and it is necessary for the development of buildings, roads, and other civil engineering projects. Sand is extracted from quarries and travels through a complex and varied series of steps from its natural deposits to construction sites. Given the resource's critical role in promoting global growth, it is imperative to comprehend the complex dynamics involved in sand extraction.

Figure 1: Sand Excavation

2. Literature Review

The issue of project scheduling is crucial from a theoretical and practical standpoint. From a practical standpoint, enhancing project scheduling—a crucial component of the project management process—can result in the successful completion of the project and a notable reduction in associated costs (Hartmann, S., 2022) [1].

Project scheduling is thought to be one of the most interesting optimization problems from a theoretical standpoint, and this has drawn the interest of numerous operations research scholars. As a result, the problem of project scheduling has been thoroughly examined and evolved over time from a number of angles. This study reviews the themes surrounding the Re-source-Constrained Project Scheduling Problem (RCPSP), assesses current advancements in the field, and presents the findings for further research (Farhad Habibi 2018) [2].

It's difficult to finish a project on schedule and within budget. A project's time and cost can be predicted in large part by using project planning and scheduling. The goal of this analysis is to determine how to balance the cost and the least amount of time needed to finish the construction project. Angel Estates and Construction Ltd., a construction business situated in Ghana's Ashanti region, provided the information regarding the expenses and length of the activities involved. The analysis employed both the critical path method (CPM) and the project evaluation and review technique (PERT). Using linear programming, the tasks were broken down into their time and cost, which made it possible to identify the essential path. Subsequent investigation showed that, as opposed to the predicted 79 days, the shortest feasible period for finishing the examined building project is 40 days (Wallace Agyei, 2015) [3].

The study offers a hybrid solution for multi-project scheduling problems with resource constraints that combines project schedule development and project priority, or criticality. Here, minimizing the make-span of the project and the penalty costs associated with certain initiatives that have a greater priority is the goal. Integrating the project priority with the activity priority allows us to solve the NP hard problem. A hybrid algorithm that is based on AHP and priority principles is used to create the project schedule. It is shown that the suggested method outperforms the current priority criteria (Amol Singh, 2014) [4].

Examining this multi-project setting raises three questions. To find the general resource capacities—that is, the total amount allotted to each renewable resource for the projects—the entire budget must first be divided across the various resource types. Determining the quantities of resources to be allocated to the various projects is the next challenge after obtaining the general resource capacity. Because of the resources allocated, each project's scheduling becomes a multi-mode resource constrained project scheduling problem (MRCPSP) (Umut Beşikci et al., 2015) [5].

Random keys form the foundation of the solution representation. The serial scheduling generation strategy uses the activity priorities, which are adjusted by the algorithm's low-level heuristics, to create active schedules. Additionally, every solution undergoes application of the double justification operator, which is a forward-backward improvement technique. The suggested method was evaluated using a number of typical problem examples from the well-known library PSPLIB and contrasted with other methods found in previous studies. The suggested strategy's efficacy is confirmed by the encouraging computational outcomes (Georgios Koulinas, et al. 2014) [6].

To handle the scheduling challenge, a personalized, dynamic, and self-adaptive variant of a multi-objective evolutionary algorithm is suggested. The efficient ε-constraint approach, an effective multi-objective mathematical programming methodology, is contrasted with the suggested multi-objective evolutionary algorithm. Several performance indicators that are frequently employed in multi-objective optimization constitute the basis of the comparison. The findings demonstrate the suggested multi-objective evolutionary algorithm's relative superiority over the ε-constraint approach (Madjid Tavana, et al. 2014) [7].

The goal of the resource-constrained problem is to determine the best order to reduce project time while taking into account existing resource limits and precedence issues. This work develops the Fuzzy Clustering Chaotic-based Differential Evolution (FCDE) algorithm, a novel way to tackling complicated optimization problems, by integrating the chaotic and fuzzy c-means clustering techniques into the Differential Evolution (DE) process. The fuzzy c-means clustering technique functions as multiple multi-parent crossover operators in the FCDE, preventing the optimization algorithm from convergent too soon and maximizing convergence efficiency by making effective use of population information (Min-Yuan Cheng, et al., 2014) [8].

To tackle the intricate issues, techniques for estimating ambiguous lower and higher partial semivariance values are presented, along with a hybrid intelligent system that combines cellular automation and evolutionary algorithms. Furthermore, numerical tests are conducted to demonstrate the efficacy of the suggested approach, and two examples are provided to highlight the relevance and application of the new models (Xiaoxia Huang, 2016) [9].

This work addresses potential research expansions while reviewing the issues, methods, and analytical models related to project control systems. The literature on optimization techniques, Earned Value Analysis (EVA), and decision support system (DSS) design was our main emphasis because these areas will aid project managers in their planning and control in unpredictable project contexts. According to the review, more investigation is necessary to create analytical models that use EVA metrics to predict project performance (Öncü Hazır, 2015) [10].

In building projects, the impact of unfavorable weather frequently results in delays, legal disputes, and financial losses. A limited range of construction activities or projects, or a specific set of weather factors, have been the subject of recent research attempts to incorporate the influence of weather on project planning. The creation of a set of weather delay maps for a few typical building tasks using historical weather data from a nation is suggested. In particular, sine curves are employed to link daily combinations of meteorological factors in order to postpone and offer coefficients for anticipated losses in productivity (Pablo Ballesteros-Pérez, et al., 2018) [11].

Data from 1387 projects were studied as part of the methodological approach, which includes a 3-year longitudinal field survey with business units from 10 different industries in 3 countries (Argentina, Brazil, and Chile). The research hypotheses were tested using structural equation modeling. The response variable schedule with PM enablers and project management efforts in training and capacities development have a substantial and favorable link, according to the data. The two factors of project success that are most impacted by project complexity are margin and schedule. An important explanatory effect is revealed by cross-industry and cross-country analyses (Marly Monteiro de Carvalho et al., 2015) [12].

The challenge of resource-constrained project scheduling is to decrease makespan by scheduling tasks according to priority and resource limitations. It is now a common problem in the context of project scheduling, drawing in a large number of scholars who have created heuristic and exact scheduling methods. But the model is overly simplified and has too few assumptions to account for a lot of real-world needs. The basic resource-constrained project scheduling problem has thus been extended in a number of ways (Acebes, F., et al. 2014) [13].

Not enough attention has been paid to the idea that one of the most crucial aspects of project and program management is schedule monitoring and control. The use of the Earned Value Management System (EVMS, commonly called EVM) may be one reason. EVM was first created as a tool for cost control and management, and it was later expanded to include schedule tracking. To control the project's duration, EVM and its derivatives—such as Earned Schedule—use cost as a stand-in for schedule performance. Although schedule, cost, quality, and project scope are correlated, it has been shown that utilizing cost to regulate duration is deceptive (Homayoun Khamooshi et al., 2014) [14].

For nearly thirty years, scholars from all over the world have been interested in the problem of automating the development of building schedules. Scholars have employed diverse methodologies and instruments to tackle the problem of scheduling. Researchers in the construction industry have always attempted to apply newly developed artificial intelligence or optimization tools to solve one of their main issues: creating a "better" building timetable. This "better" is defined slightly differently by each researcher. The study on automation in construction scheduling from 1985 to 2014 is reviewed in this article (Vahid Faghihi, et al., 2015) [15].

3. Conclusions

The resource-constrained project scheduling problem has been extensively researched in project scheduling, with academics creating both accurate and heuristic approaches to decrease makespan, as the literature study concludes. Yet, the inability of the traditional model to adequately represent the demands of the real world has prompted the creation of a number of adaptations. Additionally, the study highlights how little schedule monitoring and control is used, attributing this to the prevalence of the Earned Value Management System (EVMS) and its offshoots. The paper argues for a more sophisticated approach by highlighting the drawbacks of using cost as a stand-in for timetable performance. Additionally, the review notes that over the course of almost three decades, researchers have focused a great deal of attention on automating construction schedules. To do this, they have made use of a variety of artificial intelligence and optimization tools, which have helped them better understand what makes a "better" construction schedule. This synthesis advances knowledge on the difficulties associated with project scheduling and calls for a more flexible and integrated approach to deal with the complexities of real-world project management.

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