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APPLYING CRITICAL CHAIN PROJECT MANAGEMENT TO THE DEVELOPMENT OF DAM CONSTRUCTION PROJECTS

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MAZEDAN JOURNAL OF CIVIL ENGINEERING & ARCHITECTURE
e-ISSN:
Article id- MJCEA0102004
Vol.-1, Issue-2
Received: 22 Jul 2021
Revised: 27 Sep 2021
Accepted: 28 Sep 2021

Citation: Deshpande, B. L. & Kosamkar, V. (2021). Applying Critical Chain Project Management to the Development of Dam Construction Projects. *Mazedan Journal of Civil Engineering & Architecture*, 1(2), 16-18.

Abstract

The dam construction industry has always been considered as one of the country's most important industries due to the lack of rainfall. To accomplish this, we need to properly manage the dam construction process. Traditional algorithms, such as the Critical Paths Methods (CPM) and Program Evaluation and Review Technique (PERT) have been used since ancient times to plan and control most of the projects, including dam construction projects. With traditional methods of project management, a large percentage of time and resources are often lost due to reasons such as the lack of prioritization, student syndrome, and bad multi-tasking. The Critical Chain Project Management (CCPM) is a method for project planning, with emphasis on the resources needed to carry out the project. In this research, which was done on the Kahir reservoir, the CPM method was first used and then analyzed by CCPM method. Using resource dependency, identifying and embedding project buffers and leveling resources in this study reduced the implementation time of the project for 27 days.

Keywords: buffers, resource leveling, CPM, CCPM.

1. INTRODUCTION

Increasing the population of cities and the people's desire to live in urban areas, reduce rainfall and imbalance in rainfall, has led the country's managers to increasingly control surface water management. Therefore, managers considered building the dam as a strategic factor to deal with these problems. In fact, most developed countries consider the construction and implementation of numerous water resource development projects to accelerate the development of economic and social development. Dams are one of the most important development infrastructures with an emphasis on drinking water supply and increasing economic growth through irrigation of agricultural products, increased subsurface production and power generation, and flood control. Recognizing and evaluating these impacts in the process of sustainable rural development in relation to the situation of villages can be very useful and in order to exploit the capabilities created as a result of the construction of the dam. In addition to the positive effects of these structures, we often see their negative impacts in various social, economic and environmental dimensions. Population displacement, migration, change in the type of economic activity, the spread of diseases and the disappearance of plant and animal species are among the negative effects of these structures. In recent years, extensive research has been carried out on the dam construction industry. Of the most important branches in the dam construction is flood control, water supply, hydroelectric power generation, irrigation, reservoir operation, environmental and so on.

2. RESEARCH METHODOLOGY

Kahir Reservoir

Kahir dam is aroller compacted concrete (RCC) type with a capacity of 314 million cubic meters (MCM) with the aim of irrigation and water supply since its launch in 2011. The lake has a length of 21 km, an overflow capacity of 8560 m3 /sec, A reservoir area of 23 m2, and an overflow type is ogee spillway without a value. The length of crest of dam is 382.5 m, tge width of crown in 5 meters, the height is 54.5 meters and the volume of the reservoir is 314 million cubic meters in normal size.

Annual water supply of 20 MCM is carried out irrigation under pressure method, Chabahar and Konarak industries amount to 13 MCM, supply of drinking water from Chabahar and Konarak to 15 MCM, Rural water supply to 1400000 m3, and Artificial feeding on the bottom of the Kahir Dam is about 5 MCM of the general purpose of making the Kahir Reservoir. After using this dam, 2,450 hectares of downstream agricultural land will be used for irrigated irrigation systems. Other information is given below.

3. METHODOLOGY

Floatation and leveling of resources in the project:

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The following table is part of the Work Breakdown Structure (WBS) of the Kahir dam.

1) By critical path method (table1)

2) By critical chain project management (table 2)

Table 1 Work breakdown structure (WBS) of construction of the body

Activity	Duration of Activity	Start (Day)
Excavation of body of dam	25	7
Guide wall reinforcement	68	16
Guide wall formatting execution	69	22
Guide wall concrete construction	67	25
Excavation of dam cut off wall	8	30
Drilling	515	32
Regularization and profiling of substrate for shell execution	12	35
Execution of plastic concrete in sealing wall	523	39
Filtration and horizontal drain	423	44
Implementation of RIP RAP	501	44
Preparation and execution of shell of first part	419	45
Execution of clay layers	412	45
Execution of filter and straight drainage	349	45
Execution of sealing wall	531	274

Table 2 Work breakdown structure (WBS) of construction of the body

Activity	Duration of Activity	Start (Day)
Excavation of body of dam	25	0
Guide wall reinforcement	68	15
Guide wall formatting execution	69	83
Guide wall concrete construction	67	152
Excavation of dam cut off wall	8	23
Drilling	515	25
Regularization and profiling of substrate for shell execution	12	28
Execution of plastic concrete in sealing wall	523	232
Filtration and horizontal drain	423	137
Implementation of RIP RAP	501	193
Preparation and execution of shell of first part	419	38
Execution of clay layers	412	38
Execution of filter and straight drainage	349	93
Execution of sealing wall	531	265

A comparison chart of the CPM and CCPM method is presented in the following figure.

As can be seen clearly, the CCPM method does not exceed the maximum number of resources.

4. RESULTS AND DISCUSSION

Taking into account the floats and slack in the activities, the activities move as far as possible to the extent that they allow the leveling of the maximum resources to be appropriate. These changes are available to reduce resources to reach available resources. The result of the time of these changes was to shift the time of some activities to the Finish to Start type. Most of the changes in the current example are from day 394 to day 452 and from day 497 to day 764.We are seeing a decrease in resources in the 15th to 202th and 226th to 230th and 273th to 312th days of the project in order to flatten the resources. Most of the changes mentioned above are due to the shifting of the reinforcing operations, the formatting and execution of the guide wall, Execution of plastic concrete in cut off wall and the implementation of the horizontal drain filter. Due to the lack of flotation in the excavation of the body of the dam, the excavation of the dam's cut off wall and profiling of the substrate for the shell execution, as well as the preparation and implementation of the shell (in the first part) and the implementation of clay layers (Due to being in critical activities), there was no shifting in these cases.

5. ECONOMIC ANALYSIS

In order to carry out the economic analysis (due to the reduction of 27 days of the project time) in the present project (using the critical chain method for the project of construction of the Kahir dam) the sum of the resulting benefits including employment income and income from operation were used. The direct benefits of this project were the value of agricultural income in the region, fish farming and hydropower production, and non-direct benefits included employment during the construction phase and operating period.

After the analysis of Kahir Dam, the analysis of any dam by cpm and ccpm method can be done and the comparative statement can be prepared keeping in view the economic analysis of the structure.

6. CONCLUSION

Construction of dam like other civil engineering activities will have positive and negative effects, especially in the long run. Of the most important positive effects of dam building on the region are the following: Increase in rural development, Increase in the value of arable land, Increased revenues through jobs (agricultural and non-agricultural), Increased employment. Also, with the construction of the dam, we see an increase in employment (falling unemployment) in the region. According to inflation and unemployment in the Philips theory, inflation in the region is also decreasing with increasing employment. As a result, we will see income growth, well-being, health and education in the region. However, damage to ancient monuments (if any), damage to facilities within the study area (such as school, roads, water, electricity, and telecommunications), environmental impacts, high cost of resettlement are among the negative economic consequences of dam construction projects. It is important to consider the social issues and the sustainable development of the project and increase the amount of profit for the project.

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