Using Primavera Software in Resource Allocation and Project Evaluation of Construction Projects

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Abstract
Resource allocation is one of the most important management tasks and makes strategy implementation feasible. Those organizations in which strategic management is not implemented resources are allocated based on personal or political factors. In strategy-based organizations, but, resources are allocated based on priorities determined by annual objectives. One of the main obstacles of successful implementation of organization strategies is the failure in linking executive plans and determining the priority in allocating resources to strategic long-term programs. Nowadays most organizations have a separate process for long-term strategic planning and annual and short-term budgeting. Every organization, at least, has four types of resources to be allocated in order to achieve organizational goals. These resources include: financial resources, physical resources, human resources and technology resources. Resources may be allocated in an effective manner while success of strategy Implementation is not assured since success is achieved when plans, employees, operations, controls and commitments act to maintain and survive allocated resources.

Keywords: Allocation, Resources, evaluation, project, Primavera

Introduction
The use of resources allocation in project control is not a new issue. It was proposed in 1950s. Most methods were first those which led to an optimal solution. Production and operation sequence management is the process of controlling production and services the main objective of which is to match efforts with application of resources and equipments in order to best produce and serve. Effort is made to use available resource and time in a desirable way and prevent resource and equipment waste. Here, resource allocation is of great importance. It determines the type resource allocation and importance of various parameters based on the nature of a production system and amount, type and importance of resources. Developing a plan differs from developing a program in the issue of resource allocation in project control (Kotler,1999). A plan contains questions such as “which activities are going to be done?” or “how these could be done?” In addition, a plan estimates the time of performing a certain task in various methods and if the time is random, then it estimates time distribution. It also identifies required resources to perform tasks in various methods. Although it seems that plan is prior to program but, in fact, there is a close relationship between these two. A plan may lack a practical program and thus it must be revised. However, a plan and its related program aim to optimize one (or more) predetermined goal and the value of the objective function measures their efficiency.

Primavera Software
The software (in summary: Primavera P6) comprehensively focuses on activity of project-based organizations in order to manage the full cycle of projects and portfolios (involving all big and small projects of an organization). Projects controlled with Primavera family so far are estimated to cost over 6 trillion dollars. Companies employ Primavera project management strategy to make better decisions in portfolio management, evaluate project-relating risks and opportunities and specify whether they have sufficient resources and skills to accomplish a task. This unique strategy provides the required ability and capacity to implement and control projects in order to successfully accomplish projects in certain time period, based on a certain budget and predetermined quality level. The software is usually used for timing and controlling various projects (Yasooob,2001). It also can be used for timing and controlling and estimating costs of the project in all construction, industrial, software and many other types of projects. The process starts with entering project tasks into the software and specifying relationships between them while exerting resources available in projects on different tasks. The software then times tasks based on their relationship with resources so that the project finishes in the shortest time possible. Besides, if the resources consumption cost is given to the software, it can estimate the overall project expenditures. It is noteworthy that the software determines the time of starting and finishing every single task (Freeman & Aspry,2010).

Following objectives are met using this software:
- Making strategic decisions
- Precise control of time up to the end of project
- Identifying required resources, resource prioritization and estimation in long period of time
- Reorganizing projects based on new priorities without any negative influence on the quality
- Reporting during project accomplishment
- Just-in-time announcement of critical situations
1. A summarized description of facilities of P6

This powerful software has numerous facilities for project and time management. It is capable of organizing limited resource projects up to 100000. The user can simply store data pertaining to a project and its tasks in a database give it to managers for decision-making. The software is provides by designers who were project managers themselves and hence it meets various needs of project managers in plan designing and controlling. The huge number of projects is a main problem in project-based organizations. Such organizations use Primavera to combine, plan and control all their projects in an integrated manner. The project breakdown structure can be well defined by this software. The structure shows the organization’s project in a hierarchy. Then, EPS is defined to manage projects. Even resources can be described in the form of OBS (organizational breakdown structure) and hierarchical responsibilities (Hamidi & Jafari,2010). Although Primavera is essentially designed for project-based organizations but it can also be used for independent projects. In other words, this project control software can manage all projects and it covers a level higher than the project, the organization.

2. Resource planning in project control

Required resources are those equipments and devices needed for accomplishing a certain task. No task or activity is performed without human resources, machinery, equipments, materials and using various resources. Tasks required resources of a project are classified into three groups. One of the classifications is presented by Slovinski by which resources are divided into these classes: renewable resources, non-renewable resources and resources with dual constraints. Beside, quasi renewable resources were also suggested. Implementation of every task requires allocation of needed resources. If available resources are in levels that cause no delay in implementation of those tasks which are to be accomplished in a simultaneous manner using uncommon resources, then no alteration occurs in project timing. But the situation is not usually like this (Korooni,2000). Hence, the way and time of resource allocation becomes important.

3.1. Resource allocation manner

In the traditional and conventional manner constrained and unconstrained resources can be defined for a project. In must be noticed while allocating resources that no resource can be constrained or unconstrained innately. Nowadays, most resources are allocated using a dynamic manner associated with time targeting. Figure 1-2 the manner of allocating resources to various tasks of a project.

![Figure 1: manner of allocating resources to various tasks of a project.](image)

3.2. Techniques pf project management and control

During the time new techniques are developed for project planning and this is done performed by more advanced and more practical methods.

4. Well-known methods of project planning

4.1. Gantt chart

The technique was developed by Henry Gantt and Fredric Tailor and can be identified as the scientific method of project planning. The method uses horizontal rods representing time length of a task accomplishment for planning and tasks' names are written vertically in separate columns. Every rod is place in front of every task and the chart shows the starting date, accomplishment time length and finishing date of tasks (Berch & Grad nitzi,1992).

4.2. Critical path method

Deficiencies of Gantt's chart led to development of other methods for project planning. Some scientists of operational research (members of the British Energy Production Central Board) invented energy for the first time. They introduced a technique as the longest non-reducible path. In this method project tasks having certain times and individual relationships are placed in a group network. The longest path (in terms of time) is considered as the critical path and the time of this path specifies the project time. Primavera bases on using CPM (critical path method).
4.3: Networks with probable times in a project

4.4. A network with probable tasks

It is assumed in PERT and CMP methods that project tasks are certain and absolute and the probability of their accomplishment during the project is not 100%. Here, tasks are determined with probabilities and those necessary tasks are 100% performed.

\[ T_e = \frac{b + 4m + a}{6} \]
\[ C_e = \frac{b + 4m + a}{6} \]
\[ \sigma^2 = \frac{(b - a)^2}{6} \]
\[ \sigma = \sum_{i=1}^{n} \sigma_i \]
\[ V = \sigma^2 \]

\[ Z = \frac{x - \mu}{\sigma_{cp}} \]
\[ P = (T \leq T_e) = P(Z \leq \frac{T_e - T}{\sigma_{cp}}) \]
\[ Z = \frac{x_c - \mu_c}{\sigma_c} \]
\[ P = (C \leq C_e) = P(Z \leq \frac{C_e - C}{\sigma_c}) \]

5. Estimation of project progress (based on time and costs measures):

5.1. Progress is estimated by the accomplished work divided by the total work.

5.2. Every task is dedicated a certain weight.

5.2.1. Time weight value of every certain task is obtained by dividing its implementation time by algebraic sum of times of all tasks.

\[ DW_T = \frac{D_i}{\sum_{i=1}^{n} D_i} \]
5.2.2. Cost weight value of every task is obtained by dividing its implementation costs by algebraic sum of costs of all tasks.

\[ CW_j = \frac{C_i}{\sum C_j} \]

6. Definition of resources and functions
Resources include human, non-human and usable ones which perform the work in the framework of tasks during a project. Human and non-human resources such as engineers and equipments are always allocated to different projects based on time. Usable resources such as materials are estimated and stores based on cost per time. One can develop a hierarchical structure of resources in Primavera to show the structure of organizational resources and is used to allocate proper resources to tasks. It is also possible to define numerous hierarchical codes of resources for grouping. Moreover, those functions requiring certain skills can be defines and allocated to different tasks. This feature makes planning and timing of costs based on functions possible (Ashlaghi & Taheri, 2010).

7. Estimating progress in Primavera
7.1. Different types of progress percentage
These different types are used while updating the project timing in different periods. Its various settings are defines in Percent Complete Type tab which are exerted on tasks and even new tasks of the project.
7.1.1. Physical % Complete is expert or intellectual percentage which is entered manually and has no computing based in Primavera.
7.1.2. Duration % Complete is linked to tasks' DUR.
7.1.3. Unit % Complete is linked with resource units

8. Resource and time allocation in Primavera
There are three types of resources available in Primavera: Labor or human resource, non-labor and material (usable resource).

9. Comparing progress with baseline
Comparing resources and the initial time of a project is one of the main and most important objectives of project management and is displayed as follows

Figure3:The resource consumption profile in Primavera

Conclusion
At the present time, owners of huge businesses and contractors simultaneously manage and control several engineering and construction projects. These big projects are linked rings of a chain. Insisting on finishing the project on the determined time, considering financial limitations and maintaining the position in competitive market lead to an increase in applying project management knowledge. Hence, it is necessary for project managers to move from a traditional structure to a simple and efficient multi-project organizational structure (Armstrong, 2005). Optimal use of resources increasingly becomes more sensitive and challenges managers' minds. Organizations must use advanced software knowledge more than ever. Like other developing countries, Iran is developing and moving forward but it lack planning culture and thus some managers do not believe in project planning and control (even if they support it seemingly). It is necessary to prevent Dr ayjadstrbray rising industrial power supplies Az·hadrftn Srytrazaobl the human resources software company Hadrbdnrm learn the necessary training.
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