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Construction project management with multiple calendars

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Abstract
Project management has become a vital element in our daily life. In any industry, project management and its context are required. It is a fact that planning software is mandatory for any type of construction project. It is a useful tool to plan-ahead and controls the project. It gives an important tip to compute project activity dates and end date of the project. However, when a stakeholder/shareholder located in another country get involves in the project, this might change. Having two or more calendars in a construction schedule is not an unusual way of working style in the construction business. At this point, construction professionals need to pay more attention. In this study, two different project planning software with multiple calendars are investigated. The subject of how start/finish dates of the activities are affected according to schedules, start and finish dates of predecessor/successor activities have been investigated by reviewing examples.

Keywords: project management, construction management, planning, project.

1. Introduction

Project management has become a vital element in daily business life. In any industry, project management and its context are required. A project consists of a series of events, sophisticated structure with many activities from various disciplines and must be accomplished at a previously determined time, within cost according to the given specifications. Even though projects contain standard features, every project is unique and require unique project management approach [1]. Project management is, on the other hand, can be defined as 'the application of knowledge, skills, tools, and techniques to project activities to meet the project requirements''[2]. If there is the absence of adequate project management, this might result in; poor quality, unsatisfied stakeholders, conflict of interest, missed deadlines, etc. Project management is now needed in all sectors. Especially in construction industry project management has gained more importance.

Project management fosters five process groups to achieve the project objectives. These are; initiating process group, planning process group, executing process group, monitoring and controlling process group, and closing process group [2]. Planning is one of those five essential processes in construction.

In construction projects, it is inevitable to deal with numerous suppliers from different industries. These suppliers can be within the project country or overseas. Supply chain management (SCM) and all the activities take place here are vital for project management and planning. Supply of material, equipment directly affects construction activities at the site. It is a fact that SCM deserves a deep understanding and treatment as the start date of most events depend on the end date of SCM activities. If the project schedule has only one calendar, it is no problem as all the parties have the same time perception. However, if the project has multiple calendars for SCM and construction activities, the situation gets more complicated and requires better attention. The aim of this study to show how Primavera and MS Project work when there are multiple calendars within the project. SCM and construction activities are utilized in the case studies with the purpose of showing the cases from the real projects. SCM and construction activities are integrated into project management and significantly affect each other. Therefore, this study can be an essential tool to show the professionals how the software work with multiple calendars and what kind of differences exist in principle

2.Planning

A project contains 3 constraints. This set of project constraints usually known as the project triangle.

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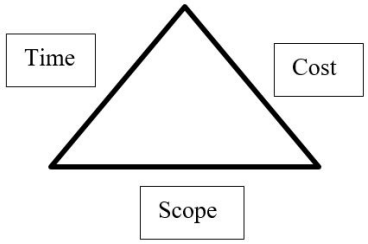

Figure 1: Project constraints iron triangle

These elements of the triangle are linked to each other, and once there is a change on one side, this will directly affect the different sides [3]. In construction industry managers face multiple issues simultaneously. They need to see the current status of the project and also the future as truly as possible. Therefore a good work plan/work schedule is required for the sake of the project [2,4,5]. Planning can give the managers direction towards success[6]. This will also enable the managers to make decisions without much struggling.

Work schedules are prepared based on the idea that the required resources will be available at the right time and place [7]. However, in practice, the funds might not be adequate, or everything might not go as planned. However, the aim of having a plan is to be prepared for worse case scenarios. Hence, it helps to reduce the risks throughout the project.

Specialists work with different data sets, and they all have their own way of thinking. This is not a common way of communication with each other, though. In other words, it is not an agreed way of data form. In this regard the work schedule is a way to show all these various data in one style. The benefit of it is that all the parties involved in the project can understand the plan and follow the schedule [8].

Delays are the most common and most significant issues in the construction industry, and they are inevitable. Planning gives an opportunity to eliminate/minimize delays [9]. To have a good plan and analyze the possibilities, it is vital to have all the required info about design, material, designer, supplier, contractor [10]. Considering the number of material/equipment to be delivered to the construction site, SCM has a considerable share in planning activities.

3. Supply chain management in construction

Current SCM practices are not capable of meeting the construction industry's needs. Delivering materials on time determines whether the project to be completed on time or not, and current practices in construction should change in order to achieve these goals [11–14].

SCM in manufacturing is in a better condition and shows better development comparing to construction SCM. It has a repetitive process, and variables are less comparing to construction. In building environment, everything changes rapidly. Every time the project location is different while a factor is always at the same place. In many ways the construction industry should learn from manufacturing in terms of SCM [14]. However, the construction industry has been plodding to form a system. The main reason lies behind this is professionals use the uniqueness of construction projects as an excuse [13]. In fact, this problem was identified at the end of the '90s. Since then, the issue has not been overcome completely.

In the construction industry, the final product is the output of the whole project on which the demands of the owner, client, or stakeholders have determinant effects. According to the requirements, the suppliers and materials are selected. Suppliers join the project structure and have an impact on the whole project. This starts an entire new chain starting from raw material, production, logistics, and delivering the project to the end user. SCM in construction requires to manage the whole chain and consequently, all the parties located in directly or indirectly [15].

Construction supply chain management can be considered as a set of management process involves managing all kind of information and activities starting from the design stage up to the handing over the stage. Therefore SCM is a bit complex as dynamic nature of construction and number of parties (including ; designer, stakeholders, contractor & subcontractors, etc.) involve in the process [12].

Designers are important players as they have a role directly/indirectly in selecting suppliers. Based on the

design requirements, the material and the supplier are determined. Sometimes, based on the design, there might be multiple supplier options for one element. In any case, starting from the design stage to delivering material to the site, excellent communication should be constructed. Otherwise, such a high amount of information cannot flow effectively in both vertically and horizontally. More parties involved in the project , more complicated the project becomes and gets harder to deal with [16]. Hence, it is advised to combine all the parties and disciplines and establish sound, responsible communication system between them [17].

Characteristics of supply chains in construction are summarized as follows;

- SC directs all the materials to the project site to be assembled. Unlike manufacturing factory construction factory is set up around a single product that goes to the one customer.
- The supply chain is a temporary structure created for one project. Therefore, throughout the project life cycle from design and turn-key, it is a little bit fragile as it is not a repetitive process

Every time a new project is born, a new supply chain is created, and it is defined as a new project. The amount of its reputation is very limited. The whole process might be very similar, though [14].

4. Material and method

4.1. Used materials

In this study, MS Project and Primavera software are used. 2 different calendars with different working& non-working days are identified. Different type of relationships between activities (start-start, start-end, end-end, end-start, ((SS, SF, FF, FS)) are tested. Calendar 1 includes standard working days, and consequently, Saturday and Sunday are defined as holidays in Calendar-1. Calendar 2, on the other hand, has different non-working days, which are Thursday, Friday, Saturday and Sunday. the connection types of the activities based on these two calendars and the lags defined in addition to these connections that affect the start and end dates of the activities.

Table 1: Calendars

Calendar	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Calendar 1	Working day	Working day	Working day	Working day	Working day	Non-working	Non-working
Calendar 2	Working day	Working day	Working day	Non-working	Non-working	Non-working	Non-working

5. Case studies

There is various software used in construction scheduling. Primavera P6, MS Project, TILOS, ASTA Powerproject, and other cloud-based planning software are widely used in the construction industry. In this study, 4 types of relationships are examined in both Primavera and MS Project. The successor activities are; installation of an elevator, wall covering, cable pulling for boiler, floor covering. Supply activities are predecessor activities.

5.1. Case-1: Finish to Start (FS+ 1 day lag)

In real construction cases, usually the supply of the elevator takes a long time. It is considered a long lead item. The start date of the successor activity is different in P6 and MS Project.

5.2. Case 2 Start to Start (SS+ 1-day lag)

When the supply of wallpaper has started, the wall cover is to start. Hence, when the wallpaper is at the site, there will be open works.

5.3. Case 3 Finish to Finish (FF+1-day lag)

In order not to lose time, the cable pulling must be ready for the boiler. Therefore, the relationship is Finish to finish.

5.4. Case 4: Start to Finish (SF+ 1-day lag)

Screed works must start before the floor covering finish.

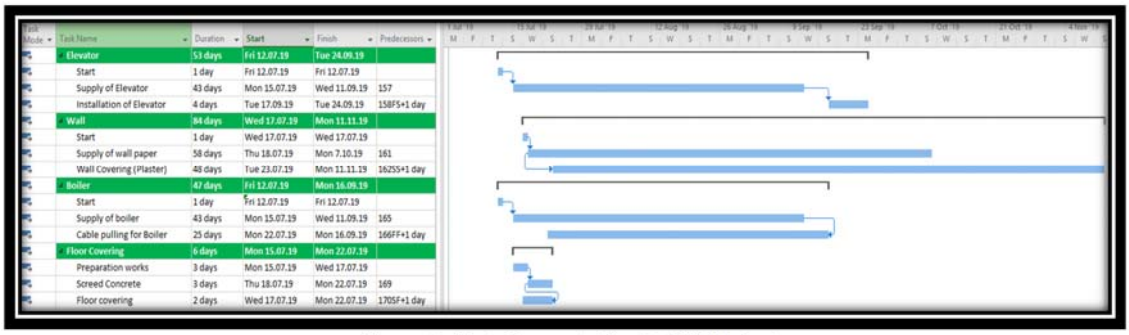

Figure 2. Tested case studies in MS Project.

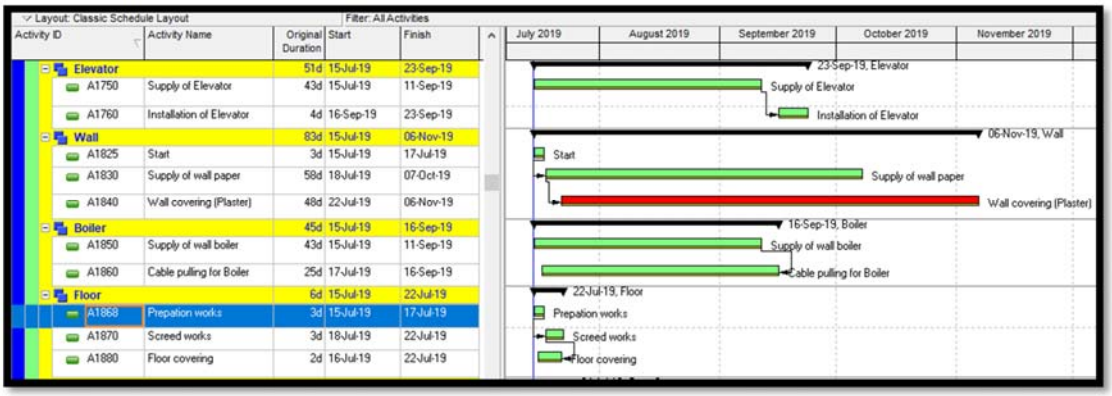

Figure 3. Tested case studies in Primavera.

6.Conclusion

It is a fact that planning software is mandatory for any type of construction project. It is a useful tool to plan-ahead and controls the project. Based on the progress of activities, it shows the overall growth of the project. Furthermore, it analyses the project status activity by activity and identifies the delays. Considering all its features and outputs t planning software is a handy tool as it computes project activity dates and end date of the project. If one of the project stakeholders is overseen, this might bring some challenges to the project schedule. This situation requires to work with multiple calendars. Having 2 or more calendars in a construction schedule is not an unusual way of working style in the construction business. At this point, construction professionals need to pay more attention as things are a bit more complicated than working with a single calendar.

Primavera and MS Project have a different way of computing the dates for successor activities start date. They work with the same principle called CPM though. Especially in the case-1 (elevator) and case-2 (wall), the dates of successor activities are different. The reason is that when there are lag time and the start date of successor activity falls on the non-working days of its calendar Project, and Primavera computes differently. MS Project starts counting the days from its (successor) own working days. Therefore, it starts counting from the first working day in its calendar. However, Primavera starts counting the lag time from the predecessor activity's calendar. Hence the dates are different as shown in the wall and elevator case. It is shown that two software have a different way of computing the dates. The professionals should be aware of this situation.

It is a common practice that the head office of the companies and construction teams have different planning software. Site team usually tend to use Primavera, and head offices prefer MS Project software. Assume that one project involves multiple calendars with thousands of activities. Furthermore, teams use different software. It is truly impossible to determine this little difference unless it is on the critical path of the project, or the schedule is being followed very closely. This type of problem in large or small size of the project might result in a significant delay or contractual conflict which would take a quite long time to settle; therefore, it is advised to have one software both in head office and site office. This will

reduce the room for error. In further studies, more software can be compared with each other when there are multiple calendars within the project.

References

[1] S.J.M.J. Jack R. Meredith, Scott M. Shafer, Project Management A Strategic Managerial Approach, 10th ed., Wiley, 2017.

[2] M.A. Langley, A Guide to the PROJECT MANAGEMENT of BODY OF KNOWLEDGE, 2017. doi:10.1002/pmj.21345.

[3] M. Note, Project Management Overview, Proj. Manag. Inf. Prof. (2015) 1–18. doi:10.1016/b978-0-08-100127-1.00001-2.

[4] S.H. Lee, F. Peña-Mora, M. Park, Dynamic planning and control methodology for strategic and operational construction project management, Autom. Constr. 15 (2006) 84–97. doi:10.1016/j.autcon.2005.02.008.

[5] M.C.J. Caniëls, R.J.J.M. Bakens, The effects of Project Management Information Systems on decision making in a multi project environment, Int. J. Proj. Manag. 30 (2012) 162–175. doi:10.1016/j.ijproman.2011.05.005.

[6] M. Radujković, M. Sjekavica, Project Management Success Factors, Procedia Eng. 196 (2017) 607–615. doi:10.1016/j.proeng.2017.08.048.

[7] H. Singh, Construction Project Management, Chandigarh, 2009.

[8] E.I.A. Lester, Primavera P6, Proj. Manag. Plan. Control. (2017) 489–508. doi:10.1016/b978-0-08-102020-3.00051-6.

[9] H.A. Abdel-Khalek, R.F. Aziz, I.A. Abdellatif, Prepare and analysis for claims in construction projects using Primavera Contract Management (PCM), Alexandria Eng. J. (2019). doi:10.1016/j.aej.2019.05.001.

[10] S.M. Chen, F.H. Griffis, P.H. Chen, L.M. Chang, A framework for an automated and integrated project scheduling and management system, Autom. Constr. 35 (2013) 89–110. doi:10.1016/j.autcon.2013.04.002.

[11] J. Egan, Rethinking the Report of the Construction Task Force, HMSO London Dep. Trade Ind. (1998) 38. http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:RETHINKING+CONSTRUCTION#0.

[12] L. Butkovic, A. Kauric, J. Mikulic, Supply chain management in the construction industry - a literature review, in: Int. OFEL Conf. Governance, Manag. Entrep., 2016.

[13] A. Akintoye, G. McIntosh, E. Fitzgerald, A survey of supply chain collaboration and management in the UK construction industry, Eur. J. Purch. Supply Manag. (2000). doi:10.1016/S0969-7012(00)00012-5.

[14] R. Vrijhoef, L. Koskela, The four roles of supply chain management in construction, Eur. J. Purch. Supply Manag. (2000). doi:10.1016/S0969-7012(00)00013-7.

[15] H. El Sayed, Supply Chain Key Performance Indicators Analysis, Int. J. Appl. or Innov. Eng. Manag. (2013).

[16] D.G. Al-Werikat, Supply Chain Management In Construction Revealed, Int. J. Sci. Technol. Res. 6 (2017) 106–110. https://doaj.org/article/2264823407514c848c9cc409e0b04918.

[17] G. A. Papadopoulos, N. Zamer, S. P. Gayialis, I. P. Tatsiopoulos, Supply Chain Improvement in Construction Industry, Univers. J. Manag. (2016). doi:10.13189/ujm.2016.041002.