The gap and its reduction between theory and reality of construction schedules in the UAE

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Abstract. The construction industry is constantly changing due to market conditions and increased competition. The competition, in particular, has resulted in the need for better schedule performance for construction projects. Construction schedules are fundamental and challenging activities in the execution as well as management of construction projects. Besides, scheduling is an essential function of the project management since it provides a roadmap illustrating all the activities, milestones, and deliverables within a project to prevent any delays during the project’s commission as well as handover. In project management, delays have an adverse effect on the construction lifecycle and mainly arise from poor planning as well as forecasting techniques, insufficient knowledge on scheduling techniques, and inadequate or inefficient communication processes or technologies. The aim of this study is to identify the gap between scheduling theory and scheduling practices in reality of construction schedules in the UAE and its reduction methods in the practice. It will review existing literature to link schedule theory and good practices to illustrate the relationship between schedule problems and usage to recommend ways of improvements. A concise methodology stating the proposed research design and instrument is also provided.

1. Introduction

The construction projects are in constant change with regards to uncertainties and actions of relevant authorities mandated to provide continuous but viable new conditions. Consequently, according to Josephson and Hammarlund [5], competition in this environment or sector has become stronger, which indicates that there is a continuous need for improvement within the construction and governing fields. The existing knowledge on improvement in construction is one of the fundamental driving forces behind developments presently executed within this sector; however, based on the report by Josephson and Hammarlund [5], the study of shortcomings in construction schedules has contributed as well as motivated the implementation of improved work.

Construction schedules are fundamental and challenging in the execution as well as management of construction projects. The latter is due to the fact that the choice of technology influences it during construction planning, work tasks definition, estimation of the required duration and resources for individual tasks, as well as identification of the interaction of between the available resources and different work tasks.
2. Literature Review

2.1 Construction Schedules

Construction scheduling is one of the fundamental aspects of project management, and it determines whether the planning processes will be successful or detrimental to the parties involved, according to Project Management Institute [3]. In order to understand how shortcomings are correlated to the scheduling process, this subsection analyzes literature in three key areas that indicate whether the construction schedule is excellent or unsatisfactory for the management of the project. These include project complexity, schedule specification, and scheduling knowledge. Although these are theoretically (scheduling theory) introduced in class, putting them into practice (scheduling practice) has been challenging since experience is also a determinant factor on whether the scheduling process will meet all the standards laid down by PMI [3] as asserted by Farzad and Moselhi [7].

Similar research has indicated that scheduling practice involves the integration of various aspects of scheduling, which include techniques and methods, guidelines, and management procedures, as well as experience of those involved or undertaking the project as indicated by Farzad and Moselhi [7]. In other words, scheduling practice must consider the project’s complexity, specifications of the schedule, and scheduling knowledge through schedule theory, management theory, participant capabilities, as well as project management.

2.2 Schedule Specifications and Project Participant Capabilities

Constructions schedules are challenging to comprehend when the project participants do not have adequate capabilities to understand its specifications. At the same time, these specifications cannot be ignored during the project’s lifecycle since they control the schedule itself and ensure that all the requirements of the projects have been fulfilled [3].

According to Project Management Institutes, schedule specification is a separate document that specifies whether the provisions of the construction schedules have been satisfied. These provisions include the project’s requirements, such as design, system characteristics, products, services, and components of the project. Unlike, the schedule itself, schedule specifications refer to the contractual agreement set at the beginning of the project management, and it is described as the guiding feature of schedule development, control as well as management [3].

3. Data Analysis and Results

A preliminary study was conducted to determine the robustness and believability of data based on the survey questions. The purpose of this study was to perform an exploration of the research topic as well as determine the quality of the results or evaluation. In other words, it was used to identify critical issues or features that were significant in the study and could be used to address the quality of the process this study has undertaken to ensure that the data is validated and reliable Sung, Yo, and Shin [12]. The first set of questions were to point out the primary factors associated with the scheduling process in theory with the first one illustrating the critical assumptions taken into consideration during the scheduling process. According to Figure 1, which presents the top four, the majority of the interviewees suggested that the most utilized assumption during the scheduling process was that all jobs have a ready time of zero (44%).

This was followed second by the assertion that each machine at the construction site could process a single job at any time at 31%. An analysis of the two assumptions suggests a correlation between the two since all jobs at the working site can have a zero time when each machine within the construction area operates optimally and efficiently.
Figure 1. Critical assumptions considering during scheduling process.

Figure 2. Most common scheduling tools and techniques affected by scheduling/assumptions.

Figure 2 shows that the Gantt chart is the most affected, followed by the Critical Path Method (C.P.M.). This is since these two, according to the respondents of the initial study, are the most used. Other practical tools and techniques impacted by the same include Program Evaluation and Review Technique (PERT) and Work Break-down Structure (WBS). According to Karabulut [4] and Alam [3], PERT, WBS, and Gantt are the most effective techniques and tools used in the planning of construction projects and, as such, any assumption included during the scheduling process influences their effectiveness towards meeting the proposed deadline.

Figure 3. Scheduling participants influence on the scheduling theories assumptions.

According to Figure 3, the owners (34%) of the projects were critical on the impact of these assumptions towards achieving the optimum outcome. In addition, they were the crucial factor in
determining when the premises were used in the scheduling process or not, followed by designers, construction managers, and project managers. This makes them the most crucial individuals in the scheduling process with regards to determining whether certain theoretical aspects were suitable for the project or not. For the owners, it is reported that they advocated for the hypotheses since it favored them with regards to budgeting. In other words, these assumptions may lead to underpricing since all other factors will be considered as constants and, as such, will not be catered for in the project schedule. If this is the case, it means that the contractor or the person in charge of the project management will have to incur the overrun costs associated with these assumptions.

4. Results and Conclusion
The primary scheduling management problems arising from the preliminary results and case study presented in the previous sections include lack of a clear view of the tasks to be completed based on the theoretical aspects of the research, lack of adequate resources or materials resulting in delays, and an overly optimistic project schedule. For instance, there are inadequate scheduling experts who take part in the scheduling process in the United Arab Emirates, as illustrated by the demographic information presented in Table 1. According to this table project and construction, managers top the list of the most involved stakeholders in the scheduling processes, followed by site engineers, as well as quantity surveyors. The resulting schedule, therefore, could result in any of the three scheduling projects, primarily if these individuals rely on their theoretical knowledge and available but limited scheduling resources.

| Expertise            | Frequency | Percentage |
|----------------------|-----------|------------|
| Designers            | 4         | 8%         |
| Site Engineers       | 7         | 14.0%      |
| Construction Manager | 12        | 24.0%      |
| Project Manager      | 13        | 26.0%      |
| Manager              | 4         | 8.0%       |
| Architect            | 4         | 8.0%       |
| Quantity Surveyor    | 6         | 12.0%      |
| **Total**            | **50**    | **100.0%** |

According to the data analysis, the primary assumptions arrived at during scheduling dictate that all jobs have a ready time of zero, and each machine within the site can process one task at any given time. Other assumptions, however, that are also considered significant in the scheduling process insist that all technological constraints and processing time can be determined in advance. In addition, once the operations of the project commence, there are no pre-emptions allowed. These assumptions are critical in determining the gap that exists between scheduling theories and scheduling practice in reality; thus, are considered to be crucial in addressing the research questions and objectives.

5. Conclusion
The presented results demonstrate that Gantt charts are the most common scheduling tools in the U.A.E. This is confirmed by the case studies analyzed in the previous section, which all utilized it to accomplish all the necessary milestones presented using the different horizontal bar graphs. CPM followed this, then PERT scheduling tools. WBS was the least used when different scheduling practices were being carried out. Consequently, owners of the projects or clients were reported to have a considerable influence on different scheduling processes, including theories or assumptions involved in the planning, scheduling, and implementation phases.

The majority of the respondents were also in agreement that all stakeholders were involved in the scheduling process and were not considered the primary cause of delays. Planning was considered the most significant aspect of the project scheduling and yet the most troublesome with regards to the scheduling process itself. The implementation phase was the second troublesome practice according to the data analysis. Based on these findings, a discussion is formulated to determine how these individual aspects of the scheduling practices and theory correlated with one another according to the formulated
research questions and objectives. Possible answers to these questions were provided, and their effectiveness in identifying the gap as well as reducing it presented or illustrated accordingly. The gap between scheduling theory and scheduling practices, in reality, is comprehensive, and this is due to the majority of the attributes described using the various tables and data analysis that followed. For instance, the expertise of those involved in the scheduling process as well as the assumptions formulated in both the planning and implementation stages.

References

[1] Salunkhe, A. A., & Patil, R. S. (2013). Statistical methods for construction delay analysis. Journal of Mechanical and Civil Engineering, 9(2), 58-62.

[2] Salama, T., Salah, A., & Moselhi, O. (2016, ). Alternative scheduling and planning processes for hybrid offsite construction. In Proceedings of the 33rd International Symposium on Automation and Robotics in Construction, International Association for Automation and Robotics in Construction, Auburn, AL, USA.

[3] Alam, S. (2019, August). An Innovative Project Management System. In 2019 International Conference on Information Management and Technology (ICIMTech) (Vol. 1, pp. 180-185). IEEE

[4] Karabulut, M. (2017). Application of Monte Carlo simulation and PERT/CPM techniques in planning of construction projects: A Case Study. Periodicals of Engineering and Natural Sciences, 5(3).

[5] Josephson, P. E., & Hammarlund, Y. (1999). The causes and costs of defects in construction: A study of seven building projects. Automation in construction, 8(6), 681-687.

[6] Floricel, S., Bonneau, C., Aubry, M., & Sergi, V. (2014). Extending project management research: Insights from social theories. International Journal of Project Management, 32(7), 1091-1107.

[7] Alias, Z., Zawawi, E. M. A., Yusof, K., & Aris, N. M. (2014). Determining critical success factors of project management practice: A conceptual framework. Procedia-Social and Behavioral Sciences, 153, 61-69

[8] Love, P. E., Smith, J., Ackermann, F., Irani, Z., & Teo, P. (2018). The costs of rework: insights from construction and opportunities for learning. Production Planning & Control, 29(13), 1082-1095.

[9] Schwabe, K., König, M., & Teizer, J. (2016). BIM applications of rule-based checking in construction site layout planning tasks. In ISARC. Proceedings of the International Symposium on Automation and Robotics in Construction. Vilnius Gediminas Technical University, Department of Construction Economics & Property.

[10] Shahparvari, M., & Fong, D. (2018, July). The Review of Rework Causes and Costs in Housing Construction Supply Chain. In The 26th Annual Conference of the International Group for Lean Construction (IGLC 2018).

[11] Salunkhe, A. A., & Patil, R. S. (2013). Statistical methods for construction delay analysis. Journal of Mechanical and Civil Engineering, 9(2), 58-62.

[12] Sung, K. S., Yi, Y. G., & Shin, H. I. (2019). Reliability and validity of knee extensor strength measurements using a portable dynamometer anchoring system in a supine position. B.M.C. musculoskeletal disorders, 20(1), 320.