

The Use of Project Scheduling Techniques in the UAE Construction Industry

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Abstract

Since the 1950's, the use of project scheduling tools and techniques has grown, and continues to grow, at a rapid pace with the increasing challenges and risks each day. The construction industry is viewed as one of the largest industries in the United Arab Emirates (UAE), yet no clear statistics have traced the use of scheduling tools and techniques in UAE construction projects. The main objective of this paper is to evaluate the application of project scheduling tools and techniques in the UAE construction industry in terms of the use, benefits and barriers. The study was conducted over a sample of 45 respondents. The study shows that the mainly used technique in the UAE construction industry is the Critical Path Method (CPM). The main identified scheduling tools are Microsoft Project and Primavera P3. The results indicate that the scheduling tools and techniques are applied 50-75% of the time mainly due to company requirements and contract requirements. The main identified benefits of using project scheduling tools and techniques in the UAE construction industry include recovering cost and time overruns and meeting tight deadlines. On the other hand, the main identified barriers discouraging the proper implementation involve insufficient training for employees and lack of knowledge about the project scheduling tools and techniques.

Keywords

Project scheduling, Tools and Techniques, Construction Industry, United Arab Emirates

1. Introduction

Since the 1950's, the use of construction management generally, and the scheduling tools and techniques specifically, has grown and continues to grow at a rapid pace with the increasing challenges and risks each day. The use of project scheduling tools and techniques has become an important means of achieving project objectives through the optimum and efficient use of resources within time and budget constraints. The construction industry in the UAE shares a large sector of the UAE's GDP. In fact, the construction sector's contribution to real GDP expanded from Dh86.1 billion in 2006 to Dh94.7 billion in 2007, around Dh104.4 billion in 2008, Dh105.8 billion in 2009 and nearly Dh114.9 billion in 2010 (Emirates 24/7, 2011).

In a large construction field as that in the UAE, risks and delays must be avoided due to their adverse effect on the project's schedule and overall cost. Construction projects are risky by nature and delays that arise from such possible risks can have adverse outcomes on the quality of work, the performance and morale of laborers, the country's overall country's economy, and the resulting claims and litigations (Pamulu and Bhuta, 2004). In a study of the main causes of delays in the UAE construction field, Faridi and El-Sayegh (2006) found that 50% of construction projects encounter delays due to several reasons and that one of the main reasons behind the delays in the UAE is insufficient early planning of the project and poor site management.

Several studies have been done over the use of project scheduling tools and techniques in the construction field. The literature review indicates that the most commonly used scheduling technique is the Critical Path Method (CPM), while the most frequently used tool or software in the construction industry is Primavera and Microsoft Project. Galloway (2006) studied the application of CPM in the US construction industry and identified the CPM as a widely used scheduling technique by contractors and owners to control, plan, and monitor construction projects and can be used for risk management also. Kelleher (2004) conducted another study over the use of CPM by the top 400 contractors in the US, and found that the percentage of companies using CPM in 2004 had increased compared to 1990 by 75%. In the Gulf region, Shash and Al- Abdullatif (1993) conducted a study of over 200 Saudi contractors to determine the common scheduling techniques in the Saudi Arabia construction field. They found that the CPM and Gantt Charts were the most commonly used planning techniques, whereas the PERT and the GERT were rarely and never used in the Saudi construction field, respectively. Popescu and Borcharding (1975) studied the developments of CPM, PERT and network analysis via computer usage. Their study highlighted the drawbacks of using computers in CPM application during the 1960's and early 1970's. Bell *et al.* (2008) identified, using a case study survey, the commonly used scheduling software in the US and the top users of such software.

Abbasi and Al-Mharmah (2000) developed a study over the top fifty industrial public companies in Jordan in order to analyze the use of project scheduling tools and techniques by the public sector there. The most frequently used project scheduling tools and techniques included the use of MS Project Planner, earned value analysis, bar charts, CPM and WBS; whereas the main benefits obtained from employing such tools and techniques were improvement in work organization, work progress, management of human resources, time utilization, quality of work, and defined goals and objectives. Olateju *et al.* (2011) studied the application of project scheduling tools and techniques in the public sector in Nigeria. The study stated that the most commonly used project scheduling techniques used in Nigeria were Gantt charts, WBS, cost benefit analysis, CPM and project sensitivity analysis, while the most commonly used tool was Project Management software. The distinguished difficulties/barriers affecting the efficient implementation of project scheduling tools and techniques were the lack of project management knowledge, bribery and corruption, the lack of professional training, rigid organizational structure, and lack of leadership commitment. Sukhoo *et al.* (2004) identified the most commonly used project scheduling tools and techniques in the Mauritius construction field, and revealed that the most identified obstacles facing the efficient implementation were the shortage of skilled staff, difficult economic and social conditions, weak political institutions, and cultural resistance to Western concepts; therefore, increasing the level of knowledge about project management and providing professional training to construction participants were recommended.

The review of related literature in highlights the uniqueness of the research in the UAE. The construction industry is viewed as one of the largest industries in the United Arab Emirates (UAE), yet no clear statistics have traced the use of scheduling tools and techniques in UAE construction projects. The main objective of this paper is to evaluate the application of project scheduling tools and techniques in the UAE construction industry in terms of the use, benefits and barriers.

2. Research Methodology

In order to study the use of project scheduling tools and techniques in the UAE construction industry, a survey research approach was implemented in this study. This approach is considered an economical and rapid method for identifying the attributes, aspects, and opinions of a large population from a group of individuals (Luthans and Davis, 1982). A sample of 45 randomly selected participants from the UAE construction industry was tested and analyzed. The instrument of data collection used was an interview-based technique where construction participants (contractors, consultants, owners, etc.) were interviewed to ensure a high response rate. The interviews took place in the construction companies. On average, each interview lasted approximately from 30 to 45 minutes, and the series of interviews lasted for one month. Using the interview process, those who filled out the questionnaire were assured confidentiality of input data and identity. In this study, the sample included contractors, consultants, and clients. A pilot study was done after the survey was prepared to improve the content, validity and time spent of the survey. The survey questionnaire was tested over 3 construction participants, of whom 1 was a contractor, 1 was a consultant, and 1 was a client. The 3 construction participants were excluded from the survey sample. After testing the survey and taking the 3 respondents' comments and feedback, the questionnaire was improved in terms of wording, presentation, and time needed to complete it. After that, the survey was distributed. Table 1 shows the respondents' profile.

Table 1: Respondents' Profile

Category	Respondents		
	Number	%	
Years of experience	> 20 years	2	04.5
	11 - 20 years	18	40.0
	< 10 years	25	55.5
Role	Owner Representatives	5	11.1
	Consultants	9	20.0
	Contractors	31	68.9
Average Project Size	< 50 (Million AED)	16	35.6
	50 – 100 (Million AED)	20	44.4
	> 100 (Million AED)	9	20.0

Note: 1 US\$ is equivalent to 3.67 AED (2014)

3. Results & Analysis

3.1 Use of Scheduling Techniques and Tools in the UAE Construction field

Thirty-two (71%) respondents stated that they are using scheduling techniques on their projects. The rest

of the analysis is based on the responses of those who use scheduling techniques (i.e. 32 responses). 53% of them strongly agreed that using scheduling techniques is important, while 50% of them assured the importance of using such scheduling techniques to the successful project delivery. As for the motivation of using these techniques, 50% of the respondents stated that they are using such techniques due to contract requirements, while 47% of them are using scheduling techniques due to company requirements. Majority of respondents (69%) stated that they use scheduling techniques 50-75% of the time, while 25% use the techniques more frequently (75-100%). 53% of the respondents indicated that they make decisions based on scheduling techniques around 50-75% of the time.

The scheduling techniques used in the UAE and their respective response rate are shown in Table 2. The most-used traditional scheduling technique is the Critical Path Method (CPM). Ninety percent of the respondents indicated that they use CPM in their projects. The least used scheduling technique in the UAE construction industry is linear scheduling. Linear scheduling is more appropriate to linear projects such as highways and pipelines. The use of the Work Breakdown Structure (WBS) technique is also common. Only 25% of the respondents use Earned Value Management (EVM) technique. This is alarming as EVM is needed to control the project and ensure that the project is completed on time and within budget.

Table 2: Use of Scheduling Techniques

Technique	Responses	
	Number	%
Critical Path Method (CPM)	29	90
Linear Scheduling	4	13
Time-Cost Tradeoff	9	28
Work Breakdown Structure (WBS)	21	66
Earned Value Management	8	25
Resource Management	8	25

As for the non-traditional scheduling techniques, 17 respondents indicated that they use Mathematical Programming, three respondents use Q-scheduling, one uses Genetic Algorithms and 7 of the respondents indicated that they did not use such non-traditional scheduling techniques in their projects.

As for the use of scheduling tools, 67% stated that they use scheduling tools and these tools are used 50-75% of the time. 50% of the respondents believed that using scheduling tools is highly important, and 60% said that project scheduling tools is highly related to successful project delivery and such tools are used by majority 50-75% in critical decision making. The results revealed that Microsoft Project Planner (MS Project) and Primavera Project Planner (P3) were the most-used scheduling tools by the respondents, while Sure Track Software is the least used scheduling tool. Only 11 respondents stated that they use new scheduling tools such as Vico 5D BIM (2 respondents), Synchro 4D (3 respondents) and Fast Track Schedule (6 respondents).

3.2 Benefits and Barriers

The second objective was to assess the benefits of applying project scheduling tools and techniques. The benefits are determined through literature review and included in the survey. The respondents were asked to evaluate each of the benefits on a scale from 1 to 5 (Strongly agree = 5, Agree = 4, Neither = 3,

Disagree = 2 and Strongly Disagree = 1). The weighted average was then calculated for each benefit. Table 3 shows the benefits ranked based on their weighted average. The top five benefits include helping in recovering cost and time overruns, meeting tight deadlines, minimizing associated delays and avoiding unexpected risks or challenges, defining goals and objectives, and revealing the available or needed manpower, material, and equipment for each project.

Table 3: The Benefits of Project Scheduling Tools and Techniques

Rank	Benefit	Average
1	Helps in recovering cost and time overruns	4.56
2	Meet tight deadlines	4.53
3	Minimize associated delays and avoid unexpected risks or challenges	4.44
4	Defined goals and objectives	4.40
5	Reveal the available or needed manpower, material and equipment for each project	4.35
6	Helps in accomplishing an effective control over the project time and budget during its life cycle	4.33
7	Measure work progress	4.30
8	Meet contract agreements or owner's desires	4.28
9	Can assist in solving claims and disputes	4.26
10	Improved planning before the work starts (and improved planning for future projects)	4.23
11	Report information and project data for future use	4.23
12	Perform risk analysis	4.23
13	Improved quality of work	4.19
14	Perform feasibility studies	4.12
15	Evaluate the available alternatives or solutions to problems and the answer to "what if" analysis	4.12
16	Serves in achieving the efficient resource utilization between the available projects by sharing the resources available in an efficient manner	4.09
17	Achieve the rewards assigned for early project completion	4.07
18	Facilitates communication between project team	4.05

Similarly, the respondents were asked to assess the barriers discouraging the proper implementation of project scheduling tools and techniques in the UAE construction industry. Table 4 shows the benefits ranked based on their weighted average. The top five barriers included: insufficient training for employees, lack of proper communication, lack of expertise or specialists, lack of knowledge about the tools and the techniques, and lack of resources and budgets for proper training.

Table 4: Barriers Discouraging Proper Implementation

Rank	Barrier	Average
1	Insufficient training for employees	4.31
2	Lack of proper communication	4.27
3	Lack of expertise or specialists	4.20
4	Lack of knowledge about the tools and the techniques	4.18
5	Lack of resources and budgets for proper training	4.16
6	Lack of client support	4.11
7	Resistance to change	4.11
8	Rapid development in project scheduling tools and techniques	4.09
9	Lack of management support	4.09
10	High cost of implementation	4.04
11	Time consuming	4.02
12	Lack of available database of previous projects	3.98

3.3 Comparison between Several Countries

Table 5 summarizes a comparison between the study results of the UAE with similar studies done in Jordan (Abbasi and AL-Mharmah, 2000), Nigeria (Olateju *et al.*, 2011) and Mauritius (Sukhoo *et al.*, 2004). Bar Charts were found to be the mostly used scheduling technique in the other three countries in comparison to CPM which is the main scheduling technique in the UAE. The UAE and Jordan revealed MS Project as a common scheduling tool between the two construction industries. The use of P3 is more in the UAE than other countries. Lack of knowledge and lack of expertise or specialists were the mutually-found barriers between the four studies, whereas better time utilization and better communication were the two common perceived benefits between the studies.

Table 5: Comparison between the UAE, Jordan, Nigeria, and Mauritius construction industries

Country	Technique	Tool	Benefits	Barriers
UAE	CPM	Primavera (P3)/ MS Project	Helps in recovering cost and time overruns	Insufficient training for employees
			Meet tight deadlines	Lack of proper communication
			Minimize associated delays and avoid unexpected risks or challenges	Lack of expertise or specialists
Jordan	Gantt -Bar Chart	MS Project	Known work progress	Difficulties in estimating activity cost
			Better work organization	Lack of Knowledge
			Defined goals and objectives - better time utilization	Change in authority
Nigeria	Gantt -Bar Chart	Project Management Software	Known work progress	Lack of PM knowledge
			Better communication	Bribery & corruption
			Good management of resources	Lack of professional training
Mauritius	Gantt -Bar Chart	Project Management Software	Better time utilization	Shortage of trained staff
			Improved communication	Difficult economic conditions
			Meet contract requirement or owner's desires	Cultural resistance to change

4. Summary and Conclusion

The use of project scheduling tools and techniques has become an important means of achieving project objectives through the optimum and efficient use of resources within time and budget constraints. In a large construction industry like that in the UAE, it is highly important to analyze the current state of usage of such scheduling tools and techniques and study the benefits and barriers of using them. The study of project scheduling tools and techniques in the UAE construction industry revealed that the level of application of such scheduling tools and techniques are considerably high due to the good level of education and experience of the surveyed participants. Based on the barriers identified by the study, the

following is recommended to recover the state of usage and improve the implementation of project scheduling tools and techniques:

- The government is encouraged to establish a planning benchmark system and enforce the use of project scheduling tools and techniques based on the country and construction market requirements.
- Construction companies should set an annual budget to cover the cost of training their employees to update their usage knowledge with the launching of new versions of such tools and techniques.
- Project Management professionals should be hired to ensure the proper implementation of project scheduling tools and techniques.
- Gradual implementation of project scheduling tools and techniques and raising the level of awareness about their importance is highly recommended.

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