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Enablers and Barriers to Project Planning and Scheduling Based on Construction Projects in Oman

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Abstract: While the concepts of planning and scheduling seem to be adequately discussed in the project management literature, relatively few examples of factors specifically affecting the performance of planning and scheduling are to be found. The study reported in this paper investigated a set of factors identified as enablers and barriers to successful project planning and scheduling of construction projects in Oman. The study adopted a questionnaire-based survey to measure the impact of each factor. The data were analysed using the relative impact (or importance) index (RII). On the basis of RII rankings, the results revealed that the identified enablers and barriers were all considered significant. This could imply that all of the factors should be considered equally from the perspective of project planning and scheduling, including schedule control. In addition, the results suggest that project managers should pay attention to the more significant barriers to mitigate their potential impacts on planning and scheduling. Recommendations for mitigating those barriers are presented. The study provides useful insights into the impact of various factors on the planning and scheduling performance of construction projects in Oman and how improvement might be achieved.

Keywords: Project planning, Scheduling barriers, Scheduling enablers, Relative impact index, Oman

INTRODUCTION

Planning and scheduling have a significant role in controlling project performance (Luu et al., 2009) and form an integral part of project management. They are often referred to as if they were synonymous rather than two distinct stages in a process for estimating the duration of the project and for providing a workable basis upon which activities can be implemented (Ahuja and Thiruvengadam, 2004). A prerequisite for successful scheduling is the definition of all the activities required to deliver the project's scope, the correct sequencing of those activities and the addition of resources and time to create the schedule (Shash and Ahcom, 2006; Kerzner, 2013). It would, however, be wrong to give the impression that these two stages are separate. Some iteration between planning and scheduling is necessary to achieve an optimal schedule that is both practicable and realistic in reflecting the risks in the project. Luu et al. (2009) showed that failure to identify and assess risks is likely to be prejudicial to the quality of planning and scheduling and, ultimately, to project performance. Understanding the distinctions between these two stages is, therefore, necessary (Kerzner, 2009). In this sense, the quality of

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the schedule is a function of the rigor and care that have gone into planning at the front end of the project where its scope was initially defined, through project execution and close out.

It is reasonable to argue that the quality of a project schedule is a key factor both in determining the duration of the project with sufficient accuracy (for the current stage in the project) and, later, in managing the physical execution of the work. Enablers and barriers to reliable project planning and scheduling are therefore of interest. Iyer and Jha (2006) have noted that the identification and measurement of the factors responsible for either enhancing or impairing schedule performance are sometimes ignored by project managers. Greater awareness of these factors would help to improve the likelihood of successful project planning and scheduling.

This paper presents the findings of a study aimed at understanding the enablers and barriers to successful project planning and scheduling and, in particular, the control of schedules during the execution of construction projects. The context is Oman, where a number of shortcomings in project management have been reported, including poor control over scope and time and cost overruns (Ballal, Elhag and Ambusaidy, 2007; Alnuaimi et al., 2009).

CONTEXT OF THE STUDY

Oman is considered to be one of the most regulated and attractive markets in the Middle East (Joshi and Ghosal, 2013). Its construction industry has been experiencing a boom with a yearly growth rate estimated between 5% and 7% (David et al. 2013). Under the current eighth five-year plan (2011–2015) and until end 2017, the country will invest heavily in infrastructure and construction, with total outputs for the plan forecasted to exceed approximately USD 50b (David et al., 2013; Oxford Business Group, 2014). The Oman Tender Board is an independent governmental unit responsible for tendering processes of all public tender projects with estimated capital costs of more than 3 million Omani Rials (USD 1 = 0.385 Omani Rial). These projects are managed through either lump sum or re-measurable contracts according to the Oman Standard Documents for Building and Civil Engineering Works.

Some of these large or mega construction and infrastructure projects have been subject to contractual problems of schedule delays and cost overruns (Alnuaimi et al., 2009; Oxford Business Group, 2013; Oxford Business Group, 2014). This problem is not confined to Oman. Time and cost overruns are reported to be commonplace in many developing countries (Ahadzie, Proverbs and Olomolaiye, 2008). Alnuaimi and Al Mohsin (2013) quantified the delays of a sample of construction projects in Oman completed in 2009 and 2010 and found that these projects were delayed on average 42% beyond the original contract period.

FACTORS AFFECTING SCHEDULING PERFORMANCE

Despite the development and integration of more sophisticated approaches and tools within project planning and scheduling, some projects fail to meet their original commitments (Moneke, 2012; Zhou et al., 2013; Taroun, 2014). Taroun

(2014) found that poor project management of schedules was a major reason for such failures. This weakness can result in unintentional process and technical constraints, such as the inefficient management and allocation of resources and, hence, unrealistic schedules (Bevilacqua, Ciarapica and Giacchetta, 2009; Luu et al., 2009). Project planning can also be affected by management factors relating to technical (e.g., resources and technology) and non-technical (e.g., human resources) risks and uncertainties that can act as barriers to effective scheduling and schedule control (Schatteman et al., 2008). These factors and others that are relevant to research within both national and international contexts of the study reported here are summarised in Table 1.

Table 1. Summary of Findings from Studies Highlighting Factors That Affect Scheduling Performance

Research Area	**Significant Factors Studied**	**Geographical Contexts**	**References**
Development and scheduling	Complex communication, lack of trading-off between schedule and cost, changes and risks, shortage of resources, lack of disciplined management, complexity of the schedule, lack of knowledgeable team	USA	Voth (2009)
Quantification of uncertainty and risk in scheduling	Incompetent team and leadership, inaccurate schedule estimates, shortage of resources	Canada	Mulholland and Christian (1999)
Efficiency of resource-driven scheduling techniques	Lack of knowledge of techniques, lack of team training, uncertain estimates of schedule and budget	Malaysia	Hameed (2005)
Outcomes of scheduling performance	Lack of coordination, lack of knowledgeable project managers, socioeconomic environments, indecisive project team, insufficient consideration of stakeholders' perspectives	India	Iyer and Jha (2006)
Enhancement of scheduling performance	Poor site management, poor coordination among parties, inadequate competence of the project team	Singapore	Hwang, Zhao and Ng (2013)
Effectiveness of scheduling control	Inaccurate estimation and forecasting of the schedule in planning, lack of efficient resources, inadequate investment in manpower responsible for the implementation and control of the schedule	Nigeria	Ibironke et al. (2013)

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Table 1. (*Continued*)

Schedule pressure on construction productivity	Proactive planning, team motivation, effective communication mechanisms, realistic scheduling	Singapore	Nepal, Park and Son (2006)
Causes of delivery delays and cost overruns in construction projects in the Gulf region	Incompetent approval of drawings, inadequate early planning and slowness of owners' decision-making process	UAE	Faridi and El-Sayegh (2006)
	Lack of experienced team attributed to the considerable amount of large or more innovative construction projects, undersupply of manpower in the industry	Saudi Arabia	Al-Kharashi and Skitmore (2009)
	Owner's additional works, poor communication between relevant governmental units and the owner, unrealistic design periods, non-availability of records of similar projects, non-availability of overall planning	Oman	Alnuaimi et al. (2009)
	Poor project management factors, client's administration, site supervision practices	Kuwait	Al Tabtabai (2002)
	Design changes, labour shortages, deficient estimates, cash flow planning	Qatar	Jurf and Beheiry (2012)
	Lack of efficient design and coordination integration in planning	Bahrain	Johny (2012)

Identification of Factors Measured in the Study

On the basis of the literature review, including the aforementioned studies, a list of 21 factors were adopted and segregated into two groups: one set of barriers and another of enablers. These are presented in Table 2. Although the factors do not exhaustively reflect the nature of construction projects, they were considered to be the most relevant to this study. To further support the adoption of these factors, two assumptions were made in light of previous studies: first, these factors have been commonly associated with planning and scheduling and second, each factor or criterion already embodies significant sub-factors to the extent that it is not necessary (or realistic) to detail each and every facet. It is suggested that a priority for project managers and project planners should be the factors at particular life-cycle stages, as reflected in Table 2.

Table 2. Criteria Used to Identify Potential Enablers and Barriers to Planning and Scheduling

Label	Factors Identified as Barriers	Stage of Planning and Scheduling in Which Those Factors Should Be Properly Addressed			Relevant Studies
		Development	Implementation	Control	
B1	Lack of effective leadership	✓	✓	✓	Voth (2009); Müller and Turner (2010)
B2	Insufficient support from project stakeholders in the development of plans and schedules	✓	✓		Iyer and Jha (2006); Davis (2014)
B3	Poor decision-making regarding activity criticality	✓	✓		Hameri and Heikkilä (2002); González et al. (2014)
B4	Lack of education and training in planning and scheduling	✓	✓	✓	Nepal, Park and Son (2006); Hameed (2005); Yang, Huang and Wu (2011)
B5	Incompatibility of planning methods with the project schedule's nature (i.e., complexity and size)	✓	✓		Jurf and Beheiry (2012); Burke (2003)
B6	Absence of schedule contingency	✓	✓		Hoel (1999); Mulholland and Christian (1999)
B7	Trivial control and reporting system between management levels			✓	Voth (2009); De Snoo, Van Wezel and Jorna (2011)

(*Continued on next page*)

Table 2. (*Continued*)

B8	Absence of resource-constrained scheduling for dealing with uncertainty problems	✓	✓		Elmaghrab, Herroelen and Leus (2003); Abeyasinghe, Greenwood and Johansen (2001)
B9	Absence of new technology and software for planning and scheduling	✓		✓	Noronha and Sarma (1991); Taroun (2014); Mokhtari, Baradaran and Salmasnia (2011)
E1	Well-documented inputs, milestones and deliverables in scheduling	✓			Odusami, Iyagba and Omirin (2003); Kerzner (2013)
E2	Proficiency of team in managing scheduled activities, deviations and corrective actions	✓		✓	Voth (2009); Hameed (2005); Hwang, Zhao and Ng (2013)
E3	Cost-efficiency in accelerating and reworking schedules and their activities		✓	✓	Ibironke et al. (2013); Mulholland and Christian (1999)
E4	Reliability of detailed schedules	✓			Luu et al. (2009); Iyer and Jha (2006)
E5	Focusing on a holistic approach rather than on completion of individual activities			✓	Cerveny and Galup (2002); Thornley (2013); Yang (2007)

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Table 2. (*Continued*)

E6	Proper understanding of the interrelationship (alignment) between scope, schedule and budget	✓		✓	Kerzner (2013); Alsakini, Wikström and Kiiras (2004)
E7	Fast re-planning and recovery from unexpected changes in the baseline schedule		✓	✓	Ibironke et al. (2013); Kerzner (2013)
E8	Effective tracking of in-progress schedule deviations			✓	Ahsan and Gunawan (2010); Voth (2009)
E9	Availability of alternate planning methods to overcome shortcomings with existing methods	✓			Bokor, Kocsis and Szenik (2011); Cegarra and Wezel (2011)
E10	Maintaining schedule quality control by excluding unintended operational behaviour		✓	✓	Moneke (2012); Steyn (2002); Hussein and Klakegg (2014)
E11	Effectiveness of resource levelling in scheduling		✓		Abeyasinghe, Greenwood and Johansen (2001); Mokhtari, Baradaran and Salmasnia (2011)
E12	Efficiency of managerial support for motivational and training programmes	✓	✓	✓	Müller and Turner (2010); Yang, Huang and Wu (2011)

RESEARCH METHOD

The study reported here is part of a larger study related to understanding the application of project planning and scheduling in construction projects in Oman. This study aimed at understanding the potential impact of enablers and barriers and their relative importance from a project planning and scheduling perspective. A structured questionnaire-based survey was used for this purpose because it can be regarded as a positivistic approach to testing the applicability of the research area where theory is being developed (Fellows and Liu, 2009). The questionnaire was piloted by individuals selected from different construction firms to ensure the clarity of its content. It was then sent to a selected number of individuals and groups engaged in public and private construction organisations and projects in Oman. The respondents were selected through a non-probability simple random selection from a public construction organisation database, as well as convenience sampling procedures. The respondents were involved in a number of large- to medium-sized construction projects located in the capital city of Oman, Muscat. Our aim was also to involve a representative sample of respondents in terms of their work experience, age and education levels.

Table 3. Background Profiles of Respondents

Characteristics		**Responses**
Job identification (All respondents)	Junior project engineers	33
	Senior project engineers	24
	Project managers	9
	Quantity surveyors	7
	Operations managers	3
	Risk managers	1
Age (years)	20–40	47
	41–60	30
Years of experience (years)	11–15	13
	6–10	17
	1–5	4
	16–20	16
	> 21	16
	Unspecified	11
Organisations	Contracting firms	33
	Public firms	20
	Construction management firms	16
	Consultancy and design firms	6
	Facility management	2
Respondents' enrolment in projects	Construction	24
	Operation	20
	Planning	16
	Design	9
	All	8
Status of projects (number of respondents)	On schedule	41
	Behind schedule	36

The self-administered questionnaire consisted of three sections. The first section captured the basic profile of the respondents and their projects. The second section was designed to assess potential enablers (12 enablers) to planning and scheduling, and the third section was designed to assess potential barriers (nine barriers). The strength of these factors' significance in the respondents' perspectives was based on a 7-point Likert scale (i.e., 1 = Strongly disagree, 7 = Strongly agree). Of 130 questionnaires distributed based on the above selection criteria, 80 questionnaires were returned and 77 were considered complete and valid (i.e., N = 77) for use in the analysis of responses to enablers and barriers. A summary of respondents and their projects is shown in Table 3.

DATA ANALYSIS APPROACH

Relative Impact Index Factor (RII)

The dispersion of the responses was initially checked using SPSS for descriptive statistics (means, standard deviations). The results showed that the majority of variables tested (factors) tended to have distributions skewed around their mean values. Consequently, the use of descriptive and multivariate statistical tests, such as analysis of variance (ANOVA) and correlation, were not thought to be appropriate (Hair, 2009). As the primary aim was to measure the extent to which these adopted factors are significant for current practice in planning and scheduling, the study adopted the RII to rank the impact of the enablers and barriers as considered by the respondents based on the occurrences of these factors in their routine work. The RII is a simple statistical measure and has been used in previous studies of construction-related problems, as demonstrated by, for example, Ghosh and Jintanapakanont (2004), Assaf and Al-Hejji (2006) and Hwang, Zhao and Ng (2013). The ranks of enablers and barriers were computed using the following formula adopted from Hwang, Zhao and Ng (2013) and Holt (2014):

$$RII = \sum (7*n_7 + 6*n_6 + 5*n_5 + 4*n_4 + 3*n_3 + 2*n_2 + n_1) \div 7*N$$

The RII ranges from 0.143 to 1 (i.e., a higher value of RII indicates a higher impact of the factor).

Where n is the constant responding to the weight given to each factor by the respondents (on a 7-point scale), for example, n_7 is the number of respondents giving each factor the highest rank on a 7-point Likert scale (i.e., 7 = Strongly agree) and n_1 is the number of respondents giving each factor the lowest rank on a 7-point Likert scale (i.e., 1 = Strongly disagree). The use of a 7-point Likert scale might require highly sensitive respondents who can differentiate among different levels of ratings. However, a study by Colman, Morris and Preston (1997) compared the association or equivalence among respondents' ratings using 5-point scales and 7-point scales, and the results indicated a high correlation (or equivalence) among the ratings using both scales.

The capital *N* is the total number of respondents used in the analysis and the RII values were computed with respect to the total number of responses (*N* = 77). The level of significance of each individual factor is measured according to the

following scale adapted from Kazaz, Manisali and Ulubeyli (2008), where $0.143 \leq RII \leq 0.286$ (not significant), $0.286 < RII \leq 0.428$ (somewhat significant), $0.428 < RII \leq 0.571$ (moderately significant), $0.571 < RII \leq 0.714$ (significant), $0.714 < RII \leq 0.857$ (very significant) and $0.857 < RII \leq 1.0$ (extremely significant).

DATA ANALYSIS AND FINDINGS

Impact Indices and Ranking of Barriers

The indices and associated rankings of the barriers are displayed in Table 4 and are discussed in the order in which they appear. According to the scale adopted by Kazaz, Manisali and Ulubeyli (2008), all barriers, except for one, are considered significant (i.e., $0.610 < RII \leq 0.688$). Factor (B2) "Lack of support from project stakeholders in the development of plans and schedules" is shown to be highly significant (RII = 0.725). In this regard, it has been argued that successful project execution depends on the consideration of the needs and deliverables of all stakeholders involved in planning prior to the development of the schedule (Halpin and Riggs, 1992; Chitkara, 2002; Weaver, 2009).

The differences in the indices of the remaining factors are, in most cases arithmetically small to justify any claims other than their relative impact rankings. Nonetheless, these factors deserve discussion. Poor decision-making regarding activity criticality (i.e., schedule activities exposed to critical constraints related to resources and dependencies) was ranked second in significance (RII = 0.688). This seems to imply that attention needs to be paid to identifying such activities in the planning phase prior to scheduling. According to Abeyasinghe, Greenwoo and Johansen (2001) and Trietsch (2005), the lack of proper understanding of activity criticality and related resources in project planning can result in "aggressive" schedules with high levels of uncertainty.

The absence of resource-constrained scheduling was found to be the third most significant barrier (RII = 0.681). Schedule-based constrained resources have been found to be a common problem in projects involving a large number of inter-dependent activities (Rivera and Duran, 2004). The planner needs to identify and define such resources at the planning stage; this is important in the context of the inherited uncertainty in the schedule and can help to avoid constraints in schedule execution (Abeyasinghe, Greenwood and Johansen, 2001; Hartmann and Briskorn, 2010). According to Table 4, the remaining barriers were perceived to have almost equal weights of potential significance to schedule execution and control.

Table 4. Impact Indices and Ranks of the Barriers to Planning and Scheduling

#	Barriers in Descending Order	RII		
		Value	Rank	Category of Significance
B2	Insufficient support from project stakeholders in planning and the preparation of schedules	0.725	1	VS
B3	Poor decision-making regarding activity criticality	0.688	2	S
B8	Absence of resource-constrained scheduling for dealing with uncertainty problems	0.681	3	S
B9	Absence of new technology and software for planning and scheduling	0.671	4	S
B1	Lack of effective leadership	0.669	5	S
B4	Lack of education and training in planning and scheduling	0.655	6	S
B6	Absence of schedule contingency	0.646	7	S
B7	Trivial control and reporting system between management levels	0.646	7	S
B5	Incompatibility of planning methods with the project's nature (i.e., complexity and size)	0.610	8	S

Notes: VS = Very significant; S = Significant

Impact Indices and Rankings of Enablers

Table 5 presents the results of the impact indices (RII) computed for the enablers. The overall findings reveal that the respondents consider almost all identified enablers as highly significant ($0.711 \leq RII \leq 0.746$). Nonetheless, the reliability of detailed schedules was ranked first as a potential enabler to successful project planning and scheduling (RII = 0.746). In this respect, the reliability of detailed schedules set up during planning can be considered an essential step that must be addressed prior to project execution. This was followed by factors concerned with the effectiveness of resource levelling in scheduling and sufficient managerial support for motivational and training programmes (RII = 0.740). The involvement of the project manager in integrating the project's plans has been highlighted as an important consideration (Mulholland and Christian, 1999; Voth, 2009). Mubarak (2010) noted that the precise loading and levelling of resources in the schedule can help interpret the trade-off between schedule outcomes (i.e., durations) and the cost of resources. Table 5 shows that all other enablers were perceived as, more or less, equally important for project planning and schedule performance.

Table 5. Impact Indices and Ranks of the Enablers to Planning and Scheduling

#	Enablers in Descending Order	RII		
		Value	Rank	Category of Significance
E4	Reliability of detailed schedules	0.746	1	VS
E11	Effectiveness of resource levelling in scheduling	0.740	2	VS
E12	Efficiency of managerial support for motivational and training programmes	0.740	2	VS
E7	Fast re-planning and recovery from unexpected changes in the baseline schedule	0.736	3	VS
E1	Well-documented inputs, milestones and deliverables in scheduling	0.733	4	VS
E5	Focusing on a holistic approach rather than on the completion of individual activities	0.733	4	VS
E3	Cost-efficiency in accelerating and reworking schedules and their activities	0.731	5	VS
E2	Proficiency of team in managing scheduled activities, deviations and corrective actions	0.727	6	VS
E9	Availability of alternate planning methods to overcome shortcomings with existing methods	0.727	6	VS
E6	Proper understanding of the interrelationship (alignment) between scope, schedule and budget	0.724	7	VS
E8	Effective tracking of in-progress schedule deviations	0.711	9	S
E10	Improving schedule quality control by considering unintended human operational behaviours in scheduling	0.705	10	S

Notes: VS = Very significant; S = Significant

RELIABILITY OF RANKINGS: KENDALL'S CONCORDANCE TEST

The Kendall coefficient of concordance is used as a non-parametric test to examine the overall agreement between several sets of judges assessing a set of tested variables or items (Field, 2005). In other words, Kendall's coefficient of concordance indicates the degree of association of ordinal assessments made by multiple respondents when rating the same investigated criteria. It ranges from 0 to 1, where a higher value of (W) means a stronger association among rankings. Moreover, the level of significance (*p*-values) associated with the W test is used to determine whether the level of agreement among respondents on such rankings is random or rated by chance (Siegel and Castellan, 1988). For the purpose of this study, the following hypotheses were developed:

> H_0: There is no significant association between the overall rankings of all respondents (i.e., rated by chance or non-independently).

H_1: Rankings by all respondents are significantly associated (rated independently not by chance).

At the 95% level of confidence, reject H_0 if the *p*-value ≤ 0.05 (i.e., accept H_1).

Table 6. Kendall Coefficients of Concordance (W) Obtained for Enablers and Barriers

Reliability Test	**Barriers (B1 to B9)**	**Enablers (E1 to E12)**
Kendall's W	0.040	0.028
Chi-square	19.744	19.145
p-value at the 95% confidence interval	0.011	0.050

Table 6 indicates the level of concordance of all respondents on the rankings of the factors related to enablers and barriers. The results revealed that there is a relatively weak level of concordance for barriers (W = 0.040, Chi-square = 19.744, *p*-value < 0.05; reject H_0) and enablers (W = 0.028, Chi-square = 19.145, *p*-value < 0.05; reject H_0). However, the statistical level of significance indicates that the level of non-concordance between respondents on the overall rankings of both enablers and barriers randomly occurred. Therefore, it can be concluded that the study's overall rankings are reliable.

Recommendations to Mitigate Barriers

While accepting that the results of the study are limited to a particular context and the adoption of convenience sampling, they have helped to improve understanding of the factors affecting project planning and scheduling of construction projects in Oman. Project managers in Oman may help improve planning and scheduling if they are able to mitigate the more significant barriers. Key decision makers on projects in Oman should also take into account the enablers that can support the goal of developing more effective planning and scheduling systems for construction projects so that the gap between actual and planned outturn can be closed, or at least reduced to a more acceptable level.

Efficiency of Stakeholders' Engagement and Decision

The findings imply that incorrect utilisation of project planning and scheduling systems is to a large extent caused by insufficient support from and the integration of, project stakeholders in setting the project plan. This means that project stakeholders in Oman should not only rely on what is documented in early planning but also provide their own visions of what should be incorporated at an early stage in a project, i.e., at the front end. Moreover, stakeholders' commitment and support should not be limited to initial project planning, but should be visible throughout the project life cycle.

Effectiveness of Decision-Making Regarding Activity Criticality

Sufficient involvement and support of stakeholders might also result in increasing the efficiency of decision-making regarding the activity criticality. González et al. (2014) argued that project managers should have sufficient experience to criticise project plans in terms of resource criticality and dependencies. This would imply that project managers and planners in Oman should prioritise their resource allocations during project planning and scheduling. In other words, key decision makers should ensure that the right resources are assigned to the right activities to help minimise the effects of resource constraints that, in turn, might result in unrealistic schedules with many uncontrollable uncertainties associated with critical activities and resource dependencies. This focus on the management of activity-based constrained resources and dependencies should be applied to the entire schedule including non-critical path activities.

Adoption of Computerised Approaches and Techniques

The findings revealed that the failure to adopt new technology, such as computerised approaches and software models for project planning and scheduling, was a significant barrier to project planning and scheduling. The complex nature of many construction projects should encourage project managers in Oman to adopt new computer-based approaches and/or optimisation tools. This might allow them to overcome operational errors in scheduling and take corrective action. In this regard, White and Fortune (2002) concluded that the lack of understanding of the characteristics of different planning methods and tools can lead to misinterpretation of the inputs needed for scheduling. In other words, project managers should bear in mind that the successful adoption of more advanced computer-based scheduling approaches can help resolve the potential limitations and shortcomings of existing planning and scheduling methods. However, coping with new technology and techniques requires a strong management emphasis on team training, IT literacy and the willingness to accept new technology, and should be considered as an essential part of project change management. According to Nah, Lau and Kuang (2001), it is important that project planners embrace such technology and understand how a change of this nature can contribute to the success of planning. Furthermore, Bates and Gawande (2003) found that the most effective adoption of technology was its use to communicate information, reduce trivial reporting and enhance the efficiency of decision-making when contemplating the need for corrective measures in case of schedule deviations.

Effectiveness of Project Leadership Team Involved in Planning and Scheduling

Effective leadership is important for promoting and integrating new approaches to the project. Project leadership with insufficient knowledge has been found to be one of the most critical issues affecting schedule performance on construction projects in general (Hyväri, 2006; Iyer and Jha, 2006; Müller and Turner, 2010). For project managers in Oman, this means placing more emphasis on the performance of site team managers and other personnel in terms of their effectiveness in project planning and scheduling, including schedule control. To

achieve this, key decision makers in Oman should also invest more in training the project team because, as with other construction projects, this issue has been found to be a major cause of failure in the implementation and control of schedules (Hameed, 2005; Moneke, 2012). For efficiency, the project team should also pay particular attention to the enhancement or adjustment of their management roles and operational behaviours (or attitudes) in planning and scheduling.

CONCLUSION

This study identified a number of enablers and barriers to project planning and scheduling for construction projects in Oman. The literature review revealed a need for more exploration and assessment of project planning, particularly in regard to the factors affecting schedule execution and control.

The overall results imply that the more significant factors should be prioritised to improve the project planning and scheduling. The performance or effectiveness of current planning and scheduling can be improved if project managers and planners consider the impact of the different factors. The efficient mitigation of the investigated barriers can help overcome the shortcomings of current planning and scheduling practices in construction projects, not only in Oman but also in other countries. Attention should be paid to the front end of the project because placing effort there is far better than reworking the project schedule during execution. To conclude, the study provides insight on the need for a more comprehensive assessment of enablers and barriers, particularly impacting project planning and scheduling from the perspectives of project stakeholders.

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