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Knowledge and Technical Skills of Project Managers and Time Performance of Power Plant Construction Projects in Iran

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Abstract: The construction industry in Iran is known for its late project delivery. The increasing percentage of incomplete projects calls for comprehensive study. Various factors that include knowledge and technical skills have been hypothesized to influence the time performance of power plant construction projects. This paper aims to examine the knowledge and technical skills of project managers as well as their correlation with the time performance of power plant construction projects in Iran. Thirty technical managers who work in power plant construction sites were surveyed. The descriptive analysis of data indicates that the respondents have minimal knowledge on project time, risk, procurement and scope management. To effectively manage the power plant time performance, project managers need to enhance their knowledge on project structure and risks and opportunity. This study contributes significant findings for the improvement of the power plant industry in Iran.

Key words: Time performance · Knowledge and technical skills · Project managers · Construction management · Power plant construction projects · Iran

INTRODUCTION

In recent years, many studies have focused on the area of project time performance, which is the most critical issue in the field of construction management [1-4]. Time performance is a serious problem because high cost and labor are spent in the attempt to complete the project on time. However, similar to other countries, Iran commonly encounters delays in construction projects, including power plants [5]. According to the reports of the Office for Supervision and Evaluation of Designs [6] in 2001, 2002 and 2003, Iranian construction projects have experienced delays of about 30, 74.5 and 75% respectively. The increasing percentage of delay indicates a serious problem in Iranian construction projects, which could be costly for both the owner and the contractor.

Iran is one of the pioneers among developing economies in the Middle East that focuses on the construction industry as an important area for development. Power plant construction projects are considered as the most important because of their significant influence on Iran's development. In addition, power plant constructions are considered as one of the largest sectors in Iran's economy and the government spends billions of dollars every year in major projects [7]. Power plants provide highly significant contribution to the high electric power consumption of approximately 75 million Iranians [8]. Therefore, numerous power plants need to be developed to cover the vast area of Iran. Given that population growth is expected to reach 90 million in the next 10 years and several old power plants are becoming inefficient, different stations are being continuously built and developed. In total, 29 power plants are under construction in Iran. Power plant construction is a national project and is initiated by the Iranian government. In terms of implementation, the Ministry of Power would award the project to either the main contractor (who would be involved in managing and supervising the project) or the ministry, who would subsequently appoint a sub-contractor to do the project.

A number of studies have assessed the cause of delay of construction projects in Iran, several Middle Eastern countries and other developing countries. These include: Al-Barak [9], Assef *et al*. [10], as well as Al-Khalil and Al-Ghafly [11] in Saudi Arabia: Mezher and Tawil [12] in Lebanon; Mansfield *et al*. [13] as well as

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Aibinu and Jagboro [14] in Nigeria; Al-Momani [15] in Jordan; Koushki *et al*. [16] in Kuwait; as well as Faridi and El-Sayegh [7] in the United Arab Emirates (UAE). Previous studies on the Iranian construction industry focused on examining the factors that cause delay [17,18,5]. Furthermore, these studies have identified that the lack of professional and efficient project management is an undeniable problem.

Voetsch *et al*. [19] found a significant and positive relationship of management knowledge and technical skills of project managers with the time performance of the construction projects. Management knowledge was described by the Project Management Institute (PMI) [20] to include nine knowledge areas used to support the five processes of project development stages, which are initiating, planning, executing, controlling and closing. These knowledge areas in project management are: *integration*, *scope*, *time*, *cost*, *quality*, *human* resource, *communications*, *risk* and *procurement*. On the other hand, El-Sabaa [21] defined technical skills *"as an understanding of and proficiency in, a specific kind of activity, particularly one that involves methods, processes, procedures or techniques"*. Goodwin [22] defined technical skills as an important and useful skill of project management, as well as explained the worthiness of examining the extent to which technical skill is an essential requirement for the project manager defined. Ives [23] likewise found technical skills as one of the success attributes of a project manager.

This research aims to investigate the knowledge and technical skills of project managers in Iran and to examine the relationship between these skills and the time performance of power plant projects. A questionnaire survey was conducted among the respondents who are, or has been, technical managers in power plant construction sites in Iran. This research would contribute to the knowledge gap on power plant construction from the perspective of project management.

Literature Review

Construction Project Delay: Construction is one of the critical stages in any project development. This stage normally involves the highest number of parties and workers and becomes the real test of conceptual ideas placed into the blue print. Project management is important in determining the construction success. The primary concern of construction project management is generally agreed to be planning, control and coordination of a project from conception to completion (including commissioning) on behalf of a client [24]. Lindebaum and Jordan [25] highlighted the emphasis on client satisfaction and Phua [26] proposed that the establishment of correlation between resources is important for the attainment of client objectives in terms of utility, function, quality, time and cost. This argument highlights the need to consider the fundamental aspects of project management in project integration, monitoring, as well as control of project contributions and output. Management of the construction process is one of the important categories for a successful project performance [27]. Compared with the other dimensions of project performance, time has been the main concern of many researchers [28,29,30] as almost 99% of construction projects worldwide encounter delays [31]. Assaf and Al Hejji [32] as well as Stumpf [33] indicated that a project completed within the pre- planned time is a rare event despite today's advanced technology and management understanding of project management techniques.

In construction, delay means a time overrun either beyond the contract date or the date that the parties have agreed upon for project delivery, both cases of which are usually costly [34]. According to Sweis *et al*. [31], delay in construction projects is connected to the construction part of the project. The majority of delays occur during the construction phase during which many unpredicted factors are involved [35]. Numerous studies have assessed project delays, such as Al-Barak [9], Mansfield et al. [13], Assef et al. [10], Mezher and Tawil [12], Al-Khalil and Al-Ghafly [11], Al-Momani [15], Odeh and Battaineh [28], Aibinu and Jagboro [14], Koushki *et al*. [16], Faridi and El-Sayegh [7], Assaf and Al-Hejj [32], Alaghbari *et al*. [29], Sambasivan and Soon [30], Levy [27], Ramanathan *et al*. [34], Ibironke *et al*. [38], as well as Le- Hoai *et al*. [1]. Among the important reasons cited by Odeh and Battaineh [28] as well as Sambasivan and Soon [30] are client-related, contractor inefficiency, lack of competent consultant, as well as material and labor problems. More importantly, Asnaashari [18] highlighted project management as one of the top five factors that leads to delay in Iran. According to Khoshgoftar [5], improper planning, poor site and contract management, lack of communication between parties, unskilled sub-contractors and inadequate contractor experience are among the top 10 causes of delays.

Zakeri *et al*. [17], Asnaashari [18] and Khoshgoftar [5] in Iran; Al-Barak [9], Assef *et al*. [10], as well as Al-Khalil and Al-Ghafly [11] in Saudi Arabia; Mezher and Tawil [12] in Lebanon; Mansfield *et al*. [13] as well as Aibinu and Jagboro [14] in Nigeria; Al-Momani [15] in Jordan; Koushki *et al*. [16] in Kuwait; as well as Faridi and

El-Sayegh [7] in the United Arab Emirates (UAE) highlighted the significant influence of the knowledge and technical skills of project managers on time performance of project construction.

Knowledge and Technical Skills of Project Managers: Knowledge is a recurrent combination of experience, values, contextual information and specialist insight that offers a framework for evaluating and incorporating new experiences and information [37]. "*The knowledge often becomes embedded not only in document or repositories but also in routines, processes, practices and norms"* [38]. Project management routines and processes could be divided into five phases and nine knowledge areas [39].

Mohamad [40], Heldmanand and Mangano [2], as well as Kerzner [3] believed that a significant interaction occurs between the different knowledge areas. For instance, project cost management primarily includes consideration on design, value engineering and optimization, estimation, cash flow management, contract administration, as well as financing and cost control. However, in the real world, other knowledge areas would likewise produce significant impacts with varying extents [41]. Mohamad [40] argued that project time management is the least understood concept in the construction industry.

In order to become a successful project manager, one should have relevant experience, knowledge on the required technology and skills in the use of computer as pointed out by El-Sabaa [21] wherein, "*Technical skill involves specialized knowledge and analytical ability in the use of the tools and techniques of the specific discipline, e.g. construction engineering or information systems."*

Khan *et al*. [42] categorized technical skills into the following elements based on IPMA [43]: project management success, interested parties, project requirements and objectives, risk and opportunity, quality, project organization, teamwork, problem resolution, project structures, scope and deliverables, time and project phase resources, cost and finance, procurement and contract, changes, control and reports, information and documentation, communication, start-up, as well as close-out.

A number of general management skills are applicable either only on certain projects or application areas. General management skills comprise much of the foundation for building project management skills and are often essential for the project manager. Hence, general management skills are frequently required on any given project (PMBOK). A few of the necessary skills for a project manager include: leadership, good communication and negotiation, ability to solve problems and organization management. Meredith and Mantel [24] categorized the necessary skills for a project manager into: re-communication, organizational, team building, leadership, coping and technological skills. Katz [44] suggested that effective administration is based on three fundamental improvable skills, namely, behavioral (human), contextual and technical. Despite their interrelation, these skills can be developed independently.

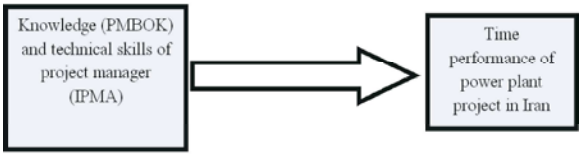

Fig. 1: The Research framework.

The successful project manager possesses technical competence gained through a career in advanced technology environment [45]. In a technical project, the manager needs to thoroughly understand the major technical issues apart from the complex and subtle second-tier problems [46]. This is the reason why project managers should have an engineering background. In general, technical personnel and executives should be assured that the project manager makes the right technical decisions.

Goodwin [22] stated that technical skills are important and useful in project management. He mentioned that the extent of technical skills as an essential requirement for the project manager is worthy of examination. Moreover, Ives [23] likewise found technical skills as one of the success attributes of a project manager.

Research Framework: The purpose of this research is to assess the time performance of power plant construction in Iran. According to previous studies, one of the methods to effectively improve project performance is by enhancing the knowledge and skills of project managers. This research used a framework that was modeled from previous studies. Figure 1 shows the framework arrangement.

To describe the relationship between the knowledge and technical skills of the project manager with the time performance of power plant, nine different knowledge areas of project management should be considered and compared with technical skills. These nine knowledge areas are listed below:

(I) project *integration* management, (ii) project *scope* management, (iii) project *time* management, (iv) project *cost* management, (v) project *quality* management, (vi) project *human* resource management, (vii) project *communications* management, (viii) project *risk* management and (ix) project *procurement* management.

In an attempt to match the technical skills from Khan *et al*. [42] based on IPMA [43] and knowledge [39] based on explanations of the nine project management knowledge areas, related skills relative to each knowledge area are listed in Table 1.

Data Analysis: Descriptive analysis was employed to rank the technical skills and knowledge areas of project managers, whereas the correlation technique was utilized to determine the relationship between time performance and various technical skills possessed by the project manager of the power plant construction. The Statistical Package for Social Sciences (SPSS) version 18.0 for windows was used in the analysis. Responses were encoded into the system using numbers to represent the actual data collected. Data were entered directly into the SPSS using a data entry interface.

Profile of Respondents: Table 2 shows the profile of respondents in terms of age, field of study, years of work experience and experiences in the construction field. Most respondents (40%) are between 51-60 years old, whereas the rest are 30-40 and 40-50 years old (30% per group).

Table 2 shows that 21 project managers worked in the field of civil construction and nine were assigned to electrical, mechanical, or industrial tasks. Only one respondent acquired a degree in project management, whereas the rest are graduates of other management fields. Most respondents (43%) have 11-20 years of experience in the construction industry. Table 2 likewise reveals that 46% of the respondents have 11-20 years experience in the construction of power plant. More than half of the respondents (53%) indicated that they have been a project manager for 1-5 years and 16 (53.3%) have managed only one power plant. All respondents reported a delay in their project, which indicates that all of the projects were completed beyond the planned duration.

Table 3 shows the length of delay that the respondents experienced in their projects. This information can be associated with the different stages of project completion wherein a few constructions are newly started whereas the others are almost finished. Most of the recorded delays fall between 1-10 months (66%).

Table 1: Nine knowledge areas of PMBOK and technical skills of IPMA

Nine knowledge areas of PMBOK	Technical skills of IPMA (2006)
1.Project integration management	Information and documentation
	Project management success
	Interested parties
	Requirements and objects
	Problem resolution
	Control and reports
2.Project scope management	Scope and deliverables
	Project structure
	Changes
3.Project time management	Time and project phases
	Start-up and close-out
4.Project cost management	Cost and finance
5.Project quality management	Quality
6.Project human resource	Project organization management
	Resources
	Teamwork
7.Project communication management	Communication
8.Project risk management	Risk and opportunity
9.Project procurement management	Procurement and contract

Table 2: Profile of respondents.

	Frequency	Percentage (%)
Age		
30-40 years	9	30
41-50 years	9	30
51-60 years	12	40
Specialization (Field of study)		
Civil Engineering	21	70
Others (electrical/mechanical/ industrial)	9	30
Years of Experience or Involvement in General Construction Project		
1-10 years	7	23.3
11-20 years	13	43.3
21-30 years	7	23.3
31-40 years	3	10.0
Years of Experience or Involvement in Power Plant Construction		
1-10 years	9	30.0
11-20 years	14	46.7
21-30 years	7	23.3
Working Experience as a Power Plant Project Manager		
1-5 years	16	53.3
6-10 years	7	23.3
11-15 years	4	13.3
16-20 years	3	10.0
Number of Power Plants managed by the Respondents		
1	16	53.3
2	8	26.7
3	3	10.0
4	3	10.0

Table 3: The delay in the construction process in terms of months.

Delayed	Frequency	Percentage (%)
1-10	20	66.7
11-20	9	30.0
31-40	1	3.3

Reliability: To assess the internal consistency and reliability of the questionnaire, we calculated the Cronbach's alpha value for the technical competency skills of the respondents (project managers of power plants) categorized under the nine related knowledge areas of project management. The cut-off point of 0.5 Cronbach's alpha value indicates sufficient reliability for the five-point scale measurement [47]. Table 4 shows the results of the reliability test.

Teamwork and problem resolution obtained Cronbach's alpha values of 0.440 and 0.426, respectively, which are below the cut-off point. Thus, these items were excluded in the data analysis due to low reliability.

Descriptive Analysis: A number of descriptive analyses were conducted to understand the ranking of project management knowledge failure, knowledge areas and technical skills of power plant construction project managers in Iran. Table 5 lists the results of the analysis of failure of project management knowledge.

Based on Table 5, the respondents recognized knowledge on project time management (M= 4.33) as the most useful to prevent delays in the construction of power plants. Knowledge toward scope (M= 4.11) and toward risk (M= 4.00) follow. Table 6 indicates the level of understanding of the project managers for each knowledge area.

According to the analysis, power plant construction managers are classified based on their level of knowledge toward knowledge management items. Managers showed the least level of knowledge toward project scope management (3.11) and then toward project procurement management (3.27), project time management (3.30) and project risk management (3.34). The knowledge of project managers toward the above mentioned items was lower than the proposed cut-off point (3.50). Therefore, these areas may cause delay in the project time performance.

Correlation Analysis: This section describes the correlation analysis between the technical skills of project managemers and time performance of construction power plants in Iran. This section determines a correlation between technical skills of the project managers and delay of power plant construction projects in Iran. The results of correlation analysis are presented in Table 7.

As shown in Table 7, two variables, namely, risk and opportunity (0.012) and project structure (0.043) are significantly correlated to time performance at $p<0.05$ value.

Table 4: Reliability test for knowledge and skills of project managers.

Variable	Number of items	Cronbach's alpha
A) Project integration management		
1.Information and documentation	1	0.521
2.Project management success	1	0.542
3.Interested parties	2	0.582
4.Requirements and objects	2	0.576
5.Problem resolution	2	0.426
6.Control and reports	2	0.505
B)Project scope management		
1.Scope and deliverables	2	0.595
2.Project structure	2	0.695
3.Changes	2	0.556
C)Project time management		
1.Time and project phases	4	0.565
2.Start-up and close-out	2	0.521
D)Project cost management		
1.Cost and finance	4	0.711
E)Project quality management		
1. Quality	4	0.681
F)Project human resource management		
1.Resources	3	0.633
2.Project organization	2	0.570
3.Teamwork	2	0.440
G)Project communication management		
1.Communication	3	0.674
H)Project risk management		
1.Risk and opportunity	3	0.653
I)Project procurement management		
1.Procurement and contract	6	0.647

Table 5: Failure of project management knowledge.

Failure	Mean	Std. Deviation
Time Management	4.33	.68
Scope Management	4.11	.89
Risk Management	4.00	.83
Procurement Management	3.50	.71
Cost Management	3.49	.99
Integration Management	3.46	.80
Human Resource Management	3.45	.69
Communication Management	3.40	.92
Quality Management	3.10	.77

Cut-off Point = 3.50.

Table 6: The level of understanding of project managers regarding the knowledge areas.

Knowledge area	Mean	Std. Deviation
Integration management	4.62	0.9
Communication	4.52	1.1
Cost management	4.48	1.1
Quality management	4..00	0.7
Human resource management	3.95	1.5
Time management	3.30	2.2
Risk management	3.34	0.8
Procurement management	3.27	1
Scope management	3.11	1.7

Cut-off Point = 3.50.

Table 7: Correlation between technical skills and time performance.

Technical skills	p-value of correlation
Time and project phases	0.317
Project organization	0.379
Resources	0.154
Communication	0.34
Information and documentation	0.288
Quality	0.302
Project structure	*0.043**
Control and report	0.252
Start-up and close-out	0.454
Project management success	0.123
Scope and deliverables	*0.085*
Procurement and contract	0.242
Requirements and objectives	*0.069*
Interested parties	0.121
Risk and opportunities	*0.012**
Changes	0.337
Cost and finance	0.38

*Correlated p<0.05 and ** Strongly Correlated p<0.01.

DISCUSSION

The discussions are developed through the use of academic literature and empirical evidence according to a few subsections that include the demographic data of respondents, results of descriptive analyses of knowledge and the relationship between project time performance and the technical skills of managers in power plant construction projects in Iran.

Generally, no official statistical data exists on the time performance of power plant construction projects in Iran. Similarly, no official professional body registers or monitors the time performance of projects, such as PMI that came out with the PMBOK Guide standard. However, two organizations, namely, the Office for Supervision and Evaluation of Designs and the Iran Construction Engineering Organization, have developed standards and certification programs for project management companies as well as established particular database for the registration of time performance of all construction companies through the National Competency Standard (NCS). However, very few companies are enthusiastic to report their time performance to these organizations. This low number may be related to either the lack of competition among construction companies or the lack of control from the government (www.tceo.ir).

Profile of Respondents: This study includes 30 respondents who were construction project managers of power plants in Iran. The respondents have different ages, fields of study and experiences. Among them, 30% are between 30-40 years old, 30% are between 41-50 years old and 40% are 51-60 years old. Data analysis revealed that 70% of the respondents are civil engineers; a proof that most power plant construction projects in Iran are managed by engineers and not by academic project managers. Almost all (except one) project managers have practical experience. However, they are not academic graduates of project management, which is an important factor in selecting a project manager for large industrial projects in developed countries.

The lack of a comprehensive law to employ an academically educated project manager is a serious issue in large power plant projects. Given that project management is a new field being offered in the universities in Iran, most of the project managers are generally graduates of other engineering fields. No rule exists to force companies to employ project managers with management background. Iran's project management is considered traditional and therefore, causes delay in construction projects [18].

Traditional management style can be improved by enhancing the knowledge and skills of the project managers. Pant and Baroudi [48] believed that project management practice has to educate and train future professionals. In fact, project management is renowned as a professional discipline within the teaching and learning of the knowledge it holds, as well as its emphasis on the aspects of literature, research and bodies of knowledge. As such, we could be inferred that the teachings in project management are embodied by the project managers. Therefore, a valid question is whether the project management programs offered by various universities provide students with the appropriate knowledge and skills in preparation for their entry into the workforce.

Knowledge of Project Managers: The majority of the respondents indicate that management knowledge toward time of project, scope and risk are the three most important factors regarding which managers should enhance their knowledge (Table 5).

The statement Al Mharmah and Abassi [49] supports the results of this study. The importance of management knowledge toward project time, scope and risk leads to project success, as acknowledged by Baker *et al*. [50], Chan *et al*. [51] and Anton [52]. Furthermore, according to recent literature, the abovementioned items have been recognized as the most influential factors in improving construction project time performance [53,54].

In addition, not only project time performance but also the success of a project is highly related to the knowledge of project managers toward these items. This issue is supported by Collins and Baccarini [55] as well as Tabish and Jha [54]. Moreover, Collins and Baccarnin [55] noted that the success of a project would likely contribute to organizational performance. Therefore, issues of lacking management knowledge could lead to project delay and can be solved by hiring the right project manager who has proper management knowledge toward failure of project management knowledge areas.

The result of the analysis as shown in Table 6 regarding the level of knowledge of project managers revealed that management knowledge toward time, scope and risk as well as procurement management have the least value. These findings are consistent with the existing literature in terms of the importance of these factors. All respondents reported that they experienced delays in their project, which indicates that all of the projects were completed beyond the planned duration. These extensions may be due to the low level of knowledge on time, scope and risk management.

In summary, the results indicate that project time management, scope management and risk management are the priority knowledge areas that must be learned by project managers of power plant construction in Iran.

Time Performance and Technical Skills: The data analyses revealed that the respondents viewed managers' skills to have a significant impact on the time performance of construction projects. Among the 17 skills listed in Table 7, respondents highlighted project structure as well as risk and opportunity as the most influential factors on the time performance of construction projects. The importance of these skills was likewise observed by Gaddis[45], Martin [46], Chan *et al*. [51], Chen and Partington [56], as well as Kerzner [3].

The skills of a project manager on project structure have been highlighted as an important factor in the time performance of construction projects in Iran. Previous studies showed that managers with better skills in managing different project structures would influence their projects' performance [57,58]. As different projects have different structures, managers should be familiar with this divergence in order to achieve effective time performance.

Risk and opportunity is another skill that influences the time performance of construction projects. DuBrin [59], Martin [46], Hyvari [60], as well as Stevenson and Starkweather [61] agreed that having the ability to manage project risk would help managers achieve better time performance. According to Barkley [62], each construction project would have its particular set of risks, such as cost overruns and substandard quality, weather, shortage of materials, price fluctuations, shortage of skilled labor and currency fluctuations. These risks may influence the time performance of construction projects. Prabhakar [63] reported that a project manager must be prepared in order to control such risks. In addition, risk management skills are necessary to organize, motivate and provide a positive influence to team members as well as make them confident to achieve the project goals and objectives [46, 63, 64].

The results of the correlation analysis between time performance and managers' skills indicated that risk and opportunity as well as project structure are positively correlated with time performance.

Previous risk studies in the field of project management by Ventovuori *et al*. [65], as well as the findings of the present study, suggest that project managers should consider the following issues related to risk:

- Identifying Risks in the Project: This is related to the understanding of the risk subjects by the project management team. In this case, the project management team has difficulties in detecting or separating risk management from other activities.
- Lack of Risk Management Knowledge: This issue is very common among management teams as risks are only identified as it appears during project implementation. On the other hand, the project management team seldom identifies risks unless they become involved in the project.
- Lack of Risk Management Motivation: In this case, the project management team assumes that their project would not be related to the risks experienced by other teams. Therefore, the team shows no strong motivation to anticipate the possible risks for their project.
- Incomplete Designs: This is one of the most common risks in construction sites. In such situation, the design complexity of the project may cause difficulties in completing certain parts of work.
- Information Flow Breaks: This issue occurs when information was not supplied during the contraction of the project. In this situation, the lack of information causes delays, misunderstandings and logistics problems that increase project risks.

- Foreign Workers: This is a controversial issue among project management teams. A few people believe that foreign workers intensify project risks. Others believe that risks brought about by foreign workers are not a serious problem, particularly in huge construction projects.
- Competition Based on the Lowest Bid: In huge construction projects, particularly those of the government, the management team is forced to award the project to the lowest bidder. In this case, risk of failure or delay may be increased because of the lack of proper planning regarding the total costs.
- Force Majeure: This type of risk cannot be excluded, as they cannot be avoided, particularly in national construction projects such as power plants. Thus, risks may be increased.

For the project structure, successful project management teams are those who are able to deliver projects in line with planned time objectives. However, this task is sometimes challenged by the complexity of project structure [14], which is one of the factors that effectively influence the time performance of the construction project. Therefore, the project management team should develop activities to control the effects of this issue on the project cycle time. According to Khoshgoftar [5], the project structure in Iran would influence the project time performance based on the following characteristics:

- Project Size: the size of the project that has to be delivered upon completion. When the project comprises several enormous phases, then the chance of delay increases. In the case of Iran power plant construction projects, size is moderately associated with time performance, among other factors. However, project cycle time grows as the project size increases, which directly influences the time performance.
- Project Interconnectivity: evaluates the integration between different parts of the project. When interconnectivity is high, a change or delay in any part would influence the whole project and consequently, affect project time performance. In the case of Iran power plant construction projects, interconnectivity appears as the most influential factor among project structure characteristics. Power plant constructions have high interconnectivity and thus a change in any part influences the project cycle time, particularly when changes occur due to references.
- Project Innovation: represents the portion of the project that must be innovated from previous projects. A high level of innovation could influence the project time performance because the working condition is new for both managers and workers. Therefore, familiarization with all aspects of the project may require longer time. In the case of Iran power plant construction projects, innovation demonstrates a less dramatic influence on project time performance. People working in the project are familiar with the project as it moves forward and changes in cycle time indicate an increasing trend as project innovation moves to higher levels.

CONCLUSIONS

The present research aimed to investigate the level of knowledge of project managers, as well as the effects of their knowledge and technical skills on time performance in power plant construction projects in Iran. To date, no research on project management attempted to empirically investigate the antecedents of project time performance. Each aspect of skills of the project manager is perceived to produce a unique contribution to the time performance of power plant construction.

The findings demonstrate that the issues associated with the knowledge and skills of a project manager and the time performance of power plant construction are mostly consistent with those of previous studies, as discussed and cited in the literature review.

Among all the parameters that have been analyzed in the present study, three knowledge areas, namely, time management, scope management and risk management, as well as, two technical skills, namely, risk and opportunity as well as project structure, were determined to have a significant effect on the time performance of power plant project managers. The results reflect the viewpoint of the project managers who participated in this study.

From the theoretical perspective, the present research has enriched the existing information through the integration of a few distinct bodies of knowledge that has certainly broadened the understanding of forecasters of time performance of power plant construction projects in Iran. Evidently, Iran lacks literature and standard practices in predicting time performance of power plant projects. Therefore, this study is a modest attempt to fill this gap in the scope of theoretical perspective. Scholars and practitioners are encouraged to seize this opportunity and strive to further highlight this issue. The key construct of knowledge and managerial skills that affect the time performance of power plant construction projects in Iran were already identified.

All this while, time performance - on-time project delivery - has been taken as the key element that leads to organizational accomplishment. Therefore, a major concern for managers is to amplify the elements that are important in this concern. The present study suggests that managers and practitioners should pay attention to the factors that would push the projects to be delivered at the proposed time.

The present study focused on Iranian power plant construction projects. Thus, Iranian construction companies, particularly power plant construction companies, have to consider the perception of the proposed factors. In general, the findings provide valuable insight for managers to adopt various and effective tools in their workplace. To achieve firm missions and objectives, as well as to obtain and maintain competitive advantages, managers and decision makers should apply effective management approaches. The current trend emphasizes on-time project delivery as one of the most essential assets in project accomplishment. This has become an important issue in Iran as well. This tendency can facilitate useful information for existing practitioners in this country.

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