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The dilemma of communications and management of remote construction projects in the kingdom of Saudi Arabia

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Abstract
Remote projects have their unique problems that are caused mainly by the remoteness of the project itself thus the loose control over communications and management. Little research was undertaken particularly in the gulf region regarding this issue and it has highlighted few unique problems associated with the communications and management of remote construction projects. This paper explores the potential use of Advanced Communications and Management Systems (ACMS) by the Saudi Electric Company (SEC) for managing its' remote construction projects in the Kingdom of Saudi Arabia (KSA). It discusses the opinions of contractors and the SEC's supervision teams regarding the weaknesses in the present communications and management systems and the potentiality of ACMS and their possible impact on project's performance and process. The study found that, although ACMS would improve some project management practices, there are barriers that limit their potential benefits in regards to other management practices. Thus, certain and planned changes to the management system and practices are necessary to ensure that the SEC is capable of achieving the full benefit from using these advanced systems.

Keywords
Mobile systems, Web-based project management systems, remote manager, virtual management.

1. Introduction

In spite of the rapid progress in the project-management field, the management of construction projects is still affected by a number of negative issues. These issues include the use of inappropriate tools and systems for communication, co-ordination and management. Yang et al (2007), for instance, suggest that the intense need for project information and effective communications by the project team can not be met by traditional communications and information management systems, as these have their shortcomings and are incapable of fulfilling project duties and objectives. One of these shortcomings is that traditional systems provide limited access to information, which is considered one of the key barriers to successful project management practices (Vadhavkar et al, 2002; Pena-mora et al, 2009). Recent studies by the Stichiting Bouw Research centre in the Netherlands (2000) indicate that 6 to 7% of contract expenses can be allocated as expenses due to failures. Many of these failures are caused by the inadequate organization and management of the construction process (e.g., a weak coordination of processes and uncertainty about

available information) (Wamelink, 2002). These shortcomings have brought about radical changes to traditional project management and communications methods so that new concepts and methods for managing projects have been invented. One of these concepts is the golden triangle: a concept that initially referred to quality, time, and cost but has since been extended to incorporate sustainability, project team and stakeholders' satisfaction, and health and safety issues. Communications and Project Management systems (ACMS), such as mobile and Web-based Project Management Systems (WPMS) that use wireless, satellite, Internet-based, or mobile tools and networks, have helped –to a certain degree- construction industry firms manage the increasing complexity of construction projects. They have also helped fulfill project objectives such as quality, scope, time, cost, etc. Remote construction projects exist in many regions around the world such as the Sahara desert, Antarctic regions, the Arabian Peninsula desert, etc. The dilemma in managing remote projects is highlighted by Deng et al. (2001), Kestle and London (2002, 2003), Kestle (2009), and McAnulty and Baroudi (2010). These authors have pointed out that the remoteness thus the loose control is major cause of the management problems.

In the KSA, remote construction projects represent a unique case. They are in remote locations with rough terrain such as mountains and deserts and in undeveloped and environmentally sensitive regions. They are far away from the supervision team office, the contractor's office and major urban concentrations. During construction, supervision teams experience countless difficulties and cumbersome management problems with respect to the supervision of the site. This lack of support negatively affects the contractors' ability to sort out construction problems. The remoteness of the projects also complicates the building permission process, as it is extremely difficult for government inspectors to visit the site regularly. The building material manufacturers experience difficulties in providing deliveries to the site, and the construction waste and disposal cannot be easily transferred away. These potential problems may negatively affect the project quality and cause substantial delays and increases in cost. This study examines a case study that is the use of ACMS by the construction department of the Saudi Electric Company and whether the use would help SEC improving the management of remote projects. A pilot study was conducted by the present research in 2009 due to the lack of previous research regarding remote projects' within the Gulf region and the KSA and to define and test the wording of questions that are going to be used in the main survey. This approach is recommended by many researchers such as Morse (1991) and Oppenheim (1992). Thus a main survey was launched in mid 2009 whereas SEC supervisors, engineers, and contractors were surveyed to find out the type of management and communications tools are they use and the impact of remoteness - represented by the impact of delay in taking decisions- on project performance and process. Also, whether the use of CPMS would help SEC improving the management of remote projects, thus, reduce delay and avoid unnecessary costs and how to customize CPMS to be relevant to the SEC's management practices. Simple statistical tools such as the Percentage and the Mean were used to analyze the data.

2. Review of the current use of ACMS

Some of the remote project management's problems would be avoided if ACMS were used. These systems include WPMS and mobile systems that feature mobile tools, personal digital assistants (PDA), wearable computers, wireless tools, etc. These systems have the capability of improving communications between project team members, enabling them to share information and quickly solve problems. Thus, they improve team members' ability to manage time and cost (Charoenngam et al 2004). Davidson & Moshini (1990) and Bowden (2005) have stated that the cost of construction can be reduced by 25% through the efficient transfer of information between the construction teams and that this transfer can be achieved through the use of ACMS. Alshawi and Ingirige (2003) and Stewart and Mohamed (2004) have identified the following benefits of using WPMS: productivity enhancement of communication between project participants, reduction in project delays, heightened awareness of project issues among all parties, and ease of access and retrieval of project information. Other advantages include: avoiding delays due to the arrival of updated drawings and documents, reducing visits to sites and travelling time to meetings, avoiding drawings mistakes, reducing time and money spent on disputes, sharing and exchanging project

information, and automating repetitive routine processes and eliminating paper reports (2003). Thomas et al. (2003) have discussed how WPMS—from the point of view of selecting contractors— can help project managers boost contractor performance and confidence by minimising subjectivity and eliminating the potential for corrupt practices, improving competitiveness through an increased awareness of competitors strengths and their own weaknesses, and nurturing mutual trust in the exchange of sensitive information such as performance data. Nitithamyong and Skibniewski (2004, 2006) have suggested that the benefits of using WPMS can be categorised into four main areas. These categories are a) cost reduction and time saving, b) enhancement of communications and collaboration, c) improvement of productivity and partnership, and d) supporting e-commerce and the customer. Leskinen (2006, 2008) has argued that it would be difficult to make a direct assessment of which mobile systems would benefit the construction industry. The most important intangible benefits would include improving customer service, gaining a competitive advantage, acquiring more timely management information, supporting core business functions, avoiding competitive disadvantages, improving management information, improving product quality, improving internal communication, implementing changes through innovation, improving external communication, and enhancing the jobs of employees. Ahuja at el (2010) suggested that adoption of Information Communication Technology (ICT) enables effective communication between dispersed project team members but he argued that strategic adoption of ICT i.e. by a number of organizations that are involved in construction process would require that all the supply chain members follow the accepted methods of communication or the communication protocols. This would enable them effectively to grasp IT benefits (Ahuja et al 2009). Thorpe (2000) points out that the Online Remote Construction Management (ORCM) process has the potential to be quite useful for remote construction sites. Superintendents, for instance, do not have to visit the site as often and there is an improved efficiency in project and contract management, better project control, excellent document control, better availability of information for project participants, better decision making, improved management of project knowledge, and improved contractual relationships. He mentions that the implementation of ORCM technology should take into account the following issues:

- equipment-related and logistical difficulties, particularly on the remote site,
- access to the Internet, which can be sometimes slow or unreliable,
- legal issues regarding the use of electronic communications,
- cultural issues, such as reluctance of staff to change existing practices,
- the expenses of the implementation of ORCM systems,
- the need for staff training.

Despite the fast developments in the IT world and the creation of many IT applications for the construction industry, there are still some issues that hinder the applicability of these systems to the construction project management.. There is a problem in regards to the diffusion of IT in the construction industry and the absorption of IT into work practices and the level of strategic investment in IT by the construction industry's firms (Alshawi et al. 2009).There are other barriers such as: the IT technical shortages, the way that IT systems are used such as the deployment of the system on "ad-hoc" basis and its' use through isolated project management practices, and these systems would be costive (Alshawi and Ingirige 2003, Nuria 2005 and Leskinen 2006& 2008). The potentiality of IT systems is also hindered by the working environment's characteristics e.g. staff resistance, existing systems and practices that do not enable smooth implementation and use of IT systems (Sidawi 2003). Although there is barriers to IT use, the literature review suggests that ACMS can impact project management practices positively. However, this research will explore whether it would have similar effect on the management practices of remote projects. The following sections discuss the problems of remote construction sites and how far ACMS are capable of overcoming these problems.

3. The management of remote construction sites

The implementation of ACMS may not be enough to successfully manage remote sites and, therefore, management practices should be improved as well. Kestle & London (2002) have suggested a framework for the design management of remote sites. The framework emphasizes the following management functions:

- Serving: remote management involves more serving than simply leading;
- Controlling: the measurement and correction of the performance of team members and site activities on a daily basis;
- Organizing: the organizational structure should establish a formal system of roles that people can perform and be supported in to accomplish the enterprise's objectives. The key factors for the management of remote sites would be value generation, knowledge integration, process integration, and timely decision-making. Project teams that are located on different and disperse sites and that communicate and share recourses electronically would be considered virtual teams and their organization would be defined as a virtual organization. Virtual organizations generally tend to decentralize management. The traditional and hierarchical management structure would thus change to a more open, interactive, collaborative, and net structure (1996). On the other hand, a crucial aspect of the success of a remote project depends on the effective sharing of knowledge and information among the different people and the building of trust among remote project teams (2007); and
- Economizing: the management's performance should be very economical, emphasizing effective action, efficient organization, optimal planning, and human-centered control together with expertise service. The overall objective is cooperation in order to derive maximum benefit for the enterprise.

4. Shortages of remote project management practices and systems

The dilemma in managing remote projects is highlighted by Deng et al. (2001), who mentioned that the extensive physical distance between project participants, sometimes extending over national boundaries, is the main cause of delays in decision making. The project team has not only to tackle the traditional management problems—such those highlighted above—but also those that specifically occur as a result of the remote locations of these often environmentally sensitive sites (Kestle and London 2002, 2003, Kestle 2009). These sites are often far from any logistic support and suffer a continuous shortage of materials and specialized labor (Kestle and London 2002, 2003). Kestle (2009) reported lack of project's pre-planning, certainty and/or clarity around project process integration. There is also misinterpretations and miscommunications of project's results or needs' issues. The centralized decision-making process and a lack of delegated authority to field personnel often hindered progress and communications at the critical emergency response and recovery stages (the same source). McAnulty and Baroudi (2010) mentioned categorized remote construction projects' problems into three categories: human Resources, production and cost management, and infrastructure and communications. They found that contractors are experiencing difficulty attracting and retaining skilled workers and working in the remote locations has a negative impact on an employee's family life. It is difficult in procurement, accessing materials and equipment in remote areas and severe climatic factors in remote areas have a strong negative impact on productivity evidenced by major support from respondents. There is lack of current infrastructure and communications.

However no previous research was found regarding the remote projects' problems within the Gulf region and the KSA. Thus, a pilot study was conducted in 2009 by the researcher to form grounded theory and set grounds for the main survey. It examined three projects' archive, interviewed few project engineers/

supervisors at the SEC's regional office and a visit has been made to one of the remote sites. It revealed the following management problems:

- The long travel times of four hour or more round trips exhausts the supervisors, especially during the extreme hot weather period that lasts around five months in the KSA. Due to staff shortages, supervisors are overloaded with responsibilities, and each has two or more remote sites to inspect. These problems sometimes force the supervisor to postpone site visits even though site visits are vital to sorting out the site queries. The unsupervised contractors seize this opportunity to use improper construction materials and inadequate construction systems to cut costs. The result is poorer quality in construction work.
- The analysis of projects' archive showed that a 30% decrease in the number of visits to the site is associated with an increase in a project's costs by about 30% and an increase in a project's estimated duration by about 20%. This also negatively affected the project's quality by about 20%.
- Contractors are reluctant to undertake remote projects due to the possible and unpredictable increase in the cost of the labor, materials, transportation, and unexpected circumstances. They are also concern with the unavailability of basic services for the labor such as housing, services, inaccessible roads, etc. These factors would sharply reduce the margin of the contractor's profits.
- There was a lack of contractor commitment to the project schedule due to the difficulties that they usually experience in providing skilled labor, transportation, etc.
- The lack of construction materials forces the contractors to regularly leave the project site in order to procure them. This absence made the sites vulnerable to theft, and the records show that there were several cases of theft of materials and equipment.
- Government authorities responsible for granting permissions are far from the project site. The remoteness keeps government officers from making frequent visits to the site to perform necessary inspections and grant permissions.
- In some remote areas, the initial survey of the project site by the SEC surveyors shows no definite owner of a specific plot of land. Thus, the SEC would possess the land and a budget is allocated for the project. Afterwards, a claim of ownership by a citizen (supported by the Sheikh [head] of one of the local tribes) would raise a legal conflict over the land ownership and cause substantial delays to the project or even halt the project until the legal dispute would be resolved.
- Delivery of materials and equipment is constrained by road/highway regulations. These conditions forced the contractor to deliver small batches of materials, which increased delivery and transportation costs. In addition, the very bad conditions of some remote roads, or the non-existence of roads at some stages, made it very difficult for all project parties to access the project site.
- The visit to one of the remote project sites produced the following notes:
- Occasional site visits are made by the SEC's supervisors to the remote project's site, and these infrequent visits cause a delay in the approval of material samples; and
- The contractor sometimes makes changes to the construction work without prior authorization, which contradicts what has been originally specified in the contract.

The pilot study revealed that the SEC's supervisors do not use standard forms to write down notes during the inspection of construction sites. They primarily use mobile phones to communicate with project personnel and the main regional office; they use digital cameras to take photos that show the progress of the construction work. Supervision teams use email to communicate with the director of the regional

office. Branch managers are not authorized to undertake decisions regarding a specific site's queries, and decisions are left entirely to the director of the regional office. This substantially prolongs the decision-making period.

The pilot study's results were used to design the main survey's questionnaire. The questionnaire is divided into two sections. The first section asks the participants about the type of electronic or traditional management systems and tools that are used at present and who uses it. Also, it asks about the frequency of the site's queries - and these queries were extracted from the pilot study- and how far these queries would affect badly the project's performance and process. Section two asks about the ACMS that they would recommend using to manage remote construction projects. They were asked how far these recommended systems would help in sorting out construction problems; and these problems were again extracted from the pilot study; and how far the use of electronic communications and management tools would improve the management of remote projects. It asks about potential barriers and how far these barriers would hinder the implementation of ACMS. The targeted population consists of contractors and SEC's supervisors/ engineers who are located in the four regions of KSA. This targeting method would provide feedback from the two major project's parties, which would increase the applicability of the proposed ACMS to both of them. In 2009, one hundred questionnaire forms were sent randomly out. Twenty five supervisors/ engineers and two contractors responded back and this represents 27% of the targeted population. The majority of respondents were SEC's staff, the results expresses about the views of SEC staff rather than the contractors.

The main survey revealed that ACMS and tools are of little use to contractors and supervisors. Most of the respondents (i.e., 70%–89%) said that they use traditional communication systems and tools such as fax machines, mobile phones, site visits, weekly/monthly reports and weekly/monthly meetings to manage jobs and to communicate between the remote project site and the supervision office. They do not use mobile systems and tools apart from mobile phones, which are used by 93% of the respondents. None of the respondents used web cams or construction robots on site. The WPMS was not used and the email service was used by only 67%. Respondents said that electronic communications and management systems are widely unused among project team members. Around third of the respondents surveyed said that queries related to the following stages: Finishing works, Concrete works, Insulation materials works and Openings (i.e. doors and windows) works take one to three days to be sorted out. Nearly the same percentage of respondents said that queries would take four to six days to be sorted out during the above mentioned stages and for Mechanical and Electrical works' stages. 30% said that queries that related to Masonry works' stage would take one to three days to be sorted out. 33%- 41% said that queries during the Mechanical works and Telecommunications and Computers works' stages take one to two weeks to be sorted out. Respondents agreed that the delay in sorting out queries negatively affect the project performance represented here as cost, time, scope, and quality criteria—and the project process; these issues, arranged from more effective to less effective, are (see table 1):

- Mistakes in construction works
- Poor quality of construction works (project performance only)
- The selection of unskilled workers to work on site
- Shortages in site equipment
- Unavailability of materials
- Low productivity of workers
- Changes to specifications/specified materials (project process only)
- Ineffective planning and scheduling of the project by the contractor
- Breakdown of site equipment (project performance only)

In regards to the potential use of ACMS tools, 82% of the respondents recommended the use of the E-mail service. 74% of them recommended the use of mobile tools, 40% to 48% recommended the use

walkie-talkie, fax and web monitoring camera, 22% to 30% recommended the use personal digital assistants and tablet computer, and 33% recommended the use of WPMS. Respondents said the recommended ACMS would be primarily helpful in sorting out the following construction problems: mistakes in construction work, delays in the project timetable, changes to the project's scope, changes to the specifications/specified materials, and increases in the cost of materials during construction (table 2).

Table 1: The negative impact of the delay in sorting out remote site queries/ problems on the project performance represented by: cost, quality, scope, time, and process (*Column number two scale: 1, does not affect to 3, heavily affects. Column number three scale: cost and time criterions: -1 increase, 0 neutral, 1 decrease; quality and scope criterions: 1 increase, 0 neutral, -1 decrease; scope: 1 increase, 0 neutral, -1 decrease). Note: The positive Mean value means positive impact on project performance and the negative Mean value means negative impact on project performance*

Type of queries/ problems	Level of negative impact of the delay on project process (impact level 1 to 3)	Mean value of the impact on project performance (represented by cost, quality, scope, and time criterions)
Mistakes in construction works	2.63	-0.48
Poor quality of construction works	2.62	-0.24
The selection of unskilled workers by the contractor to work on site	2.54	-0.44
Shortage in site equipment	2.54	-0.39
Unavailability of materials	2.52	-0.46
Low productivity of the workers	2.48	-0.49
Changes to specifications/ specified materials	2.44	-0.23
Ineffective planning and scheduling of the project by the contractor	2.42	-0.39
Improper construction methods implemented by the contractor	2.38	-0.32
Problems related to the transportation of materials to the site	2.3	-0.36
Delay in the approval of contractor submissions by the SEC engineers	2.26	-0.25
The increase in materials' cost during the building's construction	2.22	-0.27
Change of the project's scope by the contractor	2.15	-0.19
Unavailability of SEC engineers on the remote project's site due to their workload	2.15	-0.34
Delay in the project timetable	2.11	-0.3
SEC tendering system that obligates the choice of the lowest bidding value	2.08	-0.19
Inadequate equipments used	1.96	-0.29
Delay in conducting of the field survey by the contractor	1.92	-0.29
Unavailability of SEC engineers during sample testing	1.88	-0.35
Personnel safety issues	1.85	-0.06
Breakdown of equipment on site	1.81	-0.42

Meanwhile, the ACMS was considered little help in sorting out the following issues: the contractor's use of improper construction methods, the selection of unskilled workers to work on the site, inadequate equipment, problems related to the transportation of materials to the site, and delays in approving contractor's submissions by the SEC engineers. Respondents mentioned the implementation of electronic

scheduling and efficient administrative tools would have a positive impact on various aspects of projects. Meanwhile, other tools such as procurement management, communications, and the exchange of information tools were thought to have little impact on these project aspects (see table 3).

Table 2: Level of help that the advanced technology would provide to sort out construction problems/ queries

Issues to be addressed	Level of helpfulness (Mean value out of 5: 1 does not help to 5 extremely helpful)
Mistakes in construction work	4.23
Delay in the project timetable	3.92
Change of the project's scope by the contractor	3.75
Changes to the specifications/specified materials	3.69
The increase in materials' cost during construction	3.54
Personnel safety issues	3.48
Unavailability of SEC engineers during sample testing stages	3.40
Breakdown of equipment on site	3.40
Poor quality of construction work	3.35
Shortage in site equipment	3.25
Unavailability of SEC engineers on the remote project site due to workload	3.23
Delay in conducting the field survey by the contractor	3.13
Low productivity of the contractors workers	3.12
SEC tendering system that obligates the choice of the lowest bidding value	3.04
Ineffective planning and scheduling of the project by the contractor	3.04
Unavailability of materials	3.00
Improper construction methods implemented by the contractor	2.80
The selection of unskilled workers by the contractor	2.65
Inadequate equipment used	2.64
Problems related to the transportation of materials to the site	2.58
Delay in the approval of contractor submissions by the SEC engineers	2.08

Table 3 Positive/ negative impact of ACMS tools implementation on various aspects of the remote project (*Scale: cost and time aspects: -1 increase, 0 neutral, 1 decrease; quality and scope aspects: 1 increase, 0 neutral, -1 decrease***)**

System tools	Cost	Quality	Scope	Time	Mean value of the impact
Project scheduling tools	0.09	0.75	0.2	0.62	0.42
Efficient administrative tools	0.09	0.74	0.3	0.52	0.41
Effective collaboration tools	0.00	0.6	0.21	0.47	0.32
Site monitoring tools	-0.32	0.64	0.47	0.48	0.32
Cost management tools	0.09	0.37	0.32	0.47	0.31
Document management tools	-0.1	0.5	0.35	0.33	0.27
Information analysis tools	-0.14	0.50	0.41	0.23	0.25
Procurement management tools	-0.14	0.33	0.37	0.37	0.23
Communications and exchange of information tools	-0.27	0.41	0.38	0.38	0.23

Respondents said that the barriers that hinder the implementation of advanced electronic management and communications systems in SEC are primarily the management system (i.e., the organizational structure

and practices); concerns over some technical issues such as cost, maintenance, and support; difficulty in making changes to the organization's structure, internal influences, external pressures; and the level of IT skills of the staff (see table 4).

Table 4 Barriers that hinder the implementation of advanced electronic management and Communications systems in SEC. *Scale: 1 does not hinder to 5 highly hinders*

Barriers	Level of hindrance out of 5 (Mean value)
The management system (i.e., structure and practices)	3.52
Concern regarding technical issues such as cost, maintenance, and support	3.04
Difficulty in making changes to organization's structure	3.00
Internal influences	3.00
External pressures	2.92
The level of IT skills of staff	2.92
Degree of organizational readiness to adopt IT	2.79
Perceived benefits by staff	2.50
Degree of the organization's openness to external sources of information	2.48
The management commitment and perceptions of ICT benefits	2.36

5. Discussion and conclusion

The findings of this research are discussed below emphasizing on the potential barriers that limit the applicability of ACMS to the SEC's construction project management and how these barriers can be overcame. The present study demonstrated that contractors and SEC supervisors still use traditional communications and management tools and that ACMS little used by project team members. It showed that construction department at SEC experiences a number of problems regarding the management of remote construction projects such as non standard construction processes, security of the site, transportation, trust between the contractor and supervisor, contractor's commitment, excessive construction costs, employment of unskilled labor, lack of materials and equipments and non standard control and management methodologies that are used by the SEC's supervision team. The decision making is entirely up to the director of the regional office, which causes delays in making decisions. Current management mechanisms are not capable of addressing the present project's problems and queries took a long time to be addressed.

There are a number of barriers that hinder the implementation of ACMS, including cost, maintenance and support, the management system, organizational readiness to change, and the level of IT skills or staff (see similar findings by Chan et al (2004), Nitithamyong and Skibniewski (2004), Villeneuve et al (2003), Walker et al (2005), and Yang et al (2007)). Respondents mentioned that the implementation of project scheduling and efficient administrative tools would have a positive impact on various aspects of projects (i.e., cost, quality, scope, and time). Meanwhile, other tools such as procurement management, communications, and the exchange of information tools were considered to have little impact on these project aspects. The main survey found a number of issues would affect badly the project performance - represented by cost, time, scope and quality criterions- and the project process. In conclusion, the level of the ACMS applicability to SEC's project management is hindered by - the above mentioned- negative characteristics of the SEC's environment, shortages of ACMS systems and its' possible incapability to meet the unique management demands of remote projects. As illustrated in the previous section, each of these negative characteristics or barriers has its' level of significance/ impact and this should be taken into account by SEC when considering to adopt ACMS. To increase the level of applicability of ACMS to the SEC's remote project management practices, the following measures are recommended:

- Existing electronic systems should be examined to find out whether they can be integrated smoothly with the new ACMS;
- Factors that significantly and negatively influence project performance and processes, like those found in the present research, should be examined and thus incorporated into the design of the new ACMS;
- A number of technical capabilities that were found should be considered and thus embedded in the new ACMS; and
- The new ACMS should be linked with contractors' systems.

The implementation of the ACMS would not be successful, however, until changes are made to the present management practices. These practices —in comparison with London and Kestle (2002, 2003) standard, open and flexible framework—seem to be non-standard, and loose. They should be redesigned and the remote management abilities of managers should be improved to enable these managers to virtually manage the remote sites. The following adjustments are essential to the existing project's management practices:

- Negative factors that highly affect the management of projects should be investigated and proper mechanisms should be put in place to improve management;
- Proper plans should be adopted for staff training, and the staff should be informed about the benefits and advantages of the new system. However, training is also essential for the contractor's staff;
- Flexible decision-making mechanisms should be created and tested;
- Proper mechanisms for controlling and monitoring the recruitment of site personnel, shortages in manpower, and so on should be designed and implemented.

However, some problems seem to be generated during other stages of the project. For instance, issues regarding expected problems (such as site personnel recruitment and the transportation of materials) in addition to unforeseen problems (such as possible shortages in manpower and the breakdown of equipment) should be studied and resolved at the relevant stages of the project (such as the planning, tendering or contracting stages). Emergency scenarios should be established at the early stages of the project to deal with unexpected issues. During the construction stage, precise daily control and follow-up procedures should be applied regarding issues such as the remote examination of the quality of construction work, monitoring the productivity level of site workers, and calculation of the rate of material consumption. Eventually, the SEC should direct the contractor's attention to the unique problems and unforeseen issues associated with the construction of remote projects. That way, the contractor would have a chance to assess their potential negative impact on the remote project.

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