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MITIGATING AND MANAGING RISKS IN MOBILE TELECOM PROJECTS

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Proper risk management is one of the key drivers of successful project delivery. This is more apparent in competitive and fast growing industries such as telecommunication. To better understand the risks faced in construction and deployment of mobile telecom sites (MTS), a research was initiated to: (a) examine risks associated with deploying MTS, and (b) understand the means to mitigate and handle them. The first point was addressed in an earlier publication whilst this paper focuses on the second. Knowledge pertinent to mitigating and handling MTS risks has been acquired via rounds of interviews and questionnaire surveys with a panel of telecom industry experts. Flow charting has been utilized to code the acquired procedural knowledge and provide basis for developing a knowledge base expert system (KBES). The rules technique was selected for knowledge representation. Automation of the KBES is also demonstrated.

Keywords: Risk management, Risk response planning, Knowledge acquisition and management, Expert systems, Telecommunication industry.

1 INTRODUCTION

The mobile broadband is the fastest growing technology in history, according to The Broadband Commission (2013). The tremendous sales and usage of mobile phones have led cell sites to become more congested (Eid *et al.* 2014). A research was initiated by the authors to better understand the risks pertinent to deploying mobile telecom sites (MTS) in Egypt and means to mitigate and handle such risks.

There is no doubt that risk management is pivotal to successful project delivery. Efforts are typically made to identify and quantify project risks. However, these efforts are a waste if no proper actions are taken to efficiently handle the identified risks. Since the majority of risks common to deploying MTS cannot be absolutely avoided, actions are usually taken to mitigate and transfer them. This paper attempts to shed more light on mitigating and managing MTS risks. Whilst the study reflects the Egyptian perspective, due to access to information, the presented knowledge may apply to other contexts as well, particularly in developing countries.

2 RISKS OF DEPLOYING MOBILE TELECOM SITES

Several factors may affect the telecom site deployment process, including its location, purpose, client/end user requirements, key performance indicators (KPIs), etc. Furthermore, an MTS can be either outdoors or indoors, with geographical radio-coverage area ranging from macro to femto (Eid *et al.* 2014). With input from telecom industry experts, the authors classified MTS projects into four major types. After risks common to each of the four types were identified, a risk score method, presented in Heldman (2005), was used to rank/prioritize them according to severity. Full details of this stage of the research can be found in Eid *et al.* (2014). Table 1 tabulates the global list of MTS risks in reference. Risks are ordered according to the risk score for each.

Table 1. Global list of MTS risks.

Rank	Risk Descriptor	Rank	Risk Descriptor
1	People / Inhabitants resistance or opposition to telecom site	16	Currency exchange rate fluctuations
2	Need for special camouflages	17	Low productivity rate
3	Generators required	18	Special telecom equipment devices required
4	Wars or strikes or demonstrations nearby sites	19	Military refusal of permits
5	Extra charges and special treatment for Bedouins nearby the site	20	Special excavation equipment / methods
6	Stop working order, due to police records submission	21	Materials shortage
7	Materials increasing prices	22	Military delay to issue permits
8	Unacceptable lease rental value	23	Suppliers or vendors or subcontractors late delivery
9	Unavailability of skilled labor	24	Building structurally unsafe
10	Unsafe destination tower	25	High VSWR occurrence
11	Camouflages special installations	26	No LOS due to Environmental factors
12	Insufficient experience	27	Unavailability of first aids
13	Unprofessional management teams	28	Faulty telecom Equipment
14	Need for Telescopic Boom crane	29	NTRA certificate not issued due to protocol violations
15	Low material installation quality	30	Weak tower galvanization

3 RISK MITIGATION AND RESPONSE PLANNING

Risk response planning (PMI 2013), also known as risk treatment (AS/NZS ISO31000: 2009), involves identifying and making arrangements necessary to handle and control the perceived project risks. With Table 1 in place, the research proceeded to investigate the means of mitigating and managing MTS risks.

3.1 Input from Domain Experts and Survey Preparation

Several exploratory interviews were conducted with domain experts in Egypt regarding the response actions suitable to handle the 30 risks in Table 1. These experts primarily work for two groups of industry stakeholders; they are Mobile Network Operators (MNOs) and MTS contractors. After 90 potential response actions were collated, a questionnaire form was prepared in light of the guidelines given in Abd El-Razek *et al.*

(2008) to consolidate the findings of this research stage. Primary purpose of the questionnaire was to help assess the effectiveness of response actions relative to one another. The questionnaire form employed a 4-point Likert scale with the linguistic descriptors: Very Effective (VE), Effective (E), Moderate (M), and Not Effective (NE).

3.2 Analysis

Questionnaire was disseminated in 2013, i.e., subsequent to the 25th of January Revolution in Egypt. This is a critical factor as the business environment significantly changed after the revolution. Prior questionnaires will not be reflective of the current status quo. Also, in order to have an acceptable coverage of the studied domain, questionnaire was not exclusive to any single MNO or MTS contractor. It is worth noting that there are 3 MNO operating in Egypt. At the end of this stage, 25 complete responses were received and prepared for the full scale analysis.

First, the demographic analysis revealed the following about the survey respondents:

- Majority (60%) of respondents had between 6 and 9 years of experience.
- More than half of the respondents had worked with more than one MNO. This ensures outcomes to be independent of the regulations of any specific operator.
- Majority of respondents were site managers (28%), site engineers (28%), or acquisition engineers (24%). These 3 roles are the most involved in the MTS deployment process on the ground.

To facilitate the analysis of the effectiveness of response actions, a numerical scale of 4 (corresponding to VE) down to 1 (corresponding to NE) was employed. After the linguistic responses were converted to their numerical equivalents, the Mean, Mode, Standard Deviation (SD), and Standard Error (SE) for each risk response action were calculated. The Relative Standard Error (RSE) was also estimated to be less than 25%, which proves accuracy of results according to Australian Bureau of Statistics (ABS 2005). Table 2 shows the analysis results for the top 10 rated MTS risks.

The top rated risk concerns people/neighbors of the MTS who refuse and resist its deployment. Concerns about the potential health effects normally come into play, though the debate on such an issue isn't finalized yet (ANSES 2013). One response action involves choosing the MTS location where the landlord can help facilitate negotiations and settle problems with neighbors. This potential response is viewed to be very effective in rural areas compared to other solutions, e.g., at-night installations. Yet, in some situations, performing work at night may turn the last resort available.

Another risk concerns demonstrations and strikes. After the 25th of January Revolution in Egypt, demonstrations and strikes have dramatically increased. Since mobile data and voice communications are vital services, the MTS deployment team has a mandate to proceed. If none of the three actions listed in Table 2 is attainable, workarounds must be made including the change of radio frequency (RF) design and the configuration of surrounding MTSs until a technical solution is achieved.

Table 2. Risk responses of high RS risks.

Risk & Risk Response	Mean	Rating
People / Inhabitants resistance or opposition to telecom site		
1. Relocating proposed site location as far as possible from neighborhood or village center.	3.56	VE
2. Choosing a landlord that has a stature or great prestige among his neighbors or village which may reduce resistance.	3.62	VE
3. Contacting the police.	1.5	NE
4. Negotiating with the leaders of the resistance to reach an acceptable solution.	1.8	M
5. Finish Installations at night for RT sites, if applicable.	2.5	E
Need of special camouflages		
1. Hiring Telescopic boom crane and searching for space for its standings	2.5	E
2. Other solution than a camouflage can be obtained after discussing with stakeholders	3.6	VE
3. Using suitable trucks to transport the camouflage, if not done by the supplier in order not to break or crack it.	1.8	M
4. Requesting earlier the expected number and type of camouflages by a sufficient period.	2.88	E
Generators required		
1. For GF sites at far distances, installing solar cells.	2.08	M
2. Renting portable generators until work is finished and power meter is connected.	3.8	VE
3. Obtaining silent generators (no or low noise) to not disturb nearby neighbors.	2.72	E
Wars / strikes / demonstrations nearby sites		
1. Monitoring the security status and updating teams to adjust schedules & conditions	3.78	VE
2. Delay works until demonstrations have turned down or finished.	3.72	VE
3. Working at late night after arranging with spearheading demonstrators or police and security department, if urgent.	2.88	E
Extra charges and Special treatment for Bedouins nearby the site		
1. Offering them site guarding during work.	2.56	E
2. Contacting the police.	1.56	NE
3. Contacting the area sheikh or leader.	3.8	VE
Stop working order, due to submitted police reports		
1. Sending lawyers and negotiations to dissolve the problem enabling work to resume.	3.48	VE
2. Choosing a landlord that has a stature or great prestige among his neighbors or village which may reduce resistance.	2.72	E
3. Obtaining security approvals before starting work if possible.	2.2	M
Materials increasing prices		
1. Having an inventory of fundamental materials to support sufficient period.	2.4	M
2. Rechecking specs and cancelling items and materials that its purpose can be replaced with less costly solutions. (value engineering)	3.54	VE
3. Regularly checking and recording new prices and variations.	2.92	E
High / Unacceptable lease rental value		
1. Renegotiating with the land lord the rental value.	3.58	VE
2. Obtaining exclusive benefits e.g. no other mobile operator can rent the location	2.78	E
3. Researching for a new candidate.	2.36	M
4. Business case is reviewed and top management can decide if an exception can be made, if positive.	1.64	M
Unavailability of skilled labor		
1. Hiring skilled labor with certain contracts.	2.16	M
2. Unskilled workers can do uncritical work or that need limited skills, under supervision.	1.64	M
Unsafe destination tower		
1. Retrofitting unsafe masts / towers.	2.08	M
2. Using an alternative destination tower and route.	3.68	VE
3. Decrease microwave antenna diameter/ height, if applicable.	3.16	E

In rural and suburban areas, MTS are deployed to provide adequate RF coverage to desert roads, villages, and small towns. A source of power must be provided. At distant locations, it is more economical to use solar energy despite the high initial costs and lengthier process to construct and commission the MTS. Using generators can be more practical in order to bring the MTS On-Air at the earliest. In some cases, silent portable generators can power up the MTS, until being commissioned.

4 EXPERT SYSTEM APPLICATION

What distinguishes a knowledge base expert system (KBES) from systems that involve mathematical modeling is that it can simulate human reasoning (Poole and Mackworth 2010). A KBES has a capacity to deal with uncertainty, vagueness, and incomplete/qualitative information (Schmoldt 2001). As such, a KBES was utilized in this research to capture the knowledge of the studied domain. The system in reference is named Mobile Telecom Sites – Proposed Procedures and Risk Responses (MTS-PPRR). The system supports practitioners involved in the deployment process of MTS in their pursuit of a better handling of the MTS risks they might face.

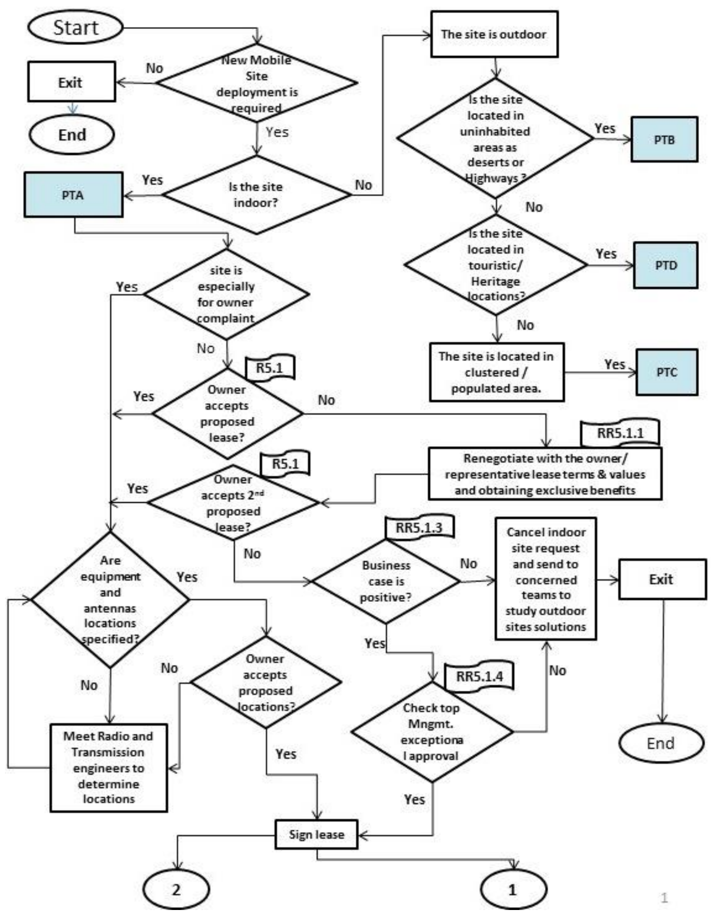

Figure 1. Flow chart extract.

Knowledge acquisition is recognized as the bottle neck in KBES development (Feigenbam and McCorduck 1983). Due to the qualitative nature of knowledge in the current research, guidelines for data acquisition by Barnard (2005) were carefully followed. Two types of knowledge were primarily considered: (1) public domain knowledge obtained via archived content, and (2) specific expert knowledge obtained via interviews and questionnaires (as explained in the previous section). The KBES represents such knowledge in symbolic forms (Durkin 1994), e.g. flow charts. The automation of the KBES allows directing the user to certain logical routes, as per the MTS case into consideration, as well as providing the proposed risk response strategy to pursue. A sample flow chart is given in Figure 1.

5 CONCLUDING REMARKS

Telecom projects have their share of risks. The ability of project stakeholders to handle these risks can make all the difference between success and failure. This research has attempted to better understand the type of risks common to MTS projects and means to mitigate and handle these risks. Moreover, capturing the knowledge in a handy platform can provide the needed support to those making critical project decisions. Human expertise can be lost through retirement, job changing or even death. Proper knowledge acquisition and storage help organizations to be more sustainable. Simply said, MTS-PPRR supports such a cause. Furthermore, the system can easily be updated whenever knowledge and technology upgrades are available.

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