



Risk Assessments for Construction projects in Saudi Arabia

Ibrahim Alrashed¹, Abdulmohsen Alrashed², Saud A. Taj², Michael Phillips¹ and Komali Kantamaneni¹

¹School of Built and Natural Environment, University of Wales Trinity Saint David, Swansea, United Kingdom, UNITED

²Glasgow Caledonian University, Department of Management, London, United Kingdom, KINGDOM

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Abstract

The construction market of Kingdom of Saudi Arabia (KSA) is significantly huge in the Middle East, which currently estimates to be >\$122 Billion per year (in recent times) and this is anticipated to reach >\$610 Billion in next five years. Construction projects in the residential sector are more positive than commercial sector, however, data on the actual percentage of success rate and vital risk factors in aforementioned projects are still limited. Accordingly, this study estimates the risk evaluation of recent construction projects in the KSA and presents a new risk evaluation method for current construction projects: this analysis constructed on new linear decision-making model. At the same time as, this study also investigates the applied applications of risk management in the trade of construction projects of both international and national companies.

Keywords: Risk appraisal, linear decision-making model, ksa, Construction Projects.

Introduction

Problems are occurring in Saudi construction projects, in recent periods are convoluting and concerning with huge ambiguities. Nonetheless, Saudi construction projects have unique characteristics as well as many risks. Risks are often rising due to the prolonged period of projects, fiscal magnitudes and complicated establishment structures¹ (Many researchers centralised their focus only on assessing the risk impacts, projects costs, health and safety and time factors in limited aspects^{2,3,4,5}. Whilst, many researchers, examined management risk especially in building projects in view of stage of the project, as the initial stage (design stage), later stage (construction stage) and they did not look into the life cycle of project perceptions^{6,7,8,9}. In addition, projects in the construction industry are appearing to be many fundamental risks due to the participation of several diverse contracting parties (contractors, sub-contractors, building designers, suppliers, non-construction professionals) and a wide range or cultural variations^{10,11}. However, risk is an indefinite and uncertain incident and project risks should be impacted positively or negatively on project components (suitability, quality and quantity, time and cost, and safety)^{12,13}.

However, removing all risks in construction projects is highly impossible: hence, construction projects needs evaluation of general risk and process control to cope all kinds of jeopardies in all circumstances. Accordingly, this paper presents a new risk evaluation methods for current construction projects, which is based on new linear decision-making model. In this paper, both national and international companies are also discussed regarding practical applications of risk management tools in the construction projects.

Background: The Saudi Arabian's construction industry:

Saudi Arabia is amongst the fastest growing economies of the Middle East. The immense revenue being generated from its vast oil reserves, which are boosts, the country's economy in recent periods¹⁴. Meanwhile, the government is also implementing new policies and procedures to further improvement of the nation's economy through a sustained diversification and investment programs. Quick and large enhancement of the housing market is a great reason for broad economic development in very recent years¹⁵. Construction projects worth are \$80,148 million in 2011, \$17 billion in 2012 and \$42 billion in 2013¹⁶. Currently, the Saudi's construction industry annual growth is 4.5% and its value \$30 Billion¹⁷. Accordingly, the construction sector should expect the continuous growth; as the Saudi's government has no intention of stopping its investment in social and economic infrastructure. The construction projects are mainly being implemented in the transportation sector, hotel, residential accommodation, energy infrastructures

Construction Projects and Sectorial Assessment: About 20% of the total construction projects are implemented in the transportation sector. One of largest projects in the aviation sector is the current expansion of the King Abdulaziz International Airport (Jeddah International Airport). The project alone is expected to cost \$7.2 billion¹⁸. Once finished, the annual capacity of the airport will increase from 17 million to 30 million passengers. Similarly, the Saudi government is striving to add 3,900 Km of track to its extensive railway network. This project is expected to gulp a total of \$25 Billion¹⁸. The progressive growth of the construction sectors has prompted the Ministry of Municipal and Rural Affairs to work closely with industry experts¹⁷. In other words, those working in the building and construction sectors will be

capable of making useful contribution to essential project demands: time and energy efficiency together with cost effectiveness and quality. Have traced the required steps to solve the problem of construction projects in Saudi Arabia that are; "Lack of materials, inadequate human and technical resources, payment dilemma, conflicts among the stakeholders, discrepancies in the original project design and the actual execution plan and differences in cultural background.

Overview of Risk Management: There is always the possibility of encountering risk in every aspect of business endeavors. Whereas some risks are self-inflicted, others are simply unavoidable. Thus, it is always important for stakeholders to assess the risks that are most likely to be encountered in their daily activities. The very first step in risk assessment is the identification and categorization of all possible risk situations. The risk involved in the construction industry include all those problems that have the potential of causing harm and or loss to people, property, or other interests¹⁹. After the identification of risk, the next step will be to evaluate and quantify the risks. However, researchers have developed many risk assessment tools in recent periods. Peltier revealed that a probability/impact matrix is very helpful in quantifying and prioritizing risk level, before acting upon them. It is particularly beneficial, as risks with higher possibility of happening needs utmost attention. One more risk assessment technique that can be used in construction projects is heat maps. Structurally, heat maps consist of the diagram that can be used to display the risks, according to specific categories and priorities²⁰. These are the usual coded colors to display the importance of the risks (e.g., red for extreme risk, yellow for average risk, and green for little risk levels)²⁰. Once the risks are identified and quantified, the right risk response strategies will be identified in net procedures. Some commonly used strategies for risk management, including abolition, decrement, retention and relocation. The selected risk response strategies are then, applied and monitored.

Methodology

Scenarios of Existed Tools for Risk Assessment in Construction Industry: Taylan et al¹¹. developed an integrated hybrid methodology, which was used to identify and assess key risk criteria of construction projects at King Abdulaziz University (KAU). The key risk criteria that were assessed in this case include time, cost, quality, safety and environmental sustainability. These methodologies involved the use of relative importance index in prioritising the project risks, based on the collected data. The practical implementation of this hybrid methodology enables the construction projects to be categorised by Fuzzy AHP and fuzzy TOPSIS methodologies. Taylan et al. also tried to integrate essential qualitative characteristics in performance analysis of construction projects and the transformed qualitative data into equivalent quantitative measures. The

results proved the possibility of assessing the overall risks of the construction projects. The integrated hybrid methodology was also beneficial in the identification of the project that has the lowest risk. Liu proposed a fuzzy risk assessment method that has the potential of preventing occupational hazards. This technique employed a two-stage quality function deployment (QFD) tables to illustrate exact association that exist between buildings substances, categories and reasons of hazard, while the identification processes are accomplished with the help of the fuzzy analytic network process (ANP) technique. The risk assessment, based on the fuzzy implication method was determined through failure modes and effect analysis (FMEA). The performance assessment result obtained through and then provided satisfactory assessment for risk values for the reasons of work-related risks.

A fuzzy multiple criteria decision-making (FMCDM) tool has also been used to measure hazard for urban building projects. In this case, Kuo and Luo (2012) used consistent fuzzy preference relations (CFPR), to analyze the comparative impacts of 20 recognized risk issues on the project concert. The likelihood of each risk factor occurring is analyzed with the fuzzy multiple attributes direct rating (FMADR). This risk assessment method was found to be very reliable and effective in evaluating the overall project risks that can be encountered when executing a metropolitan construction project. The aforementioned risk assessment tools have been found to be very helpful in explaining the different risks that face contractors, carrying out construction works in Saudi Arabia¹⁹. However, all aforementioned methodologies often failed to quote some important during the evaluation of risk assessment in the Saudi construction projects. Accordingly, a novel procedure – Linear Decision Making Model is established to achieve research goals within time frame for accurate risk assessment.

Linear Decision Making Model: This method comprises three phases (figure 1): contractors, sub-contractors and project designer interviews and surveys for evaluation of intensity of risk (1-Initial Evaluation), Data collection from KSA government on construction projects (2-Mid Evaluation) and foreseen decision, based on aforementioned two phases (3-Final Decision)

From above figure 1; phase one illustrates that, interviews and surveys are vital for initial evaluation, phase two demonstrates that the government reports and academic papers are furthermost important for mid evaluation and finally, phase three expresses that, assessment and analysis from phase one and two are key factors for establishing final decision on risk of construction projects. At present, this was applied only to KSA construction projects. However, in the future it can be applicable to any countries' projects particularly construction projects.

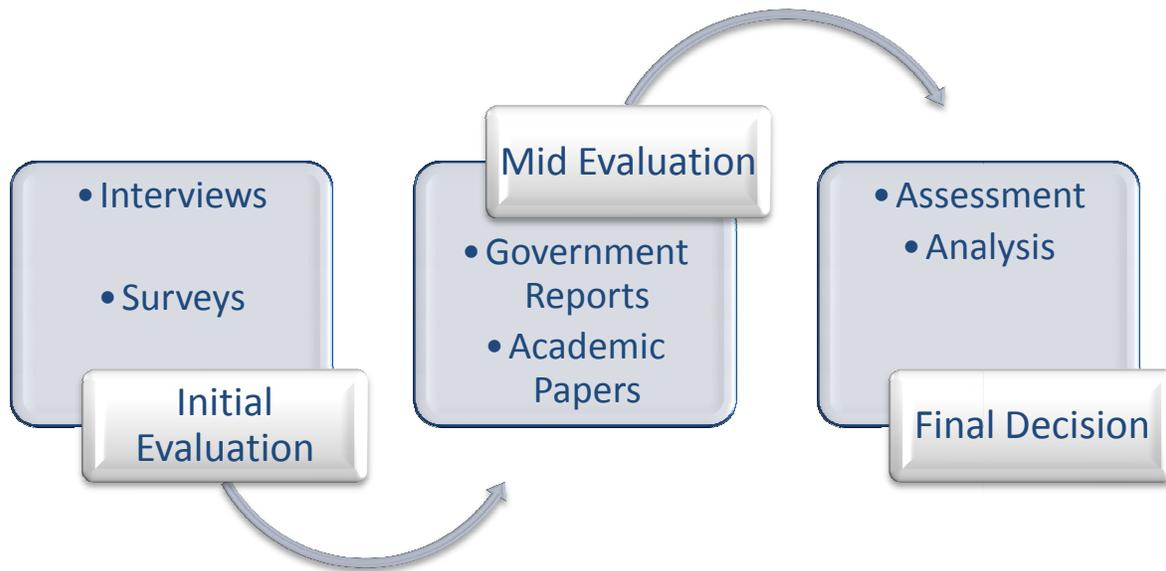


Figure-1
Linear Decision Making Model

Table-1
Qualitative Questions (Interviews and Surveys)

Number	Questions	Possible Answers Choices
1.	Are you focused on major risks and uncertainties?	1. Yes
2.	Do you think there is adequate support from national and local governments to assess all types of risk?	2. No
3.	Do you think that- housing sector is major segment in construction industry in fiscal perspective?	3. Not Known
4.	Are you analysing the risk prior and after the projects?	

Data: This study constructed on data from government reports, qualitative interviews, as well as surveys from contractors, subcontractors, designers and project experts. Accordingly, twenty-five interviews and three surveys were conducted during data collection process. Therefore, more than 180 government reports and approximately 250 academic papers were analysed. Based on this research, novel results offered. Qualitative interviews and surveys were undertaken in various places of the KSA in 4 vs. three methods, i.e. interviews and survey restricted to only four main questions (Table – 1) with 3 possible answer choices (agree, disagree and not known). Accordingly, questionnaire was distributed to the participants. Out of 170 communities, 153 of them agreed to answer the questionnaire/ interviews. 33 of the respondents did not return the questionnaire (or did not show interest to give answers at interviews spot) in a specified time. Consequently, 120

respondent’s answers (includes 25 qualitative interviews) were analysed to obtain risk intensity in KSA construction projects.

Results and Discussions

Due to the qualitative methods (short survey and a limited number of interviews) used in this study, the results reflected the views of 120 responses of selected groups (figures 2 to 5), who are designing construction projects and who are performing as contractors and subcontracts in the KSA. Accordingly, survey and interviews and academic research and government report results examined and then used as supporting material to estimate risk intensity in construction projects along with costs. In this survey and interviews, respondents are from Jeddah (32), Riyadh, (28) Mecca (10), Medina (10), KASTU (12) and Dammam (20). While, 8 groups/communities are also participated which are came from the academic field and government’s procurement and financial departments.

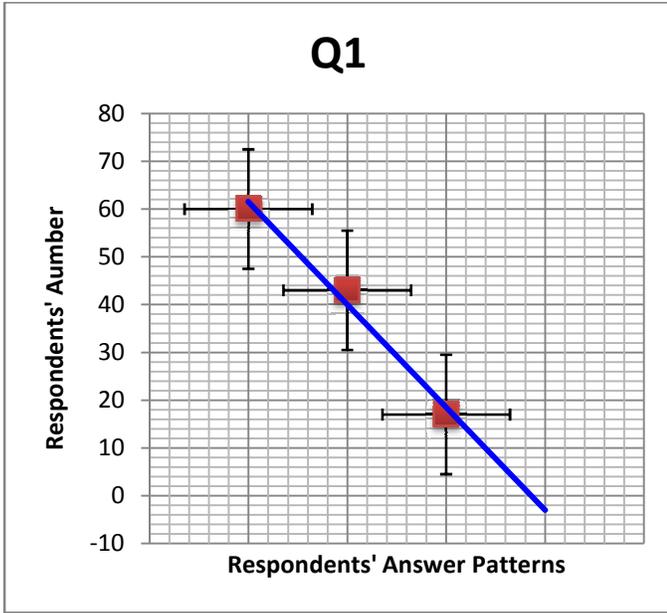


Figure-2
 (Q1-Question 1) Respondent Answer Patterns

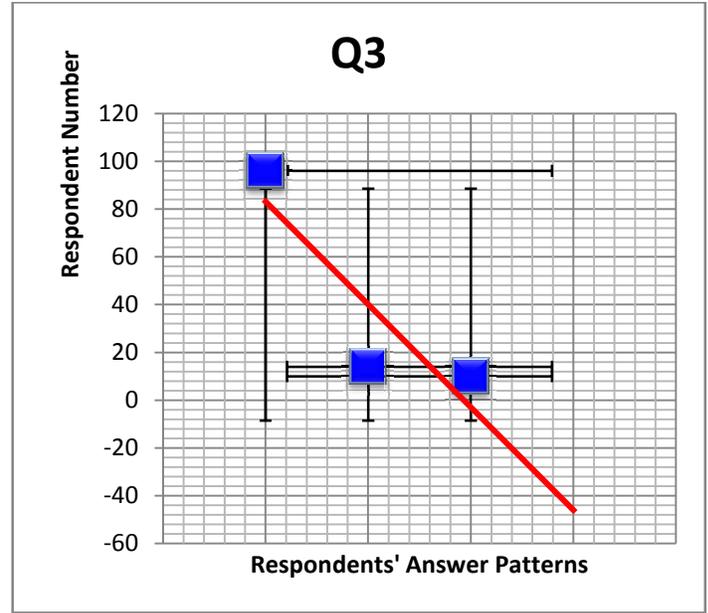


Figure-4
 (Q3 – Question 3), Respondent Answer Patterns

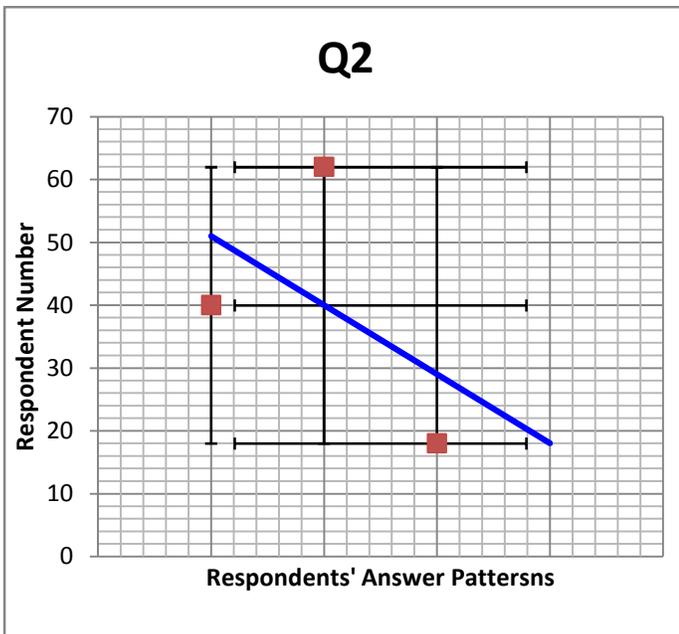


Figure-3
 (Q2 – Question 2), Respondent Answer Patterns

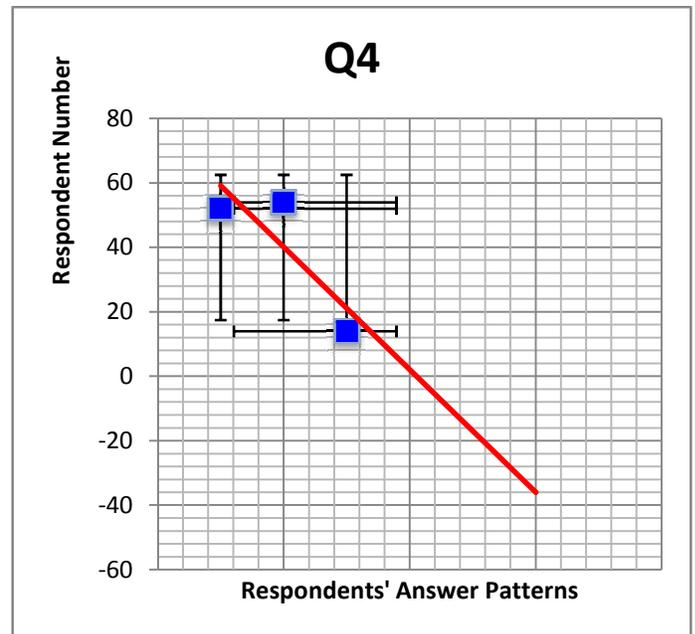


Figure-5
 (Q4 – Question 4), Respondent Answer Patterns

From above figures (2 to 5) proved that, the housing sector is a major division in constructed (79% agreed) projects. However, only half of the communities (50%) focused on risk analysis prior and after projects. However, KSA construction project costs (table 5) are also evaluated based on analysis of qualitative interview, survey and government reports.

Fiscal Costs for Construction projects: Research analysis results revealed that, since 2010, Saudi construction project

costs increased enormously (figure 5) and it reached \$72 Billion (2011), \$71.7 Billion (2012) and more than \$120 Billion (\$122) with 19.5% growth rate in 2013. Whilst, research estimations, explored that 2014 construction projects costs will be \$130 Billion and it will be \$610 Billion in coming 5 to 8 years period. In addition, the Saudi government is going to implementing many prestigious projects in next five years. Currently, five prestigious construction projects including Kingdom Tower (world largest tower) are under construction.

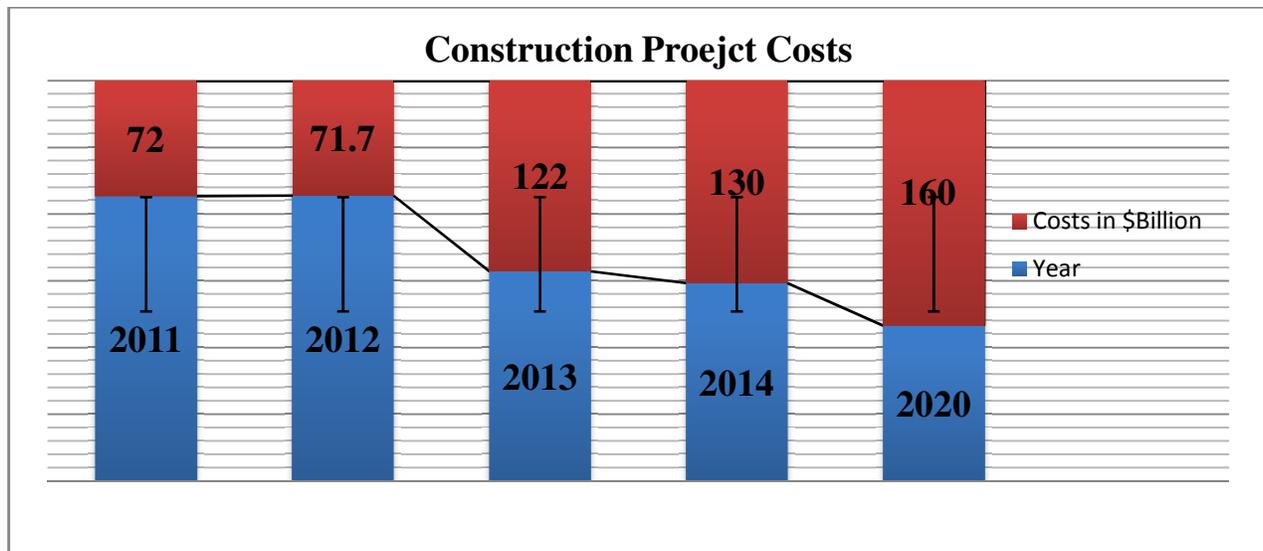


Figure-5
Construction Project Cost Trends

Conclusion

This qualitative study results achieved by conducting qualitative interviews, questionnaire surveys in various parts of Saudi as well as government reports by incorporating linear decision-making model. This tool rigorously evaluated at different phases and offered the factual costs for construction projects. Therefore, the requirements for finding risk that was specified for building/construction projects were conferred from different angles of observation. Moreover, construction corporations and groups should facilitate the procedure of dealing with the project in the initial development and later construction phases. While, many contractors and construction project specialists expressed that, no need of a complete evaluation of risk. However, they have very good idea on risk assessment. Moreover, current construction project cost is \$122 Billion and it will be \$160 Billion by 2020. Accordingly this research concluded that, risk in Saudi construction projects depended on various factors, and project costs probably super optimistic in next five years.

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References

- Smith N.J., Merna T. and Jobling, P. *Managing risk in construction projects*, John Wiley and Sons, (2013)
- Shen L.Y., Wu G.W. and Ng C.S., Risk assessment for construction joint ventures in China, *Journal of Construction Engineering and Management*, **127(1)**, 76-81 (2001)
- Tam C.M., Zeng S.X. and Deng Z.M., Identifying elements of poor construction safety management in China. *Safety Science*, **42(7)**, 569-586 (2004)
- Chen P., and Wang J., Application of a fuzzy AHP method to risk assessment of international construction projects. In *Electronic Commerce and Business Intelligence, 2009. ECBI 2009. International Conference*, IEEE, 459-462 (2009)
- Ebrat M. and Ghodsi R., Risk Assessment of Construction Projects Using Network Based Adaptive Fuzzy System, *International Journal of Academic Research*, **3(1)** (2011)
- Abdou O.A., Managing construction risks, *Journal of Architectural Engineering*, **2(1)**, 3-10 (1996)
- Uher T.E. and Toakley A., Risk management in the conceptual phase of a project. *International Journal of Project Management*, **17(3)**, 161-169 (1999)
- Chapman R.J., The controlling influences on effective risk identification and assessment for construction design management, *International Journal of Project Management*, **19(3)**, 147-160 (2001)
- Zou P.X., Zhang G., and Wang J., Understanding the key risks in construction projects in China. *International Journal of Project Management*, **25(6)**, 601-614 (2007)
- Morledge R. and Smith A., *Building procurement*, John Wiley and Sons (2013)
- Taylan O., Bafail A.O., Abdulaal R. and Kabli M.R., Construction projects Selection and risk assessment by Fuzzy AHP and Fuzzy TOPSIS methodologies, *Applied Soft Computing*, (2014)

12. Barber R.B., Understanding internally generated risks in projects, *International Journal of Project Management*, **23(8)**, 584-590 (2005)
13. Dikmen I., Birgonul M.T. and Han, susing fuzzy risk assessment to rate cost overrun risk in international construction projects, *International Journal of Project Management*, **25(5)**, 494-505 (2007)
14. Wanies-guirgis, C.H.R.I.S.T.I.N.A., Trade integration in the middle east and the north africa region: what is in their horizon following the arab spring?, *Currents Int'l Trade LJ*, **21**, 43-43 (2012)
15. Dhonte P., Bhattacharya R. and Youssef T., Demographic Transition in the Middle East-Implications for Growth, Employment, and Housing (No. 2000-2041), International Monetary Fund, (2000)
16. Arabian industry Saudi construction sector set to grow by 10% from 2015. <http://arabianindustry.com/construction/news/2014/jan/26/saudi-construction-sector-set-to-grow-by-10-from-2015-4577014/#.Uz-w3ax2Bdh> Retrieved 2nd April, (2014)
17. Delottie, Deloitte GCC Powers of Construction 2013 Construction section Overview: Eighty-Seven Years in Middle East, (2013)
18. Mohammed J. and Bubshait A., Development and Financing Techniques for Transportation Infrastructure in Saudi Arabia, (2014)
19. Jannadi A.O., Risks associated with trenching works in Saudi Arabia, *Building and Environment*, **43** (2008) 776-781 (2007)
20. Cavusgil S.T. and Deligonul S., Exogenous risk analysis in global supplier networks: Conceptualization and field research findings. *Information Knowledge Systems Management*, **10(0)**, 1-19 (2011)