# The Investigation of Risk Management at the Stage of Construction with Interpretive Structural Modeling method (Case Study: Yazd-Naein Oil Pipeline Construction Project)

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**ABSTRACT**

**Recognizing the nature of risks effective on oil projects is an important issue in the risk management of companies such as Iranian Oil Pipeline and Telecommunication Company. This study aims at identifying risks and extracting the structure of relationships between critical risks of Yazd-Naein oil pipeline construction project using Interpretative Structural Modeling (ISM) to help the pillars of the project. To do this, using different techniques, first the critical risks of the project are identified and prioritized and then using ISM, the reciprocal relationships between risks and their effectiveness on each other are recognized. This study has made attempt to make a more realistic comprehension for confrontation with non-security caused by the risks of Yazd-Naein oil pipeline construction project using ISM. The results showed that sanctions risk on project has to be concentrated by risk management since it has the highest effect on other risks and the least affectability from them. Also, since the opinion of experts have been used in this study, in the case of using in similar projects, it is expected that the implementation of the mentioned structure may positively and significantly influence the achievement of project goals such as cost, time, project scope, quality and sanitation, security and environment.**

**KEYWORDS**

**Risk management, risk identification, risk analysis, interpretive structural modeling (ISM), Cross-Impact Matrix Multiplication Applied to Classification.**

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## 1. Introduction

Oil and gas industry is important and strategic for every country and plays an important role in the economic development of that country [1]. Since oil and gas projects include different risks, the management of such risks is important to make sure of the successful performance of the projects [2, 3]. Pipeline is a safe and economical method to transport oil products exposing to a wide range of risk and in the case of the occurrence of such risks, there is the probability of so severe and unpleasant accidents. Recently, so many studies have been conducted in the field of project risk [4]. Kraidi et al [5] investigated risk factors related to oil and gas pipelines in Iraq focusing on the identification and analysis of risks caused by third party disorder to prepare comprehensive pattern of risk management. Zuofa and Ochieng [6] investigated risk management methods in the oil and gas industry of Nigeria and concluded that unawareness about project risk management, lack of education, bureaucratic government system and imperfect formation of a team are among factors which limit the effectiveness of project risk management. The previous studies reveal that due to limited resources on the identification and recognition of cross impact between the risks of oil pipelines construction projects in Iran, there is a research gap in this field. Therefore, it is necessary to use a method to achieve cross impact among the risks of these projects and show their effectiveness and affectability on each other and make a more realistic comprehension for confrontation with non-security caused by such risks.

## 2. Methodology

This study aims at identifying the critical risks of the construction project of Yazd-Naein 16-inch with a comprehensive study and investigation to extract the structure of relations between these risks. This strategic study is considered among mixed studies and is considered an applied one in purpose. In this project, totally 60 risks were identified and prioritized using checklist, interview and using similar projects by 24 managers and supervisors of projects and also experts involved in oil pipelines construction projects. Next, the identified risks were analyzed based on probability-impact assessment technique by 10 experts and through interview and holding session and the probability and impact score of each risk was achieved, after the qualitative analysis of the risks, the risks were quantified and prioritized and the risks were categorized in three critical, important and acceptable groups.

## 3. Research Findings

Among 90 prioritized risks, 11 risks were identified as critical ones. Then, to extract the structure of cross impact among critical risks, ISM was implemented. Figure 1 shows the ultimate ISM achieved in this study which has been consisted of six levels. Risks of level six are the most effective ones which directly influence level five risks. The risks of level five also directly influence the risks of level four and these impacts continue level to level and to the first level. In this model, the risks of level one are the most impressible ones. Next, using cross impact matrix analysis, the type of variables has been specified considering their impact on other variables and variables are divided into four groups of autonomous, dependent, interface and independent. Accordingly the risk of sanctions impact on project is among independent variables such variables have low dependence and high conduction. In other words, high effectiveness and low affectability are among the features of such variables. The risks of sanction impact on project and project time increase are considered among dependent variables due to extra works announced by client. Such variables have strong dependence and weak conduction, such variables have mainly high affectability and low impact on system. The risk of project transfer to weak subcontractors by the contractor is considered interface, such variables enjoy high independence and high conduction power, in other words the effectiveness and affectability of such criterion are so high and any small change on these variables causes basic changes in system. The other risks are considered autonomous, that is they have low independence and conduction power, such criterion generally separate from system because they have weak connections with system. Any change in these variables doesn't cause serious change in system.

## 4. Discussion & Conclusion

This study aims at identifying critical risks of Yazd-Naein oil pipeline construction project with a comprehensive study and investigation and extracting the structure of relations among such variables. Therefore, with the help of interpretive structural modeling process, reciprocal relations among risks were achieved, next according to cross impact matrix analysis the type of variables has been specified considering effectiveness on other variables. This study represents a new recognition of the nature of the risks of Yazd-Naein oil pipeline construction project and represents their levels. This study has made effort to represent condition for a reasonable decision-making for managers in confrontation with non-security and the risks of Yazd-Naein oil pipeline construction project using ISM method and consequently reduces the impact of key risks on projects and meanwhile helps managers

understand across impact between different risks of Yazd-Naein oil pipeline construction project and its consequences on decision-makings about response to risk strategies. Most studies have been conducted on the identification and management of the risks in oil pipelines construction projects in Iran only identified the risks and no study has been conducted on the identification and analysis of reciprocal relations among the risks of oil pipelines construction projects so far. Therefore, this study has an innovative aspect and causes a more realistic understanding for confrontation with non-security caused by the risks of oil pipeline construction projects. Since, the opinions of experts involved in oil pipeline construction projects in Iran have been used in this study, it is expected that the implementation of the mentioned structure in this study may have a positive and significant effect on the achievement of the research goals in the case of being used in similar projects.

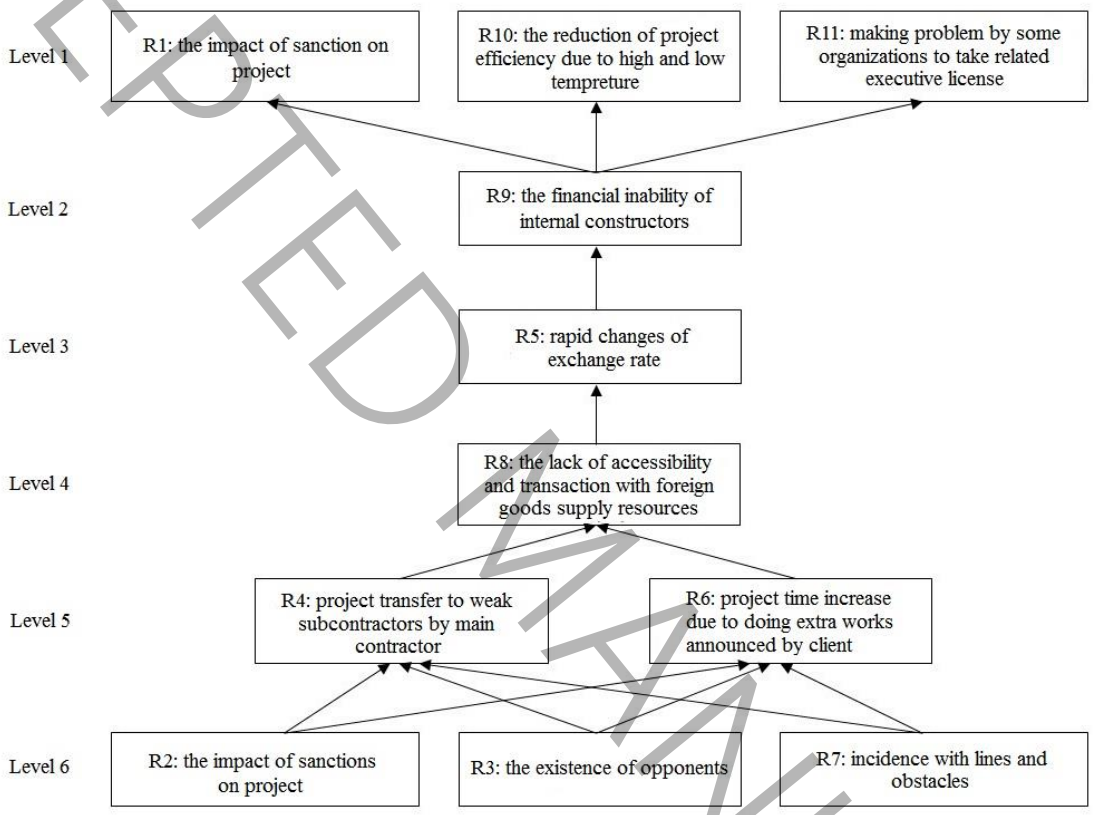


Figure 1: the interaction network of ISM

## 5. References


[1] A. Correljé, C. Van der Linde, Energy supply security and geopolitics: A European perspective, Energy Policy, 34(5) (2006) 532–543.

[2] D. Cooper, P. Bosnich, S. Grey, G. Purdy, G. Raymond, P. Walker, M. Wood, Project Risk Management Guidelines: Managing Risk with ISO 31000 and IEC 62198, John Wiley & Sons, 2014.

[3] T. Aven, J.E. Vinnem, H.S. Wiencke, A decision framework for risk management, with application to the offshore oil and gas industry, Reliability Engineering & System Safety, 92(4) (2007) 433-448.

[4] PMI, Project Management Institute, a Guide to the Project Management Body of Knowledge (PMBOK). Newton Square, Project Management Institute, (2016).

[5] L. Kraidi, R. Shah, W. Matipa, F. Borthwick, Analyzing the critical risk factors associated with oil and gas pipeline projects in Iraq, International Journal of Critical Infrastructure Protection, 24 (2019) 14-22.

[6] T. Zuofa, E.G. Ochieng, Issues in risk management: the perspectives of managers in Nigeria's oil and gas industry, International Journal of Engineering Research & Technology, 3(4) (2014) 369-374.