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A brief review on NIOC exploration directorate geophysical mega project: research and development on subsurface imaging improvement

Peyman P. Moghaddam, Keivan Hosseini and Alireza Khorakian

¹ Earthquake Research Center, Ferdowsi University of Mashhad, Mashhad, Iran, E-mail:ppm1407@hotmail.com

ABSTRACT

With overwhelming demand on improving geophysical technology by NIOC and with agreement of oil ministry of Iran to engage universities in oil and gas exploration and development, a geophysical mega project has been assigned to Ferdowsi university of Mashhad (FUM). The title of the project is "Technological improvement on subsurface imaging methods for hydrocarbon exploration in Kopeh Dagh Basin". In this paper, I briefly review the project and its components and propose possible ways to achieve the goals for this project.

Keywords: Ferdowsi university of Mashhad Geophysics mega project, technology development, subsurface imaging improvement

INTRODUCTION

The rate of unsuccessful drilling by NIOC exploration department is in all-time low. One obvious and preventable reason is the technological deficiencies which exists in NIOC exploration workflow. This fact used to be ignored for decades till recent years with new appointment of oil ministry and director of NIOC exploration department and their vision regarding the importance of technology in oil and gas exploration. They initiate five exploration mega projects to be assigned to five universities in Iran which are able to provide the capabilities to do these projects. All these projects are focusing on exploration techniques and technologies. The target of these project is to fill the technological gaps which are created in past decades between Iranian vendors and their international counterparts. This would enable Iranian vendors (with their university partner) not only to apply the latest technologies in Iran oil and gas exploration but also to compete in an international environment. All five projects have the same architecture in term of deliverables and targets. Table 1 shows the title of these projects and assigned universities.

PROJECT SCHEDULE AND TIMELINE

A budget of approximately 4 million Euros has been assigned to each project which is spread over the span of 10 years through 4 phases. Table 2 shows the project schedule for each individual projects. In phase 1 of the project a roadmap for the technology is being devised by the university with the help of Iranian and international technology experts. In phase 2 each technology is being developed in laboratory scale then to semi industrial scale. In phase 3 the technology is being adopted in NIOC platform and applied to the basin or area of interests in the project. In phase 4 technology is being obtained by university spin off company so that it can apply the technology in NIOC's other area of interests with additional goal of also being able to compete in international market.

Table 1 Title of mega projects and their assigned universities

University	Mega Project Title	
Shahid Beheshti	Technological improvement on geo-chemical exploration methods with emphasis on hydrocarbon basin modeling in North Dezfool area	1
Kharazmi	Technological improvement on fractured carbonate reservoir studies in Abadan area	2
Ferdowsi Mashhad	Technological improvement on subsurface imaging methods for hydrocarbon exploration in Kopeh Dagh Basin	3
Shahrood	Geomechnics application in hydrocarbon exploration and new technologies for drilling and petroleum engineering for exploration wells	4
Chamran Ahvaz	Technological improvement on geo-chemical exploration methods with emphasis on surface and subsurface geo-chemical investigation in Abadan area	5

GEOPHYSICAL MEGA PROJECT

Geophysical Mega project with title "Technological improvement on subsurface imaging methods for hydrocarbon exploration in Kopeh Dagh Basin" has been assigned to Ferdowsi university of Mashhad. The

target of this project is to identify and develop all the geophysical technologies which are not available in Iran and are in high demand for today oil and gas exploration in the country. Phase 1 of the project compromise of 7 steps which is depicted in Table 3. The target of phase 1 is to create a report on high demand technologies/road map for achieving them and requirements for university technology center responsible to execute the project. Focus of this project will be in three distinctive technology areas as follow,

1) Exploration geophysics research and development

In this area it focuses on three main subjects,

a) active seismic research and development, this compromises of seismic acquisition, processing and interpretation when there is a controlled source involve in the seismic acquisition.

b) passive seismic research and development, this contains passive seismic acquisition, processing and interpretation

c) Application of potential fields in exploration, this includes EM and gravity measurement (acquisition, processing and interpretation) and their application in hydrocarbon exploration

2) Geological exploration research and development, research on basin evolution modeling and petroleum system modeling is considered to be included in Mega project as geological exploration research and development.

3) Reservoir geophysics research and development, this contains all the geophysical studies at reservoir level such as reservoir characterization, facies modeling, AVO inversion, core data integration and ultimately quantitative interpretation (QI) which is a combination of integration of the seismic data with petrophysical and rock physical studies. QI study is new technology which hasn't been adopted in Iranian oil and gas field and we are hoping to initiate this study on Kopeh Dagh basin.

Table 2 The mega project schedule

Creating the technologies roadmap	Phase 1
Developing the technologies from laboratory experiment to semi industrial experiment	Phase 2
Deployment of the technologies in NIOC exploration workflow	Phase 3
Full in-house deployment of technology and service deliveries through science based companies spin off from university	Phase 4

Table 3 Mega project phase 1 schedule

Identification of geophysical technologies in hydrocarbon exploration	1-1
Identification of geophysical technologies which are in research and development phase by Iranian and international universities	1-1-1
Identification of geophysical technologies which are currently in use by NIOC and IOC's	2-1-1
Report on all the geophysical technologies currently in use or in research	Output 1
Assigning priority to technologies based on NIOC demands	3-1-1
Report on assigned technologies	Output 2
Designing proposals on development of assigned technologies	4-1-1
List of high demand technologies for draft proposals preparation	Output 3
Evaluation of NIOC data-bank and resources for development of each technology	2-1
Evaluation of each report existing in NIOC on technology	1-2-1
Summarize all the reports in one comprehensive report on technology	2-2-1
Report on NIOC previous exposure to each technology	Output 4
Locating the international research/technology centers which are leading in each technology	3-1
Finding at least three centers which are active in technology	1-3-1
A report on list of international research centers paired with high demand technology	Output 5
Establishment of geophysical technology center in university specifically to achieve the target of Mega project	4-1
Hardware requirement investigation	1-4-1
Human resource requirement investigation	2-4-1
Software requirement investigation	3-4-1
Report on technology center requirement to be able to properly execute the Mega project	Output 6
Final report on high demand technologies/road map for achieving them and university technology center responsible to execute the project	Output 7

CONCLUSION

The aim of mega project is to identify the potentials of research institutes and universities in Iran, create a list of high demand projects and distribute these projects within these institutes according to their capabilities and resources which they have available to successfully do the projects. We hope after completion of this project, we would be able to domesticate most of the high demand technologies for NIOC exploration.

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