



Strengthening Geophysical Research in Oil and Gas Sector: A Need of the Hour

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Keywords

R&D, Geophysical Research, Software Development

Summary

This paper is an expression of an idea which can help build a strong foundation of self-reliance and growth. Fostering Research and Development (R&D) is essential for invention of new technologies and solving complex geological problems at hand. It reduces dependencies on external agencies and provides a fall back option in difficult situations. R&D, coupled with software development, can bridge the gap for the end-users. In-house developed application software contributes towards considerable savings, both during procurement and maintenance. Although this philosophy is applicable to almost all scientific organizations, the present discussion is restricted to relevance of Geophysical Research in exploration for oil and gas.

The suggested software development program can be a befitting scientific contribution to the major new NATIONAL PROGRAM – *MAKE IN INDIA*; designed to facilitate investment, foster innovation and enhance skill development.

Introduction

In today's competitive environment, every scientific organization needs an in-house R&D wing. Many oil gas companies have created their own R&D institutes and supported academic institutions leading to the development of new technologies that suit several E&P requirements. It provides an opportunity to be in touch with academia and domain experts to ensure that new ideas and technologies are brought into the organization and inducted for practical use. Its prime objectives are to recognize and capitalize on opportunities in data analysis; cost reduction, savings in time and assist the users overcome the challenges confronting them.

Oil and gas industry very well understands the need of application software throughout the seismic data Acquisition, Processing and Interpretation (API) cycle. The need starts as early as in planning survey design for good quality data acquisition, followed by seismic data processing; and subsequently for G&G interpretation for prospect generation and de-risking through advanced seismic inversion and AVO studies, coupled with processing and interpretation of petrophysical data, Rock Physics Modeling and other non-seismic techniques.

Although today, the commercially available software are the major workhorses taking the total load, yet a gap is felt by the geoscientists, who despite their best efforts are being deprived of the true professional satisfaction. Some of the reasons triggering dissatisfaction are as follows:

- Commercially available application software involve high cost, both at the time of procurement and during maintenance
- Provide limited freedom of customization for achieving target specific requirements
- Increase dependencies on various external agencies for maintenance, upgrades, trainings and trouble shooting
- The road map of commercial software companies may not allow them to (a) attend to the user specific or data specific problems and provide customized solutions in a time bound manner; and (b) they may not like to invest to solve a one-time requirement of the user.

R&D leads to continuous improvement of existing practices, finding better solutions and inducting state-of-the-art technologies and their application to provide customized solutions with added functionalities, thereby increasing the effectiveness of G&G in exploration. Moreover, it facilitates conversion of innovative ideas and expertise within the organization into workflows that can easily be practiced by the users.

Need

Present day hydrocarbon scenario of India can be described as:

- 60% of the prognosticated oil gas reserves are yet to be harnessed
- deep water and ultra-deep water oil and gas resources have to be tapped
- shale gas resources of nearly 96 TCF to be recovered, and
- 90% of the prognosticated CBM resources have to be realized.

In Indian scenario, the broad exploration challenges confronting geoscientists can be broadly listed as follows:

Sub Basalt Imaging: With current technology, the energy penetration is a problem, which result in poor sub basalt images

Effect of coal on imaging: Since coal absorbs maximum energy, sub-coal imaging is inadequate.

Thrust Fold Belt Imaging: Rough topography, complex near surface and subsurface conditions are the major impediments towards faithful imaging of these areas, which are generally known to be favorable hydrocarbon habitat

Thin Pay Resolution: Resolving beyond conventional limits would be highly beneficial for generating prospects.

Therefore, a big thrust in applied R&D activities is needed to develop solutions with direct utility to the organization. This needs a paradigm shift in R&D commitments as competition for these resources intensifies.

Method

A pre-requisite is to find answers to the basic questions like *where we are now? where we want to go? and by what time?* This can give a strategic direction which needs to be followed.

Strategic thinking can tell what might happen and generate options; then comes the decision part of making choices from the appropriate options; followed by strategic plans for taking actions and clearly understanding how the decisions are to be implemented (Figure 1). The broad objective could be to develop the R&D centers into world class institutions, with induction of best technical brains and commitment to R&D spending. This helps strengthening technical and scientific manpower for better decision-making and capacity-building in E&P companies. R&D spending is to be seen as one of the means of assuring delivery and should increase to a level that can enable technology to generate a genuine competitive advantage. To sustain the R&D efforts and keep the technological edge, peer reviews and collaboration with educational and technical institutions are fundamental.

After lot of brainstorming, interviews with domain experts and focus group discussions, a three pronged approach is suggested by the author to achieve the objectives. This involves (i) In-house R&D, (ii) Collaborative R&D with agencies of repute having necessary domain expertise, and (iii) Joining consortia or gainfully utilizing facilities available at scientific research parks and incubation centers. A SMART goal could be to convert the results of R&D to application software suites for seismic data processing and G&G Interpretation at par with commercially available software by next 10 years. It would be all the more desirable if the software suites so developed could address the aforementioned exploration challenges by using new technologies inter-alia:

- Long offset seismic data acquisition and processing SRME for Marine data; Seabed node; Broadband seismic etc.
- Advanced Near Surface Modelling and Advanced time & depth imaging technologies

- Continuous Wavelet Transform based approaches for time-frequency analysis
- Bandwidth enhancement algorithms

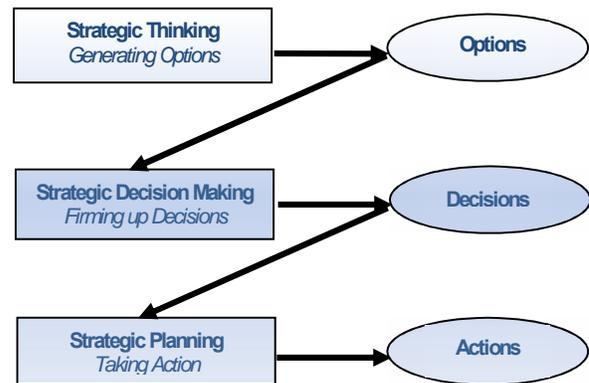


Figure 1: Strategic thinking leading to Strategic Planning.

Risk Factors

The whole idea sounds good, but the very nature of R&D involves uncertainties and some inherent risks, which may defeat the very purpose if they are not properly addressed in the initiation and planning processes. It has been observed that lack of seriousness in these two areas are the main reasons for time and cost overruns in majority of projects. Sometimes a solution may be impossible due to lack of skillsets and knowledge of the team members. Complex techniques like Reverse Time Migration (RTM), which was not commercially viable a decade ago, is easily realizable today with the availability of enhanced computing power. Additionally, sustaining the pace of R&D and motivating the researchers to refresh and stay current with the technological advancements is in itself a task for the managers. The risks involved could be mitigated by addressing the following issues:

- The selection of thematic areas for Collaborative R&D is a very crucial component. If the projects to be undertaken are not in-line with the Actions formulated by the Institute and do not fulfill its requirements, then such projects would become non-productive, as they are not capable of adding any value.
- Lack of systems and processes in place, which makes roles and responsibilities hazy and ambiguous is a very dangerous situation to be in. Sufficient time needs to be spent in clearly defining *who will do what?*

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- Once the software suites are developed, ensuring the utilization, regular trainings to users and system administrators becomes crucial for effective use. The mechanisms for knowledge transfer from seniors to juniors and above all the ownership of continuously evolving product needs to be meticulously planned, efficiently executed and monitored.
- Timely incorporating patches and upgrades are necessary for incorporating new technologies for enhancing processing and interpretation efficiencies.

Conclusions

The major benefit of the investment in R&D is an increase in knowledge base of the organization, providing the capability to handle acreage specific problems and has long-lasting value to meet future requirements. It reduces dependency on commercial software products.

The innovations can be patented / copyrighted giving a competitive edge in the industry.

Software development is an integral part of applied research, without which the implementation of many of the geoscientific techniques is not possible. It helps analyzing the data interactively, reduces turnaround time and is less error prone, if implemented correctly. The routine and more mundane, but nevertheless essential, tasks can be made as automated procedures that will be a boon to the users.

Besides developing a new revenue stream for tapping global opportunities, these ideas, if implemented as suggested, would go a long way in augmenting ONGC's efforts towards *Make in India*, a program of National importance and pride.

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Acknowledgements

The author is grateful to the ONGC Management for granting permission to present these thoughts. This paper is made possible through the encouragement, guidance and support from Mr Anil Sood, Executive Director, ONGC. Thanks are due to Dr. JVSSN Murty, Ex GM (Geophysics), ONGC and a National Mineral Awardee for inspiring this work and adding value to the thought process. Thanks are also due to Mr PK Chaudhuri, GM (Geophysics), ONGC for useful discussions.