

Preliminary Project Report

2.7.9 IOR Pilot Projects – Learning by doing

Decision and Data Analytics for planning and implementation of IOR Pilot Projects

Project number and location (UiS, NORCE, IFE): 2.7.9, UiS

Project duration: 2 Years (Oct. 2020-Oct. 2022)

Project manager: Rouholah Ahmadi (post doc)

PhD students and postdocs: Rouholah Ahmadi (post doc)

Other key personnel: Reidar Bratvold

1. Executive summary

IOR projects are cash intensive with high operating costs and offer uncertain benefits. They are attractive from the perspective of improved oil recoveries and the ability to utilize some of the existing infrastructure. However, there are two key issues that complicate the IOR project decision. The first issue is pre-investment decisions aimed at ensuring future flexibility for the implementation of IOR projects at the time of initial development program. Next, significant risk reduction is required that could be followed through a sequential learning, via implementation of smaller projects with existing constraints. The objective of this project is to create value through improved decision making and uncertainty understanding for the planning and implementation of IOR projects by using a generic decision-driven data-assimilation approach. A decision and data analytical framework for the purpose of generating decision supporting information for IOR projects with particular focus on the IOR pilot project decisions will be developed, evaluated, and tested.

2. Introduction and background

The project has been initiated at the National IOR Centre of Norway (UiS) Oct. 2020 and lasts two years. The objective of the project is to create value by developing a generic framework and method and to improve decision making and uncertainty understanding for the planning and implementation of IOR projects (smart water injection, polymer/surfactant injection, etc.) by using a generic decision-driven data-assimilation approach. The framework and method will be used to study the impact of uncertainty about the benefits of a technology and information gathering decisions. The main deliverables from this project are:

- ❖ A systematic and innovative solution to the IOR project, via developing a generic decision-driven data-assimilation framework for enhancing decision making and uncertainty understanding for the planning and implementation of IOR projects (smart water injection, polymer/surfactant injection, etc.)*
- ❖ Demonstrating developed methodology and workflow on industry-relevant cases*

3. Results

- ❖ Developing generic models (in Python) to support:
 - Real option valuation using least square Monte Carlo simulation (LSM)**
- ❖ Writing a first paper on “An Exposition of Least Square Monte Carlo Approach for Real Options Valuation”*

- ❖ *Conducting research on extending the use of approximate dynamic programming within the LSM method*
 - ❖ *Implementing the Lundin project entitled as “Value of data in Edvard Grieg future decisions”*
 - *Developing and describing a generic decision-driven framework for creating value from flexibility in IOR contexts*
 - *Assessing the value of information (VOI) of the water-alternating-gas (WAG) pilot project in Edvard Grieg oil field*
 - *Preparing a paper on the “Assessment of Value of Information for IOR Pilot project Implementation”*
4. Conclusion(s)
- A practical framework for valuing several real options has been developed to support IOR managers’ and decision makers’ decisions to enhance the value of the project. The real options could include a variety of flexibilities including continuing the project, temporary suspension of the project, waiting and gathering more information about different uncertain parameters such as residual oil saturation, expanding the project, changing the project scale, etc. This approach provides a basis for the decision makers to value both information gathering and building in flexibilities to create value by enhancing future decisions.*
5. Future work/plans
- ❖ *Research*
 - *Calculation of VOI for WAG Pilot Project in Edvard Grieg Field*
 - *Extending the use of approximate dynamic programming to enhance the feasibility of applying LSM approach for larger-scale sequential decision-making problems*
 - ❖ *Journal/ Conference Publications*
 - *Submitting the first article entitled “An Exposition of Least Square Monte Carlo Approach for Real Options Valuation” to an appropriate journal by the end of December 2021.*
 - *Submitting the second paper on the utility of LSM approach for real option valuations for the oil field production projects to a relevant Conference by the end of December 2021*
 - *Writing down, editing, and submitting the third journal paper on the “Assessment of Value of Information for IOR Pilot project Implementation”, planned in Year 2022*
 - *Preparing fourth paper on “Improving the Feasibility of LSM Approach for Larger Scale Sequential Decision Problems Using a Modified Approximate Dynamic Programming (planned to implement in Year 2022)*
6. Dissemination of results
- ❖ *Preparing the research article “An Exposition of Least Square Monte Carlo Approach for Real Options Valuation” (Ready for submitting to a relevant Journal)*
 - ❖ *Writing down the Conference paper on the use of LSM approach for real option valuations in oil field production projects*
7. References

Not yet published