

Petter Osmundsen¹ and Kjartan H Teigen²

IMPROVED RECOVERY FROM EXISTING FIELDS A SURVEY OF DECISION CRITERIA¹

¹ University of Stavanger, Norway, (47)51831568, Petter.Osmundsen@uis.no

²Norwegian Petroleum Directorate Norway, (47)92096067, Kjartan.Teigen@npd.no

BRIEF OVERVIEW

The decline in oil prices combined with high costs which are slow to deflate has brought forward the date when many fields on the Norwegian continental shelf (NCS) will cease production. Measures are therefore urgently required to extend the producing life of these fields and to improve their recovery factor. The government has identified a number of projects in this area which it believes will provide a good return for both society and the oil companies, but which have nevertheless been postponed or not realised. Against that background, this article surveys oil company decision criteria for projects which could improve recovery in order to identify possible reasons for the failure to decide on them. Subjects we discuss include required rates of return, capital rationing, parameters for measuring financial performance, management parameters in the companies, organisational structures, and research and development incentives.

METHOD

The article draws on a number of meetings and conversations with key specialists in oil companies, contractors, oil service enterprises and government. In analysing the incentive structure in the contracts regulating the industry, we make use of contract and incentive theory – e.g., Hart (1995) and Bolton and Dewatripoint (2005). To understand how the behaviour of oil companies is affected by their perception of oil company valuations by capital markets, we benefit from behavioural economics studies of the petroleum sector. See e.g., Osmundsen et al (2006, 2007).

RESULTS AND CONCLUSIONS

We have identified general stoppers for improved oil recovery (IOR) projects. These include 1) the priorities set by oil companies for their resources (rigs, capital, personnel), between exploration and IOR, and between the NCS and other regions, 2) the conflict between short-term key performance indicators (KPIs) for decision-makers and long-term value creation, 3) organisational challenges (sub-optimisation), 4) the overdimensioning of robustness requirements, 5) the excessively long lead times for IOR measures compared with the producing life of the field. IOR is an umbrella term which covers many different types of projects, and the survey of project stoppers accordingly needs to be supplemented with stoppers for specific categories of IOR measures. See the figure below. A great deal stands to be gained in economic terms from improving recovery factors on the NCS. An increase of just one per cent in oil recovery over and above existing plans would yield revenues in the

¹ We would like to express our thanks for rewarding conversations with and comments on the article itself from a number of key specialists in the oil sector, government and the academic community. Address for correspondence: Petter Osmundsen, department of industrial economics and risk management, University of Stavanger, NO-4036 Stavanger, Norway. Tel: +47 51 83 15 68. Mobile: +47 99 62 51 43. E-mail: Petter.Osmundsen@uis.no. Home page: <http://www5.uis.no/kompetansekatalog/visCV.aspx?ID=08643&sprak=BOKMAL>

order of USD 17-25.5 billion² at today's oil price.³ Research in the form of pilot projects is important for exploiting this potential. But the knowledge from such projects often accrues to more players than those who bear the investment cost. Coordination problems could consequently arise, and government intervention may be required to ensure that the work is done. A number of other challenges related to an IOR commitment are also faced at present. Oil prices are uncertain in the short term, and we have experienced a cost explosion in the industry. Pressure on margins could prompt a reassessment of the cessation date, and a number of IOR measures could have become more time-critical. On a more general basis, IOR projects also face challenges related to measurement problems. It is difficult to evaluate cause and effect with hindsight – which factors were the ones which yielded improved recovery?

	Method	Possible project stoppers
<i>Conventional methods</i>	Pressure maintenance and drainage - Water injection - Gas injection - Water alternating gas (WAG) injection	Price assumptions Adequate number of wells and maintenance Short-term focus – desire for gas at an early stage (or possible loss of options) Availability of gas
	Wells - Drilling, pressure and underbalanced drilling - Maintenance	Availability of rigs Maintenance costs
<i>Advanced methods</i>	Chemical flooding - Polymers: polymer flooding, linked polymer solution (LPS), bright water, silicates, etc - Surfactant flooding - Low sal, low sal + surfactants - Microbial methods - Foam	Decision on pilots – potential for market downturn Technical risk – a number of methods call for pilot testing and will require major modifications to existing installations Logistical challenges Chemical consumption – chemicals not sufficiently “green” Upsides/options not protected
	Gas-based injection - Rich gas - CO ₂	Decision on pilots – potential for market downturn Availability of gas (or CO ₂) Major modifications required for carbon injection
	Advanced wells - Pressure and underbalanced drilling	Decision on pilots – potential for market downturn Health, safety and environmental (HSE) considerations

Fig. 1. Production methods and possible project stoppers

Given the critical time frame, having IOR plans ready in advance is important. And pilot projects must be launched today, so that the increased knowledge becomes available in time. That argues in favour of a collective IOR effort involving both companies and government.

² Monetary amounts have been converted from Norwegian kroner to US dollars at an exchange rate of NOK 1 = USD 0.17.

³ Interview with Johannes Kjøde, Norwegian Petroleum Directorate, *Norwegian Continental Shelf* no 2, 2009, p 6.

The companies should ensure that short-term performance indicators cause the fewest possible distortions – financial decisions should be reached on the basis of a long-term criterion in the form of net present value. Furthermore, the companies should be aware of the time-criticality of IOR and put the necessary contingency plans in place. Testing should also be conducted now in order to know as much as possible about effective IOR measures. The government should help to facilitate cross-licence coordination of pilot projects. Because of knowledge overspill (externalities) between licences, these should also provide direct support for such projects. The government should also continuously identify existing investment incentives in the companies in relation to socio-economic profitability in order to detect possible deviations.

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