

The NPD has calculated the profitability of exploration on the Norwegian continental shelf (NCS) over the past decade. The analysis shows that this activity has been profitable in all areas and has contributed substantial value to Norwegian society. Even very small discoveries can be profitable when tied back to existing infrastructure.

Exploration over the past decade has contributed substantial value to Norwegian society. That emerges from the NPD analysis, which presents the direct financial value creation from these activities in 2008-17. All profitability analyses are pre-tax calculations. The calculations do not take account of indirect economic effects such as the consequences of extending field production and spin-offs for the rest of the economy. Nor has the value of geological information acquired by exploration been quantified in this analysis. Its methodology and assumptions are described in fact box 4.1.

EXPLORATION AND COSTS DURING THE PERIOD

Exploration activity measured by number of wells spudded was high during the decade, with an annual average of 51 wells. It was at its highest in 2009, with 65 wells spudded, and lowest in 2017 with 36 (figure 4.2). The largest number of wildcats was drilled in the

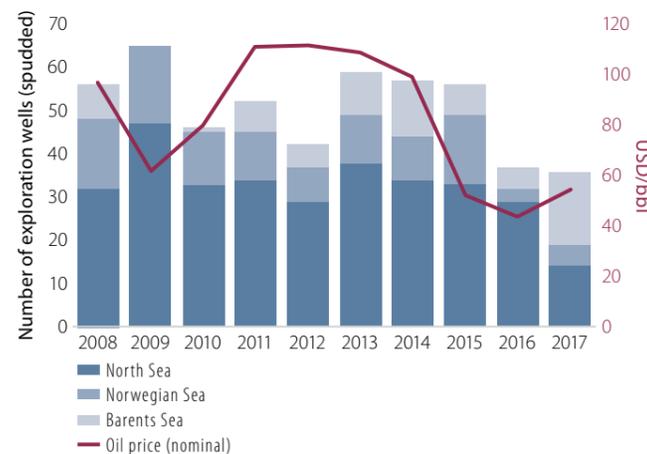


Figure 4.2 Exploration wells spudded by area, 2008-17.

North Sea during the period.

Combined with strong oil and gas prices, the high level of activity during the period to 2015 contributed to a substantial growth in costs. The companies therefore initiated measures to reduce expenses, enhance operational efficiency and limit capital spending. The fall in oil prices reinforced the need for cost cuts.

The oil price decline and consequent capital rationalisation led to a sharp drop in exploration investment from 2016 (figure 4.3). Exploration expenses are outgoings incurred from the award of a production licence until a possible discovery is developed, and comprise spending on seismic surveys, wells, field evaluation and administration. Drilling represents the largest individual factor in total exploration costs. Rig hire is the largest component in expenditure.

Figure 4.4 shows the decline in drilling cost per well over the period.

This figure shows that costs per well are lowest in the North Sea and highest in the Barents Sea, al-

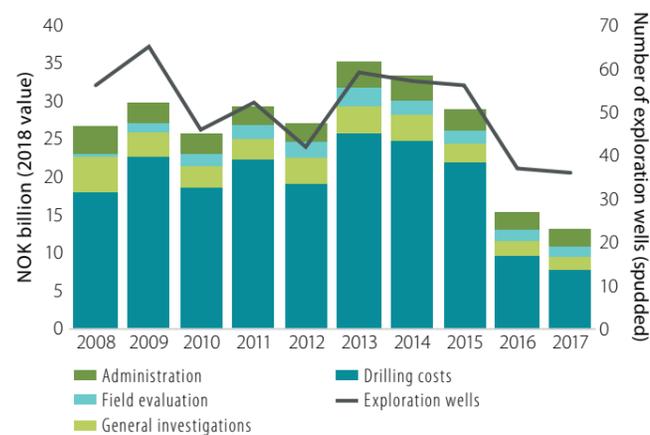


Figure 4.3 Exploration costs and wells drilled, 2008-17.

Fact box 4.1: Methodology and assumptions

This analysis covers all phases of the industry, from exploration to cessation and removal (figure 4.1).

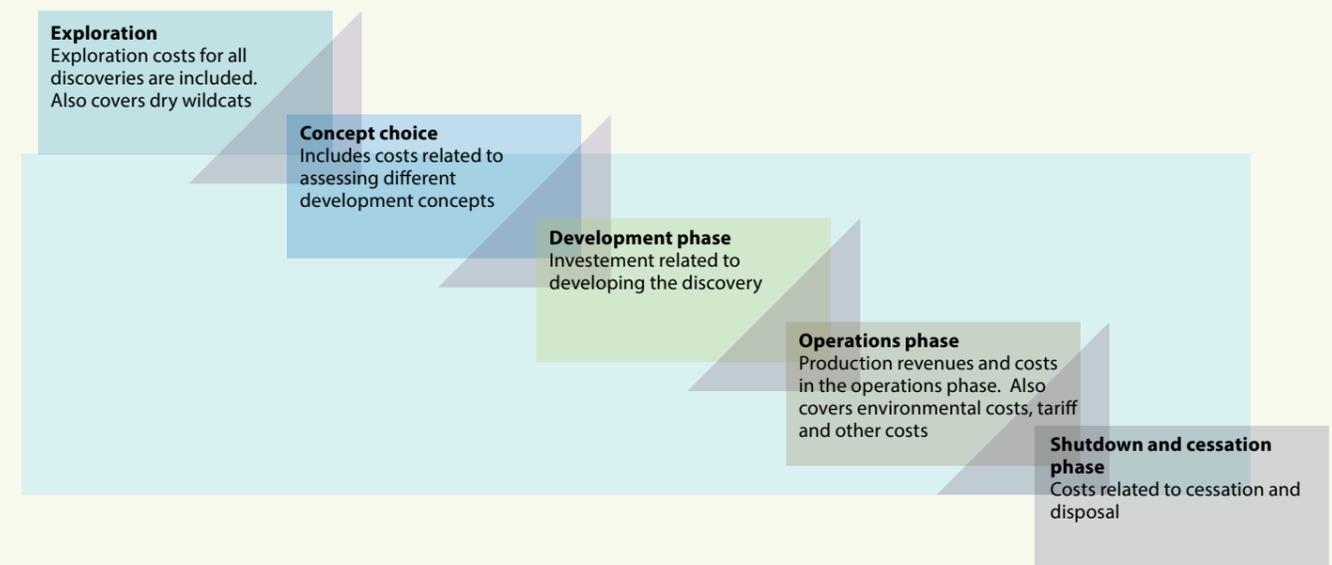


Figure 4.1 Illustration of the various elements included in the analysis.

The profitability of exploration is defined as calculated revenues from discoveries in the period less all expenses, including exploration and cessation costs. Exploration costs include both successful exploration and exploration which has failed to prove resources. Income and cost flows are discounted to the same year.

A total of 190 discoveries were made during the decade, of which 73 are categorised in resource class (RC) 6 – in other words, finds where recovery is not very likely (figure 1.10). The 7319/12-1 (Pingvin) and 7435/12-1 (Korpfjell) discoveries from 2014 and 2017 respectively are examples of finds placed in RC6 and thereby excluded from this analysis, which covers the remaining 117 discoveries.

Forty-eight of these are already in production (RC0-RC1), in the planning phase (RC2-RC4) or at a stage where recovery is likely but not clarified (RC5). Production and cost profiles reported by operators in connection with the revised national budget (RNB) have been applied in these cases. Examples include 16/1-9 Ivar Aasen from 2008, a field already on stream (RC0-RC1), 16/2-6 Johan Sverdrup from 2010, which has been clarified and is in the planning phase (RC2-RC4), and 7220/11-1 (Alta) from 2014, where production is likely but not clarified (RC5).

Thirty-nine of the discoveries in the analysis are either being or expected to be developed with other finds in coordinated developments (RC0-RC5). These discoveries are not reported separately, but form part of other overall profiles. To establish production and cost profiles per discovery, they are treated as a share of the overall profile reported by the operator for the RNB. The base estimate for calculated resources per discovery is used to compute this proportion. An example is provided by the discoveries in the Noaka area (north of Alvheim, Krafla and Askja).

The NPD has prepared separate production and cost profiles for 30 of the discoveries. Eleven of these are being or will be phased into coordinated developments initiated before the analysis period began, such as the 15/9-B-1 find from 2009 which is already on stream as part of the Sleipner Vest field. The remaining 19 discoveries had not been evaluated (RC7F) at 31 December 2017 and therefore lacked their own reporting, such as the 6707/10-3 (Ivory) find made in 2014 north-east of Aasta Hansteen.

NOK 523 per barrel has been assumed as the future oil price (in fixed 2018 value). At today's exchange rate with the US dollar, this corresponds to just under USD 65 per barrel. NOK 1.90 per scm has been assumed as the gas price. These figures accord with the RNB for 2018 (Report no 2 (2017-2018) to the Storting from the Ministry of Finance). Historical prices for oil, gas and natural gas liquids (NGL) are used for the period before 2018. Real discount rates of four and seven per cent are applied. Estimated spending for 2018 and beyond reflects the cost level in 2017 with a total uplift of 17.5 per cent up to 2029 (in accordance with the 2018 RNB).

The estimates for the profitability of exploration are uncertain. This reflects the inherent uncertainty of resource and cost estimates as well as of forward-looking price trends for oil and gas. No development decision has yet been taken for a significant proportion of the discoveries made in 2008-17. How far plans for these finds have advanced varies, so production and cost estimates are of differing maturity. Uncertainty about the start of production also has a substantial effect on present value. That applies particularly to discoveries in the Barents Sea, where little infrastructure is in place.

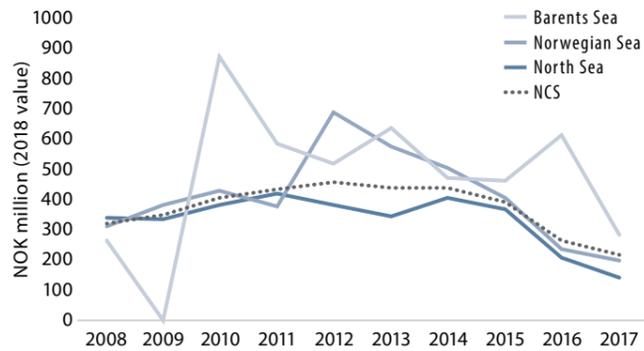


Figure 4.4 Average exploration well cost (drilling expense per well) by area, 2008-17.

though that varies somewhat over time.

The most important reason for the high cost of drilling in the Barents Sea over the past three years is several complicated wells.

It is important to emphasise that a significantly larger number of wells were drilled in the North Sea during the period than in the Barents Sea. This means that extreme values have a bigger effect on average cost in the latter area than in the former.

DISCOVERIES AND RESOURCE GROWTH DURING THE PERIOD

The 117 discoveries forming the basis for this analysis represent a total resource growth of about 1 150 million scm of oil equivalent (oe). Their size varies from the biggest (16/2-6 Johan Sverdrup) at roughly 400 million scm oe to the smallest with less than a million scm oe.

Figure 4.5 shows the size of the discoveries in the

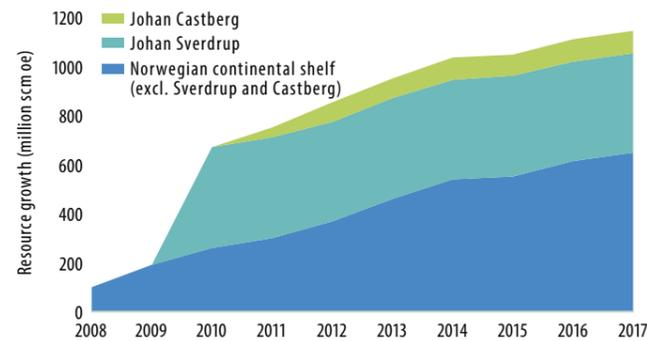


Figure 4.6 Resource growth on the NCS in the 2008-17 analysis period.

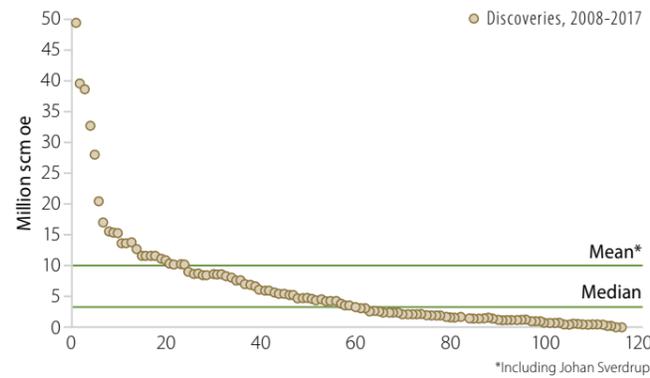


Figure 4.5 Discovery size per find, 2008-17. The Johan Sverdrup discovery of about 400 million scm oe falls outside the scale used in the figure.

analysis. The mean discovery size (including 16/2-6 Johan Sverdrup) was about 10 million scm oe, with a median size of just under four million scm oe. A mean significantly higher than the median indicates that the biggest finds greatly exceeded the typical discovery size. In other words, they accounted for a high proportion of resource growth. That emerges clearly from figure 4.6.

VALUE CREATION IN THE PERIOD

The profitability of exploration is calculated with discount rates of four and seven per cent. Net present value at these rates is about NOK 930 billion and NOK 560 billion respectively. The overall net cash flow is estimated at almost NOK 1 600 billion. These estimates show that exploration has been profitable in all parts of the NCS (figure 4.7).

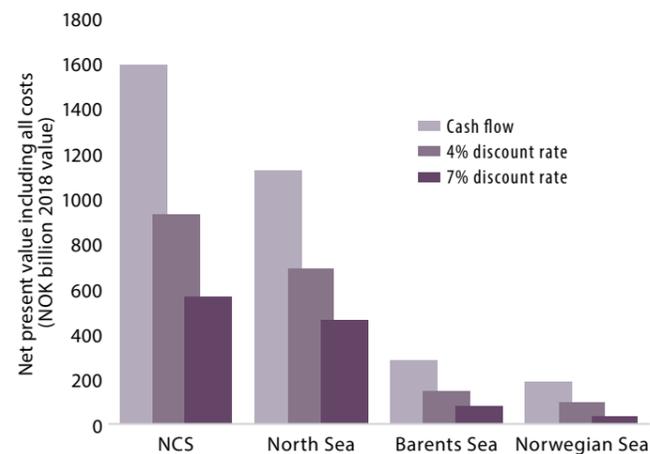


Figure 4.7 Net present value of exploration in 2008-17 at various discount rates).

VALUE CREATION FROM THE VARIOUS SEA AREAS

Figure 4.8 shows that the present value per krone spent on exploration is highest in the North Sea. NOK 1 000 invested in exploring this area yields a return of almost NOK 3 000. Exploration in the Barents and Norwegian Seas yields returns of NOK 2 100 and NOK 1 300 respectively for each NOK 1 000 invested. These values are additional to a seven per cent return.

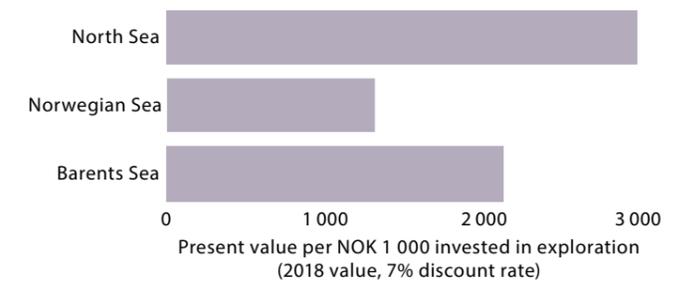


Figure 4.8 Present value (seven per cent discount rate) per NOK 1 000 spent on exploration.

Fact box 4.2: 25/1-11 R Skogul



Figure 4.9 Oil and gas from Skogul will be processed on the Alvheim FPSO. Artist's impression: Aker BP

Utilising existing infrastructure can also make very small discoveries commercial. This type of development is an important part of the future on a maturing NCS. An example of this is Skogul, which was proven in 2010. Previously called Storklakken, this discovery in the central part of Norway's North Sea sector will be one of the smallest fields on the NCS with a reserve base of roughly 1.5 million scm (about 9.4 million barrels) of oil. Skogul is to be developed with a bilateral well drilled from a subsea template tied back

to the installations on the Vilje field, with production piped on from there to the Alvheim field. Oil and gas from Skogul will be processed on Alvheim's floating production, storage and offloading (FPSO) unit. Alvheim is also the field centre for Volund and Bøyla. Plans call for Skogul to come on stream in the first quarter of 2020, with Aker BP as operator. Investment is expected to be about NOK 1.5 billion. The discovery would not have been commercial without the tie-in to existing infrastructure.

SENSITIVITY ANALYSIS

The NPD has analysed the sensitivity of profitability to changes in oil and gas prices.

A 20 per cent increase in these prices would yield a net present value of almost NOK 900 billion at a seven per cent discount rate. A 20 per cent decrease would yield a net present value of roughly NOK 250 billion (figure 4.10). The cost level is the same in both calculations.

The profitability analysis has also been tested for a corresponding increase in operating expenses, which include environmental costs. This would not have a decisive effect on the results.

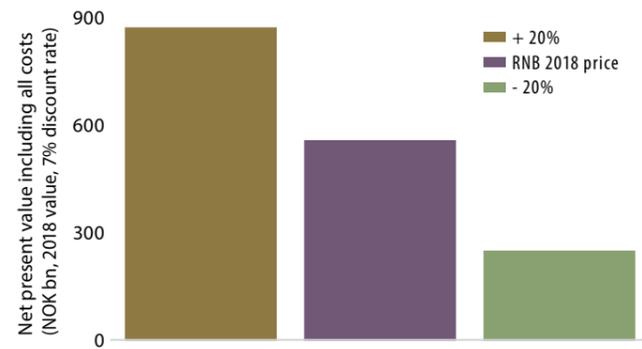


Figure 4.10 Net present value of exploration in 2008-17 at various prices and a discount rate of seven per cent.