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Scope:

The report provides an initial test of various explanations of the economic performance of domestic suppliers to the Norwegian offshore industry in the years 1993-1996. In general, the economic performance of the offshore suppliers is found to have improved continuously since 1994.

Against the backdrop of the NORSOK restructuring process, a new data set on these features for 392 suppliers to the Norwegian offshore industry 1993-1996 was collected. The importance of determinants endogenous to the suppliers that figures so prominently in recent resource-based perspectives in strategic management could not be clearly established.

Controlling for offshore investment levels and supplier competitiveness, product/market factors and upstream/downstream orientation are found to be statistically significant determinants of the economic performance by two of three measures of economic performance applied. Firm size and corporate affiliation are the most significant overall features for explaining economic performance, followed by product- and customer specialisation.

Key-words:

Suppliers, Norwegian offshore industry, strategic management, economic performance, resource-based perspective

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## Summary

Based on a survey of 601 sub-suppliers to the Norwegian offshore industry, the report provides an initial statistical test of various explanation of their economic performance in the years 1993-1996. In general, the economic performance of the offshore suppliers is found to have improved continuously since 1994. Against the backdrop of the NORSOK restructuring process, product market factors are found to best in explaining economic performance. General structural effects are found to be insignificant in explaining economic return, as are organisational factors. The advantage of analysing suppliers to upstream and downstream offshore activities is underlined.

Based on material from the survey of sub-supplier, the report also provides an initial test of resource-based perspectives on strategic management and resource development in the upstream and downstream segments of the offshore industry.

## Preface

This report is part of the project “Effects of NORSOK on small and medium sized enterprises”. The project is financed by the Research Council of Norway (the Petropol committee). It is part of a project package at Rogaland Research and the Center for Technology and Human Values at the University of Oslo, aiming to analyse the transitions in the Norwegian petroleum industry since 1994.

The work has been conducted by a research group at Rogaland Research. The following persons have participated: Senior researcher Odd Einar Olsen (project leader), researcher Jon M. Steinecke, researcher Emma Olivieri Askevold and researcher Ole Andreas Engen (project quality assurance).

Data was collected in 1997, by the use of key informant interviews and a questionnaire to small and medium sized suppliers to the Norwegian oil industry (400 respondents). We would like to thank all informants, who willingly have shared their experience and views, and also thank all the companies taking the trouble to answer our questionnaire.

A group consisting of practitioners from the petroleum related industry has followed the work, and provided useful and important comments and information. The following persons have participated: Rune Espedal (OLF), Bernt Haave (Baroid AS), Elling Håmsø (Norsk Oljerevy), Ståle Kyllingstad (IKM), Øystein Kristiansen (Oljedirektoratet) og Øystein Søyland (Sørco AS).

The research group, however, is fully responsible for the report, including its shortcomings or errors.

Stavanger, May 1998

# 1. Introduction

Declining production in mature fields, relatively small sizes of new fields, the fall in oil prices and the high tax takes in old fields have combined to squeeze profit margins on petroleum exploitation in the Norwegian Continental Shelf (NCS). The NORSOK initiative was launched in 1993 as a co-operative effort combining oil companies, offshore suppliers and regulating authorities. The aim was to improve the competitiveness of firms operating on the NCS. An initial task force identified ambitious and explicit goals of a 40-50% reduction in project time-costs over a five-year period, identifying the best 1993 offshore industry performance as a reference point.

1993 provided an unique setting for the industry restructuring process. Initially, the Ministry of Oil and Industry had registered no applications for new field exploration or operation and the profitability of new field developments appeared to be meagre. The whole industry adhered to the view that a common initiative had to be launched in order to make Norwegian offshore investments attractive once more.

In 1998 this whole process may appear as something of a paradox. Offshore activities were once more on a historically high level in 1997, and the outlooks for the Norwegian oil and gas industry in 1998 are even better.

How much this turnaround can be attributed to the NORSOK initiative, how much it is a mere reflection of recent technology developments and how it is due to other structural processes remains unresolved. Nevertheless, the Norwegian offshore industry is apparently in a much better state than it appeared to be in at the beginning 1993.

Recently, some concern has been voiced that the Norwegian petroleum authorities and the oil companies has had the most to gain in this process. Contractors and other offshore suppliers have had to pay the cost by experiencing considerable profit squeeze. The distribution of costs and benefits of the NORSOK restructuring 1993 - 1997 is the common theme of this report.

The report test the argument that the economic performance of offshore sub-suppliers are driven by the fit between firm-specific resources, the characteristics of their task environment, and the strategic choices made by the management of the sub-suppliers. Based on a survey of 600 firms in the Norwegian offshore industry, the characteristics of successful and unsuccessful sub-suppliers in the value chain of the oil and gas industry are identified both theoretically and empirically. The main purpose of the survey has been to explore the various dimensions supplier-purchaser relationships in upstream and downstream segments of the Norwegian oil industry. The relationship between various sub-supplier characteristics and their economic performance is studied for a subset of petroleum-dependent supplier firms. The various chapters of the report are outlined in figure 1.1.

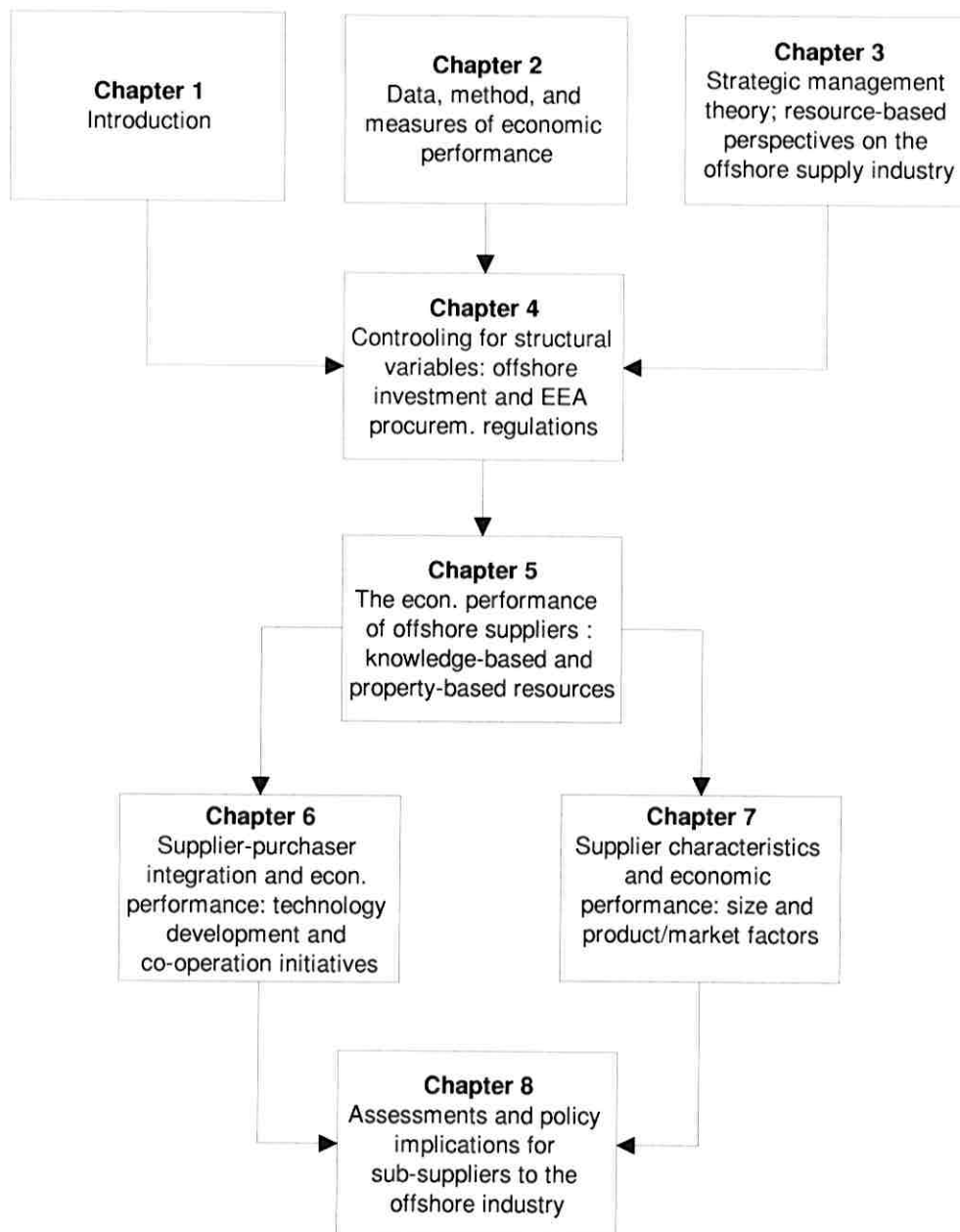


Figure 1.1: Report structure

The current context of the Norwegian offshore industry is briefly described in the opening chapter. An initial attempt to determine the size of the sub-supplier industry is put forward. Chapter 2 provides a presentation of the data and limitations on the data set. The chapter also introduces a simple linear regression model, and provides an initial presentation of the dependent variable. In chapter 3, the basic theoretical foundations of the strategic analysis of the supplier firms are presented. The basic concept of an environmental differentiation between suppliers to upstream and downstream activities is put forward in an introduction of resource-based perspectives on strategic management.

In chapter 4, this initial exploration is controlled for some of the effects of the structural conditions facing the suppliers to upstream and downstream offshore activities as an attempt to isolate the particularities of the NORSOK restructuring process from other factors of industry organisation and competition. Chapter 5 provides an initial attempt to test the relevance of resource-based perspectives on the strategic management and economic performance of suppliers to the offshore industry.

Chapter 6 complements the exposition given in chapter 5. Having explored the fundamental characteristics of the sub-suppliers, chapter 6 is devoted to a brief descriptive study of attempts to integrate supplier-purchaser and supplier-supplier activities in the offshore sector.

Chapter 7 pulls the analysis of the supplier industry together, exploring the relation between various firm-specific characteristics and their economic performance. The common traits of suppliers with above-normal economic performance and below-normal economic performance are presented in an analysis of the most successful and the least successful suppliers.

Chapter 8 summarizes the findings of the various models presented in the earlier chapters. Assessing the relevance of structural, network and firm-specific variables in explaining the economic performance of upstream and downstream sub-suppliers to the Norwegian offshore industry in the mid-1990s, some policy implications are identified.

## **1.1 Norwegian oil industry restructuring in the 1990s - by accident or by design?**

### **1.1.1 Background**

The oil companies are comparatively large enterprises in the context of the Norwegian land-based economy. An exceptional large share of domestic demand is directed toward the supply of services and constructions from the local construction industry and engineering firms. The Norwegian oil industry has some basic characteristics:

- *Co-operation and competition between oil companies.* Both on the British CS and the Norwegian CS the oil industry is organised into territorial blocks or fields that will be leased, usually by a joint enterprise of several oil companies. A lease grants the group the exclusive rights to explore, develop and eventually produce from findings made within the field. If a field within the NCS is to be developed, investments in the range of NOK 1 billion to NOK 70 billion are normally required, depending on the location and accessibility of the finding. The main argument for the oil companies to join forces in field exploration and development are the huge technical and economic risks involved in the process of identifying and retrieving offshore oil and gas. One oil company becomes the operator of the group, acquiring the main responsibility for developing the field. This includes developing technical concepts, organising the overall procurement process, making the major employment decisions and so forth.



On the NCS the formal choice of field operators are made by the Norwegian authorities. Operator responsibilities may shift within the group in the course of the lifetime of the field.

- *Project organisation.* Normally the operator company establishes a temporary project organisation in order to develop an offshore oil field. Project leadership is delegated extensive decision-making responsibilities. Once a field is in production the project organisation is terminated and the remaining production and installation maintenance activities are managed by the operators as a routine operation. The kernel of the project organisation is usually constituted by long-term employees of the operating company who is transferred to other activities or projects once the project organisation cease to exist. In order to be able to perform the task of field development the operator must be able to organise and co-ordinate the activities of employees hired into the project organisation from a large number of firms. Due to the character of task, the operating company usually will not have the technical capacity to control the field development process in all aspects. Instead, a construction company will be hired to work on behalf of the operator as the main contractor of the field. This major engineering firm will have a larger stock of in-house technological expertise.
- *Activity linkages and time pressures.* Field development activities are thus strongly interlinked. This applies both at the level of planning and design as well as on the stage of the more routinised operations, often causing time pressures in order to avoid project windows of costly lead time. The strong organisational pressure to complete tasks within given time periods implies that once technological choices have been made, these in turn determine the range of choices made available to participant at a later stage.
- *Upstream and downstream segmentation.* The oil industry value chain can be separated into five segments. Moving from downstream to upstream activities the segments are
  - field exploration, drilling, production
  - operations, supply services, transportation, catering, administration etc.
  - manufacturing (engineering, construction of platforms/vessels)
  - installation and maintenance of platforms/vessels
  - construction and operation of petroleum processing plants.

The first two segments constitute downstream activities in the oil and gas industry. The latter three construction-oriented manufacturing segments constitute upstream activities.

### 1.1.2 Offshore industry restructuring in the 1990s

The 1990s has seen a restructuring of the Norwegian offshore industry. A range of different factors have been presented in order to explain the sources of industry restructuring. In 1993 the Norwegian government initiated the NORSOK plan, which aims to cut discovery-to-production lead times and costs. The Norwegian Petroleum Directorate estimated that future field development costs could be cut by over 50 percent through increased use of subsea technology, floating production platforms, horizontal drilling, and extended reach and highly deviated wells. In addition, enhanced oil recovery (EOR) techniques have raised estimates of remaining recoverable reserves in several large fields. The NORSOK plan was implemented by 1995, and is focussed on developing the NOC industry in two areas in particular:

- cultural changes in the Norwegian offshore industry, bringing new managerial principles to the fore, and
- the introduction of a common set of new technology standards in order to increase co-operation and thus to increase rents

The industry evolution can by no means be attributed to the effects of NORSOK (and its British corollary CRINE) initiatives alone.

Identifying a range of structural changes both in the British as well as in the Norwegian oil industry, Wright (1996) attribute the overall industry changes to three main factors, each one affecting the economic performance of the firms in the industry. Firstly, the regional petroleum provinces are maturing (smaller fields and deeper waters). Secondly, institutional cost reduction initiatives (CRINE, NORSOK) are being conjoint with new contractual strategies to reduce the time-scale from field discovery to the production of first oil or gas, and to enhance revenue. Thirdly, technology improvements are adjusting the definition of marginal fields.

The three groups of factors contribute to the restructuring of the North Sea oil industry by creating new threats and opportunities for incumbent firms as well as for potential entrants to the supplier industry. Some further characteristics of the oil industry restructuring are displayed in the following.

#### Increased contractor risk

The relationship between operators and contractors have traditionally been governed by market contracts. These are yielding to informal less complete governance structures based on the expectation that trust, personal relations and a shared set of common norms and values will make relational contracts a feasible alternative for in governing offshore projects. An (un)anticipated consequence of this shift in mode of governance from market contracts to long-term co-operation agreements based on organisational governance has been that not all aspects of the co-operation has been or can be covered by the contract itself. Incomplete contracts increase the specification uncertainty and uniqueness of the parties to the contract, and these relational contractual arrangements have to be complemented by additional systems of governance.

The new contractual arrangements are being implemented in segments of the North Sea contracting industry. This may lead contractors to find themselves taking a more proactive role, and bearing more risk, in order to land new leasing and EPCI contracts being placed by the oil companies.

#### Market polarisation

The size distribution of firms in the supply industries is being altered, reflecting fundamental changes in the relationships between the operators and the contractors/suppliers to the oil industry. As partnering agreements are becoming more common, contractors are finding themselves as providers of integrated services. This has polarised the field between large, broadly skilled providers and smaller specialist niche companies, while the middle ground is in the process of disappearing.

#### Cultural changes

With the restructuring of the supply industries, former potential competitors and industry rivals are taking on new task. Firms are required to develop new skills in teamworking and co-operation. The sharing of information in more open relationships are a difficult transition to make for many companies.

Recent surveys of the Norwegian oil industry finds that petroleum-affiliated enterprises increasingly compare themselves - openly or covertly - to fellow competitors in order to acknowledge more cost-efficient production processes (OSU 1997). Benchmarking and other tools for identifying quality improvement procedures and cost saving initiatives are increasingly being applied. As a strategy for developing knowledge-based resources, a growth in the use of benchmarking could be interpreted as an increasing interest in imitating or learning from firms that display above-average returns. An increase in the use of benchmarking can be interpreted as an organisational search for competency blueprints by mimicking role models (Oliver 1997: 708). This could come in addition to direct imitation of successful competitors, such as late-mover imitation of a rival's technology. The use of such competency blueprints has been proposed to lead to differential rents when the firms of different segments of an industry does not face the similar resource rules and standards in their regulatory environment. Accordingly, differential rents is arguably more likely when firms in an industry make limited use of benchmarking and competitor imitation.

#### Oil company specialisation

Oil companies are increasingly concentrating on the core activities of finding and selling oil. With the oil companies divesting tasks which can be supplied by specialist providers, contractors and suppliers to the oil industry are being required to take on increasing technical and commercial responsibility in the field development and maintenance process.

### Project timescale

The lapse from initial discovery to the first oil is being produced has been considerably reduced. In order to simplify the formal bid process, main contractors profit from routine interactions with the oil companies by establishing long-term relationships with them.

### Technology

Improvements in drilling technology, floating production systems and subsea equipment are radically altering the definition of marginal fields. While relatively few of the technologies are new, with antecedents often traceable back to the 1980s or earlier, it is the field topography of the 1990s which has seen a breakthrough in applications and capabilities (Smith Rea 1996). The 'new' technologies are having major repercussions in the contractor industry, as the new design and fabrication requirements are gearing construction and conversion more towards the conventional shipyards than the offshore fabrication yard.

Another finding from industry surveys 1996-1997 is that NORSOK is somehow assumed to be causally related to a reduction in the amount of R&D activities of small and medium-sized enterprises (SMEs) in the industry, and that this effect has become more manifest in recent years (OSU 1996, OSU 1997). This has gone in tandem with the imposition of new technological standard under the auspices of the NORSOK initiating parties.

The new standards-setting procedures can be viewed as a regulatory process involving both political and economic actors. Leveque (1995:108-9) stylise such regulatory procedures as a *flexible governance process* involving a "bilateral co-ordination mechanism between government and a coalition of firms". Industry, as well as other interested parties, is directly involved in the process. It helps to define objectives, the choice of means and the time-schedule for compliance. Industry therefore contributes significantly to the definition of the outcome of the process. The logic of this interactive process relates to the minimisation of administrative costs, the identification of option values and the attainment of consensus", whereby industry agents seek to reduce uncertainties and to gain stability and trust.

All NORSOK standards are established by expert committees with at least three industry representatives. In a complementary study of technology development and innovations in the supplier industry during the NORSOK restructuring process, Olivieri Askevold (1998) does not find any indication of any organisational advantages accruing to the offshore suppliers represented in the NORSOK standardisation committees on an individual basis.

The NORSOK standards are of three categories:

- Design Principles, which identify the overall design criteria of plants and systems as well as the choice of tools and equipment,
- Common Requirements, describing the minimum requirements of an acceptable technological standard in the design, production, installation and documentation of tools and equipment, and
- System Requirements, describing the product, environmental and operational requirements of a complete technological system.

As of April 1998, 95 standards have been produced covering 18 separate technological areas (figure 1.2). Almost half of these are related to three technological areas - drilling, material technology and process management. The use of these common requirements are expanding to new areas, thus reducing the oil companies' dependence of particular suppliers. While the number of system requirements have been reduced, the number of common requirements have increased significantly, thus increasing supplier competition by making it easier for operators to switch between suppliers (NORSOK 1995:21).

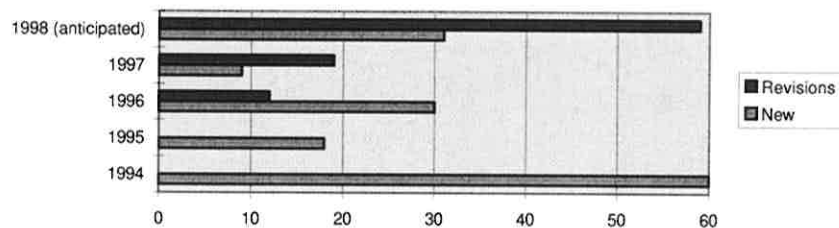


Figure 1.2: Number of NORSOK standards issued 1994-1998 by type<sup>1</sup>

### Product-orientation

At the same time, reductions in project lead time require companies to have technological solutions at hand. New solutions cannot be developed from the very beginning, but major new products must be as fully developed as possible from the outset. According to new standards (NORSOK - ), contractors are free to offer any solution that meets a general functional specification.

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<sup>1</sup> Source: Norsok Standards Info Bulletin no. 7 (NTS, March 1998).

### 1.1.3 Restructuring effects on supplier profitability

The economic efficiency gains anticipated as a result of the NORSOK restructuring process alone has proved hard to accomplish. One of the aims from the outset in 1993 has been to reduce operation costs by some 50% by 1998. Operation costs is determined as the sum of wage costs and product inputs, divided by the resource units extracted. The reduction in such costs have only been 19.2% the first three years from 1993 to 1996 (SSB 1998b). A reduction of 50% requires an additional reduction of costs with some 1/3 over the years 1997 and 1998. As of the beginning of 1998, such cost reduction levels appear unfeasible.

The significance of maturing fields, cost reduction initiatives and technology improvements in explaining improved profits in the offshore industry in the 1990s remains the subject of some controversy. Some observers attribute increased profitability more to technological than to contractual factors embedded in the cost reduction initiatives (Smith Rea Energy Analysts 1996), whereas others aspire to explain improved economic performance more by the current changes in contractual arrangements.<sup>2</sup>

In order to assess the impact of the NORSOK initiative on various participants in the Norwegian oil industry, several attitude surveys have been issued among chief decision-makers and key managerial staff in or affiliated to the Norwegian offshore industry the last two years. Typically the respondents have been selected amongst (i) industry regulators (ministries, directorates), (ii) oil companies, (iii) major offshore contractors, and/or (iv) SME suppliers to the offshore industry.

Some of the survey findings with regard to SME performance are presented in figure 1.3, sorted into response groups. While the proportion of larger contractors, operators and industry regulators that perceive that SME suppliers are the losers in the process have more than doubled in one year (from 35% to 84%), the change among the SME offshore suppliers is much less significant (from 41% to 50%).

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<sup>2</sup> In addition, the imposition of the EEA competitive regulations in 1993 has also affected the industry as a whole.

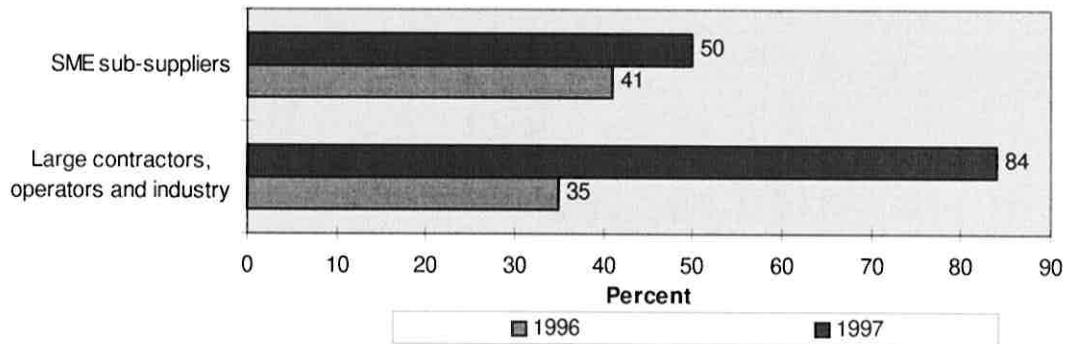


Figure 1.3: "NORSOK has come to mean that (industry) pressures have switched from main suppliers to SME sub-suppliers".<sup>3</sup>

A common theme emerging from these surveys is that the effects of the oil industry restructuring is unequally distributed across both the size hierarchy and the supplier hierarchy of the Norwegian oil industry. At least cognitively, the NORSOK restructuring process(es) are affecting SMEs somewhat differently than the larger companies. There is an increasing consensus in the industry that pressures have switched from the main suppliers to SME sub-suppliers.

Previous studies lend some support to such claims. Petroleum-related suppliers to the Norwegian oil industry display large variations with respect to profits and turnover across the different segments which constitutes the domestic oil industry. In an empirical study of the performance of Norwegian oil industry suppliers 1991-1995, Walderhaug and Kristiansen (1996) found that SME suppliers outperform the large contractors with respect to profitability in the period 1991-1992, while this is reversed for the years 1993-1995, when the large contractors displayed a higher profitability than small and medium-sized enterprises. Return on sales is higher in the SMEs than in the large contractors in the period 1991-1993, shifting again to the advantage of the latter in 1994.<sup>4</sup>

## 1.2 Some key research topics

The presentation so far would seem to justify the following key research topics:

<sup>3</sup> (proposition fits "very well"/"fairly well") *Source*: MMI 1996, 1997.

<sup>4</sup> Notably, both shifts coincide with the advent of the NORSOK oil industry restructuring initiative which from a feeble start in 1993 was formally institutionalized with explicit proposals formulated by industry task forces in 1995 (see A for more details on this process).

- is it possible to identify the SME suppliers as uniformly losing out on economic performance in comparison with the main contractors in the industry restructuring process of the mid-1990s?
- what structural processes should be deemed most significant in explaining the economic performance of domestic offshore suppliers in the 1990s? Is it business cycle effects, alterations in procurement regulations following the establishment of the EEA, or indicators of NORSOK effects that display the most significant relationships with economic performance?
- what are the characteristics of outperformers and underachievers in the offshore supplier segment?



## 2. Data and method

### 2.1 Databases

The domestic offshore industry is dominated by a handful of operators and major constructors. Offshore activities on the Norwegian Continental Shelf reached a high in 1993. The number of firms that currently are petroleum-related suppliers to the Norwegian oil industry remains to be identified. This is a complex task as oil industry supplies constitute only a fraction of total turnover. Very few business units are totally dependent upon deliveries to this industry sector, and only some 100 suppliers have an annual turnover of more than NOK 100 million to the offshore industry.

The exact number of suppliers and sub-suppliers to the Norwegian offshore industry remains difficult to establish. Entry and exits of suppliers correlate with the offshore investment level and the total number of suppliers also depend on the choice of cut-off rules used to identify their product/market offshore dependency. Radical cut-off rules are more inclusive, whereas conservative the more exclusive set of firms. Irrespective of the cut-off rules applied, the domestic offshore supplier industry proper has been put at somewhere between 800 and 1600 firms (table 2.1):

DATABASE	YEAR(S)	NO. OF SUPPLIER	IDENTIFICATION CRITERIA
Norw. Labour Dir.	1998	800	By petroleum specialisation
ACHILLES register	1993-97	1400 - 1600	Domestic and foreign-based, actual and potential
OSU	1995-97	c. 1500	None

Table 2.1: No. of suppliers to the Norwegian offshore industry. Alternative databases.

The Norwegian Labour Directorate performs annual employment surveys of petroleum-related activities. These surveys include establishments and enterprises that are engaged both in petroleum-related as well as other economic activities. Primary petroleum-related activities are identified as the exploration, development, production and the transportation of oil and gas from offshore installations in the North Sea. Primary petroleum-related activities also include all activities that involve the direct supply of goods or services to this industry area as well as the construction and operation of transportation systems and refineries.

There are several obstacles involved in demarcating petroleum-related activities. For Labour Directorate include providers of products and services specialising on supplying the petroleum industry. Such sub-suppliers of instruments or production systems that are to be installed on offshore vessels or on inland plants are included in the annual

employment survey, whereas producers or suppliers of products or services aimed at the more general domestic inland market that does not provide particular adjustment efforts to be made operational in the Norwegian petroleum industry are not included. In total, the core of the petroleum-related industry and supply system include some 800 establishments in 1997 (Norwegian Labour Directorate, 1998). This core includes the licensees on the Norwegian Continental Shelf (SSB 1998 C-400).

Other studies of suppliers to the Norwegian petroleum industry complement the regular studies of the Labour Directorate by assessing the economic performance and operations of those supplier firms that provide general supplies of general goods and services to this industry, thus identifying more peripheral segments of the value chain in the petroleum industry. The choice of functional cut-off rules proves to be critical in efforts to quantify the total number of firms involved in petroleum-related activities in any year. Both by using relative (Wiig 1996) and absolute cut-off rules (OSK, various years), the extended system of significant suppliers to the Norwegian petroleum industry amounts to something in the number of 1500 - 1800 establishments.<sup>5</sup> All sets are stripped of establishments with less than 5 employees, and self-employed one-man companies are not included in these numbers.

Based on 1400 enterprises registered as offshore suppliers in 1993, Wiig (1996) classify almost 900 of these as being petroleum related. Of these, she identify 1/3 (300) establishments as being petroleum-specific suppliers (more than 75% of total turnover from supplies to the offshore industry), while 2/3 (almost 600 establishments) are petroleum-related suppliers with from 25% to 75% of total turnover emanating from supplying the offshore industry. Wiig does not separate the supplier segment into main suppliers and sub-suppliers, but observes that the petroleum-specific establishments are dominated by some 30 major corporations that all had a 1993 turnover in excess of 250 million NOK.

## 2.2 Survey sample

The data on oil industry suppliers has been taken from a survey of 601 suppliers to the Norwegian oil industry performed by the MMI in September-October 1997. Respondents were questioned on the strategic decision-making process in the firm, on supplier-purchaser relationships in the oil industry, and on organisational interaction between oil industry suppliers and purchasers in the period 1993-1996. The questionnaire was originally addressed to a randomly selected subset of suppliers

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5 There has been no systematic attempts to analyse the organizational ecology of suppliers to the Norwegian petroleum industry. Longitudinal studies of entries and exits to the supply industry remains largely unexplored. Using absolute value of turnover (OSK var. years) operates with a database of some 1500 names. Wiik (1996) sort suppliers by the relative impact of supplies to the oil industry on turnover, identifying three strata of suppliers. Petroleum-dependent suppliers, petroleum-related suppliers, petroleum-affiliated suppliers.

registered in the Achilles register in 1995. The questionnaire contained questions with categorical and fixed response alternatives only. Open-ended response alternatives were avoided. In addition, longitudinal data on economic performance in each firm for the years 1993 to 1996 were obtained, and the two data sources were combined to produce the final data set.

Data for testing the attributes of sub-suppliers to the Norwegian oil and gas industry on hypothesised relationships were obtained and collected in a telephone survey of 601 suppliers. Three groups of suppliers were derived from the responses obtained on questions related to the respondents dependency on the petroleum industry 1993-1996 (see appendix 1 for details).

As economic performance is identified amongst others by operating profits, only those establishments who reported petroleum dependency both by the beginning (1993) and the end of the period to be studied (1996) were included in the net sample. This produced a subset of 168 respondents. The size distribution of the responding establishments produced a mean size of 204 employees at the end of 1996, with a standard deviation of almost 546. Six of ten respondents in the net sample had less than 50 employees at the end of 1996.

Each firm in the sample may cover supplies to one or more segment of the oil industry. In the net sample, the firms were assigned to a stable or an unstable segment of the petroleum industry, depending on the location of the majority of the purchasers on the oil industry value chain. Thus, we reduce the suppliers' affiliation with the oil industry to a dummy indicating the qualitatively different effects of the NORSOK restructuring initiative on the competitive environment of upstream or downstream suppliers to the Norwegian oil industry.

### **2.3 Survey explanatory variables - validity and reliability**

Data for testing the attributes of offshore suppliers on the various hypothesized relationships with economic performance were obtained in a telephone survey of offshore suppliers. The questionnaire was originally addressed to a randomly selected set of offshore suppliers taken from the Achilles 1995 register as well as from the respondent register of the 1997 OSK industry survey. The two registers are complementary, as only 1 out of 3 registered in the OSK database are also registered in the Achilles database. The joint registers contains some 850 offshore suppliers. From these two databases 601 suppliers were selected, predominantly from the Achilles database which was used in its entirety and complemented with names drawn at random from the OSK database. 400 responses were successfully obtained, yielding a response rate of 66%. Only one respondent reported having made no transactions with the offshore sector in the 1993-1996 period. With 7 respondents deleted in addition from various purposes (large part of responses missing, double interviewing), this added up to a gross sample of 392 offshore industry suppliers (*i*). The gross response rate of 65% is satisfactory, and would imply that one of four suppliers in the total domestic population of petroleum sector suppliers took part in the survey.

Above-average economic returns and below-average economic returns are assessed using financial indicators obtained for each respondent. Incorporating only the respondents that provide such economic measures for the whole four-year period reduce the gross sample from 392 to 345. The dataset is trimmed additionally as establishments with less than 5 employees have been omitted from the gross sample.

Eventually, two subsets were derived from the original gross sample of respondents in order to omit suppliers with only peripheral interests in supplying operators and main contractors in the offshore industry.

The measures of economic performance assessed using three different financial indicators based on accounting figures for each year. The three measures reflect the financial outcome of all activities that each firm is engaged in. The financial measures include results from all activities in the enterprise, also those that are not oil-related. In order to exclude respondents that only have marginal economic results from activities related to the Norwegian oil industry, only respondents that report to have at least half of all turnover from supplies to the offshore industry in 1993 as well as in 1996 are included. This produce a subset of 168 petroleum-related sub-suppliers (ii).

To delimit the response group even more, only identical respondents are included in the final subset. This makes reference to those sub-suppliers that have maintained the same functional activities throughout the entire period 1993-1996. As such, they have not been engaged in mergers and acquisitions in the four-year period, adding or shedding new activities to those already established. They have not themselves merged with other companies, nor have they themselves acquired control of other businesses. Such a subset of petroleum-related, identical offshore sub-suppliers add up to a mere 99 respondents (iii).

Both subsets are representative of the survey as a whole with respect to the proportion of the respondents identified as SMEs and with no corporate affiliation (independent majority owner). Two operational subsets are produced in order to identify respondents. In a larger sub-set, the qualifications were less strict than in the smaller sub-set, where only suppliers that had remained identical for the whole period (the suppliers had not been subject to mergers and acquisitions) were used.

	(I) GROSS SAMPLE (N=392)	(II) SUB-SET OF PETROLEUM-RELATED SUB-SUPPLIERS (N=168)	(III) SUB-SET OF PETROLEUM-RELATED AND IDENTICAL SUB-SUPPLIERS (N=99)
No. of employees (mean, s. dev.)	140.4 (381.3)	184.3 (472.8)	124.2 (309.5)
ROA <sub>96</sub> (mean, s.dev.)		0.078 (0.253)	
ROS <sub>96</sub> (mean, s.dev.)		0.037 (0.324)	
LIR <sub>96</sub> (mean, s.dev.)		1.46 (0.68)	
Proportion of suppliers			
• downstream orientation	72.1%	64.3%	
• SMEs (< 251 employees)	87.5%	82.7%	85.9%
• Independents (no corp. affil.)	28.1%	27.3%	32%
• Capacity producer	42.1%	36%	32%
• Mainly distributor/agent	33.2%	20.2%	23.4%

Table 2.2: Descriptive statistics of suppliers

As displayed in table 2.2, the descriptive statistics of the smaller subset corresponds most to the characteristics of the whole sample. The average number of employees in the gross sample was 140.4, with a standard deviation of 381.3. In the larger subset, this average increases to 184.3, while the set of petroleum-dependent and identical suppliers have a mean number of employees of 124.2.

In the gross sample seven of eight respondents are SMEs (87.5%), while in the smallest subset this proportion is somewhat reduced, to 85.9%. This is, however, larger than the 82.7% of the respondents who are SMEs in the larger subset. In the gross sample, 28.1% of all respondents have no corporate affiliation. In the smaller subset, the relative number of independents have increased to 32%.

In the gross sample, the number of capacity suppliers and product suppliers are divided almost equally, with 42% of the respondents being capacity producers in 1996. In the set of petroleum-dependent and identical suppliers, only 32 % are capacity-producers. And finally, 1/3 of all respondents in the gross sample are primarily sales outlets or distributors of goods and services produced elsewhere. In the smaller subset, more than three of four (76.6%) of all firms are offshore suppliers mainly by producing own goods and services.

In the statistical analyses of economic performance the explorations was performed on the smaller subset identified from survey.

## 2.4 Assessing economic performance

Economic performance is typically assessed by exploring return on investments. Accounting values and replacement costs may be used to value the tangible assets of the firm with a certain degree of error. The tangible asset value of the firm may be measured by the replacement cost (RC) of the tangible assets of the firm. The value for RC may be estimated using accounting based values for the assets of the firm. The market value to replacement costs ratio (MV/RC) is by definition Tobin's  $q$ . For practical purposes Tobin's  $q$  may be calculated as:

$$q = MV/RC \quad (1)$$

Tobin's  $q$  is a surrogate measure that caters for elements that do not appear in the accounts of the firm. Intellectual and organisational competencies are such elements, and reflects the supervaluation of industry reputation, goodwill at mergers etc. Thus for a firm with no intangible asset value Tobin's  $q$  should equal 1. As the value of the firm's intangible assets increases the value of Tobin's  $q$  will increase.

Economic performance in year  $t$  for respondent  $i$  is measured as a function of the performance in the previous year ( $t-1$ ) as well as the sum of a whole artillery of dichotomous indicator variables operating at various levels of analysis - at the structural level, at the inter-organisational level, at the firm level and at the product/market level. Indicator variables are grouped by their level of analysis. The same general model is applied when testing each group of indicator variables in separate models. The general model is put as

$$r_{t,i} = r_{t-1,i} + \sum_{j=1}^n \alpha_j K_{j,i} \quad (2)$$

where  $r_{t,i}$  is the economic performance of supplier  $i$  as measured in year  $t$ ,  $r_{t-1,i}$  is the corresponding measure of the economic performance of oil industry supplier  $i$  in the preceding year  $t-1$ ,  $K_{j,i}$  is a vector of  $j$  indicator variables in firm  $i$  ( $j = 1, \dots, n$ ) and  $\alpha_j$  is the variable coefficient corresponding to variable  $j$  in oil industry supplier  $i$ . The analysis presented in this paper relies on the following model, drawing on a structure initiated by Schmalensee and extended by Rumelt and McGahan and Porter:

$$r_{t,j} = r_{t-1,j} + \alpha_j + \beta_j + \epsilon_{t,j} \quad (1)$$

In this equation,  $r_{t,j}$  is the accounting profit measure in year  $t$  of respondent supplier  $j$ . Economic performances are measured using three different indicators: (a) as liquidity, i.e. the ratio of current assets to short-term debts, (b) return on sales, defined as the ratio of operating income to identifiable assets, and (c) as the ratio of operating profits to

operating income. To see whether the results are robust, all three measures of economic performance are introduced as dependent variables in separate models. Because accounting conventions typically exclude intangible assets from the balance sheets measured assets are likely to be on the low-hand side. By using operating income the effects of differences in financing are ignored. Both measurement error and accounting conventions are likely to influence both industry segment and corporate-affiliation effects on profitability (Steineke 1998b). All provisional results should therefore be interpreted with utmost care.

The opening term of the right-hand side in equation (2),  $r_{t-1,j}$ , is the accounting profit measure over the preceding year. The remaining terms represent various independent variables. The model(s) are estimated using dummy variables to represent effects at various levels of analysis. Structural, inter-firm, product-market and variables internal to the enterprise are analysed separately (see the appendix for the definitions). For an analysis at the industry level,  $\alpha_i$  might represent an industry segment dummy (upstream or downstream orientation), whereas  $\beta_j$  might be a dummy representing corporate affiliation (or lack thereof).

As the model is specified so that the first year of the time series is used as input in modelling the economic performance of the consecutive year, only three years of performance remains to be analysed. To deal with the possibility that a shock in year  $t-1$  might influence profits in year  $t$ , a serial correlation in the errors could be allowed for. This possibility has been ignored in this probe of economic profitability measures.

#### **2.4.1 Measures of economic performance**

The use of multiple indices of economic performance is more important than the choice of any particular measure, since any single measure may generate criticism. To enhance the reliability of the results and minimise potential bias associated with the use of any individual ratio, three measures of economic performance were used. To facilitate comparison with prior research on the profitability of suppliers to the Norwegian offshore industry, the preferred measures of economic performance were pre-tax figures for return on sales (ROS) and return on assets (ROA). In addition, the short-term liquidity ratio (LIR) was used. These correspond to the measures of economic performance used in by Walderhaug and Kristiansen (1996).

Such accounting-based measures of a firm's economic performance may be criticised as a measure of management effectiveness in the use of tacit resources. The measures' relationship with the firm's strategy may however be direct, and as argued in Tallman et al. (1994), the performance impact of a firm's strategy is more directly reflected in accounting profits than in stock prices. This is an important prerequisite particularly when assessing the economic performance of small firms whose stocks are traded only irregularly.

In order to test the reliability of the explorative findings, separate analyses are made for three measures of economic performance. The financial indicators included are return on operating assets (ROA), return on sales (ROS), and finally a liquidity measure (the ratio of short-term debt on operating assets - LIR). By running the analysis of economic

performance thrice, the robustness of the simple statistical model can be assessed with somewhat more reliability. Should a variable prove to be statistically significant for more than one type of measure, this will be taken strengthening an initial finding of a statistical relationship between the economic performance and an independent variable - this variable being structural, inter-organisational or a resource endogenous to the supplier.

These measurements of economic performance may all be distorted by the accounting practices of the firms. Reported financial figures are heavily influenced by factors that remains hidden behind the aggregated figures. Accounting profit remains the least helpful when comparing firms with large variations in intangible assets. In attempts to rate the three measures of economic performance qualitatively, ROA and LIR are the least transparent measures of economic performance (with respect to hidden factors), and ROS a more transparent accounting measure. This does not, however, provide for a qualitative ranking of the measures of economic performance used in this study.

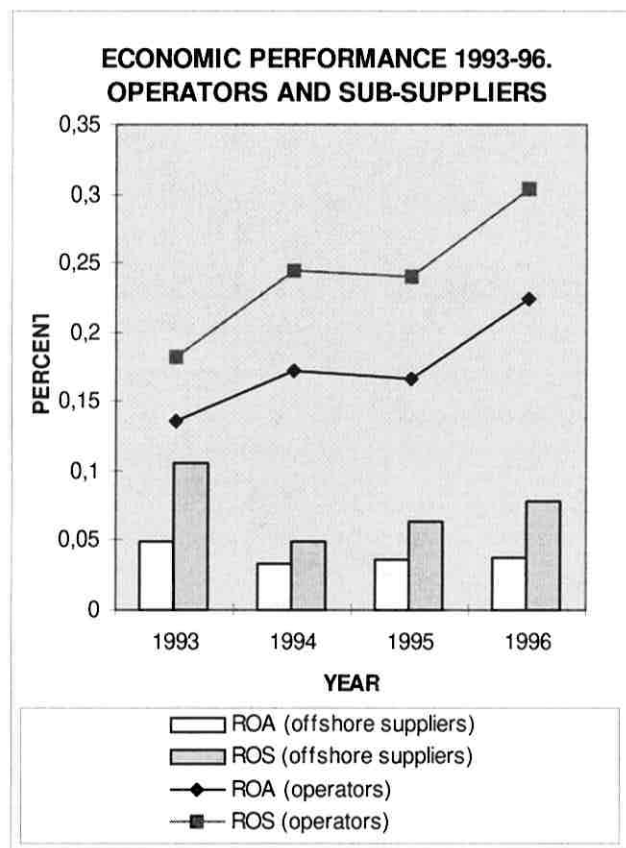


Figure 2.1: Economic performance 1993-1996. Return on assets (ROA) and return on sales (ROS) of operators and petroleum-dependent suppliers.



As displayed, the ratio of current assets to short-term debt displays a continuous improvement over the whole period (ratio as displayed on the right-hand Y-axis). The two other indicators displays a common shift in 1994, when both measures are reduced. Both measures of operating income improve for the period 1994-1996 (ratios displayed on the left-hand Y-axis).

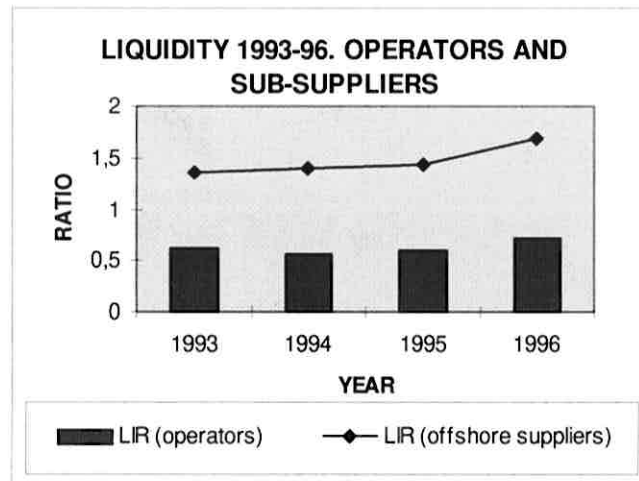


Figure 2.2: Economic performance 1993-1996. Short-term liquidity (LIR) of operators and petroleum-dependent suppliers.

The development of the economic performance of the petroleum-dependent suppliers remains ambiguous. While the LIR mean improves from 1993-1996, both LIR variance and standard deviation expands as well. Both mean ROS and mean ROA is reduced from 1993 to 1996. While ROS variance and standard deviation expands in the four-year period, ROA variance and standard deviation is reduced over the same four years.

Analyses are performed for all groups of variables. In addition, the sextiles at the extremes (the 1/6 of the firms with the highest or lowest performance) are isolated and the analyses are repeated on this much smaller set of firms. In this way, some of the simpler characteristics of a group of above-average performers and a group of below-average performers may be compared. The nature of the data usually only allows for analyses covering single years, and not for longitudinal studies covering the whole period 1993-1996. This is mainly due to the fact that a lot of the data only relates to the status of the respondents at the beginning of the period in question (1993) and at the end (1996). Detailed information on the individual years 1994 and 1995 are largely unavailable, so that most analyses are made on the current status of the sub-supplier industry, holding  $t=1996$ .

#### **2.4.2 Above- and below average performers in the offshore supplier industry**

The most successful sub-suppliers to the Norwegian offshore industry has been identified as those respondents that displays the biggest relative increase in economic performance in the years 1993-1996. The least successful sub-suppliers are correspondingly identified as those respondents that display the lowest growth in economic performance 1993-1996. Relative rather than absolute change in economic performance is essentially the selection criteria.<sup>6</sup>

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<sup>6</sup> This selection criteria was originally proposed by O.E.F. Olsen and E. Olivieri Askevold.

### **3. Theory**

The chapter presents the basic theoretical arguments upon which the offshore industry is analysed. A more detailed introduction to resource-based perspectives on strategic management, which complements the theoretical argument presented in chapter 2, is relegated to chapter 7, where the relationships between resources internal to the firm and their economic performance is explored using the petroleum-related suppliers to the Norwegian offshore industry as a case study.

In studies of strategic management, the task environment of a particular enterprise has traditionally been segmented according to some easily identifiable characteristics based on technological, economical, social and/or political factors. Which factors are deemed the most important in segmenting the industry or business environment varies.

In the Norwegian petroleum industry of the 1990s, offshore activities are traditionally segmented by their location on the value chain. Offshore activities are identified as upstream or downstream.

Upstream, the petroleum industry has seen engineering achievements whose scale and complexity have few equals. Downstream, the offshore industry is tackling projects of comparable complexity to give major corporations the business structures, systems, processes and behaviours that will secure and sustain competitive advantage. In the following, a core assumption will be that from the perspective of sub-suppliers to the offshore industry, suppliers to upstream and downstream activities face qualitatively different task environments in the 1990s. Some theoretical consequences for the strategic management of petroleum-dependent sub-suppliers in the same era are specified. The remainder of the report is devoted to test this fundamental assumption at various levels of analysis.

#### **3.1 Strategic management and task environments**

In terms of conceptions of the firm, the reporting will theories dealing with the firm and their environments. The relationship between the supplier firm and their task environment will be a prime concern. The task environment can be identified as “those environmental facets which relate to the setting and attainment of an organisation’s goals. This includes input and output channels, competitors and regulators” (Nohria and Gulati 1994: 229). In this relational, open systems perspective of the firm, the organisation is seen as “both as a system of internal relationships and as a part of a larger system encompassing the environment in which they operate. The environment sets conditions that help shape the organisation, even as the organisation shapes and influences its environment” (Lawrence and Dyer 1983: 295).

A strategic analysis of the offshore supplier industry in Norway relations between the supplier firm and its environment. The environment can be analysed using a range of dimensions. Both political, social, technological and political aspects of the industry

environment may be of relevance. In a heavily regulated capital-intensive industry such as the Norwegian oil industry, the technological and economic political dimensions have dominated in previous studies. The NORSOK restructuring process have brought economic and social aspects to the fore. In the following upstream and downstream orientation in the offshore supplier industry will be taken to represent two qualitatively different task environments. This have implications for the hypothesized relationships between the strategic managerial decisions taken by the various offshore suppliers and their effects on the economic performance of the suppliers.

Almost any textbook on business strategy will conceptualise strategy as a basic SWOT exercise; the act of achieving fit between the strengths (S) of the firm and the opportunities (O) posed by the environment, while simultaneously safeguarding the weaknesses (W) of the firm from threats (T) of the same competitive environment. In the traditional setting of SWOT strategic analysis, environmental threats and opportunities is the domain of the industry analyses springing from the works of Porter (Foss 1997). In the context of strategic management, the domain of application of resource-based perspectives differ significantly from the Porter approach, focussing instead on the analysis of the strength and weaknesses of firms.

### **3.2 Resource-based perspectives**

The debate in strategic management has for decades been occupied with identifying the various sources of performance difference among firms. Research growing out of economics and theories of industrial organisation identify industry structure as a core determinant of success or failure. Segmenting the offshore supplier industry into an upstream and a downstream segment is one such illustration. Differences in firm performance is considered to be related to what industry or segment the firm is located in. Recently, claims that firm performance is mostly influenced by organisational processes endogenous to the firm has been voiced in management literature and assembled under the banner of resource-based (RB) views of the firm. In the RB perspective industry structure is less important than factors idiosyncratic for every firm.

The resource-based view of the firm (RB) provides a useful complement to the structural perspective on strategic management brought to prominence by Porter (1980, 1991). RB shifts the emphasis in strategic management from industrial organisation and the competitive environment of the firm to the resources that firms acquire and refine internally in order to compete in that environment. Firm resources and capabilities that enable them to generate above-normal rates of return and to consistently sustain competitive advantage are focused. Although resource-based concepts have generated a great deal of conceptualising in the management literature of the late 1980s and early 1990s (see Wernerfelt 1984, Schulze 1992, Foss 1997, Oliver 1997 for some suggestive theoretical contributions, Connor 1991, Foss et al. 1995, Montgomery ed. 1995 for more

comprehensive reviews), RB is just beginning to occasion systematic empirical exploration.<sup>7</sup>

The main question in strategic management is not which disciplinary perspective or mode of explanation is the more appropriate one, but rather under what conditions a given perspective is the most appropriate. In this report we will argue that the North Sea oil industry of the 1990s provides a suitable testing ground for the resource-based view of the firm and its conversation with strategic management. The Norwegian oil industry is undergoing a formidable restructuring with repercussions into the supplies and other auxiliary activities, confronting suppliers to the industry with new managerial and strategic challenges. The competitive environment of the industry is being reorganised, putting serious strain on resource combinations within the particular firm in or affiliated with it. This structural transformation is making new resource combinations more valuable and renders other resource combinations strategically obsolete to these firms. The RB can be applied to explore systematically how suppliers to the oil industry cope within different strata of the offshore industry, and to identify types of resources internal to the firm that affect competitive success and economic performance in a positive or negative way in upstream or downstream offshore activities.

In order to be able to apply the resource-based view of the firm in an industry study, we argue that property-based and knowledge-based resources of individual firms should be identified. The distinction between the two types of resources can be made operational and explored for their performance in relation to dynamic measures of competitiveness and innovation capacity in a subset of firms supplying the Norwegian oil industry in the period 1993-96. We have earlier in the report identified upstream activities as a stable segment and downstream activities as an unstable segment of the Norwegian oil industry in the 1993-1996 period. Following Miller and Shamsie (1996) we will initially assume that property-based resources contribute the most to firm performance in stable, predictable environmental settings, whereas the firm typically derives the greater utility from knowledge-based resources when an industry segment is changing and getting more unpredictable.

In order to present this argument, we first identify resources as fundamental determinants of firm performance. We then describe how firm's resources and capabilities can affect their performance and innovation capacity, and how RB can be integrated with industry analysis in order to identify the competitive advantages of firms. We close by presenting some characteristics of the Norwegian oil industry restructuring in the 1990s, arguing that environmental change in the industry makes it particularly well suited for an application of the RB.<sup>8</sup>

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<sup>7</sup> As far as we are aware, empirical applications of RB has so far been performed only on the pharmaceutical industry (Henderson and Cockburn 1994), the ball-bearings industry (Collis 1991) and the film industry (Miller and Shamsie 1996).

<sup>8</sup> Proposals of industry-specific indicators of property-based and knowledge-based resources are identified and operationalized in a separate paper (in process).

RB reject the purely contractual interpretation of the nature of the enterprise. In this setting, property rights and incentives are essential in order to conceptualise the firm. In the RB, the primary characteristic is an emphasis upon *resources* as a fundamental determinant of firm performance. The firm is regarded as a repository of distinct competencies<sup>9</sup> that yields competitive advantages for some of them, and no such advantages for other firms (Foss 1996a). As such, resources needed to conceive, choose and implement strategies are heterogeneously distributed across sets of competing firms (Schulze 1992).

It has been commonplace in the debate on resource-based perspectives on strategic management that it neglects or even rejects the environment. However, as Foss (1997) argues, environmental analysis - in the sense of an analysis of how to obtain the best product-market position - may be seen as complementary to the RBP. The two approaches are complementary in the sense that in the conventional SWOT framework, the RBP essentially details the strengths (S's) and weaknesses (W's) of the firm, whereas an analysis of environmental opportunities (O's) and threats (T's) of the firm is the domain of structural approaches to the firm's task environment (Barney 1991). In the next chapter, the relevance of some structural control variables are tested to see how much the economic performance of offshore suppliers is related to the business cycle and energy industry procurement regulations that has been introduced in the EEA independently of the industry-specific cost-reduction NORSOK initiative.

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<sup>9</sup> Competencies defined as abilities to combine heterogenous resources more productively.

## **4. Controlling for structural effects**

New rules of the EEA have laid down directives for governments and other public bodies when tendering or contracting for goods, works and services in co-ordinating the procurement procedures of entities operating in the water, energy, transport and telecommunications sectors within the European Economic Area. Parts of the regulations are effective for private enterprises, when such activities are based on exclusive rights provided by state authorities. All exploration and field development activities on the NCS are thus regulated. The public and private companies engaged in this part of the Norwegian offshore industry are subject to the EES directives of the procurement sector. For offshore operators in the North Sea, this implies that all procurement activities, including those that only indirectly stems from the particular exploration and production permits. The directive is made operational for all upstream activities, including transport to on-land refineries. Downstream activities, such as refining itself or product marketing, is not affected by the EES procurement directive regulation.

### **4.1 Competitive deregulation in the EEA**

Trade liberalization and increased international competition for offshore contracts has been one of the consequences of the Norwegian entry into the EEA. The internal European market no longer provides for discrimination of suppliers to the offshore industry on the basis of nationality. A more efficient handling of trade flows have increased the frequency of direct transactions between producers and end users, consequently reducing the role of supply mediators. This competitive deregulation of the offshore industry follows in the wake of the establishment of the EEA. All operators are obliged to follow the common rules of public procurement, installed in all EEA countries from the beginning of 1993. According to this rules, all procurements surpassing a limit value (as of June 1997 at NOK 3,3 million) is put out for public bidding for qualified agents in all countries within the EEA.

#### **4.1.1 Achilles**

The establishment of the European Internal Market and - as for Norway, the EEA - has lead to a range of adjustments to the rules regulating the procurement activities of oil and gas companies who benefit from possessing exploration and development licenses on the NOC. The new regulations require that suppliers to the oil and gas companies are selected on the basis of objective criteria following from an open tendering process. Registration in the offshore industry's own register of suppliers (Achilles) is the one qualitative requirement for bidding in major contracts in the Norwegian offshore industry. The Achilles common qualification arrangement (Achilles FKO) has been instituted in order to simplify offshore procurements as well as to insure that competitive requirements installed in EEA are being complied with. In effect, Achilles registration has become a prerequisite for vendor listing.

From a feeble start as a register mainly aimed at identifying suppliers to the offshore oil industry by browsing the Yellow Pages, Achilles has evolved into a compulsory qualification system encompassing not only the supplier industry but also the operator companies and the licensees on the Norwegian Continental Shelf as well. Registration is adjusted either by passive elimination of the firm should it fail to file comply with annually required updates of turnover information) or by active withdrawal.

Registration of a company is not rolled over automatically from year to year. Instead, the company is required to file information on a regular basis annually with the administrator of the register in order to maintain a presence and thus avoid being automatically excluded in future bidding rounds of any significance. As displayed in figure 4.1, most sub-suppliers to the Norwegian offshore industries remained ignorant of this requirement until 1991, but then swiftly acted as the new competitive regulations were installed. By 1995, more than three in four sub-suppliers were registered. By 1997, 82,5% of all sub-suppliers have registered in order to be allowed into the competition for major offshore contracts. Among the most petroleum-dependent sub-suppliers, the Achilles registration requirement is even more manifest. Only 7,5% of the sub-suppliers remain unregistered by 1997.

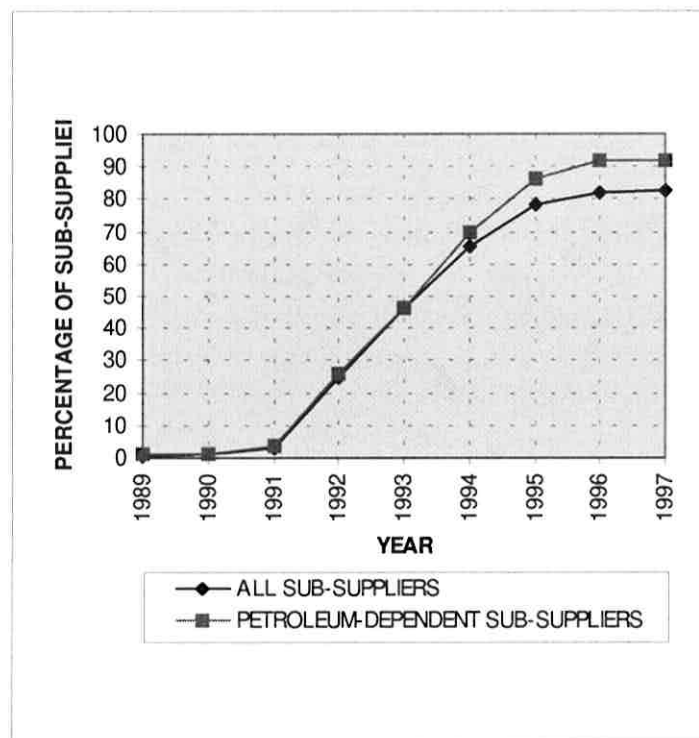


Figure 4.1: Achilles registration by first year of entry.



The considerable number of suppliers that remains unregistered in Achilles. Although 332 of 400 sub-suppliers were enregistered in Achilles by the end of 1996, only 275 of these provided information on their first year of Achilles registration.

#### 4.2.1 Investment levels

In the 1993-1996 period, the level of Norwegian offshore investments have been on a slight albeit continuous decrease. From a level of 55 billion NOK in 1993 the accrued investments in 1996 amounted to less than 50 billion NOK (figure 4.2).

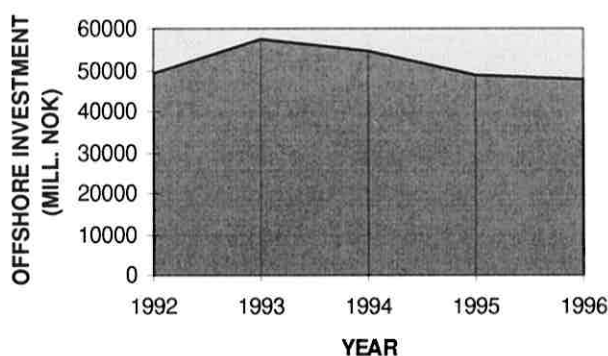


Figure 4.2: Offshore investment 1992-1996 (accrued).

The following hypotheses may be formulated, describing anticipated relationships between economic performance and essentially non-NORSOK structural variables:

*Hypothesis 1: A high investment level will produce superior economic performance for all offshore suppliers, irrespective of upstream or downstream orientation.*

*Hypothesis 2: Achilles registration will produce superior economic performance for all offshore suppliers, irrespective of upstream or downstream orientation.*

To measure the investment level the lagged log of upstream and downstream investment levels ( $INV_{t-1}$ ) were used as a dichotomous variable. Lagged variables were also found to yield more explanatory power with respect to Achilles registration.  $ACH_{t-1}$  was used as a dummy variable, indicating that the supplier was enregistered in the Achilles register the previous year.

Separate models were estimated for three successive years (1994-1996) in order to examine the dynamics of the structural relationships on economic performance and to test these hypotheses over the years. This method was then used to assess whether the significance of these structural variables were on the increase or on the decrease in the 1993-1996 period.

The results are presented in table 4.1. The regression results are presented by the standardised beta values, which give the change in predicted value of the dependent variable per standard deviation increase in a predictor variable - easily interpretable when dealing with categorical variables.

Model no.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. variable	$ROA_{t-1}$	$ROA_{t-1}$	$ROA_{t-1}$	$LIR_{t-1}$	$LIR_{t-1}$	$LIR_{t-1}$	$ROS_{t-1}$	$ROS_{t-1}$	$ROS_{t-1}$
	$t = 94$	$t = 95$	$t = 96$	$t = 94$	$t = 95$	$t = 96$	$t = 94$	$t = 95$	$t = 96$
Constant	-0.137	-0.019	-0.018	-0.683	1.011	0.473	-0.208	-0.414	0.001
<i>Indep.</i>									
$ROA_{t-1}$	0.31**	0.66**	0.52**	-	-	-	-	-	-
$LIR_{t-1}$	-	-	-	0.63**	0.63**	0.58**	-	-	-
$ROS_{t-1}$	-	-	-	-	-	-	0.63**	0.19**	0.56**
$INV_{t-1}$	0.037	0.014	0.006	0.058	-0.023	-0.002	0.047	0.115	0.021
$ACH_{t-1}$	-0.08	-0.13*	0.1	0.012	0.021	0.49	-0.036	-0.074	-0.068
R <sup>2</sup> (adj.)	0.076	0.438	0.253	0.375	0.385	0.336	0.385	0.032	0.305
F-value	4.559	34.7**	15.6**	26.7**	28.2**	22.9**	27.9**	2.43*	19.9**

\*\* : sign. at 5% (two-tailed)

\* : sign. at 10% (two-tailed)

N = 167

Table 4.1: Structural relationships on economic performance. Results of regressions of successive years 1994-1996.

As displayed in table 4.1, the economic performance of the set of petroleum-dependent suppliers is only insignificantly related to the level of direct upstream or downstream offshore investments (lagged one year to correct for autoregression). Achilles registration does not seem to relate neither significantly or positively to the economic performance of the firm. In two of the three measures, investment levels and Achilles registration contributes less to economic performance at the end of the period than at the beginning.

In the context of resource-based perspectives on strategic management, an important shortcoming has been that there has been no well-articulated model of resource creation. Attempts to integrate resources across organisations may reveal how real options are identified in particular organisations. In resource mobilisation, the object of study is not conceptualized as a single enterprise constituted by a bundle of resources, but rather as a group of organisations constituting a portfolio of real options. The firms participating in efforts to create new strategic resources may be seen as having in any point in time “a number of strategic options which they may exercise in their input (e.g. in the spot market, through alliances, long contracts, vertical integration etc.) and in output markets (through product differentiation, different designs, different marketing channels etc.)” (Foss 1997:25). The aim of resource-based strategy in this extended perspective then becomes the acquisition of an optimal bundle of options where optimality is a matter of striking a balance between the cost of acquisition of options and the benefits these options may bring in terms of added flexibility in the new environment of the industry. In chapters 6 and 7 these output market options and the input integration options are analysed empirically to see whether they may explain the economic performance of the offshore suppliers any better than endogenous factors (as explored in chapter 4) and structural factors (as explored in the current chapter) may do.

## **5. A resource-based analysis of economic performance**

In the RB literature, resources have alternatively been defined as “anything which could be thought of as a strength or weakness of a given firm”, as “those (tangible and intangible) assets which are tied semi-permanently to the firm” (Wernerfelt 1984), or as “all assets, capabilities, organisational processes, firm attributes, information, knowledge etc. controlled by a firm that enable [it] to conceive of and implement strategies that improve its efficiency and effectiveness” (Barney 1991:101).

Key issues are those related to the ownership and control of particular immaterial assets, using concepts such as capabilities, core competencies, learning and tacit knowledge. The firm is characterised more as a collection of resources than a set of product-market positions, and the corporate strategy of the firm focus on the internal resources of the firm in order to identify and convert distinctive competencies into competitive advantages.

### **5.1 RB and the competitive advantages of firms**

Firms cannot expect to obtain competitive advantages when strategic resources are evenly distributed across all competing firms and are highly mobile. Yet, the value of an individual resource is likely to be at least partially contingent upon the presence (or absence) of other resources; that is, it may be a system of resources that matters, not the individual resources taken separately. Further, the value of resources will change over time. What was once an advantage may one day become an encumbrance, even though the resource itself has not changed (Foss et al. 1995:8). Resources are defined as heterogeneous when their economic returns are made dependent on what other resources they are combined with, and strategic resources tend to be heterogeneous. Strategic assets, those that are necessary to sustain competitive advantage, are developed internally and cannot be purchased in the factor markets.

A significant feature of RB is the emphasis that is placed on the tacit nature of information in order to explain resource heterogeneity. In particular, it is asserted that the ownership and competitive advantages of firms comprise tacit information which in itself is not so easily transferred between firms, even when contractual relationships should allow for it (Casson 1997: 112-114).

Barney (1991) identify four empirical indicators of the potential of firm resources to generate sustained competitive advantages, assuming that firm resources may be heterogeneous and immobile (table 5.1).

VALUE	UNIQUENESS	IMPERFECT IMITABILITY	SUBSTITU- TABILITY	EFFECTS ON COMPETITION
No				Competitive disadvantage
Yes	No			None
Yes	Yes	No		Short-term competitive advantage
Yes	Yes	Yes	No	Temporary competitive advantage
Yes	Yes	Yes	Yes	Sustained competitive advantage

Table 5.1: Types of resources and competitive advantage (After Barney 1991)

Among resources of value to the firm has been mentioned reputation, buyer-seller relationships, tacit knowledge, R&D expertise, and technological capabilities (Barney 1991, Mahoney and Pandian 1992). If such valuable resources should be of a competitive advantage to the firm, they need to be combined with other attributes such as uniqueness, imperfect imitability and/or substitutability. Sustained competitive advantage refers to the implementation of a strategy of value-creation that is not susceptible neither to duplication nor implementation by fellow competitors.

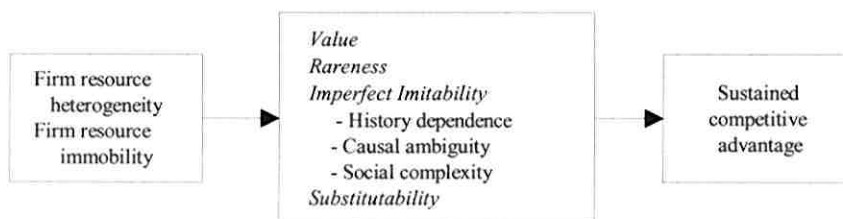


Figure 5.1: Resource attributes and sustained competitive advantage

To be of a competitive advantage to the firm, a valuable resource should hold at least two of the Barney attributes. Applying attributes as sources of competitive advantage are increasingly confounded once their qualitative content is allowed to change, so that resource value, uniqueness, imitability and substitutability is made subject to change. This calls for going beyond purely internal analyses of firm resources, and rather to explore internal resources in context with the competitive environment and the organisation of resource stocks themselves.

By way of strategic analysis, the classification principles provided in Barney (1991) is completely unfalsifiable. The way out, as indicated in Foss (1997), is to operationalise the key criteria that various resources have to meet in order to yield sustainable competitive advantage. One way of operationalising resources is to construct proxy variables that correspond to the arguments that sustained competitive advantage hinges on whether the resources are valuable, rare, costly to imitate or substitutable.

In principle, such exercises may be performed. Expert knowledge may be applied to assess the cost of imitation of particular products or processes, rarity may be estimated by counting their prevalence in competing firms etc. (Foss 1997). The proxies obtained can then be used as independent variables in examining their explanatory power on economic performance or innovativeness in a group of firms. This is the approach that will be explored in chapter 4.5.

The literature remains ambiguous on the significance of firm size on the development of new resources as well as on the rentability of existing ones. While some observers argue that the RBP is particularly well suited to analyse small firms where the number of strategic variables and resource combinations are limited (Porter 1994), other take the opposite position. If the set of resources is large, random developments are less prone to make an impact on the resource development of established, diversified corporations (Foss et al. 1995:14-15). This should then augment the explanatory potential of internal analyses of the firm such as those following RB. The significance of establishment size on economic performance remains to be explored in the resource-based view, as most successful applications of the RB so far have been to studies of diversified and well-established companies. But in explaining economic performance, establishment size is only one of many factors of relevance.

## **5.2 Resources and innovation capacity**

Both the literature on industrial organisation and on technology management indicate that many small, entrepreneurial business establishments which generate new, commercially viable innovations fail, while big corporations survive and prosper in spite of a less meritorious record with respect to technology development. One explanation for such a phenomenon is that the larger firms are more likely to possess the relevant co-specialised assets - a portfolio of heterogeneous resources - within their boundaries to appropriate economic returns from innovations. With respect to innovative capability, two distinct strategies has been identified (Teece 1986). Firms pressing or formulating a *sponsor strategy* push or formulate the imposition of a particular technical standard. Business establishments which follows a strategy in the hope that eventually will dominate, is termed *followers*. Generally, a sponsor strategy is only viable for larger corporations which can create an expectation that they can commit specialised resources to create a standard that will prevail in the market in the long run.

The resource-based view holds that valuable resources are those that competitors cannot imitate immediately. Often innovations, whether under patent protection or without it, falls into the category of valuable assets (Foss et al. 1995). Hitherto, the RB have been less concerned with technology development issues, although technical innovations themselves are of great significance to the competitiveness and profitability of the business enterprise, in particular as innovation activities involve elements of organisational learning that by themselves are novelties to the firm (Foss 1997). Once produced, technological innovations can be aligned with functional "complementary assets" that incorporate both resources and capabilities, such as marketing or after-sales services, in order to appropriate economic returns from the innovation (Teece 1986).

Christensen (1995) makes an attempt to bridge analyses of technological innovation with recent RB of business strategy by linking different technical categories to their strategic relevance. From the perspective of resource profiles he argue that technical capabilities should be related “not only to products and markets but to the relevant innovative assets or asset constellations to which they may contribute” (Christensen op.cit.:742).

### **5.3 RB and the strategic management of firms**

Competitive advantage is a function of not only of firm effects alone, but also of organisational governance and industry structure. This calls for the integration of RB with industry analysis, fusing the RB’s focus on the strengths and weaknesses internal to the firm with threats and opportunities in the competitive environment. External influences are strategic industry factors that impact the firm through altering buyer and supplier power, competition intensity, industry and product market structure. Such factors influence *what* resources are selected as strategically essential to protect and develop by managerial teams, as well as *how* these resources are selected and deployed within the firm (Oliver 1997).

There is little consensus in the management literature as to whether organisational resources or market competition are the more important external factors in shaping firms’ economic performance and capacity for innovation. Rather, organisational resources and the competitive setting interact and are important in shaping performance and strategy. In addition, an approach unifying the different RB variants has yet to emerge, so that the field of RB applications in strategic management remains diverse.

Organisational resources and the competitive environment itself is also altered by mergers and diversifications of firms. The possible association between firm diversification and performance remains elusive, and in the resource-based discussion the diversification-performance linkage is embedded in the greater discussion of whether diversification strategies make any difference on economic performance at all. Mahoney and Pandian (1992) argue that RB on diversification suggest that firm effects exist in the form of focus effects. Being less focused, widely diversified firms are unable to transfer resources to different markets given that the wide diversification is congruent to the presence of less firm-specific resources. Correspondingly, in mergers and acquisitions a given resource will lose more value when transferred to markets that are less similar to that in which it originated.

Focusing on the firm, a bidding firm will be unable to appropriate economic rents if the resources appropriated in the merger are incompatible with the existing resource stock of the bidder. Then a merger will have a negative effect on profitability. Alternatively, the merger will have a positive effect on profitability if the bidder has private information or synergies which are not easily imitable or substitutable.

In the RB the ability to learn and adapt to changing environmental conditions is a primary concern, because rent-generating resources must be replicated and upgraded as well as protected (Schulze 1992). In order to identify which types of resources generate above-normal rents in practical application for strategic analysis, the RP is in need of a

feasible typology of resources. The aim of applying the RB in the analysis of offshore suppliers is to produce a resource-profile of each petroleum-dependent sub-supplier. The profile is produced by focussing on the management of various types of resources. The strategic resources are classified into property-based and knowledge-based categories. To identify these resources, theoretically consistent indicators of the various resource types are used for empirical analysis.

#### **5.4 Property-based and knowledge-based resources**

Resources can be - and has been - categorised in a number of ways. As mentioned earlier, Barney (1991) separate resources by their rent-generating potential using qualitative indicators such as value, imitability, uniqueness and substitutability. Kay (1993) identify financial, physical, human, organisational and tacit resources separately. The question of which resources a firms should employ, acquire or develop in order to create or support competitive advantage is not entirely solved in Barney's static compartmentalization. Schulz (1992) argue, for instance, that a corporate competence should not be hard to imitate (as argued by Barney), but should be highly imitable as its value is increased by it being easily transferred between business units. As such, it would seem that RBs are in need of better definitions of organisational resources, their degree of firm-specificity, and identification of conditions under which different types of resources are capable of generating economic returns (Schulze 1992:40).

Whether or not an asset can be considered a resource will depend as much on the environment the firm is situated in - both competitively and contextual - as on the properties or organisation of the asset itself. The competitive value of resources can be enhanced or eliminated by changes in technology, competitor behaviour, or buyer needs which an inward or purely firm-oriented focus on resources will overlook (Porter 1991, Miller and Shamsie 1996). A study of the contemporary North Sea oil industry evokes precisely such changes within the competitive environment. The 1990s have seen changes in technology, a change in culture whereby former rivals find themselves co-operating, and re-specifications of buyer needs in the form of new contractual relationships, thus providing ample testing grounds for applications of RP analysis.

In the interest of testing and advancing applications of the RB, Miller and Shamsie (1996) develop a distinction between property-based and knowledge-based resources. Property rights are tied to specified and well-defined assets. The exclusive ownership and control of a particular resource that cannot be legally challenged, exploited or imitated by competitors may yield economic returns with a high degree of certainty. Delineated property rights make particular resources valuable and as resources becomes more valuable, property rights become more precise (Mahoney and Pandian 1992: 370). Examples of property-based resources are enforceable long-term contracts that monopolise scarce factors of production, that embody exclusive rights to utilise or develop potentially profitable technology, or assure distribution channels for a particular products. Thus, property-based resources apply both to particular products and processes. While most competitors will be able to identify a rival's property-based resources they will lack the legal rights to acquire or imitate such resource(s) themselves.



Another group of resources are protected not by legal rights but by knowledge barriers. They are not acquired because they are difficult to understand for outside observers, they involve elusive talents, fleeting competencies and generate economic rents in mysterious ways. Such resources often take the form of particular organisational skills and creative talents. Such resources provide payoffs not by market control or by precluding competition, but by providing the firm with skills that allow it to adapt to new market challenges.

While property-based resources allow a firm to control resources in order to gain a competitive edge over market rivals, knowledge-based resources are design to respond and adapt to potential challenges facing an organisation in the future. The two types of resources may not be independent, as the latter may be used to identify, develop and procure the former. In addition, property-based and knowledge-based resources has been separated into discrete and systematic resources, respectively.

In all, there are then four types of resources to account for when applying the RB. A core assumption of applications of resource-based theories is that property- and knowledge-based resources have different properties with respect to economic and innovation benefits. Property-based resources yield benefits in stable, predictable environments while the payoff of knowledge-based resources is the highest in unpredictable, turbulent environments. A simple demarcation between environmental stability and environmental instability could be that unpredictability is augmented in markets where the technological make-up is changing, whereas predictability is improved in markets characterised by established standards and dominant designs. This argument is probed in the remainder of the paper, and illustratively demonstrated using the North Sea oil industry of the 1990s as a case.

#### *Discrete property-based resources*

In an industry where co-ordination and co-operation is institutionally encouraged, the ability to deliver and produce in accordance with established standards on functional specificity makes it easier for industry participants to establish the value of properties, claims and contracts and to plan for additional resource acquisitions. Thus, the standardisation process provides predictability, ensuring that property-based resources will continue to buffer a firm from competitors as long as the production standards reigns (Miller and Shamsie 1996; 524).

#### *Systemic property-based resources*

Some property-based resources come in the part of components arranged into systems. Component value relies on their integration with the system as a whole. Integrated supply, manufacturing and distribution networks may be valuable because steady sources of supplies are ensured. In these cases, the managerial task is not so much to obtain and tie up more and more assets, but to enhance the pre-existing system itself. Resources are added not so much as to substitute for existing assets, but to complement them.

Like discrete property-based resources, systemic property-based resources are of more use in predictable than in uncertain competitive environments. The value of a system is easier to appraise and to augment in order to increase the scope of market control. With unpredictable changes in the environment, existing systems may become obsolete. If a new standard in production technology is established unexpectedly, existing technology co-operation networks may become obsolete. If future demand for particular products are hard to anticipate, systems of production may wither unpredictably.

In accordance with the description provided above, the following hypothesis may be put forward:

*Hypothesis 3: Property-based resources will produce superior economic performance for offshore suppliers with a downstream orientation, as the NORSOK process makes this a relatively predictable segment of the offshore industry. They will not do so for suppliers primarily oriented towards the more uncertain upstream segment of the industry.*

#### Discrete knowledge-based resources

Discrete knowledge-based resources may take the form of particular technical, functional or creative skills (Itami 1987), which are of value to the firm because they are subject to uncertain imitability. Competitors do not know precisely what to buy or imitate in order to generate similar economic returns, neither do the managers of the firm themselves. Firms benefit from the simultaneous development of such resources, which are flexible and easily adjustable to the firms' current stock of other knowledge-based resources. These synergies assure that knowledge-based resources remain of value even when the competitive environment is changing unpredictably.

Knowledge can be lost, but is lost more easily in stable setting where competencies evolve more slowly and are easier to copy. In stable settings, the cost of retaining talent and particular easily identifiable skilled personnel are high.

#### Systemic knowledge-based resources

Co-ordination and team skills promote adaptation and flexibility in multidisciplinary teamwork. The way skills are complemented in teams give many firms their particular competitive advantage. Such collaborative skills are nurtured by complex, long-term projects which force personnel from different part of the organisation to work together, promoting learning and even more effective teamwork in the future (Itami 1987). Unlike physical assets, knowledge-based skills do not deteriorate as they are applied and shared, but augment their value. Advertising expenditures have been identified as a reasonably effective proxy for capturing a firm's intangible assets such as brand names and reputation (Mahoney and Pandian 1992).

*Hypothesis 4: Knowledge-based resources will produce superior economic performance for offshore suppliers with an upstream orientation, as global competition and absence of local regulation makes this a relatively unpredictable segment of the offshore industry. They will not do so for suppliers primarily oriented towards the more regulated downstream segment of the industry.*

## **5.5 A resource-based perspective on upstream and downstream oriented offshore suppliers: some findings**

In order to test the hypotheses and thus assess the applicability of resource-based perspectives on the strategic management of firms operating in the offshore supply industry, we introduce indicators of knowledge-based and property-based resource development. The indicators are based on the material reported in the industry survey, making strategic decisions related to endogenous resource management operational in identifying such resource indicators. *MARC* is the natural logarithm of the marketing costs at the end of the period - theoretically taken as an static indicator of the level of knowledge-based resources present in the enterprise at the end of the period. *MARCDYN* is a dichotomous variable indicating whether the marketing budget has increased more than 10% with respect to total turnover 1993-1996 (then *MARCDYN*= 1) or remained relatively unchanged or even been reduced (*MARCDYN*= 0). This dichotomous variable is taken as an indicator of the systematic development of knowledge-based resources in the period. Finally, *PATENT* is a dichotomous variable indicating whether the sub-supplier has obtained and commercialised any new patenting or licencing rights in the course of supplying the offshore industry 1993-1996. This variable is taken as an indicator of property-based resource mobilisation. The sub-suppliers are segmented according to their location in a relatively turbulent offshore environment (upstream supplier segment) or a relatively stable offshore environment (the downstream supplier segment). The significance of property-based and knowledge-based resources on the average economic performance in the period is tested for all three measures of economic performance. The dependent variable covering the whole four-year period is defined as the sum of the economic performance for each of the four year less the average performance for the whole population. If this synthetic dependent variable comes out as being positive, the respondent performs above average, while if it comes out as being negative, the respondent is in the less than average half of the population. Linear regression results are presented in the following table, indicating differences in the effect of property-based and knowledge-based resources on the economic performance in each of the industry segments.

Model no.	DOWNSTREAM SUPPLIERS			UPSTREAM SUPPLIERS		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dep. variable</i>	<i>TAVROA</i>	<i>TAVLIR</i>	<i>TAVROS</i>	<i>TAVROA</i>	<i>TAVLIR</i>	<i>TAVROS</i>
<i>Constant</i>	-0.03	-0.273	-0.014	-0.02	-0.512	0.06
<i>Indep.</i>						
MARC	0.031	0.154	0.015	-0.013	0.364**	-0.247
MARCDYN	-0.119	0.108	0.008	0.319**	-0.192	0.299*
PATENT	0.245**	0.132	0.208*	0.151	0.16	0.059
R <sup>2</sup> (adj.)	0.022	0.029	0.008	0.067	0.07	0.046
F-value	1.623	1.807	1.209	2.06	2.097	1.71

\*\* sign. at 5% (two-tailed)

\* sign. at 10% (two-tailed)

n=44-82

Table 5.2: Regression results of resource type on average economic performance 1993-1996 by supplier orientation

The indicator variables selected to demonstrate property-based and knowledge-based attributes exhibit only weak and mostly insignificant relationships with the various measures of economic performance. In general, the displayed relationships remain ambiguous. For instance, in model (1) only holding patenting rights or licencing rights (PATENT) appears to be positively and significantly related to the average economic performance of downstream suppliers 1993-1996. Two of the three resource-based indicator variables tested are dummies (PATENT, MARCDYN), and robust relationships are found only for PATENT where the positive effect is stronger in all pairwise comparisons between upstream and downstream suppliers.

With respect to knowledge-based resources, the relationships are ambiguous. In model (5), the coefficient of MARC indicates that a 10%-rise in that variable is associated with a significant rise in the average 1993-1996 liquidity ratio of upstream suppliers of 3.6 percentage points. However, in the two complementary models of the upstream suppliers' economic performance the MARC indicator is associated with a negative relation with economic performance. Similar ambiguous results are found for the indicator of dynamic knowledge-based resource accumulation (MARCDYN) as well.<sup>10</sup>

As displayed in table 5.2, the internal resource-base performs vaguely as expected in the two supplier segments. The explanatory power is weak. Using only variables that are endogenous to each supplier seriously underspecifies the overall model. Significant explanatory variables remains missing. In order to compensate for this lack of precision, we will seek to introduce structural and product/market variables into the general model in order to explore alternative variables and expand the general resource-based framework.

<sup>10</sup> Interaction effects between MARC and MARCDYN are have not been tested.

## **6. Supplier-purchaser integration in the oil industry 1993-1996**

In the resource-based perspective resource selection and accumulation are functions both of decision-making within each firm and external, integrative strategic factors. These factors influence what resources are selected, how they are selected and how they are deployed - even in co-ordinated moves together with other firms. External industry factors influence the firm through buyer-supplier relationships, co-operation agreements, technology development collaboration, shared project organisations and other initiatives that require separate firms to share resources in order to develop them further.

The Norwegian offshore industry has seen systematic efforts by suppliers and operators to integrate and co-ordinate activities located at various stages of the petroleum value chain. Both upstream and downstream activities are involved, although the intensity of such efforts correlate over time both with business cycles, the oil price level as well as with co-ordination incentives provided by local industry regulation authorities. Both sub-suppliers as well as oil companies (offshore operators) are actively engaged in attempts to integrate offshore activities. These integrative efforts have not come without obstacles for the parties involved. The chapter summarise the findings made in a minor 1982 study of offshore suppliers, and compare these early findings with the results found in a similar 1997 survey of sub-suppliers to the offshore industry.

In a survey of 70 direct suppliers to the Norwegian offshore industry in the early 1980s (that is supplying the oil companies without intermediaries), the motivation for supplier co-operation was explored (Reve and Johansen 1982, quoted in Reve and Stavseng 1987). Although the data have only been assessed descriptively, they nevertheless provide a catching glimpse of the three main groups of strategic factors that motivate co-operation arrangements. Such arrangements are made

- in order to integrate complementary resources,
- in order to take advantage of economies of scale, and
- in order to reduce transaction costs.

The survey addressed the significance of these three motivations as driving forces in inter-organisational co-operation in the supplier segment. The first of these, resource complementarity, stood out as the most significant element in inspiring such efforts. When suppliers co-operate, this was initially done in order to be able to comply with the contractual specifications of the oil companies in better way. This factor was identified as significant or very significant by 2/3 of the suppliers. Access to new technology was the second most important driving force when seeking to establish co-operation arrangements.

Access to skilled manpower was regarded as very important or important by 40% of the respondents, whereas gaining access to financial resources was viewed as important or very important by less than 1/5 of them. An equally low score was accomplished by the factor “ameliorating opportunities to specialize”. Reve and Stavseng (*op.cit.*) argue that this could be interpreted as a rank-order among the group of motivational factors, whereby economies of scale is ranked lower than resource complementarity.

“Gaining a stronger position in negotiations” was classified as a politically determined economy of scale-factor. Almost half of all suppliers identified this as being important or very important in explaining co-operation arrangements. Given the industrial organisation of the Norwegian offshore industry in the early 1980s, (a structure that predominate at the mid-1990s as well), this should come as no surprise. A relatively large number of petroleum-dependent suppliers are facing a highly structured group of operators who amount to 30-40 major international oil companies.

Reductions in transaction costs proved to be a weak motivational force in petroleum sector co-operation at the beginning of the 1980s. However, supplier co-operation arrangements were highly frequent at this period (68 of 70 respondents reported being involved in them). This seems to indicate that there were - and are - purely economic gains to be made, too.

The NORSOK restructuring process of the 1990s has highlighted this last motivational element even more. Taking the lead from the Reve-Johansen study referred to above, the NORSOK initiative could somewhat crudely be presented as an effort to downplay resource complementarity and economies of scale to the advantage of a more focused effort in reducing transaction costs. The identification of explicit goals in cost reduction (in the range of 30% to 50%) in new offshore field development projects is merely an indicator of this refocusing within the Norwegian petroleum industry. Some of the repercussions of the attempt to reduce transaction costs on the frequency of co-operation arrangements in the offshore supplier industry is presented in the following. At first glance, co-operation arrangements among suppliers, and between operators and the supplier industry, appear to be less frequent in the mid-1990s than in the early 1980s - less than 70% of all suppliers report having entered into new co-operation arrangements in the period 1993-1996 compared to 68 out of 70 in the Reve-Johansen survey.

A conclusion on the evolution of co-operation and supplier-purchaser integration is however premature. The material from a 1997 survey of supplier-purchaser and supplier-supplier organisational integration in the Norwegian offshore industry is presented in more detail in the following sections.

## **6.1 Modes of integration**

The organisation of economic transactions has been arranged along the market-hierarchy continuum. Recently, various network approaches has been introduced as hybrid forms located somewhere in between the contractual relationships typical of market transactions and the procedural relationships characterising transactions within the organisation hierarchy. In offshore exploration and development projects these forms of integrated activities reflect the different procurement strategies available to operators

and construction companies. In the offshore industry, various co-operation arrangements can be arranged along the market-hierarchy continuum depending on the degree of organisational integration required in such initiatives (Figure 6.1)<sup>11</sup>.

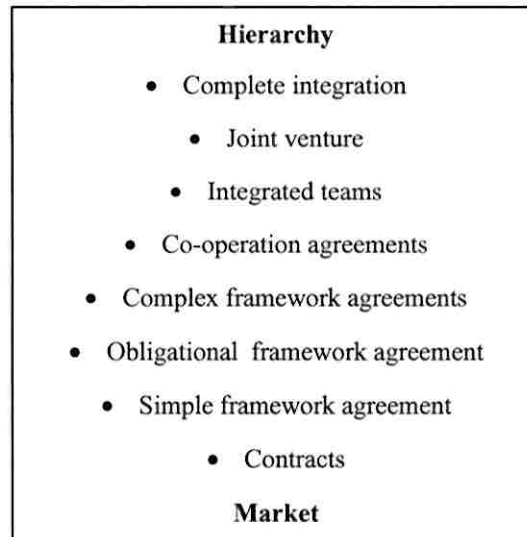


Figure 6.1: Modes of integration

In a resource-based perspective on diversification and co-operation, the endogenous resources of firms may be developed and accumulated by co-operation arrangements. This is deemed essential in task environments with continuous high turbulence and a relatively high frequency of strategic shocks.

Strategic shocks may come in many forms. Firstly, mergers and acquisitions may restructure the industry. Secondly, the entry of new competitors, and the exit of established ones may have similar effects. Thirdly, the formalisation of new and unanticipated strategic alliancing may combine complementary resources in competing firms and increase market power for the participating firms. Olivieri Askevold (1998) voice some of these arguments in her study of technology development alliances in the Norwegian offshore industry under the NORSOK regime. The effects of various ways of integrating economic activities may be related to the stability or the turbulence of the task environment of suppliers operating in the two main segments of the industry. In the period 1993-1996, no significant pattern emerges as to which of the two segments are the most turbulent with respect to industrial organisation, and which is the relatively stable one (table 6.1).

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<sup>11</sup> We owe this observation to Henning Jakobsen.

	DOWNSTREAM SUPPLIERS 1993-1996	UPSTREAM SUPPLIERS 1993-1996
Proportion of suppliers who merged 1993 - 1996	23,1%	28,3%
Proportion of suppliers who acquired other firms 1993 - 1996	32,7%	30%
Segment increase by entry of new firms	1,5%	3,8%
Segment decrease by supplier exits	0%	0%
Proportion of suppliers engaged in integrated tech. development 1993 - 1996	37,4%	49,2%
Proportion of suppliers engaged in co-operation arrangements 1993 - 1996	83,2%	73,3%

Table 6.1: Stability and turbulence in offshore industry segments; descriptive statistics

While the number of suppliers who have experienced mergers and acquisitions in the period are about the same in the two segments, there have been no exit of firms and very few new entries. The most manifest difference between upstream and downstream suppliers is their level of engagement in cooperated technology development projects. Almost half of all upstream suppliers have engaged in such activities in the 1993-96 period, while somewhat more than a third of downstream suppliers have participated in similar activities.

In recent offshore procurement contracts, the various integrative efforts of the participants have in addition to the arrangements identified in box A taken such forms as leasing, parallel work(s), large systems solutions and explicit incentive contracts. Haugland (1996) summarily assess the characteristics of using each procurement strategy and identify situations in which they appear to be most applicable.

Three dimensions of offshore construction projects are that they (i) typically are costly, (ii) there is a high level of specification uncertainty involved between contractor and contractee, and (iii) that every project tend be unique with respect to the construction skills and competencies required (Haugland in Heum et al. 1996).

Greve et al. (1996) provides a systematic overview of the different types of procurement strategies that are in use in the Norwegian offshore industry. Traditionally, the operators have laid out the fundamental preconditions of offshore construction projects. Contractor companies have been introduced to the construction relatively late in the project. Vast resources have been put into use in work that does not add value to the installations themselves, such as task duplication and extensive controlling of prior works.

In the Norsok restructuring process, cost reduction these projects are being organised differently. Framework agreements have been identified as a particularly advantageous way of organising projects where processes and products are standardised across different operators and development projects (NORSOK 1993).



At the mid-90s, the Procurement Directive of the EEA, new NORSOK initiatives sponsoring increased standardisation and the early identification of main suppliers in construction and fabrication has increased the frequency in the use of framework agreements. The requirement of functional specifications towards offshore sub-suppliers has not increased correspondingly. Over-specification has become more common as the main contractors and suppliers of total system solutions in the offshore industry attempts to reduce their own exposure to technological and process uncertainties.<sup>12</sup> Co-operation initiatives, efforts at team integration and joint ventures across organisations still remain atypical occurrences.

## **6.2 Co-operation agreements**

In the NORSOK restructuring process, the common assumption has been made that offshore operators and suppliers have duplicate competencies. One way of reaping cost benefits have been to make attempts to organise construction projects so as to produce complementary competencies amongst projects participants rather than duplicate skills and competencies (Haugland 1996). This requires more systematic project co-ordination among operators and suppliers, not least as operators are required to be able identify what kind of activities are best done by the operators themselves, what kind of goods and services that are best obtained through market transactions, and what kind of resources are amassed by integrating operator and supplier activities through co-operation agreements.

Ideally, the greatest benefits should be obtained in contexts where operators, contractors and sub-suppliers share skills and competencies democratically in order to find the best solution possible. Once such a project solution has been identified, an agreement can be made on how costs and benefits are to be shared.

In reality, there is great risk and uncertainty involved in identifying both costs and benefits. Typically, the agreement incorporating how the project participants shall share profits is negotiated as the costs and benefits themselves are being incurred. This affects the participants' incentives to share skills and competencies as well as to generate relational contracts.

Surveys of the offshore industry are regularly performed in the offshore industry. As of 1998, more than half of all offshore enterprises expect supplier alliances to be important for their future economic performance. Three out of four respondents report having participated in such alliances.

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12 O. Lappegaard at the Offshore Strategy Conference (OSK) Stavanger, Norway January 1998.

The more complex forms of interaction required in working in integrated teamwork have only been experienced by half of the enterprises in the industry.

*Hypothesis 5: Participation in co-operation agreements will not produce superior economic performance for offshore suppliers with a downstream orientation. They will do so for suppliers primarily oriented towards the more turbulent upstream segment of the industry.*

### **6.3 Technology development contracts**

Traditionally, new capabilities and new competitive strategies have only rarely been developed in inter-organisational co-operation or through strategic alliances. In a capability paradigm of strategic management, the mobilising of resources complementary to those embedded in the enterprise itself is an essential aspect of strategic management. The resources of other firms - fellow competitors or partners - can be put into use in arrangements attempting to integrate the resources of the participants. Co-operation agreements and technology development contracts are but two modes of integration. In capability paradigm, such strategic integration of activities is essential in task environments characterized by continuous high turbulence and with frequent unanticipated strategic moves (mergers and acquisitions) in the industry. As demonstrated in Olivieri Askevold (1998), the various segments of the domestic offshore supplier industry is characterised by their own particular task environments that generate different opportunities in the implementation of different technology development strategies. This yield support for the following hypothesis with respect to technological process and product development strategies:

*Hypothesis 6: Participation in technology-development projects will not produce superior economic performance for offshore suppliers with a downstream orientation. Technology-development participation do so for suppliers primarily oriented towards the more turbulent upstream segment of the industry.*

### **6.4 Purchaser specialization**

For offshore suppliers, there may be several advantages of having multi-buyer relationships. A dominant buyer will have considerable purchasing power, and may require the development of supplier resources that yield low economic returns over time.

*Hypothesis 7: Purchaser specialisation will produce inferior economic performance for offshore suppliers irrespective of orientation.*

Table 6.2 displays the results of a simple linear regression testing these hypotheses. The statistical relationship between three dichotomous variables indicating organisational integration experience between the sub-supplier and offshore purchasers (co-operation agreement participation 1993-1996 (COOP), technology development participation 1993-1996 (TECHDEV), buyer dependency, with major client taking being responsible for more than 50% of total offshore turnover (PURCDOM) and economic performance are displayed.

Model no.	DOWNSTREAM SUPPLIERS			UPSTREAM SUPPLIERS		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dep. variable</i>	ROA <sub>96</sub>	LIR <sub>96</sub>	ROS <sub>96</sub>	ROA <sub>96</sub>	LIR <sub>96</sub>	ROS <sub>96</sub>
<i>Constant</i>	-0.073	0.131	-0.139	0.071	0.486	0.045
<i>Indep. variables</i>						
ROA <sub>95</sub>	0.775**	-	-	0.542**	-	-
LIR <sub>95</sub>	-	0.725**	-	-	0.601**	-
ROS <sub>95</sub>	-	-	0.793**	-	-	0.544**
COOP	0.215**	0.149	0.168**	0.018	-0.14	0.077
TECHDEV	-0.095	-0.109	-0.049	-0.028	0.067	0.008
PURCDOM	-0.075	0.013	-0.103	-0.02	0.276*	0.218
R (adj.) <sup>2</sup>	0.692	0.497	0.723	0.197	0.313	0.336
F-value	35.193	16.092	40.791	3.147	4.995	5.436

\*\* sign. at 5% (two-tailed)

\* sign. at 10% (two-tailed)

n=35-61

Table 6.2: Regression results of supplier-purchaser integration and economic performance 1996 by supplier specialisation

The indicator variables selected to demonstrate resource integration attributes exhibit only weak and mostly insignificant relationships with the various measures of economic performance. In general, the displayed relationships remain ambiguous. However, for downstream suppliers the relationship between economic performance and participation in co-operation agreements are significant and positive (models (1)-(3)). For downstream suppliers there is an insignificant neagative relationship between technology development efforts and economic performance, while the relationship between buyer specialization and economic performance is ambiguous. The effect of technology development on economic performance is more favourable on upstream suppliers in all pairwise comparisons of economic performance. For upstream suppliers all the relationships are, however, ambiguous.

## 7. Economic performance, size and product/market variables

From chapter 5 and 6 the application of resource-based perspectives in explanations of the economic performance of offshore suppliers has displayed few significant relations between endogenous factors and economic performance. Alternatively, more conventional exogenous supplier characteristics and product/market factors are explored to whether they yield more significant results.

The results of the industry surveys performed by the NORSOK secretariat in 1996 and 1997 presented in the introduction would indicate that the following hypotheses seem reasonable:

*Hypothesis 6: A large offshore supplier will produce superior economic performance in comparison with small- or medium-sized suppliers irrespective of orientation on the offshore industry value chain.*

In addition, a range of other product/market hypotheses in relation to the economic performance of the individual offshore supplier may be formulated.

*Hypothesis 7: A supplier with no corporate affiliation will produce inferior economic performance in comparison with suppliers that are daughter- or sister companies of a larger commercial enterprise irrespective of supplier orientation on the offshore industry value chain.*

*Hypothesis 8: Suppliers that are mainly capacity suppliers will produce inferior economic performance compared with product suppliers irrespective of supplier orientation on the offshore industry value chain.*

*Hypothesis 9: Suppliers with a all-dominating buyer in the offshore industry will have inferior economic performance than suppliers with a more diverse offshore customer portfolio, irrespective of supplier orientation on the offshore industry value chain.*

*Hypothesis 10: Suppliers whose value-added is mainly from domestic factor inputs (local production and services) will have inferior economic performance than offshore suppliers who operate mainly as agents or distribution outlets for products and services produced by others.*

Findings with respect to these hypotheses are presented in the following. Complete models using all product-market independent variables are identified, and reduced models using backward reduction on the linear regression, are presented in table 7.1:

Model no.	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dep. variable</i>	ROA <sub>96</sub>	ROA <sub>96</sub>	LIR <sub>96</sub>	LIR <sub>96</sub>	ROS <sub>96</sub>	ROS <sub>96</sub>
Method	OLS	Backward	OLS	Backward	OLS	Backward
<i>Constant</i>	0.089	0.066	0.917	0.445	0.02	0.044
<i>Indep. variables</i>						
ROA <sub>95</sub>	0.822**	0.826**	-	-	-	-
LIR <sub>95</sub>	-	-	0.658**	0.665**	-	-
ROS <sub>95</sub>	-	-	-	-	0.586**	0.476**
<i>Size dummies</i>						
Small	~	-	~	-	~	-
Medium	-0.081	-0.078	-0.045	-	-0.175*	-0.16*
Large	-0.034	-	0.06	-	-0.023	-
<i>Corp.affil. dum.</i>						
Mother	0.064	-	-0.339	-0.126	0.076	-
Daughter	0.048	-	-0.311	-	0.081	-
Sister	0.015	-	-0.105	-	0.027	-
None	0.147	0.096	-0.301	-	0.275	0.203**
PURCDEP	-0.093	-0.093	-0.074	-	-0.006	-
CAPAC	-0.054	-	-0.089	-	-0.026	-
VALUADD	-0.071	-	-0.001	-	0.041	-
R <sup>2</sup> (adj.)	0.617	0.635	0.385	0.422	0.336	0.389
F-value	14.858	38.329	6.311	32.058	5.305	19.032

\*\* sign. at 5% (two-tailed)

\* sign. at 10% (two-tailed)

*n*=98-99

Table 7.1: Firm-specific relationships and economic performance 1996

As in the general models presented in previous chapters, the economic performance of the suppliers are most significantly related to the economic performance of the same firm the preceding year. The effect of other firm-specific variables is summarised in the following.

## **7.1 Establishment size**

Too few observations were available to differentiate between small and medium-sized enterprises when running the models. Economic performance is systematically more negatively related to medium-sized enterprises than to large enterprises with more than 250 employees. Size variables are only statistically significant at the 5% level in one model (6), but these relationships are robust as they share the same negative sign overall. The relationship between economic performance and large size is ambiguous, and is not relevant in any of the reduced-form models (2), (4) or (6).

## **7.2 Corporate affiliation**

Corporate effects are ambiguous as well. No corporate affiliation appears to be more positively related to economic performance than corporate affiliation, although these findings are essentially ambiguous. Only in model (3) does corporate affiliation(s) display more positive relationships with economic performance than no corporate affiliation does. In the reduced-form models, sister or daughter company affiliation is of no relevance.

## **7.3 Mode of production**

The economic performance of the supplier is systematically related to their main product-market identification. Economic performance is negatively related to being a capacity producer (CAPAC). Overall, this relationship is, however, insignificant and irrelevant in all the reduced-form models.

## **7.4 Value-added: domestic or foreign**

Whether the offshore supplier functions mainly as a sales outlet for products produced elsewhere or adds value from own factor inputs (VALUADD) does not relate significantly to the economic performance of the firm. At best, the overall relation is ambiguous. This relationship as well remains irrelevant in all reduced-form models.

## **7.5 Customer specialisation**

The relationship between customer specialisation (PURCDEP) and economic performance is uniformly negative but insignificant. In one of the reduced form models (2) this variable is included in the final form, yet remains insignificant.

## 7.6 Outperformers and underachievers: major findings

The relative growth in economic performance for all firms 1993-1996 was identified running linear regressions of the individual economic performance on the average performance on the whole set of suppliers.<sup>13</sup>

Sub-suppliers in the top sextile (1/6) are identified as outperformers in the 1993-1996 period, while sub-suppliers in the bottom sextile are correspondingly identified as underachievers in the 1993-1996 domestic offshore supplier industry. In these subsets, two for each measure of economic performance, each sextile contains from 16 to 21 enterprises. In related studies (Tallman et al. 1994:30) the rate of growth in economic performance (the  $\beta$ ) has been interpreted as a measure of performance which address the strategic power of the enterprise, revealing relationships that measuring economic performance simply by accounting returns do not.

Because of the small number of respondents in the various subsets, the results were investigated to see whether the findings were driven by outliers. Outliers were found to have significant effects in most models. The models were therefore re-estimated omitting all outliers. Observations lying more than three standard deviations from the mean were identified as outliers. Typically this approach resulted in the omission of one or two observations from the subset of winners or losers.

The re-estimated linear regression results are presented in the following table, holding 1996 economic performance as the dependent variable and using the 1995 performance as well as a set of product/market characteristics as independent variables:

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<sup>13</sup> The regression is identical to the one used to identify the dependent variables in chapter 5.

Model no.	OUTPERFORMERS			UNDERACHIEVERS		
	(1)	(2)	(3)	(4)	(5)	(6)
<i>Dep. variable</i>	ROA <sub>96</sub>	LIR <sub>96</sub>	ROS <sub>96</sub>	ROA <sub>96</sub>	LIR <sub>96</sub>	ROS <sub>96</sub>
<i>Constant</i>	0.115	0.404	0.073	0.139	-0.192	0.019
<i>Indep. variables</i>						
ROA <sub>95</sub>	0.825**	-	-	1.171**	-	-
LIR <sub>95</sub>	-	0.959**	-	-	1.086**	-
ROS <sub>95</sub>	-	-	0.391**	-	-	0.7**
<i>Size dummies</i>						
Small	~	~	~	~	~	~
Medium	-0.077	-	-	-0.154	0.548*	-
Large	0.072	-	-	-	-	-
<i>Corp.affil. dum.</i>						
Mother	-0.059	-	-	-0.706**	-0.201	-
Daughter	~	~	~	~	0.461*	~
Sister	~	~	~	~	~	-
None	-	-0.171*	-	-	-	-
PURCDEP	-0.124**	-	-	-0.878**	0.694**	-0.28
CAPAC	-0.11	-0.292**	1.06**	-0.681**	-	-
VALUADD	-0.288**	-0.266**	0.77**	-	-0.323**	0.337*
R <sup>2</sup> (adj.)	0.98	0.867	0.955	0.844	0.887	0.609
F-value	83.25	26.981	78.848	15.109	16.661	8.789

\*\* sign. at 5% (two-tailed)

\* sign. at 10% (two-tailed)

n=16-21

Table 7.2: Regression results of firm-specific variables on outperformers and underachievers

As displayed, the reduced variability in the economic performance of the group of winners and losers allow for some fairly robust results with product-market characteristics typically explaining more than 80% of the variation in economic performance among winners and losers - in one instance as much as 98%. Product/market factors appear to explain variation in economic performance rather well, and much more precisely than do the resource-based theoretical indicators analysed earlier.

The most noteworthy observation to be made from tables 7.1 and 7.2 is that while there are relevant yet insignificant relationships between firm size and economic performance and corporate affiliation and economic performance in the overall population of offshore suppliers, these firm characteristics are largely irrelevant in explaining the economic performance of outperformers and underachievers. For those offshore suppliers that have followed the most profitable and least profitable strategy in the



period 1993-1996, other product/market factor are more significant in explaining economic performance.

The relations between offshore purchaser dependency (PURCDEP), product orientation (CAPAC) or autonomous production (VALUADD) and economic performance are more significant.

## 8. Discussion

A summary of all hypothesized relations between general economic performance in the offshore supplier industry and various explanatory variables are presented in table 8.1. The robustness of the findings varies. For a majority of the variables, the findings are ambiguous, as the statistical relationship either (i) varies with the different measures of economic performance, or (ii) is found to be statistically insignificant, or (iii) both. The findings are rated so that (-) or (+) should be taken to imply that an insignificant positive or negative relationship has been found on two of the three measures of economic performance used. When -/+ is given, this implies ambiguous findings with no relationship established between economic performance and the explanatory variable, whereas - or + implies that a significant negative or positive relationship is found to exist in two or more of the three measures.

	HYPOTHESIZED	FINDING
<i>Structural</i>		
• ACH	+	+/-
• INV	+	-/+
<i>Product/market</i>		
• SIZE		
Medium	(+)	-
Large	+	(-)
• CORAFILL		
Mother	+	-/+
Sister	(+)	+/-
Daughter	(+)	+/-
None	-	(+)
• PURCDEP	-	-
• CAPAC	-	-
• VALUADD	-	-/+

Table 8.1: A summary of finding on structural and product/market variables

Only three statistically significant relationships have been established. There is a negative relationship between economic performance and size for medium-sized firms. There are also negative relationships between economic performance and purchaser specialisation (PURCDEP), and between economic performance and production type (CAPAC).

Some significant relationships between economic performance and supplier location on the value chain have also been established. A summary of all hypothesized relations between general economic performance in the offshore supplier industry and explanatory variables in the two major industry segments are presented in table 8.2. In general, the findings are more robust for downstream than for upstream suppliers.

	UPSTREAM SUPPLIERS		DOWNSTREAM SUPPLIERS	
	HYPOTHESIZED RELATIONSHIP	FOUND RELATIONSHIP	HYPOTHESIZED RELATIONSHIP	FOUND RELATIONSHIP
<i>Resources</i>				
• PATENT	-	+	+	+
• MARC	+	+/-	-	+
• MARCDYN	+	(+)	-	+/-
<i>Integration</i>				
• COOP		+/-		+
• TECHDEV		+/-		-
• PURCHDOM		+/-		+/-

Table 8.2: A summary of findings on upstream and downstream orientation.

For suppliers mainly oriented towards downstream activities (manufacturing, construction and installation) only one significant relationship between economic performance and explanatory variables can be identified. There is a significant and positive relationship between economic performance and the holding of patenting or licencing rights. There are no consistent relationship between the economic performance of such suppliers and their attempts to integrate activities with other suppliers or operators through co-operation agreements (COOP), through technology development projects (TECHDEV) or by grooming competencies through customer specialisation (PURCHDOM).

Somewhat more robust results may be presented for suppliers oriented towards the upstream segment of the industry (exploration, drilling and production). As for suppliers in the downstream segment, there is a significant and positive relationship between economic performance and the holding of property-based resources such as patenting or licensing rights. Such suppliers also benefit significantly from controlling knowledge-based resources (MARC, MARCDYN). In addition, there is a positive and significant relationship between the economic performance of upstream suppliers and engagement in co-operation activities, whereas there is a negative relationship between economic performance and participation in technology development projects for this set of suppliers to the offshore industry.

Finally, the enterprises displaying above-average or below-average economic performance have made strategic choices and strategic moves within the industry in the period 1993-1996 that significantly sets them out from the majority of other petroleum-dependent suppliers to the Norwegian offshore industry. Outperforming (above-average top sixth) suppliers and underachieving (below-average bottom sixth) suppliers were identified and analysed separately. The most significant factors and their relationship with the economic performance of outperforming or under-performing suppliers, respectively, are presented in table 8.3.

	OUTPERFORMERS		UNDERACHIEVERS	
	HYPOTHESIZED RELATIONSHIP	FOUND RELATIONSHIP	HYPOTHESIZED RELATIONSHIP	FOUND RELATIONSHIP
<i>Product/market</i>				
• SIZE				
Medium	+	(-)	+	-/+
Large	+	(+)	+	none
• CORAFILL				
Mother	+	(-)	+	-
Sister	+	~	+	~
Daughter	+	~	+	+
None	-	-	-	none
• PURCDEP	-	-	-	-/+
• CAPAC	-	(-)	-	-
• VALUADD	-	-/+	-	-/+

Table 8.3: Strategic outperformers and underachievers: a summary of findings.

The strategically most significant success factors for outperforming and underachieving suppliers to the Norwegian offshore industry in 1996 can be identified from table 8.3. For the top 1/6 of the suppliers there are merely two significant relationships. ASD hypothesized, there is a significant negative relation between economic performance and owner independence. There is a similar negative relation between purchaser dependency and economic performance. Suppliers who have a dominating offshore client does not benefit from such a dependency in total offshore sales.

In the bottom 1/6 of the suppliers, other variables display significant relationships with economic performance.

The regression results summarised here displays severe limitations. Firstly, the results rely on rather unsophisticated categorisations of 1993-1996 processes within each supplier firm participating in the survey. Secondly, significant explanatory variables may have been omitted, due to the absence of reliable data. In addition, the functional form of the regressions may be erroneous.

## **9. Implications for policy and future research.**

### **Conclusion**

The major objective of this report was to develop and test a resource-based model of the relationship among firm-specific resources, managerial strategies and economic performance. The report provides regression model(s) to test the viability of such relationships. The estimations does not support the resource-based models in all predicted paths, but displays an overall support for hypotheses related to the significant relationships between property-based and knowledge-based resources in various segments of the Norwegian offshore industry.

Overall economic performance of offshore suppliers was shown to be better predicted by product/market characteristics such as product scope and purchaser dependency than by the theoretically motivated indicators of the endogenous resource base of the individual supplier. However, measures of firm size and corporate affiliation, which were predicted to be positively related to economic performance, was found generally to be insignificant in predicting the economic performance of offshore sub-suppliers. A consideration for future research should be to assess the more long-term impact of technological change on economic performance, as the dynamics of the NORSOK restructuring process becomes more evident.

Consistently strong statistical relationships between some independent variables for winners and losers in the sub-supplier segment indicate that the factors strategic to firms that have above-average returns as well as less than average returns differ from those of the sub-supplier segment as a whole. The economic pay-offs of participating in technology development projects and innovation appear to be unevenly distributed among upstream and downstream-oriented suppliers.

A weakness of the report derives from the unavailability of a complete register of sub-suppliers to the Norwegian offshore industry. Dependence on secondary data and doubtful representativity of the survey sample is compensated by the large subset. Some of the proxies used in the statistical models, especially for structural processes, were insignificant. These variables could - and should - be replaced with more representative measured variables which may produce more reliable models with more explanatory power. The sub-supplier segment may also be differentiated differently, independent of location in the value chain. However the feasibility of RBP should not be completely rejected on the basis of this initial study.

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## Appendix 1 Definition of Petroleum Dependency

Respondents distributed by type of petroleum dependency based on responses to questions concerning corporate affiliation and portfolio of oil industry customers 1993-96

QUESTION	SUBSET 1: PETROLEUM DEPENDENT (N <sub>1</sub> = 168)	SUBSET 2: IDENTICAL AND PETROLEUM DEPENDENT (N <sub>2</sub> = 99)
“How much of total sales in 1993 can be attributed to sales to the oil and gas industry in 1993?”	> 50%	> 50%
How much of total sales in 1996 can be attributed to sales to the oil and gas industry in 1996?”	> 50%	> 50%
“Has the company been acquired by another company in the period 1993-96?”	~	No
“Has the company merged with other companies in the period 1993-96?”	~	No

## **Appendix 2: Questionnaire**

# BRANSJE- UNDERSØKELSE I OLJEINDUSTRIEN.

1 Goddag mitt navn er....og jeg ringer fra Markeds- og mediainstituttet, MMI i Oslo. Vi holder for tiden på med en undersøkelse for RF Rogalandforskning, som ønsker å kartlegge konkurranse- og innovasjonsevnen til bedrifter som er leverandører til norsk oljeindustri. I den forbindelse ønsker jeg å snakke med.....(se navn på ringelisten). Intervjuet tar ca. 12 min. og svarene som gis vil bli behandlet konfidensielt.

## Opplysninger om bedriften

Er bedriften et aksjeselskap?

Ja ..... 1  
Nei ..... 2

2 Hvis bedriften er et aksjeselskap, er den pr. 1.januar 1997 et morselskap i konsern, et datterselskap i konsern, et søsterselskap i konsern eller uten slik konserntilknytning?

Morselskap i konsern ..... 1  
Datterselskap i konsern ..... 2  
Søsterselskap i konsern ..... 3  
Ingen slik konserntilknytning ..... 4

3 Hvor mange ansatte hadde bedriften pr. 1. januar 1997?

NOTER ANTALL

4 Eierskifte, endringer i eierstruktur 1993-96

Har bedriften vært gjenstand for oppkjøp i løpet av perioden 1993-1996?

Ja ..... 1  
Nei ..... 2

5 Har bedriften selv kjøpt opp etablert virksomhet i løpet av perioden 1993-1996?

Ja ..... 1  
Nei ..... 2

6 Har bedriften skilt seg av med deler av virksomheten i løpet av perioden 1993-1996?

Ja ..... 1  
Nei ..... 2

Prosjekt

8773

Skjemanummer

7 Bedriftens økonomiske resultater

Fra og med 1993 til og med 1996 har inntektene fra leveranser til oljeindustrien.....

LES OPP

Økt mer enn 25% ..... 1  
Økt mellom 10-25% ..... 2  
Vært tilnærmet uforandret (+/- 10%) ..... 3  
Blitt redusert med mellom 10-25% ..... 4  
Blitt redusert med mer enn 25% ..... 5

DEL Hvor stor del av bedriftens samlede driftsinntekter skyldes salg og leveranser til oljeindustrien?

ANDEL AV SAMLEDE DRIFTSINNTEKTER

A n d e l i 1 9 9 3

DEL.A

Ingen ..... 1 1  
Mindre enn 25% ..... 2 2  
Fra 25% til 50% ..... 3 3  
Fra 50% til 75% ..... 4 4  
Mer enn 75% ..... 5 5  
Alle ..... 6 6

DEL.B Andel i 1996

9 Hvor stor del av disse leveransene skyldes salg til virksomhetens største kunde i oljeindustrien?

F:  
del.a=2,6 del.b  
=2,6 V: -

Andel i 1993 9.A

Mindre enn 25% av alle leveranser til oljeindustrien ..... 1 1  
Fra 25% til 50% av alle leveranser til oljeindustrien ..... 2 2  
Fra 50% til 75% av alle leveranser til oljeindustrien ..... 3 3  
Mer enn 75% av alle leveranser til oljeindustrien ..... 4 4

9.B Andel i 1996

<b>10</b>	Hvordan har fortjenesten på oppdrag og leveranser til oljeindustrien vært i forhold til fortjenesten på andre oppdrag og leveranser i 1993 og i 1996?		
	<input type="text" value="LES OPP"/>		
		v.-	v.-
		1	10.A
		199	
		3	
		↓	
	Fortjenesten på leveranser til oljeindustrien har vært lavere enn fortjenesten på andre oppdrag og leveranser .....	1	1
	Fortjenesten på leveranser til oljeindustrien har vært som for andre oppdrag og leveranser .....	2	2
	Fortjenesten på leveranser til oljeindustrien har vært høyere enn fortjenesten på andre oppdrag og leveranser .....	3	3
			↑
<b>10.B</b>	I 1996		
<b>11</b>	Hvor mange kunder fra oljeindustrien hadde bedriften ved.....?		
		v.-	v.-
		Utgang	11.A
		en	
		av	
		199	
		3	
		↓	
	Ingen .....	1	1
	1 .....	2	2
	2-4 .....	3	3
	5-10 .....	4	4
	Mer enn 10 .....	5	5
			↑
<b>11.B</b>	Utgangen av 1996		
<b>12</b>	<input type="text" value="Bedriftens aktivitetsområde"/>		
	Hvilke aktiviteter er virksomheten i dag hovedsakelig rettet mot i sine leveranser til oljeindustrien?		
		v.-	v.-
	Undersøkelser, boring og produksjon .....	1	
	Driftstjenster;baser, transport, catering, administrative tjenester.....	2	
	Bygging (prosjektering, konstruksjon, fabrikkasjon) av plattform/skip .....	3	
	Installasjon, vedlikehold av plattform/skip .....	4	
	Bygging og drift av foredlingsanlegg/ilandføringsanlegg .....	5	

<b>13</b>	Hvilket av de to følgende utsagn beskriver best virksomhetens leveranser til oljeindustrien i 1993?		
		v.-	v.-
	Leveransene til oljeindustrien består hovedsakelig av spesielle systemer, spesielle systemkomponenter eller kompetanse basert på funksjonsbeskrivelser eller funksjonsytelser .....	1	
	Leveransene til oljeindustrien består hovedsakelig av standardiserte produkter eller tjenester hvor produksjonsvolumet kan variere fra leveranse til leveranse .....	2	
<b>14</b>	Hvilket av de to følgende utsagn beskriver best virksomhetens leveranser til oljeindustrien i dag?		
		v.-	v.-
	Leveransene til oljeindustrien består hovedsakelig av spesielle systemer, spesielle systemkomponenter eller kompetanse basert på funksjonsbeskrivelser eller funksjonsytelser .....	1	
	Leveransene til oljeindustrien består hovedsakelig av standardiserte produkter eller tjenester hvor produksjonsvolumet kan variere fra leveranse til leveranse .....	2	
<b>15</b>	Hva er det viktigste grunnlaget for bedriftens salg til oljeindustrien i Norge. Er det.....?		
	<input type="text" value="LES OPP"/>		
		v.-	v.-
	Agentur/forhandler for annet/andre selskaps produkter eller tjenester.....	1	
	Produksjon eller tjensteyting enten egenutviklet eller på lisens .....	2	
<b>16</b>	<input type="text" value="Bedriftens tilknytning til oljeindustrien"/>		
	Hvor store kostnader hadde bedriften på å markedsføre sine produkter og tjenester mot oljeindustrien i 1996? Anslå i % av samlede driftskostnader i 1996.		
	<input type="text" value="Vi tenker her på messedeltakelse, annonsering m.v."/>		
		v.-	v.-
	<input type="text" value="NOTER BELØPET"/>		
<b>17</b>	Hvordan har disse markedsføringsutgiftene utviklet seg i forhold til omsetningen fra oljeindustrien i perioden 1993 til 1996?		
		v.-	v.-
	Blitt relativt større (økt i forhold til omsetningen) .....	1	
	Uendret i forhold til omsetningen .....	2	
	Blitt relativt mindre (avtatt i forhold til omsetningen) .....	3	
	Vet ikke .....	4	

18 Jeg skal nå lese opp ulike selskaper og vil at du skal angi hvilke endringer bedriften har hatt i sammensetningen av disse kundene i perioden 1993-1996? Endringene vi tenker på er.....

LES OPP ENDRINGENE FOR HVERT AV SELSKAPENE NEDENFOR

	Etablert som ny kunde i perioden 1993 - 1996	Mistet/avsluttet kundeforhold i perioden 1993 - 1996	Kundeforhold vedvart gjennom hele perioden	Ingen leveranser/-avtaler i perioden 1993-96	
<b>LES OPP ET OG ET SELSKAP</b>					
<b>Operatørselskaper</b>					
Agip .....	1	2	3	4	1
Amerada Hess .....	1	2	3	4	2
Amoco .....	1	2	3	4	3
British Petroleum.....	1	2	3	4	4
Conoco .....	1	2	3	4	5
Deminex .....	1	2	3	4	6
Elf Aquitaine.....	1	2	3	4	7
Esso .....	1	2	3	4	8
Fina .....	1	2	3	4	9
Mobil.....	1	2	3	4	10
Norsk Hydro .....	1	2	3	4	11
Philips Petroleum.....	1	2	3	4	12
Saga.....	1	2	3	4	13
Shell .....	1	2	3	4	14
Statoil .....	1	2	3	4	15
Total .....	1	2	3	4	16
<b>Leverandørselskaper</b>					
ABB-selskaper .....	1	2	3	4	17
Aker Maritime-selskaper.....	1	2	3	4	18
Anchor/M-I Drilling Fluids.....	1	2	3	4	19
Baker Hughes .....	1	2	3	4	20
Halliburton .....	1	2	3	4	21
Kongsterg Offshore.....	1	2	3	4	22
Kværner-selskaper.....	1	2	3	4	23
Schlumberger.....	1	2	3	4	24
Smedvig-gruppen.....	1	2	3	4	25
Transocean .....	1	2	3	4	26
Umoe-selskaper .....	1	2	3	4	27
Andre leverandører.....	1	2	3	4	28

19 Hvor stor prosent del av bedriftens driftsinntekter fra oljeindustrien i 1996 skyldes leveranser til operatørselskaper?

v: -

NOTER I PROSENT

20 Når du tenker på bedriftens siste levering/leveranseavtale til oljeindustrien

Hvilket selskap var mottaker av leveransen?

Angi virksomheten eller selskapets navn

v: -

noter \_\_\_\_\_

+

21 Hva besto den siste leveransen i hovedsak av?

v: -

Standardisert produkt .....	1
Standardisert tjeneste.....	2
Spesialisert produkt.....	3
Spesialisert tjeneste .....	4

22 Hva var omsetningsverdien av denne siste leveransen?

v: -

NOTER BELØPET  
I HELE TUSEN

23 Når ble kundeforholdet til denne kunden etablert?

v: -

NOTER ÅRSTALLET

**24** Langs en skala fra 1 (ikke viktig i det hele tatt) til 4 (svært viktig), vil jeg du skal vurdere ulike faktorer etter hvor viktige de var for bedriften for å få dette siste leveranseoppdraget?

LES OPP

	Ikke viktig i det hele tatt	Noe viktig	Ganske viktig	Svært viktig	
Prisen på varen/tjenesten .....	1	2	3	4	1
Markedsføring på konferanse/messe .....	1	2	3	4	2
Markedsføring gjennom annonsering .....	1	2	3	4	3
Markedsføring av varen/tjenesten gjennom uformell, direkte henvendelse mot kunden .....	1	2	3	4	4
Distribusjonsevne; kontinuitet og pålitelighet i leveransen .....	1	2	3	4	5
Kvalitet og presisjon i leveransen .....	1	2	3	4	6
Referanser fra bedriftens samarbeidspartnere i produksjonen av denne varen/tjenesten .....	1	2	3	4	7
Referanser fra tidligere kunder .....	1	2	3	4	8
Varigheten av leverandørforholdet .....	1	2	3	4	9

**25** Hvordan har kostnadene utviklet seg for det aktuelle produktet eller den tjenesten som denne siste leveransen omfattet i perioden 1993-1996? Har de blitt.....

LES OPP

	v: -
Redusert mer enn 10% .....	1
Redusert mindre enn 10% .....	2
Uendret .....	3
Økt mindre enn 10% .....	4
Økt mer enn 10% .....	5

**26** Hvordan har prisen utviklet seg for det aktuelle produktet eller den tjenesten som denne siste leveransen omfattet i perioden 1993-1996? Har den blitt.....

LES OPP

	v: -
Redusert mer enn 10% .....	1
Redusert mindre enn 10% .....	2
Uendret .....	3
Økt mindre enn 10% .....	4
Økt mer enn 10% .....	5

**27** Hvordan har betydningen av bedriftens generelle markedsføring (messer, konferanser, annonsering) av dette produktet eller denne tjenesten endret seg i perioden 1993-1996? Har den.....

LES OPP

	v: -
Fått mindre betydning for salg .....	1
Uendret betydning for salg .....	2
Fått større betydning for salg .....	3
Irrelevant for salg .....	4

**28** Hvordan har betydningen av bedriftens markedsføring av dette produktet eller denne tjenesten mot denne kunden endret seg i perioden 1993-1996? Har den.....

LES OPP

	v: -
Fått mindre betydning for salg .....	1
Uendret betydning for salg .....	2
Fått større betydning for salg .....	3
Irrelevant for salg .....	4

**29** Hvordan har betydningen av uformelle henvendelser med denne kunden endret seg fra 1993-1996? Har den.....

LES OPP

	v: -
Fått mindre betydning for salg .....	1
Uendret betydning for salg .....	2
Fått større betydning for salg .....	3
Irrelevant for salg .....	4

**30** Hvordan har betydningen av referanser fra samarbeidspartnere endret seg fra 1993-1996? Har den.....

LES OPP

	v: -
Fått mindre betydning for salg .....	1
Uendret betydning for salg .....	2
Fått større betydning for salg .....	3
Irrelevant for salg .....	4

**31** Hvordan har betydningen av referanser fra kunder endret seg fra 1993-1996? Har den .....

LES OPP

	v: -
Fått mindre betydning for salg .....	1
Uendret betydning for salg .....	2
Fått større betydning for salg .....	3
Irrelevant for salg .....	4

**REG** Opplysninger om ulike sider ved bedriftens tilknytning til oljeindustrien

Var bedriften registrert i ACHILLES - oljeleverandørenes leverandørregister pr. 1. januar 1997?

	v: -
Ja .....	1
Nei .....	2

**33** Når ble bedriften første gang registrert i ACHILLES?

F. Veg-1 v: -

REGISTRER ÅRSTALLET

<b>34</b>	Har bedriften tatt i bruk nye patenter/produksjonslisenser i sine leveranser til oljeindustrien i perioden 1993-1996?	v. -
	Ja .....	1
	Nei .....	2
<b>INN</b>	Har bedriften inngått samarbeidskontrakter med kunder i oljeindustrien i perioden 1993-1996?	v. -
	Ja .....	1
	Nei ( Merk av, ⇒ TEK ) .....	2
<b>36</b>	Hva er varigheten av den sist inngåtte samarbeidskontrakten med en kunde i oljeindustrien?	v. -
	Mindre enn 2 år .....	1
	Fra 2 til 4 år .....	2
	Mer enn 4 år .....	3
<b>37</b>	Er samarbeidskontrakten etablert med ny kunde som bedriften tidligere ikke har levert til?	v. -
	Ja .....	1
	Nei .....	2
<b>38</b>	Er samarbeidskontrakten etablert med et operatørselskap?	v. -
	Ja .....	1
	Nei .....	2
<b>39</b>	Har det vært noen endring i rolledelingen mellom deltakerne underveis i samarbeidet?	v. -
	Ja .....	1
	Nei ( Merk av, ⇒ TEK ) .....	2

<b>40</b>	Hvike følger har dette fått for bemanningen deltakerne i mellom?	v. -
	Endringen i rolledeling er gjennomført uten personellendringer .....	1
	Endringen i rolledeling har ført til at kvalifisert personell er overført mellom organisasjonene .....	2
	Endringen i rolledeling har ført til at nytt personell har måttet fremskaffes utenfra .....	3
<b>TEK</b>	Har bedriften inngått avtaler om teknologlutvikling med noen av kundene i oljeindustrien i perioden 1993-1996?	v. -
	Ja .....	1
	Nei ( Merk av, ⇒ NAV ) .....	2
<b>42</b>	For hvor mange år gjelder den sist inngåtte utviklingsavtalen?	R: 0-99 v. -
	NOTER ANTALL ÅR <input type="text"/>	
<b>43</b>	Hvem tok initiativet til denne utviklingsavtalen?	v. -
	Bedriften selv .....	1
	Kunden .....	2
<b>44</b>	Er teknologlutviklingen basert på funksjonsspesifikasjoner som allerede er formulert i NORSOK-standard?	v. -
	Ja .....	1
	Nei .....	2
<b>NAV</b>	Registrer virksomhetens navn	v. -
	noter .....	
	.....	+



## Appendix 3: Lists of abbreviations, symbols and variables, tables and figures

### Abbreviations

ACHILLES	: Norwegian supplier database for offshore contractors and operators on the Norwegian Continental Shelf
CRINE	: Cost Reduction In the New Era, the cost reduction initiative of the British Offshore Sector
EEA	: European Economic Area
NCS	: Norwegian Continental Shelf
NTS	: Norwegian Technology Standards Institution
NORSOK	: Norsk Søkkel Konkurransesposisjon, the Competitive standing of the Norwegian Offshore Sector, the Norwegian initiative to reduce cost on offshore projects
OSK	: Offshore Strategy Conference
SME	: Small and Medium-sized Enterprises

### Symbols and variables

ACH ( $t$ )	: Competitiveness dummy, $ACH(t) = 1$ if supplier is registered in Achilles in year $t$
CAPAC ( $t$ )	: Product/market dummy, $CAPAC = 1$ if supplier is identified as capacity producer in year $t$
COOP	: Activity integration dummy, $COOP = 1$ if supplier has participated in any form of co-operation agreements with other offshore companies 1993-1996
INV ( $t$ )	: Investment level in year $t$
LIR	: LIquidity Ratio
MARC	: Discrete knowledge-based resource indicator. Natural logarithm of marketing cost (as % of total turnover) + 1
MARCDYN	: Systemic knowledge-based resource indicator. Dummy, $MARCDYN = 1$ if the marketing costs of the supplier has seen a relative increase with respect to total costs 1993-1996
MV	: Market Value
PATENT	: Discrete property-based resource indicator. Dummy, $PATENT = 1$ if supplier has obtained or commercialized new patenting / licensing rights in the course of supplying the offshore industry 1993-1996
PURCDEP ( $t$ )	: Product/market dummy, $PURCDEP = 1$ if > 50% of the supplier offshore turnover in year $t$ is due to sales to a single customer in the oil and gas industry

PURCDOM : Supplier network structure dummy, PURCDOM = 1 if total no. of oil and gas industry customers < 5 in 1996

RC : Replacement Cost

ROA : Return On Assets

ROS : Return On Sales

$$\text{TAVLIR} : \text{Average LIR 1993 - 96, TAVLIR (i)} = \frac{\sum_{n=1993}^{1996} LIR_{i,n}}{4} - \frac{\sum_{i=1}^k \left( \sum_{n=1993}^{1996} \frac{LIR_{i,n}}{4} \right)}{k}$$

$$\text{TAVROA} : \text{Average ROA 1993 - 96, TAVROA (i)} = \frac{\sum_{n=1993}^{1996} ROA_{i,n}}{4} - \frac{\sum_{i=1}^k \left( \sum_{n=1993}^{1996} \frac{ROA_{i,n}}{4} \right)}{k}$$

$$\text{TAVROS} : \text{Average ROS 1993 - 96, TAVROS (i)} = \frac{\sum_{n=1993}^{1996} ROS_{i,n}}{4} - \frac{\sum_{i=1}^k \left( \sum_{n=1993}^{1996} \frac{ROS_{i,n}}{4} \right)}{k}$$

TECHDEV : Activity integration dummy, TECHDEV = 1 if supplier has participated in technology development projects with other offshore companies in the period 1993-1996

VALUEADD : Product/market dummy, VALUEADD = 0 if the supplier's main function is to operate as an agent or distributor of products/services manufactured abroad or by other companies

$\alpha$  : variable coefficient

$\varepsilon$  : error term

$K$  : vector of variables

$i$  (subscript) : supplier identifier

$q$  : Tobin's q

$r$  : economic performance measure (general)

$t$  (subscript) : year

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## **Appendix 4: Publications from the project**

Askevold, Emma Olivieri: *A Journey into the Unknown". Innovative and Technological Searches in Norwegian Small and Medium Sized Oil Contractors*. Rogaland Research Report RF- 1998/128.

Steineke, Jon Moxnes: *Between the Devil and the Deep Blue Sea. Exploring the Economic Performance of Suppliers to the Norwegian Offshore Industry*. Rogaland Research Report RF-1998/122.

Steineke, Jon Moxnes: *Procurement as if Price Mattered? Success Factors in Purchaser-Supplier Relationships as Perceived by Suppliers to the Norwegian Oil Industry*. Rogaland Research Working paper RF-1998/123.

Steineke, Jon Moxnes: *A Probe of the Economic Performance of Petroleum-related Suppliers to the Norwegian Oil Industry*. Rogaland Research Working paper RF-1998/124.