Contracts and Incentives Innovation in Norway's Offshore Sector

Petter Osmundsen[1]

University of Stavanger

Petter.Osmundsen@uis.no

Abstract- **The paper analyses whether added value can be obtained from better collaboration between oil companies and contractors. The topic is addressed by analysing organisational patterns, contracts and compensation formats. Specific issues raised in this paper include the following questions. Are innovations needed to contractual terms and tendering processes? Do contractors have sufficiently strong incentives to exploit the opportunities for service provision offered by existing technology? Do they have sufficient incentives within the framework of existing and future contracts to develop new technological solutions? Do the tender criteria pick up technological and organisational improvements? Do requirements for transparency and auditability prompt decision-takers to hesitate to select contractors with superior technology because that can be difficult to verify in a tendering process?**

Keywords- Collaboration; Contracts; Incentives; Innovation

I. INTRODUCTION

In the oil White Paper presented in 2003 (Report no 38 to the Storting 2003-2004), the Norwegian government expressed a desired to realise the added value which could be obtained from better collaboration between oil companies and contractors, not least by changing and improving the way the division of work was organised offshore and on land. So what has happened? Many improvements have been made and many routines revised. But a number of obstacles have also emerged on the way to realising the full collaborative potential – partly internal organisational factors in the company, partly negotiations and contractual relations between employers and employees, and partly coordination problems between oil and contractor companies. This article discusses some of these challenges.

Drilling operations are used as a case throughout the article, and I draw on a project in which I collaborated with the Norwegian Petroleum Directorate (NPD). This work provided good access to empirical material. I gained access to rig and oil service contracts, and we had a series of meetings with key players in oil and service companies. We also had one meeting with the Norwegian Oil and Gas Association . In addition, I have surveyed relevant academic literature and best practice studies. Since the major oil companies and oil service companies are present in Norway, and since most elements of the contracts and work procedures in the industry follow an international standard, many of the findings reported in the paper are relevant to other petroleum extraction countries.

Specific issues raised in this article include the following questions. Are adjustments needed to contractual terms and tendering processes? Do contractors have sufficiently strong incentives to exploit the opportunities for service provision offered by existing technology? Do they have sufficient incentives within the framework of existing and future contracts to develop new technological solutions? To answer these questions, the financial incentives available to contractors have been studied. These have proved to be relatively complex, since one must look not only at existing deals but also at the implicit incentives in the evaluation criteria used by the oil companies when awarding new contracts. This article also discusses various forms of collaboration between oil and contractor companies – how best to involve contractors in developing solutions and services. I start by reviewing the basic structure of oil service and rig contracts.

II. HOW CONTRACTS ARE DESIGNED IN THE OIL SERVICE AND THE RIG SECTOR

As a result of declining efficiency and a strong growth in costs of drilling, a number of innovations have emerged in the organisation and designing of contracts for oil services and rigs. A larger element of multi-delivery agreements can be seen, and new incentive systems have been designed. The general reward format for oil services is payment per metre drilled when operational, and otherwise a standby rate. This differs from rig charters, which are largely based on day rates. A possible reason for the difference is that drilling involves fairly significant variable costs (wear and tear), making activity-based payment more relevant. Drilling contractors also have more direct influence on the drilling tempo – to be effective incentives must be made contingent on outcomes within the control sphere of the supplier. Payments are withheld (punishment, negative incentive) should the contractor suffer downtime faults. For a more detailed description, see Osmundsen et al. (2010).

The compensation format for rig charters was earlier based on payment per metre drilled. Today's industry standard is day rates, which are differentiated by operating status:

[1]Department of industrial economics and risk management, University of Stavanger, Department of Industrial Economics, 4036 Stavanger, Norway. Tel: +47 99 62 51 43, Email: Petter.Osmundsen@uis.no, Web: WWW. UiS.no/Osmundsen,

- operating rates
- stand-by rates
- mobilisation rates.

If the rig contractor cannot provide a unit which satisfies the technical requirements at the agreed date, a zero rate apples. The contractor may lose USD 500 000 per day, for instance, which offers a strong incentive to secure uptime. The charter also normally allows the oil company to cancel if start-up is delayed by a specified number of days. Rig contractors with a limited portfolio accordingly carry a substantial risk in relation to downtime. On the other hand, the rig contractor is also best placed to affect operating status. However, the consequential costs of delayed drilling – which can be very substantial – are not passed on to the rig contractor.

The contracts often represent only a downside to the rig contractors, since the highly valued upside related to drilling speed, discovery and production is retained in its entirety by the oil company. Incentive contracts are relatively difficult to structure, since both sides have incomplete information. Furthermore, planning and determination of the well path rests with the oil company and are not available when a bid based on day rates is made.

Perhaps the most important reasons why charter rates are not linked to metres drilled it that these lie largely outside the rig contractor's control. First, a large number of service companies affect the progress of drilling operations. Second, the oil company normally retains the right to adjust the drilling programme by changing wells, well depths and so forth.[2]

The following discussion builds on general contract and incentive theory. Good overviews are provided by Bolton and Dewatripoint (2005), Salanié (1998), Hillier (1997), Hart (1995), Laffont and Tirole (1993) and Milgrom and Roberts (1992). I also build on research applying incentive theory to the petroleum sector. See Osmundsen et al. (2008, 2010) and Olsen and Osmundsen (2005).

III. INCENTIVE STRUCTURE

Incentives are often treated in discussions of compensation formats as synonymous with various types of bonus systems. That is far too narrow. In addition to such explicit incentives, one needs also to take into account implicit incentives provided by evaluation criteria for awarding contracts. The financial incentive structure for a rig contractor or oil service company includes the following considerations:

(1) evaluation criteria for the award of drilling assignments

(2) the compensation format and incentives in the applicable contract

(3) remuneration in the next contract.

Management attention at rig contractors is focused on securing employment for the units. Evaluation criteria for awarding such assignments accordingly function as an implicit incentive scheme. Since historical figures for uptime (the proportion of time when the contractor can provide a well-functioning rig) and drilling efficiency are used when awarding charters, these parameters set strong implicit incentives even if the latter are not explicitly included in the compensation format for the rig charter. Furthermore, the compensation agreed for the next contract will represent incentives driving the rig contractor and oil service company towards a high pace (higher rates in the next contract) or a low pace (lower rate or unemployment when the contract expires).

Typical evaluation criteria for hiring drilling services – in no particular order – include:

- expertise
- financial strength
- day rates
- ability to finish on time
- compliance with regulations
- operational efficiency and achievements
- health, safety and environment (HSE) system and culture
- high pressure and temperature (HPHT) expertise and experience.

These evaluation criteria establish implicit incentives for the contractors. Price (day rates) can be seen to be only one of many evaluation parameters. The oil business is perhaps the leading example of an industry where choosing the lowest price does not necessarily represent the best economic solution. Lifetime costs are what count, and the income side must always be taken into account.

[2] See Corts (2000), Corts and Singh (2004), and Osmundsen et al (2008).

IV. TECHNOLOGY DEVELOPMENT – DIFFERING GOALS

The oil companies and their contractors may have rather different objectives with technology development. The ideal position for a contractor is to develop technology in close cooperation with an oil company. That secures both user relevance and financing. The contractor will also often want to be responsible for both development and implementation phases. Apart from providing employment, this gives control over the product developed. Furthermore, the contractor want a long-term contractual relationship with the oil company which has financed the development, as well as exclusive rights to the end product. The last of these includes no restrictions on sales to other oil companies, while the oil company which contributed to the research must pay the full price to secure the hardware, processes or services developed.

Close relations with different contractors is the ideal position for the oil company. That permits tailoring to its specific operating conditions. The oil company does not want to be bound in any way – after the development phase, for instance, it wants to have a free choice of contractor and technical solution. The oil company wants user rights to the developed product, and does not want to "pay twice" for the same thing. If possible, it also wants exclusive rights – in other words, the ability to commercialise possible newly developed products or services itself. A stronger focus on technology as a separate business area can be seen in the oil companies.

As explained above, the ideal positions for contractor and oil company do not entirely coincide. As in other contexts, there are conflicts of interest as well as shared interests. The latter involve creating a product or service which adds value. The conflict involves which side will reap the financial benefits of this added value, and which is to have ownership and user rights. Ownership and reaping value added are in turn closely related. The outcome is normally a negotiated solution somewhere between the ideal positions of both sides, where their relative bargaining power determines who does best. Bargaining power is determined by the availability of credible alternatives. The contractor, for instance, could do well if it possesses a unique technology and expertise, and if it can and wants to part-finance the project itself. Unique expertise and financing opportunities strengthen the contractor's bargaining power, and allow it to retain more of the upside.

Sooner or later, technological innovations will benefit the whole industry. Knowledge has the character of a common good. The latter can easily lead to undersupply. From the perspective of the industry – and society – the following questions can therefore be asked:

- could the chosen solution fall short of the optimum socio-economic outcome?
- could a lack of bargaining power at certain contractors yield contractual solutions where the incentives for technology development are too weak?
- does the contractor have incentives to exploit the potential in existing technology?

One consideration in this context is that the incentives implicit in a tendering context may be too narrow. Could the measurability problem associated with technology-related quality mean that price becomes the most important selection criterion? Do the tender criteria pick up technological and organisational improvements? Today's requirements for transparency and auditability are sound principles. But one must be aware that they could prompt decision-takers to hesitate to select contractors with superior technology because that can be difficult to verify in a tendering process. The safest course for the bid evaluator could be to select known alternatives at a low price. That does not advance the industry.

Since oil services are often delivered under long-term contracts, such as five years with two options for the oil company to extend by three years, it is appropriate to look at contractor incentives to develop technology within the framework of the specific contract. This is also a relevant focus because oil companies are normally best able to finance research and can define clear research needs. Do contractors have incentives to improve services within the framework of an existing contract, or to deliver a better project than the hours for which they are paid? Relevant examples are new technology which can reduce the time used, cut downtime or boost earnings.

The answer is often no. On the contrary, delivery of the best solution could be disadvantageous for the contractor since it may then need fewer employees ant thereby lecc revenue according to the contracts. If it proposes measures which involve transferring personnel from offshore to land, fewer employees receive the offshore supplement, and employees face greater uncertainty over the location of their workplace. Within the framework, it is questionable whether the incentives to improve deliveries are strong enough to outweigh the disadvantages. On the other hand, developing better solutions may increase the contractor's opportunities to win new contracts. But no guarantee normally exists for contractors who make a commitment to technology development. Implicit promises of awarding a further job to the same contractor for good performance are not necessarily to be trusted. The oil companies usually want to retain competition over deliveries, and to avoid being locked in. Practical and institutional obstacles also hamper long contracts. If the same contractor is awarded contracts time and again, other companies will complain and the number of bids eventually decline. Since petroleum developments involve a government licence, the oil companies are also subject to the competition rules in the European Economic Area, which set clear limits on creating permanent "house" contractors. However, some companies provide incentives to amend the division of labour between land and offshore by meeting the training costs required for such changes and by retaining the offshore rate for employees transferred ashore.

Do contracts based on hourly rates provide contractors with optimum incentives? Personnel costs are often incorporated in the day rate. Specific staffing is defined in the contract, and hourly rates are specified for land and offshore personnel. Fewer people offshore calls for a greater degree of multidisciplinary working by remaining employees. That calls for training, and the question of whether oil company or contractor should bear the cost is relevant. If the oil companies are to bear all or part of the training costs, the question arises of whether these should be paid directly (earmarked) or incorporated in the rates (as part of a general payment). In principle, these approaches should be equivalent to each other. In practice, however, contractors do not appear to see it that way. They prefer training costs to be paid directly. A possible reason may be that incorporating them in the rates means they can be competed away.

V. CHALLENGES AND OBSTACLES IN EXISTING KPIS

Another set of issues is presented by key performance indicators (KPIs) and internal evaluation criteria used in managing the oil industry. Effective company management requires individual activities to be split up and operationalised – as individual projects, for instance. These are then managed and evaluated against specific project-defined targets – KPIs. The advantage of this type of division is that each department and project knows what it has to do and what it will be measured by. The challenge is always to find good KPIs. Clearly measureable criteria such as volume, production cost and time could clash with quality, lifetime costs and flexibility. Taking account of these additional dimensions is important.

In addition, there is a clear threat of sub-optimisation. Since the measurement system normally only picks up benefits and costs for the individual project, people at the project level will not necessarily take account of costs incurred in other departments or at other times (involving maintenance, upgrading and removal, for example). Nor will they internalise benefits incurred by other departments or projects. The latter is particularly relevant for technological advances. In other words, undersupply of technological innovation is a problem not only at the level of society (between different companies) but also within a company – and its relevance is particularly high in large companies. The company's internal management and reward system may penalise departments or projects for all costs incurred for R&D, including those related to pilots, but fail to ascribe to it the benefits of the innovation to other departments or projects. This could mean that insufficient research is pursued not only for society but also for the company.

Take a specific example in the drilling sector. A drilling manager in an oil company is asked to accommodate a pilot project on their field. This could potentially enhance drilling productivity, increase drilling opportunities, and improve the company's overall drilling portfolio. But the drilling manager's own field is the only one included in their KPIs. Bearing full responsibility for downsides such as downtime during the test period, the manager is accordingly inclined to turn down a request for a pilot. KPIs can accordingly contribute to sub-optimisation. To realise this type of research project, it is thereby important that KPIs are adjusted for the field(s) concerned.

VI. OIL COMPANY AND CONTRACTOR TRADE-OFFS

Seen from the perspective of an oil company, closer integration between the two sides would present two seemingly incompatible targets for the reward structure.

(a) An incentive structure which creates target compatibility – in other words, a compensation system which allows the contractors to share in the gains made jointly. That suggests various forms of profit sharing.

(b) Flexible compensation structures which mean changes can easily be made along the way. That normally suggests cost-plus compensation.

When oil and contractor companies work closely together, as with the operation of oil and gas fields, it is important to ensure that both sides are pulling in the same direction. Only when target compatibility has been achieved can the full benefit of collaboration be secured. This is normally done with the aid of incentives. Ideally, these are of a higher order – in other words, they are not related only to costs in the specific delivery but also take account of the income side (including user flexibility and quality) and life-cycle costs (operating and maintenance costs). The incentives will normally relate to specific targets (delivery requirements, productivity, milestones) and will be based on a set of assumptions. These usually include a requirement for the oil company to provide specified documentation (drilling plans, stratigraphic data and so forth) in a given time frame. In other words, the incentive systems assume predictability.

One advantage of close integration between contractor and purchasers is flexibility. This is especially important for drilling, particularly in the reservoir. New information from the latter will often make it desirable to adjust the original drilling plans in order to achieve optimum drainage, and the financial importance of this can far outweigh other considerations – including minimising drilling costs. The oil company's need for control and flexibility conflicts with the goal of incentive systems with predictability. The simplest way of achieving flexibility is various forms of cost-plus compensation, such as day rates. If target-based incentive systems are to be used, the targets must be adjusted when the oil company changes the original drilling plan. That weakens the incentive system because the contractor now knows in advance that good opportunities exist for renegotiation. Incomplete contract elements also have the effect that the contractor can normally achieve the bonus in any

event, since they can usually blame changes by the oil company for failing to reach targets. Renegotiation also involves direct transaction costs.

The impression given by incentive contracts in use for oil services is that they are relatively simple and unbureaucratic to administer. If changes occur in the basis for calculating the applicable benchmarks, these are not adjusted. When a contract has been awarded, it is adhered to. However, that may have consequences for future productivity requirements. The benefits of complying with the contract without renegotiation are predictability and saving on transaction costs, while the drawback is that conditions can arise which are perceived as inequitable by one of the sides. However, that perception could be less significant if incentives are defined per well section. An overall incentive for the whole drilling operation in conditions without renegotiation opportunities, on the other hand, could create conditions where the contractor fails to earn the bonus even if a good job has been done.

It is difficult to make a scientific assessment of the effect of new incentive elements in oil service contracts. Several challenges are faced. First, the contracts used are often relatively complex and not directly comparable from project to project. Second, this type of commercial contract is not normally open and testable knowledge. Third, the various projects are not directly comparable. Cost savings have been reported for drilling service contracts with new contractual forms. See Osmundsen et al. (2010). Hydro introduced a performance adjusted price system (Paps) a few years ago to provide incentives for oil services. The new elements are that penalties are supplemented by rewards for good performance, and that the penalties/rewards are based on well sections rather than the complete well. Benchmarks for drilling efficiency are set for each section through a dialogue between oil company and service company. By meeting these benchmarks, the contractor can obtain a substantial additional reward. The upside is higher than the downside (asymmetry), but both have a limit. In other words, this is a target-sum contract – more specifically a section-based, asymmetrical and piece-by-piece linear payment per metre drilled, with a floor on the downside and a cap on the upside. General benchmarks are revised annually, with ever more ambitious goals being set. If formation or operating conditions differ from the assumptions, benchmarks can be amended along the way. This must be agreed in writing between the land organisations before starting on the relevant well section.

Hydro reported that it was very pleased with the new contracts, and estimated that savings were NOK 100 million with NOK 30 million going to the contractors. Few change orders have occurred so far and administrative costs are reported to be low. Still, to my knowledge the remuneration scheme was not applied in future contracts. One of the objections to this incentive scheme is that the oil service company can receive bonuses for good performance in certain well sections even if the complete well turns out to be unsuccessful. Thus, overall incentive compatibility is not secured by this scheme.

Osmundsen, Roll and Tveterås (2010) study the reasons for variations in drilling speed (measured by metres per day) on the Norwegian shelf over time, and show that the pace fell sharply after 2004 and then showed a rising trend over the past year. However, not enough contract data was available to use this as an explanatory factor, and the authors cannot say whether any of the improvement is attributable to the introduction of new incentive elements in oil service contracts or rig charters.

New ideas on closer collaboration on the operations side have certain parallels in field development, where the Norsok process to cut costs through greater standardisation assigned a number of coordination jobs to the supplies industry. Turnkey contractors were established to handle coordination of engineering, procurement, construction and installation (EPCI) contracts. The actual work had also been outsourced earlier under fabrication contracts, but coordination and interfacing between the sub-deliveries remained with the oil companies. A very high level of outsourcing also prevails in the drilling sector, estimated at 90 per cent. A full transition to running operations from the contractor's control centre seems to involve a similar type of outsourcing for coordination jobs. Instead of buying consultancy services (at hourly rates) for each sub-process, where each person is specified, the customer buys a complete operations service.

In any event, it will normally be the case that the oil company draws up the drilling programme and supervises it but that coordination between the various drilling functions is outsourced. Such a solution is the only way all the benefits of decentralisation can be obtained. By serving several oil companies from the same location, and operating a number of fields simultaneously, the contractor can achieve specialisation, develop expertise and secure economies of scale. More flexible staffing will be possible because personnel are not dedicated to specific projects but can be allocated to where they are needed at any given time. That reduces dead time. In addition to saving costs, a key argument when engineers are in short supply is that competent labour is freed up. Scarce berth capacity offshore is also liberated, and savings are made on helicopter transport.

However, this raises a number of key questions. What functions belong to the strategic core of the oil companies? The answer varies from company to company. Some want control over drilling interfaces. They regard drilling as one of the primary jobs of an oil company and want to exercise full control over the process. Strategic considerations can also play a part. They see that service companies are taking over jobs internationally which were previously reserved for the oil companies, and regard this as a clear sign that the latter have outsourced too many functions. They may also have made big investments in their own operations centres, and it would accordingly be constructive not only to seek solutions where all operations occur from the contractor's premises, but also to pursue intermediate solutions where the oil company retains coordination of key elements in the drilling process. One example involves contractor personnel working during the day at the customer and spending the rest of the time at their own centre. Many oil companies want to retain control over elements involved in the drilling process while securing access to capacity, and by retaining their own expertise they avoid becoming locked into specific contractors – which

can weaken bargaining power and technical opportunities in the long run.

The degree of outsourcing normally depends on the level of maturity of the supplies market. If its liquidity is low, oil companies often dare not make a commitment to outsourcing. Competition is insufficient, and they risk getting locked in – in other words, it will subsequently be difficult to swap contractor after the contract has finished or the customer finds itself in a weak negotiating position over changes to the original terms during the life of the contract. Where customers have become locked in, competition over new contracts will be less efficient if the implicit incentives which the contractor has associated with the need to secure new contracts are weakened. (When many oil companies are afraid to be locked in, the market does not develop either.) The big players on the Norwegian shelf seek to avoid this problem by having several contractors and by periodically changing contractor. However, a balance must be struck here between competition and the desire to develop tailored contractor services which will often call for specific investment.[3] Other relevant considerations are ownership of information, information security and flexibility. These considerations could suggest keeping the activity in-house. The cost benefit of outsourcing operational coordination lies partly in the ability of the contractor to standardise operations. The drawback of that from the operator companies' perspective, is that they have fewer opportunities to choose their own systems and analyses. For that reason, it could also be difficult to find opportunities to sell in more outsourcing in so far as international oil companies want the same system throughout their global business. Should this system then be dictated by solutions chosen in Norway? It is therefore perhaps simpler to change specifications and training in Norwegian oil companies than in the big international ones.

Possible outsourcing of a number of drilling-related functions to contractors must be characterised as a relationship contact. Operation from the contractor's centre could involve a contractual lock-in for the oil company and accordingly requires great trust between the sides. Building up such trust takes time. One example cited of a trust-based relationship like this is the collaboration between Hydro and Baker over many years.

A core question in organising interfaces between land and offshore in the oil industry is where operations personnel should be located on land – at the contractor or the oil company? A mix of solutions is seen in practice, but the balance varies from one oil company to another. One answer is for contractor personnel to be located at the operator's premises during the day and at their own centre the rest of the time, with a number of base personnel permanently located at the contractor (partial decentralisation). Another is to concentrate a number of functions at the contractor (full decentralisation). As with many other organisational issues, various factors must be weighed against each other in each case, and no general and universal answer exists.

Contractors face corresponding trade-offs when decentralising a number of drilling-related functions. Trust is something which must cut both ways. A good deal of investment must be made in equipment in order to implement a different division of labour. These are typical "specific" investments – in other words, they primarily have value in the specific contractual relationship. If this goes wrong, the alternative value of the equipment is low. It accordingly represents a risky investment for the contractor, who will be concerned to recoup their investment with a relatively high degree of certainty. Experience here is not exclusively positive. Important questions include who pays for the equipment and training. Furthermore, it is important to predict whether the contractor can retain the cost gains achieved in the longer term or whether renegotiations will be required when efficiency has become high (the ratchet effect). Or will the gain be competed away in the longer term. Taken together, many factors could weaken the contractor's incentives to invest in new operating facilities. Why should the contractor then make a commitment to developing new solutions? Training also becomes more expensive with new modes of operation, where employees must have broad expertise – that also represents a specific investment for the contractor company. It is easy to lose such personnel.

The general impression is that contractors often think industrially. They want good and secure margins in growth sectors, with the focus on the long term. They do not wish and are not able to accept much risk, and certainly not outside their own sphere of control. They also value projects which involve employee training and where the customer helps to boost their expertise.

Experience from the Norsok process, where many contractors ran into financial problems, helps to explain the unwillingness of contractors to accept risk. On the other hand, the process could not have been implemented without an active contribution from the contractors. The latter now refuse to develop new solutions without financial security. A question here is whether contractors are to cover the investment in training and new centres, or whether these costs should be incorporated in the hourly rates. The challenge with the latter solution is that the margin may be competed away in the long term. That creates a chicken-and-egg problem – contractors will not invest until they are certain of demand and of recovering their spending, and the operator will not use the service until it is available – preferably from several contractors.

It may be the case that new modes of operation will arrive with the new companies on the Norwegian continental shelf. Because they have small organisations, these players will want to outsource more functions to contractors and are looking to a greater extent for an overall solution. Small oil companies will want a different division of risk with contractors, and will be

[3] The same need to strike a balance arises in selecting the duration of contracts – short periods ensure strong competition but weaken opportunities for tailored solutions. See Osmundsen (1996).

looking for other kinds of contracts – where the contractor bears part of the consequential costs of downtime, for instance, or shares in the production and oil price risk. An obstacle here is that contractors lack the ability or willingness to accept this type of risk. Their response is that the new companies are unwilling to pay for the responsibility they want to transfer. Examples from the UK of such risk transfer to the contractor required the renegotiation of the contract because the contractor could not bear the risk. It is probably necessary here to learn from the Norsok process, and not include more risk than contractors can bear. The latter – with certain exceptions – do not want turnkey contracts because they are unwilling to accept reservoir risk. However, that does not exclude intermediate forms where greater responsibility – if not all – is transferred to the supplier. With the entry of many small companies to theNorwegian shelf, innovative thinking is needed about contracts and the division of labour. However, financial difficulties for a number of the small oil companies will slow down the process of changing modes of working in the short term, since this normally calls for a high level of trust and security of payment.

VII. CONCLUSION

A socio-economic concern is underinvestment arising because companies fail to internalise positive external effects. Contract theory has shown that similar forms of sub-optimisation can also occur internally in companies or in contractual relations between two companies. Asymmetrical information and lack of opportunities to enforce contracts, for instance, could undermine activities which would be economically profitable. This article provides a number of examples of this from the oil sector. It also questions whether the management models used by the oil industry take adequate account of the companies' corporate economics. A balance must be struck here between taking care of the overall picture and establishing efficient and decentralised management models.

To achieve efficient company management, individual activities must be split up and operationalised – as individual projects, for instance. These are then managed and evaluated against specific project-defined targets – KPIs. The advantage of this type of division is that each department and project knows what it has to do and what it will be measured by. The challenge is always to find good KPIs. Clearly measureable criteria such as volume, production cost and time could clash with quality, lifetime costs and flexibility. Taking account of these additional dimensions is important. In addition, there is a clear threat of sub-optimisation. Since the evaluation and measurement system normally only picks up benefits and costs for the individual project, employees at the project level will not necessarily take account of costs incurred in other departments or at other times (involving maintenance, upgrading and removal, for example). Nor will they internalise benefits incurred by other departments or projects. It is important to monitor this type of erroneous disposition and adjust the KPIs so that the best possible account is taken of the overall picture. At the same time, excessively complex management structures must be avoided and management efficiency maintained. Difficult trade-offs are involved here. One possible solution is for certain functions with great collective value – such as research and development – to be handled or at any rate coordinated centrally in the company.

Incentives for technology development could be too weak within the framework of existing contracts, and institutional and practical considerations also make it difficult to reward technological advances through the guaranteed award of new contracts. Another relevant challenge – which is not discussed in this article – is the growing demand for transparency and auditability when awarding contracts. These are sound principles. But it is also necessary to be aware that they could prompt decision-takers to hesitate to select contractors with superior technology because that can be difficult to verify in a tendering process. The safest course for the bid evaluator could be to select known alternatives at a low price. Assume that a contractor can deliver a service which enhances the recovery factor of the reservoir on an expectancy basis, but with somewhat greater variance. The buyer who supports this delivery in relation to known and secure alternatives must in the event produce an objective justification for this. They then stick their neck out, and it is uncertain whether prevailing reward and promotion systems incentivise that. If the person concerned is a platform manager, for instance, they have strong incentives to maintain the prevailing production plan but perhaps insufficient incentives to increase volume beyond that. A number of increased recovery measures also have a certain effective life, and the sitting platform manager then bears the risk of downtime or reduced production while their successor reaps the rewards of increased production. This kind of sub-optimal incentive does not advance the industry. Could the measurability problems associated with technological quality lead to price becoming the most important criterion? Do tender criteria pick up improvements in technology and organisation? It is important here that the companies make conscious choices under these circumstances, that they set evaluation criteria for quality which are clear and as predictable as possible ahead of tendering processes, and that KPIs for procurement personnel support this system.

REFERENCES

[1] Bolton, P and M Dewatripoint, (2005), *Contract Theory*, MIT Press.

[2] Corts, K, (2000), "Turnkey Contracts as a Response to Incentive Problems: Evidence from the Offshore Drilling Industry", working paper, Harvard University.

[3] Corts, K S, and J Singh (2004), "The Effect of Repeated Interaction on Contract Choice: Evidence from Offshore Drilling", *Journal of Law, Economics, and Organization* 20 (1), 2004, 230-260.

[4] Hart, O (1995), *Firms, Contract, and Financial Structure*, University Press Hillier, B, 1997, *The Economics of Asymmetric Information*, MacMillan Press Ltd, London.

[5] Laffont, J-J and J Tirole, 1993, *A Theory of Incentives in Procurement and Regulation*, MIT Press.

[6] Milgrom, P and J Roberts (1992), *Economics, Organization, and Management*, Prentice Hall, Englewood Cliffs, NJ. Osmundsen, P (1996), "Repeated auctions of franchises for nonrenewable resources", *Journal of Regulatory Economics*, 10, 183-189.

[7] Olsen, T and P Osmundsen (2005), "Sharing of Endogenous Risk in Offshore Construction", *Journal of Economic Behavior and Organization*, 58, 4, 511-526.

[8] Osmundsen, P., T. Sørenes, and A. Toft (2010), "Offshore Oil Service Contracts - New Incentive Schemes to Promote Drilling Efficiency", *Journal of Petroleum Science and Engineering* 72, 220-228.

[9] Osmundsen, P., Roll, K., and R. Tveterås (2010), "Exploration Drilling Productivity at the Norwegian Shelf", *Journal of* Petroleum *Science and Engineering*, 73, 122-128.

[10] Osmundsen, P, T Sørenes and A Toft (2008), "Drilling Contracts and Incentives", *Energy Policy* 36, 8, 3138-3144.

[11] Report no 38 to the Storting 2003-2004, Oil White Paper presented in 2003. Salanié, B, 1998, *The Economics of Contracts*, MIT Press, Cambridge, Massachusetts.