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# Rhetorics and realities in new product development in the subsea oil industry

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In any context people draw on an abstract, generative structure of rules and resources in order to act. While some of the rules are 'open' and accessible to everyone in an industrial network, there are also 'hidden' rules, which can be derived using data which may come from several sources—such as informal communications, and individual perceptions of past actions of participants within the network. These sources are differentially accessible, and consequently the hidden rules may be construed differently by different players. One situation in which researchers have an unusual opportunity to uncover the hidden rules governing collaborative new product development, and the process by which they are inferred, is when major changes are disrupting hitherto smooth business relationships, provoking highly vocal self-examination of industry network functions. The study reported here is utilising such a period in the North Sea oil and gas-related industry to elucidate the process of inference of the hidden rules, the varied construction of these by different actors within the industry network, and the impact of the abstract structure thus generated on decisions about product and service innovation by the actors. In this industry the new 'products' developed are productive oilfield infrastructures and their diverse product and technical service components. © 1997 Elsevier Science Ltd and IPMA

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This paper discusses the importance of innovation and the use of a triangulated methodological approach to uncover the dynamic process by which the 'hidden rules' of an industrial system are inferred by actors in different positions within the network and how that impacts on actions at organisational and industry levels. The industrial network used here as the source of empirical data is the North Sea oil and gas industry, an extremely complex and extensively subcontracted industry involving several thousand companies providing a wide range of both high and low technology products and services.

## *The importance of innovation in the UK oil- and gas-related industry*

The North Sea oil province was one of the first, major, subsea oil provinces in the world to be exploited. In most of the last twenty years The North Sea oil industry has absorbed 20–25% of total UK industrial investment, and current forecasts indicate that this will not start to decline significantly until 2020.<sup>1</sup> This vast investment goes into the development of highly custo-

mised 'products'—the infrastructure for exploitation of subsea oilfields, each of which demands continuous technological and organisational innovation during its lifecycle of 25 years or more.<sup>2</sup> This is because the operating conditions in every field are unique, and continue to change over the life of the field. The solutions and technologies adopted in the early stages of subsea exploitations are constantly adapted and added to from varied sources. Many situations have been encountered for the first time in the North Sea, and thus many leading edge products and processes are initially developed there, then adapted for use in other subsea environments around the world. This is widely testified to in the Trade Press and in oil-related companies' Annual Reports.

Other factors which render the industry's product development processes suitable for in-depth study are:

1. It is a major, technologically-advanced, global industry.
2. It is very different from other industries in which product development involving suppliers and clients has been studied, and thus tests the generality of findings from, for example, the automotive industry.

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3. In spite of the high degree of vertical integration of the largest companies, the exploration, construction and production of oilfields has been heavily subcontracted for decades. Thus many companies are highly-experienced in working in a very complex 'extended enterprise environment'.<sup>3</sup>
4. This pattern of product development is characteristic of a number of major industries whose 'products' are developed over a period of time, in large unique projects, such as infrastructure, defence and aerospace.
5. Operating subsidiaries of the large companies and headquarters of the smaller companies tend to cluster tightly at a few locations, in an 'industrial village',<sup>4</sup> increasing the possibility of informal interactions between company staff. These are also very frequent at the actual sites of production, due to the presence of several subcontractors working at each site.<sup>5,6</sup> Thus informal communication between firms has always been extensive and important, leading to the growth of a rich interfirm communication language and culture, and empathy.
6. The industry is at present undergoing major changes in contracting customs, driven by the need to cut costs.<sup>6-8</sup> Formerly the ultimate clients, the major oil companies, closely supervised choice and management of all subcontracting by their main contractors, and also subcontracted directly to many firms of all sizes. Now the majors are transferring increasing amounts of responsibility to 'alliances' or 'partnerships' of contractors for up to five years (the maximum allowed under European Union competition policy).

#### *The process of innovation in the industry*

While leading-edge firms may come up with innovative product ideas, and undertake some independent development, much of the development process is dependent on physical access to, for example, the client's oilwell. Thus in order to complete a product innovation process it is usually essential to be contracted alone or as one of an alliance of firms to undertake the work. Consequently, both individual product innovations and the firm's capability to innovate depend on obtaining a steady flow of suitable contracts. To achieve this desired state it is of key importance to innovative firms to understand the rules driving decisions to award contracts.

Because of ongoing changes in contracting customs in the North Sea, the rules which governed subcontracting until 1992 are changing, and firms tendering for contracts are concerned to understand the new rules.

#### *The rules which inform decision-making*

In any context people draw on an abstract, generative structure of rules and resources in order to act.<sup>9</sup> In the context of the North Sea oil industry, the resources are the industry network as it is perceived by the decision-maker. The rules fall into two categories, in terms of the way in which they are formulated, and the degree of consensus about their content and reliability. The open rules constitute one category, set forth in formal communications by powerful actors in

the network, such as government regulators and large companies. There is likely to be a high degree of consensus about their content, but not necessarily about the extent to which they actually direct action. The hidden rules constitute the other category. Because they are inferred from the perceptions of organisations in different positions in the network of actions by actors in the network, including themselves, the hidden rules are more likely to be construed differently by individual organisations. Where this is the case, self reports by network participants may be expected to conflict.

This has been demonstrated for other contexts in a series of studies<sup>10,11</sup> which showed that the use of participant self reports to measure network links did not yield valid measures of communication that could be observed by independent coders. In addition, other studies have shown that self-reports can be internally inconsistent. Sabel<sup>4</sup> reviewed a number of papers in which small firm owners, jealous of their autonomy, indignantly denied that they relied on cooperative activity of any sort, although in the same interview they had described relationships with other organisations which were clearly cooperative by the researchers' criteria.

Such studies have fuelled a debate about the accuracy of network research which has relied on individual reports alone vs that which has used observational data to derive the abstract structure underpinning decision-making. This debate was reviewed in some detail by Corman and Scott.<sup>12</sup> They concluded that structures derived from perceptual data are related to observational data in a way that partly, but not entirely, validates self-reports as measures of structural elements of the networks. They pointed out that structure is related reciprocally and dynamically to action. The abstract structure underpins decisions to act, and then systemic action produces or reinforces relations between actors, which in turn lead to modification of the structure.

Their analysis points out the methodological difficulties of uncovering the hidden rules, since it leads to the conclusion that not only will they differ between participants, they will also change over time for any given participant. Corman and Scott<sup>12</sup> suggested that the problem posed by the limitations of self-reports could most effectively be overcome by changing the unit of analysis. They proposed that situated action (in this case the exchange of messages) should be the key unit of analysis rather than the abstract structure of rules and resources (in this case the perceived network).

However, these studies concede that self-reports are likely to contain information about the process by which that actor arrived at the construction, and thus sets of reports from actors in each major subset of network participants which has some common perspective on network actions may throw light on the characteristics of the process of deriving the hidden rules, and the abstract structure of which they are a part.

Since this process is ill-understood and itself of considerable importance for understanding how decision-making and action are directed, it is a topic worthy of research in its own right, but generally difficult to approach. In the oil industry context examined in the present study, since major changes are currently taking place in the open rules, the process is speeded up and

also registered in an unusually observable fashion. Network participants at several levels of the supply chain have all been sent official messages from clients that radical change is taking place. These messages have repeatedly been delivered in companies' Annual Reports, in official speeches at industry conferences, and through other widely accessible media (see, for example, recent Annual Reports of BP, Shell, Conoco and others). The subsequent changes have led to the loss of many communication channels between the major clients and smaller firms in the industry network, due to downsizing and increased outsourcing by the largest, client companies in the network<sup>5,13</sup> and the anxiety created is driving a great deal of reflection and highly vocal debate. This in turn is being recorded in the industry press and conference papers.

This offers an unusually rich body of information to draw on in a study focussing on the processes which lead to changes in decision-making and action within the network as a whole, and also on the continuous feedback loop between an individual organisation's perception and the actions which result.

## **Methodology**

The researchers were based in Aberdeen, which, like Houston in the USA is an oil industry 'industrial village', where most large firms and many small firms in the industry are represented locally, with much interaction at work and socially between firms' employees and their families. This permitted a methodological approach similar to that employed by Bott<sup>14</sup> in her study of conjugal roles and social networks. A rich body of contextual information was collected in a quasi-ethnographic manner, from sources including local and industry press, from discussions with industry engineers and managers attending innovation and project management courses taught by the researchers, and through participation by the researchers in industry workshops and conferences approximately once a month. The main issues which emerged from discussions, concerning the changing relationships between industrial network participants, were explored further through 74 semi-structured interviews with managers from all levels of the network who were directly concerned with managing interfirm interfaces. Within this well-informed context, the researchers collated and analysed primary and secondary information of several types in order to characterise the rule-making process of organisations in the three major groups within the industry. These groups were:

1. The Operators—large international oil companies such as Shell, BP, Conoco, Elf etc. who directly license blocks of territory from governments (mainly the UK and Norwegian governments). These in their turn subcontract much or all of the work of design, build and operation of productive oil and gas fields to subcontractors, including
2. Prime contractors, large companies such as Schlumberger, Baker Hughes Inc, Brown and Root (part of US-based Halliburton Group), Wood Group (UK-based), etc which undertake to supply a wide range of the services required, partly from their inhouse capability, partly through forming

partnerships with other contractors, and partly through further direct subcontracting.

3. Several thousand smaller firms offering a range of products and services mainly to the prime contractors. They include a substantial group, perhaps 250 which are acknowledged to be significant suppliers of technological innovation to the industry. This group formerly had close direct links with the Operators, but many now find that they have lost these links due to greater reliance on complete outsourcing by some of the main Operators.<sup>7,8</sup> This has pushed many of the smaller firms into reliance on relationships with prime contractors, most of whom lack prior experience of managing innovation either inhouse or in collaboration.

The three sides of the triangle of the research design were as follows:

1. Establishment of the open rules—from the official sources publicly provided to all members of the industry. The sources used are described in the results section.
2. Establishment of the hidden rules—the sources of data about the generative structures, and by implication the hidden rules, were communications by industry managers from different parts of the network, made between July 1994 and December 1995. These communications included comments, questions and discussions at industry conferences and Workshops, semi-structured interview data and commentary in the local and trade press written by individuals who were not presenting their own formal company policy, but rather discussing their concerns about confusing changes in their environment.
3. Establishment of situated actions of actors at the three levels of the network, from reliable records such as:
  - (a) Calls for tender and announcements of contracts awarded in the daily journal of the European Commission (OJ).
  - (b) Press releases announcing contracts, alliancing agreements etc by companies.
  - (c) Statements in standard documents exchanged by companies such as prequalification questionnaires, statements of procurement policy etc.

The analysis employed juxtaposed the information derived from (2) to that of (1) and (3) respectively to uncover the algorithms relating the three.

## **Results**

### *The open rules in the North sea oil industry*

The open rules were communicated in a number of formal and acknowledged ways:

The open rules included the legal framework, within which everyone claimed to operate, and also many industry- or large firm-specific rules communicated in:

1. Industry Associations' publications.
2. Calls for prequalification and tenders. Announcement of contracts.
3. Annual Reports and public relations material about the company.

4. Internal but freely available newsletters of large firms.
5. Scheduled speeches by managers representing their companies at industry or other conferences and workshops.
6. Articles by senior managers of large companies in their official capacity, published in the trade press or other open media

Note that comparable communications from smaller to larger firms were not registered as part of the open rules by network actors—the hierarchical power positions of actors determined whether their formal communications rated as rules. This could easily be detected by the researcher/outsider to the network by the style of language employed—the rhetorical effects of large-scale power relations is discussed in detail by Richardson and Liggett.<sup>15</sup>

#### *The hidden rules*

The hidden rules were inferred by extracting the implications of groups of statements as follows:

1. Open rules—1. Since 1992 several Operators have announced their desire to engage only in contractual relationships with either a small number of large integrated service providers, or to an alliance of firms providing a full service. With these, they wish to enter a partnership to share risk and rewards. This is in place of the direct relationships they previously had with large numbers of subcontractors, and contracts.
2. Since 1993 invitations to prequalify and to tender for Operators' large contracts must be advertised in the EU journal and contracts must be awarded to the 'best' tender. But how are the factors really weighed up? When the prime contractor with a five year contract is asked for a best lifecycle cost tender, is the tender really calculated over the 25 years of the facility or the five years of the contract?
3. Any firm can apply to prequalify, by law.
4. Operator calls usually require evidence of previous experience of North Sea subcontracting.

*Situated action*—contracts are awarded to specific alliances or firms.

*Unknown*—what are the hidden rules defining the actual selection of contractors?

*Prime contractor comment*—“They (those offering tenders) know exactly what and who they want and tailor prequalification criteria accordingly”.

*Subcontractor comment*—“The Operators say that everyone is invited to prequalify for contracts, but when we wrote asking for the forms one did not respond. Another demanded that we pay several hundred pounds for the forms. This keeps the small firms out” (comment by a small firm CEO made at a workshop in 1995 on subcontracting organised by several public sector agencies).

*Hidden rule*—Only some, large, integrated service providers need apply. In order to make sure that the legal definition of 'best' does not conflict with the Operators' definition of 'best' as large/cheap, unwanted prequalifiers are discouraged. Prime contractors are more concerned to get the five year con-

tract than to give a 25 year lifecycle best costing, and so five year costs are paramount.

*Situated action*—Moves to increase bargaining-power of smaller suppliers—Most small, technology-based firms have attempted to increase their critical mass and acceptability in terms of the received message that only large contractors are wanted and that they must be able to deliver more value within projects by either forming cooperative groups to market the superiority of their products and/or by acquisition of other firms in order to be able to shoulder more of the financial risk.

*Open rule*—“Innovation is essential for cost reduction” (official statements by all Operators)

*Situated actions*—Some of the major Operators have cut R&D spending, as recorded in 1994 Annual Reports (Shell, BP). There has also been a move to enter information-sharing consortia for e.g. deep water drilling technology, with other Operators.<sup>16</sup>

*Prime contractor's comment*—“Our engineers want innovation which uses established technologies and has an effect which is confined to their part of the system” (interview comment by manager in prime contractor charged with orchestrating collaborative innovation).

*Hidden rule*—only low risk, minimal innovation is acceptable to most prime contractors, who are now making the decisions which used to be made by the end-client, the Operator. Decisions to adopt are being made on the basis of the local risk/return trade-off to contractor only, not on risk/return over the whole of an Operator's assets.

*Open rule*—“Both risks and rewards are shared in a partnership”.

*Comment of leading edge firm in an alliance*—“If you are sitting round a table and one of the other firms in this alliance is your competitor in another situation, you are not going to bring your latest technology to the table”.

*Situated action*—this alliance does not benefit from most innovative product.

*Hidden rule*—Only in a contract which permits secrecy will the technology leader supply product technology which gives it a competitive edge. Here power lies with the technology leader. Where the technology leader believes it would carry all the risk of intellectual piracy in a 'risk/reward' arrangement, it covertly withholds while overtly sharing.

These statements all contrasted the open rules with actions interviewees had perceived within their part of the network, and they derived their own set of hidden rules as implications of how the official statement was limited in application to contexts defined by recorded actions.

In some areas there was wide agreement between these categories about a hidden rule ... e.g. “short-term cost-cutting takes priority over all else” ... against the open rule that lowering costs over the lifecycle of an asset were the main concern. In other areas, there was divergence. For example, small, technology-based firm managers insisted that prime contractors had gone on an indiscriminate acquisition spree, in order to be able to offer an in-house capability to cover a wide range of services, rather than

subcontracting to providers who could cut costs through a more innovative design engineering solution. On the other hand, prime contractors insisted that they had only acquired companies in order to build up core businesses, and that their service provision maximised efficiency. Derived hidden rules would differ here depending on company's position in the network:

*Hidden rule for prime contractor*—"Operators are not putting a priority on innovation. We have difficulty in managing externally-provided innovative services in which we have no in-house expertise, and so it is more efficient for us to acquire a firm to give us an in-house service capability."

*Hidden rule for small, technology-based firm*—"Innovative solutions which will cut prime contractor costs will only be acceptable if the reduction is very substantial, and we should not be too detailed about the technical solution offered in the bid, or it will be pirated by the contractor's in-house service without acknowledgment."

## Discussion

The conclusion of this study was that hidden rules were inferred or constructed from the cumulative evidence available to individual firms about the actions they perceived to have taken place in the recent past, and how they related to the open rules. The two groups of rules were not constructed as an arbitrary set of 'Thou shalt' and 'Thou shalt nots'. They were constructed into a coherent belief system, the firm's or individual manager's industry reality which was articulated as a story about what was perceived to be going on. This belief system was that on which decision-making was based. It was a continuing serial, and so the construction of the hidden rules was evolving over time as actions took place and new sets of open rules were handed down.

The differences between hidden rules inferred by different actors indicated the importance of immediate, personal experience. The actions and experiences which appeared to be most important for determining the individual manager's perception of the hidden rules were, in the cases researched here, those which were closest and most directly experienced, for instance the failure of a contractor to send out a prequalification questionnaire, success or failure of a recent tender by the firm, etc.

However, in the highly interactive network of the oil-related industry in the Aberdeen area, there was also an active consensus-forming process, which may have been honed by the pressures of the ongoing changes in contracting practice. Workshops arranged by public sector or commercial conference organisers, focusing on the changes, were providing a very active forum for discussion. Since these were well-attended by managers under extreme work pressure, it is likely that an active process of seeking information and seeking confirmation of tentatively-held theories was also an important part of the process of identifying hidden rules.

### *The constant process of construing the reality*

Taken together, the formal communications from large companies often contained contradictory and conflict-

ing messages, for example those cited above about the importance of innovation and the cut in R&D budgets. It is possible that large firms were conscious of this but unconcerned, since there is a general awareness that different groups pay attention to different messages, and contradictions may go unnoticed by those which have the power to cause discomfort to the company. While many people will note a statement in the current Annual Report, a smaller and less influential group are likely to wade through, and be disturbed by, the meaning of the small print in a prequalification questionnaire for suppliers.

The nature of the contradictions in themselves sends informal signals to interested parties. The supplier assumed that the questions in the client's prequalification questionnaire were more likely to carry reliable implications about who would be acceptable, than any general statements which appeared to be in conflict with them in the Annual Report.

### *What is the relation of the reality constructed by suppliers to the reality of the customer?*

It is obviously important for the firm offering to develop a new product that it has construed its customer's real wishes accurately. But one of the difficulties in the oil industry at present is in identifying the customer. Is it the Operator, who has ultimate control and liability for an oilfield, or is it a prime contractor or alliance of firms which has been given full responsibility for an integrated operation? The current rhetoric says that it is the contractor, but the smaller firms are unconvinced that the rhetoric will not change as Operators discover disadvantages associated with distancing themselves from the subcontracting process. This in itself reveals that the firms in the network, particularly the innovative smaller firms which are most vulnerable to this distancing, are aware of the continuing evolution of the customer reality and its implications for their own position, but not in a position to influence it.

### *When do hidden rules become evident?*

At a time of radical change within an industry, when complaisant relationships are disturbed, it becomes easier to see what the hidden rules of the previous paradigm were, as managers reflect on them publicly and privately. However, in such an interregnum the hidden rules become quite fluid. The constant process of comparing the evolving set of open rules with actions drives decisions which then change the industry structure. In the North Sea oil industry the Operators were pushing costs and innovation decisions down the supply chain. Prime contractors, in a situation of oversupply, were reluctant to accept innovation risk. Innovative small firms were recognising the need to communicate more effectively with target markets and were trying to become larger to strengthen their bargaining position and increase their visibility. From their perspective the clients were becoming smaller and more numerous—"We have doubled the customer base but we are still gaining the same revenues." Previously the clients had been a small number of Operators, now they were a large number of project managers in individual fields. The risk/reward ratio of

innovation was different for these clients, and the smaller firms were responding to their perception of this change in the market.

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