CONSULTING ENGINEERING UNDER EUROPEANISATION: DENMARK-BASED PROFESSIONAL SERVICE FIRMS IN TURBULENCE

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Although large European-based consulting engineering companies adopt different strategies in the emergent global economy, they share an assumption that players can obtain market gain through cross border mergers, acquisitions, or strategic alliances. They aim at synchronising these mergers with their internal organisation. The research has aimed at combining macro-oriented approaches to the professional service firms with grounded studies of the development of professions in consulting engineering companies. Corporate strategies and the role of knowledge management in European consulting engineering companies are discussed. In doing so, it focuses on strategies of large companies. Two Danish cases are presented where knowledge management strategies are intertwined with different responses to globalisation. The first has a multidisciplinary profile, with certain selected core competences. It has expanded internationally, has restructured its services in several countries and business areas and has attempted to support this by IT as a lever for virtualisation and accessibility of company knowledge. The second company operating with two selected core competencies has entered an alliance with a large global player in order to become stronger in its development of local innovative and knowledge intensive solutions. In doing so both companies' professionals experience a number of new dimensions to the development of their work. Knowledge management strategies of their companies urge them to formalise and transfer their knowledge as best practices, which in the first step is an endogenous process strengthening the existing professions, but also threatening them with an iron cage of "templates" preset procedures to be followed in an attempt to transfer knowledge from project to project and obtain cost reduction.

Keywords: business strategy, consulting engineering, globalisation, knowledge management.

INTRODUCTION

Consulting engineering faces an apparent paradox. On the one hand it is claimed that the sector will have to globalise, not only because of economies of scale, but also since major customers have been restructured leaving a few multinational players, which demands professional business service at a multinational level. Yet on the other hand, the very core of delivering professional business service seems to demand closeness and co-presence with the customer representatives (Løwendahl 2000). The type of knowledge, which is crucial for the products, implies that close interaction is needed. It is this tension that the present contribution wishes to address. The point of departure is Denmark- based consulting engineering companies. The Danish consulting engineer sector has been under heavy turbulence the later years, transforming the three leading companies into Scandinavian multinationals. The Swedish financial company Bure

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Equity thus bought Carl Bro, a 2000+ employee company (23rd on the European market in 2001) and merging it with Swedish companies, developing it into number 15 on the market in 2002. In other sectors such merger would possibly not even be noticed. In consulting engineering however the world largest company hosts 16.000 employees (STD, 2002), and at the same time the European consulting engineering companies to a varying degree operate on a wider global market and in this sense there seems to be a fragmentation in Scandinavian, European and Worldwide elements of globalisation.

METHOD

The approach in the paper is multidisciplinary and combines macro and micro elements. The theoretical inspiration stems from management, innovation and anthropological contributions to the discussion on the management of knowledge.

The macro level of the analysis of the consulting engineering sector's national, regional and global development derives from statistical material from various sources. First, the Swedish Federation of Consulting Engineers and Architects (STD) produces widely quoted comprehensive material on the global and regional consulting engineering sector including the Scandinavian markets (STD, 2002). It also includes material from the European Commission, Euroconstruct, the Danish ministries for trade and housing and FRI, The Danish Association for consulting Engineers (FRI, 2001). Statistics on the sector are flawed by the problem of defining what kinds of operations are to be taken on board. The borderlines between management consulting, semi-public engineering bodies, industrial engineering, including engineering divisions of large manufacturing corporations, all raise difficulty in describing the sector in figures. *The grounded (micro level) analysis* draws on qualitative case material from two Danish engineering companies: one company is among the five largest in Denmark and operates internationally; the other is a medium-sized company, but still among the major twenty players in engineering in Denmark. The author has carried out four interviews on knowledge management and globalisation with two representatives from each company and two observers. The analysis of knowledge management strategies and practices is based on two previous studies (Bellouki, 2001, Simonsen, forthcoming). One is an interview-based case study (Kvale 1996), and the other an ethnographic-based investigation (Emerson *et al.* 2001, and Heyl 2001). In the large engineering company, Bellouki carried out a series of interviews with employees, managers and staff officers on the Knowledge Management activities. He focused on the building division of the company. In the medium-sized company, Simonsen was employed for five months in a co-operative project between the Technical University of Denmark and the company itself with the aim of studying and improving the knowledge management practices. Simonsen participated in three building design projects, making participant observations, and carried out interviews and dialogues with members of the organisations. In order to maintain anonymity, some features of the cases have been changed.

CONSULTING ENGINEERING – A PROFESSIONAL BUSINESS SERVICE INDUSTRY

The conceptualisation of consulting engineering as a sector has to be done cautiously. The notion of sector is used to denote an arena for companies producing comparable products on the basis of comparable competencies. The focus here is on building design and production in relation to dwelling, infrastructure projects and industrial buildings. The consulting engineering companies have core competencies, which can be described as multidisciplinary engineering, project management, construction management,

structural engineering, electrical, mechanical, environment and energy engineering (STD, 2002). Usually, the consulting engineers operate as service providers for customers, sometimes directly, sometimes indirectly, through partners or consortia and they can therefore be understood as part of a broader service sector (Larsen, 2001, Løwendahl 2000). The competition is relatively incomplete and restricted by network relations and lack of comparable products. Consulting engineering competencies overlap with several other sectors. The overlaps with architects' and contractors' construction and project management have already been clearly identified. More recently, IT management and consulting have also been added as part of the portfolio of some of the consulting engineers. The work of management consulting is also sometimes very similar to the consulting engineering practices. Public or semi-public infrastructure-bodies might operate their own engineering departments (railways, transport). Engineering departments in large corporations, might act in a similar role in the corporations' change programmes, or are encouraged to seek external customers. Finally, engineering might be part of contracting, public institutions, or component manufacturers, attaching design knowledge to the building components. Such patterns are more frequent in some parts of the world than others, for example in South Europe, where engineering to a larger degree is integrated in contracting, in contrast to North European habits (FRI, 2001). It follows that consulting engineering have trouble protecting a core capability, that other companies cannot substitute or take over. There is, however, within the construction domain a whole set of institutions protecting the specialisms of engineering. Norms and standards are probably the strongest institutional means, but also price systems and labour market arrangements contribute to the creation of barriers to competition. Finally, networking with other parties in the construction industry implies good access to new contracts/jobs when the partners in the network produce them.

GLOBAL KNOWLEDGE ECONOMIES?

Globalisation can be described through at least three different forces: dramatic advances in the capabilities of information and communication technologies, in transportation speed and capacities and the liberalisation of previous national regulatory regimes (OECD, 2001, Kang and Johansson, 2000, Lundvall and Borras, 1998). This tendency is denoted time-space compression, where the role of space is indeed relativised without being dissolved (Castells 1996) leading to a compression of time, where the world seems to collapse upon us (Harvey, 1996 p. 240). Harvey sees an increased emphasis on local culture as an attempt to guard against the ravages of time-space. Lundvall and Borras too argue for increased paradoxical importance of spatiality pointing out that in a knowledge economy, tacit knowledge is central and that proximity play a central role in the genesis of tacit knowledge and in the capacity to exploit it (Lundvall and Borras, 1998, p39). Currently we witness considerable cross border mergers and acquisitions in the service sector (OECD, 2001, Kang and Johansson, 2000). A large group of companies believe they can obtain economies of scale and scope with internationalisation as a proper contemporary response. Within the service sector it is important to note that management consulting has undergone a profound internationalisation, through the formation in the early 90s of the "big five" and the development of a much more multinational market.

There are however limits to globalisation. First, the world trade patterns actually imply that the sphere of interest of consulting engineering to a large extent is Europe or US. Roughly, 60% of world trade is internally exchanged in the EU (Castells, 1996, p. 100).

And even if the focus is restricted to the EU, a number of barriers prevail. Difficulty in opening public procedures for competition (building contracts) and lack of compatibility between national norms in the building industry are examples of these problems. EU attempts to regulate tendering or to harmonise standards still have a long way to go. Although national markets in Europe are still important units for numerous reasons, certain segments have also been developing within international competition (STD, 2002, Scheuer, 2001, Sjöholt, 2001). STD mentions, for example major civil engineering works in the United States as attractive to European interests. Another example is Scandinavian consulting engineering companies in alliances contractors in Africa and Asia. STD also note how even the larger companies might realise 80% of turnover in the home market. The trends in the sector can therefore hardly be described as being under a uniform pressure towards the formation of larger units of consulting engineering companies. The qualitative contention adopted here is that globalisation is modest and fragmented; it breaks down certain barriers and therefore contributes to the formation of a larger international market but also maintains more local competition. The building industry will continue for quite some time to have strong local elements in Scandinavia. The emphasis chosen here therefore is on the globalisation trends related to the European market.

Strategies in a European knowledge economy

Consulting engineering companies are in a situation where a set of general trends can be said to challenge almost any company, regarding the reduced importance of geographical, sector and regulatory barriers and the stronger emphasis on the handling of knowledge. The trends however leave open room for manoeuvre. The strategic responses can be characterised according to major types of consulting companies. The European Commission (1998) introduces four types of construction companies, which have been modified to suit consulting engineering companies:

- Super-companies operating internationally under their own brand and through locally named wholly owned subsidiaries. Such super-companies have the complete spectrum of resources and skills at their disposal allowing them to bid for the financing, developing and managing of the longest most technically and commercially challenging of projects. The knowledge profile of these companies can be described as multidisciplinary (STD, 2002).
- Service centre companies target a specific sector of the volume market, so that their product is of world class. They are still able to deliver at economies of scale. These companies are often seen as specialist subcontractors, and often do not interface with the client.
- Niche market companies specialise in a very narrow part of the sector, where their skills, equipment, or products differentiate them, thus having a similar specialised knowledge profile.
- Low-capital SME-companies operate almost exclusively within a highly focused segment on the local markets.

The super-companies experience an enforced competition on an international market. Their response is usually aggressive, as they try to obtain leading positions within a few core competencies (say: bridges, tunnels). These companies use mergers, acquisitions and strategic alliances to gain access to national markets and to strengthen their position (see also OCDE, 2001). It is believed that cultural differences can be overcome (see Gertsen *et al.*, 1998) and that mergers are economically feasible (OECD, 2001). Knowledge management is part of the corporate strategies for the internal development.

They are big enough to contain large groups of specialists and at the same time maintain a multidisciplinary profile. The service centre and niche market companies operate on the edge of the international market. Their main revenue stems from local activities, but their growth potential is related to breaking this frame. These companies are typical objects of the super-companies acquisition strategies or they form alliances themselves with other local and global partners. The companies have to balance between specialisation and multidisciplinary (Gibbons *et al.*, 1994, Gann, 2000). The small enterprises play a large role on the local markets. They are flexible and can adapt to new conditions quickly. Networking between the companies and through professional associations means potentials for forming project consortia with a multidisciplinary profile. The companies feel the dynamics of the knowledge economy by stronger local competition and by an increasing flow of new methods, products and norms. This means a new pressure and they have to tackle more new information and knowledge than previously.

KNOWLEDGE MANAGEMENT

For the super-companies knowledge management has been framing a number of activities in roughly the last seven years. Although the coupling is not always strong, the super-companies link internal and external elements of corporate strategy. Core competencies can be obtained externally by sourcing, by establishing strategic alliances, or through merger and acquisition of entire companies. But core competencies also derive directly from internal management activities as Sverlinger (2000) describes through the cases of Swedish super-companies such as SWECO, Scandiaconsult and Jacobson and Widmark (J&W). These companies began in 1997-98 to develop internal knowledge management strategies. The strategy would become known gradually among managers, but even in 2000 communication to employees was incomplete and the strategy not sufficiently operated. Sverlinger finds that the most important form of exchanging knowledge is through direct interaction, but at the same time intranet, training and recruitment supporting knowledge management were in place none of the companies had appointed a chief knowledge officer.

The three Danish super-companies COWI, Rambøll and Carl Bro are perhaps significant in their emphasis on intellectual capital accounts as important parts of their strategy (Erhvervsfremme Styrelsen, 2000). A further important dimension in the Danish strategies is the use of gatekeepers of specific knowledge domains, use of academic contacts and professional associations to influence definition of norms, and gather information (Boligministeriet, 1997). It derives indirectly from the above status that even super-companies have gone through an emergent path of developing knowledge management. Using trans-national competencies, forming virtual teams etc., have been less in focus than would be expected, when compared to other sectors. Knowledge management in the typical medium-sized companies has as in large companies an external and internal component. The external is however, far more in accessing knowledge produced by others, typically through project cooperation or strategic alliances. The internal follows roughly the patterns of the super-companies, although the management style and the size of departments often imply that organic cooperation exists and that knowledge sharing efforts can be applied directly. The small consulting companies operate locally and are vitally dependent on networking with other players (Boligministeriet, 1997). Norms issued by public bodies need to be absorbed, therefore participation in external training and other activities arranged by semi-public bodies is extremely important. Internally, the strategies are less formalised and might be organised

as one-man-one-specialism (Boligministeriet, 1997). Internal knowledge sharing is therefore less important than is often assumed. External (personal) networks are however vitally important for producing, acquiring and sharing knowledge. Egbu and Sturges (2001) claim however, that small construction companies with less than eight employees use a series of internal knowledge management tools such as regular meetings, quality circles, coaching, mentoring, job-rotation and the like.

Knowledge management strategies in two Danish consulting engineering companies
Below two consulting engineering companies are described. The structure follows selected elements of knowledge management. The first example is a super-company, the second a specialised medium-sized company. They both operate with overall matrix organisations. The focus horizontally is on customer groups and/or products, whereas the vertical focus is major areas of competence. The super-company employs around 2000 people operating worldwide. Less than 50% of the turnover is however generated abroad, despite gained market shares in Eastern Europe since 1990. The medium-sized company employs some 500 people in a number of offices around Denmark, but none abroad. The company operates with more specific portfolios of competence, such as building physics, thermal engineering and the like.

Corporate Strategy and Management
The super-company aims at expanding internationally and supports this by its knowledge management strategy. The company has identified core competencies wishing to gain a market-leading position in Europe in these areas. Mergers and acquisitions are an integral part of its strategy. Knowledge management includes a strong IT component as enabler for virtualisation and accessibility of company knowledge. The super-company has an expansive export strategy. It has appointed a knowledge-manager and adopted an explicit corporate strategy of knowledge management. The medium-sized company has experienced growth on the Danish market and has started looking abroad. The company has certain core competencies, which require expert knowledge. This has lead to an alliance with a large global player reinforcing its ability to develop innovative and knowledge intensive solutions. Knowledge management as an activity is integrated within the managerial roles of project, department and corporate managers. There is however no knowledge-manager or officer. The knowledge management strategy for both companies is directly linked to corporate competitive strategy and is organised with close links to top-level management. They both have ongoing activities to realise the knowledge management strategy. This strategy is made explicit and is backed up with the appointment of a responsible manager and in the large company a knowledge officer. Knowledge management plays a role as part of the external branding of the company as well. Both companies have implemented means to evaluate the strategy, and to evaluate the knowledge component in the companies. The larger one uses knowledge accounting and a yearly intellectual capital report as part of the strategy. The medium-sized evaluation system is less systematic.

Information Systems
The two companies employ a set of IT-systems including accounting/Enterprise Resource Planning (ERP), office/document handling, CAD and project management tools. All these systems support the managing of knowledge in storing and providing different forms of information. In the super company this concerns six different systems. Several of them was implemented before the knowledge management strategy was realised, but a further and more integrated use has been a central element of knowledge

management, being the first step of its implementation. In particular, the Intranet and the enterprise portal have been positioned as central in both companies. Moreover, integration between systems has become a central preoccupation. The intranet is used to store and support information on various knowledge areas. The capture of best practices and the facilitation of professional networks are central elements. Also more "mature" explicit information such as standards, guidelines, templates for formulas and other documents are part of the intranet-facilities, not to mention e-mail communication, bulletin boards and corporate information. In both companies the aim is that codified knowledge is to be supported by Intranet.

Two types management information systems are implemented: ERP-systems and document handling systems. Their aim is to integrate in the same database accounting, Human Resources (enforcing hours spent registration) engineering data and project management. The companies use several different engineering information management systems. The production and handling of drawn information is central here. The knowledge management element relates to the potential reuse of drawings at either component level (building elements) or higher levels (buildings). Several project management software packages are in use. Also different types of project webs are used. The companies adopt *a "forced" "best-of-breed" strategy*. Single source is interpreted as impossible given that the IT has to be used in markedly different ways depending upon co-operating partners (see Koch, 2001).

Organisation
Both companies' organisations are characterised by an emphasis on projects as the main value adder. In the large company, an explicit managerial goal is to do projects in a multidisciplinary manner and across departmental borders. Moreover, the employees interpret project work as essential for developing new knowledge. Nevertheless, the company still has a relatively hierarchical organisation with several levels. The knowledge management strategy focuses on frameworks for the projects. In contrast, the medium-sized enterprise emphasises small organic departments and fewer hierarchical levels. In both companies knowledge management means focusing on and enhancing existing professional disciplines, the aspiration is to create an "adhocracy of networks". These professional networks acknowledge proposals for best practices, which then are registered on the intranet. The medium-sized company has groups and departments, which directly co-operate with the parallel departments of the strategic alliance partner, developing knowledge in critical areas. In the large company, there is a focus on the role of the middle managers. They are supposed to exercise leadership by communicating values and norms, knowledge and information, by enabling cross-departmental co-operation etc. These values are transmitted, following the company's knowledge management policy. This focus can be seen as resonant with Nonaka and Takeuchis (1995) "middle-up-down management". The focus on middle management is not exercised in the medium-sized company.

Personnel, Training and Office Design
Human Resource Management is central in both companies' understanding of knowledge management. Recruiting, training and retention are important ways of developing and maintaining knowledge resources. The two companies both assert that employee turnover should be lower. The medium-sized company have experienced a fall in the (previously long) length of employment; the larger one has to tackle an average short period of employment. The loyalty activities also rely on the assertion that an important part of the company's knowledge resides with the employee. Training is not uncontested however, since some managers and employees feel they learn mostly by

participating in direct project work. There is an attempt to support knowledge sharing behaviour, partly by changing the culture and partly by using rewards. In the large company, there is an understanding of the necessity of such rewards, but apart from minor rewards related to proposals for best practice, no system is currently in place. In the medium-sized company, such rewards have not yet been discussed. Both companies have rearranged parts of the office space. Shared open spaces are organised according to the departmental structure in order to support exchange of knowledge within the same specialism. The projects typically cut across departmental structures, and project team members thus still have to meet formally. In the medium-sized company, there is an attempt to downplay hierarchy by letting the department manager work in the open space among the other employees. However, corporate management has been strengthened at the same time.

Project Processes - Knowledge production
Project processes are the central arenas for acquisition, retrieval, sharing and production of knowledge. The dynamics of projects have features like:

- Fluctuating client requirements and demands, i.e. project conditions are unstable over time.
- The economy of the project sets clear frames for innovative and creative activities. Project managers are frequently monitored on a narrow economic result basis only.
- Projects might not be fully manned from start to end. Rather only the project manager and/or a few others participates in the entire design, whereas others enter the project when a certain engineering speciality is needed. This puts pressure on coordination.
- The technical IT has to be used in markedly different ways according to the needs of co-operating partners, as observed previously.

The single project gives rise to negotiations on necessary knowledge, potential reuse of knowledge and how to create new knowledge. The quotation phase and the start up phase of projects often lead to early identification by project managers or others of needs for the source of knowledge. This often occurs on basis of the participants' knowledge of the existing competencies in house. The intranet or ERP/HR-facilities are rarely used in this phase to support these evaluations. In the design process, problem solving most frequently occurs by directly asking colleagues, searching for persons having solved a similar problem before. This again is predominantly done on the basis of direct interpersonal interaction.

DISCUSSION

The grounded studies have shown that the assembly of IT and human resource oriented tools is necessary to support knowledge production and companies have used considerable energy in putting this basic infrastructure in place. The knowledge management strategies reflect and are intertwined with two very different responses to globalisation. The large company is leading an aggressive expansion strategy, seeking to gain foreign market shares, using IT as a lever for export of company knowledge. But the small company aims at making an alliance with a foreign company, importing new knowledge ad competencies, thus strengthening its development of local knowledge intensive solution. The knowledge management strategies of the two engineering companies are a combination of elements aimed at enhancing knowledge production and thus competitiveness. Competitive strategies, however, are focused on the local market

for both companies. The IT-component was the most developed in the two companies, but the soft tools of organisation, human resources etc. are also well developed. The conceptualisation of knowledge itself seems to be limited, or only used for quantification purposes. There is thus overall still relatively little focus on the actual knowledge production in projects. It should have been expected that there was more focus on developing knowledge sharing and knowledge production in project groups. Importantly, the medium sized company however experimented with the integration of knowledge management into projects. The little focus on project processes possibly affects the socio-political learning processes. In practice, the companies seemingly have adopted a heterogeneous understanding of the possible diverse forms of knowledge, social and codified, supported more or less by information systems and other tools for ordering elements of a wide diversity, that need to be maintained and developed as such. As already noted the project manager is inclined to focus on costs related directly to the particular project. Those of the knowledge management activities that cut across projects therefore have to justify itself within the single project, or it has to be embedded in other routines in the company. The companies are in the process of addressing this as far as the internal processes are concerned. They lever new mechanisms for legitimacy of knowledge management-activities, but the special character of a project further relates to the inter-organisational co-operation in the sector, which implies that handling of knowledge across projects somehow has to be tackled at this level as well. At the very least, technology and other means must be mobilised to maintain and communicate experiences first in the single project and then from the single project to the next and to participating corporate "memories". The strong element of temporary co-operation forms at the global level will continually challenge the companies in their endeavour to control the knowledge processes.

CONCLUSION

European consulting engineering is on the edge of a breakthrough into a global market. Although a group of players already have considerable international presence and experience, other large and medium-sized companies still concentrate on regional markets. Some players, especially the large and medium-sized, contend that they can obtain considerable market gain through cross border mergers, acquisitions, strategic alliances as well as by synchronising the internal processes of value adding with new markets and co-operating partners and by overcoming cultural barriers. Others will largely continue to operate in local markets albeit under changed conditions. The two Danish engineering consulting cases had different responses to globalisation of knowledge and markets. The super-company's export strategy, aiming at international expansion supported by a strong knowledge management strategy, included an IT component for accessibility of company knowledge on foreign markets. The medium-sized company's import strategy, aiming at making an alliance with a large global player in order to build competencies and become stronger in developing local innovative solutions. The common denominators in both companies' knowledge management strategies are the focus on human resource development and organisational improvements. Location and information strategies are markedly different. Although the present globalisation trends are modest and fragmented, their impact seem nevertheless to be that the large and medium-sized firms are likely to be enrolled in even larger multinationals, such as it was seen in the 90s in the field of management consulting. These mergers and acquisitions will be cumbersome and problematic. The negative results of such mergers are however rarely so severe that the large companies cease believing in globalisation and concentration. While proximity and co-presence probably

will remain important in building production, many other elements might be profoundly changed, even business structures, building components and design approaches.

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