

Offshoring engineering

- Experiences of Scandinavian Engineering Consultants

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Abstract

Offshoring, a strategy of transferring activities across national borders, is becoming increasingly attractive for engineering consulting firms operating in Europe. Offshoring may occur through using external resources (outsourcing) or through relocating internal activities (foreign direct investment, captive arrangement). The consulting companies may experience lack of skilled personnel and or an increasing pressure on costs. Moreover countries like India offers highly qualified engineers at a relative low pay.

The aim of this contribution is to investigate Scandinavian based consulting engineers' experiences using offshoring. It often begins with a single project, but early positive experiences and for example Indian flexibility quickly can lead to a much more profound collaboration and even to a strategic transformation of the Scandinavian firm.

Theoretically the paper builds on international business and strategic management approaches. The empirical method is desk research looking at selected companies in Denmark, Sweden and Norway. The study is of exploratory nature and focus on a single case supplemented with a preliminary status of the 30 largest consulting engineering companies in Denmark, Norway and Sweden. Through the literature search on offshoring in general and a compilation of studies of engineering offshoring it is shown that offshoring involve significant strategic choices and are not sufficiently dealt with if understood as single project endeavours. Moreover even within the project frame, trust, communication and proper (soft) management are important. The results thus show that a transactional approach to the collaboration appears to be insufficient and that the offshoring firm can be seriously challenged in its strategy. Offshored task encompass BIM design, design of standard bridges and even larger infrastructure projects. The firm strategies in using offshoring are differentiated; in house, outsource, offshore, and captive local investment. Consulting Engineering firms in Scandinavia entering offshoring should practice openness

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for a longer term journey of learning and strategic engagement even if the collaboration start with a single project and even possibly ends there.

Keywords: Offshoring, Consulting Engineering, Scandinavia, International Business.

1. Introduction

Engineering outsourcing is expected to be a business worth US\$150 billion a year by 2020, which would make it five times larger than it was in 2010 (Sehgal et al 2010). It is common to assume that companies are seeking to cut costs for an expensive activity, i.e. the engineering of new products, by placing it in low cost countries (Sehgal et al 2010). The largest engineering offshoring destination is India, with about 25 percent, but China is also an important location and its role will increase in the coming years (Sehgal et al 2010). Together India and China graduate more than 800,000 new engineers each year, most of them willing to work at pay far below the Western levels (Messner 2008, Sehgal et al 2010). A series of other countries also host offshored engineering such as Philippines, Malaysia, Thailand, Brazil, Hungary, Ireland, and the Czech Republic. Companies doing offshoring of their engineering works are predominantly based in United States accounting for 70 percent of the business, with Europe and Japan covering the rest (Sehgal et al 2010).

The aim of this contribution is to investigate Scandinavian based consulting engineers' experiences using offshoring. It often begins with a single project, but Jensen (2009) shows how early positive experiences and Indian flexibility quickly can lead to a much more profound collaboration and even to a strategic transformation of the Scandinavian firm. In an international perspective the Scandinavian consulting engineering companies are medium-sized. The largest having an annual turnover just above 5 billion and headcount in the range 4-8000 (The Swedish Federation of Consulting Engineers and Architects, STD 2010).

Theoretically the paper builds on international business and strategic management approaches. The results from this strand of research is reviewed and drawn upon. The empirical method is desk research looking at selected companies in Denmark, Sweden and Norway. A single case is described and analyzed along with the status of the consulting engineering companies. Managerial implications are drawn for the Scandinavian companies.

2. Method

The overall approach is multidisciplinary, but with a basis in the Resource Based and Knowledge Based Views of the firm (RBV and KBV, Bunyaratavej et al. 2011, Grant, 1996, Vivek et al., 2009). An interpretivist and abductive epistemology is used (Dubois & Gadde, 2002).

The theoretical frame is first informed by a literature review carried out in summer 2012, following Hart (2009) and Webster & Watson (2002). The search's aim was to assess the knowledge accumulated in leading journals on offshoring companies' longer-term development and their internal and external organization. The delimitation of the search –

following Hart (2009) – was aided by relying on previous literature reviews of the area (Bunyaratavej et al., 2011; Hätönen & Eriksson, 2009). These reviews suggest that international business, strategic management, operation management (supply chain management), (industrial) marketing and purchasing would be important research strands to pursue, not giving construction or consulting engineering special attention. The three search engines used were primarily Science Direct, secondarily ABI/Informs and Business Source Complete (EBSCO). The time scope selected was 2007 and on, focusing on the most mature offshoring setups. Articles and journals oriented toward IT technology were disregarded (but not business studies of IT sector firms). Several consecutive searches, were made, giving a seven-article sample with longitudinal studies of offshoring. This focused sample includes four articles from *Journal of World Business* (Jensen, 2012; Lampel & Bhalla, 2011; Periera & Andersson, 2012; Vivek et al., 2009), one article from *Journal of International Management* (Jensen, 2009), one from *European Management Journal* (Hutzschenreuter et al., 2011), none from *Journal of Operations Management* and many other journals included in the first search.

Second supplementary references on engineering offshoring in the global construction industry were gathered (Jarvenpaa and Keating 2012, Messner 2006) as well as broader studies of engineering offshoring (CEO 2008, Lewin et al 2009). A Science Direct search in the two areas revealed very scarce sources, Jensen (2009) being one exception.

To identify the largest Scandinavian engineering consulting companies, the STD (2010) study was used. The ten largest in Denmark, Norway and Sweden measured on turn over and number of employees was selected. Each of them was studied through desk research using annual reports, media coverage, linkedin data and other types of information. Material on offshoring was found on consulting engineering companies operating in Scandinavia with headquarters in Denmark and Sweden, but not in Norway. Two long term cases were particularly well described. For anonymity reasons the case description below is a mixture of the two, and Danish sources are left out (translation from Danish is carried out by the author). The case should be considered as early stage exploratory, relying on secondary sources. Also the desk study material of the largest engineering consultancy companies constitute an early stage exploratory study of offshoring, and it was chosen only to use this material in the discussion only as comparison to the case company.

The limitations of the present research work are thus the limited empirical basis it is built on. It is for example not possible to discern global presence of the investigated consulting engineering companies with a local business in say India, from offshoring of tasks from Western Europe to India. Moreover a theoretical contribution should develop a framework for understanding project based companies doing offshoring and the longer term impacts.

3. Frame of Understanding

First a definition of offshoring is provided then offshoring developments in general is described and finally within engineering and construction.

3.1 Definition of Offshoring

Offshoring is defined here as a strategy of transferring activities across national borders, which may occur through using external resources (outsourcing) or through relocating internal production activities (direct foreign investment, captive arrangement) (Bunyaratavej et al., 2011; Hätonen & Eriksson, 2009). It follows that outsourcing and offshoring overlap and is related, as shown in table 1.

Table 1. The four main strategic options of offshoring /outsourcing (adapted from Bunyaratavej et al., 2011)

	Insourcing	Outsourcing
Onshore	1.Internal domestic Provision	3. Domestic outsourcing
Offshore	2.Captive/foreign subsidiary Offshoring	4. Offshore outsourcing

Offshoring and captive setup refers to the situation where the firm owns and runs offshored units in another country (Bunyaratavej et al. 2011), whereas offshore outsourcing refers to the situation with simultaneous transfer of ownership and location of an activity (Hätonen & Eriksson, 2009: 147). This definitional model is challenged by multiple practices of the companies that involve a range of hybrids, in-betweens, intermediaries, expats etc.

3.2 Long term offshoring tendencies

Offshoring has been around for some time and longer term trends are emerging. Hutzschenreuter et al. (2011) study the development of white collar offshoring and Hätonen & Eriksson (2009) the practical and theoretical development of outsourcing in a systematic manner. The parallels between the two studies lead to adopting Hätonen and Eriksson framework as covering offshoring as well. Although the framework is tentative and ex-post, it can be used as a systematic attempt to conceptualize longer-term offshoring developments. The framework consists of four phases:

- Transactional
- Resource seeking
- Transformational
- Developmental

The first phase is transaction. Hätönen & Ericsson (2009) characterize it as a “big bang”, where the make or buy dilemma seriously tilts toward buy. Activities are turned over to outside vendors in the belief that market mechanisms of distant markets result in lower transactions costs. Transaction Cost Economics (TCE) is the main theory. The second phase is resource seeking. Here, companies rely on external sources to provide production components and services. The main theory becomes the Resource Based View (RBV) (Hätönen & Eriksson, 2009: 152).

The third phase is transformational. The main theory is RBV, in combination with organization theory. In this phase, all parts of an organization can in principle be turned over to outside vendors (Hätönen & Eriksson, 2009: 152). And as offshoring and outsourcing become integrated legitimate tools in the management repertoire, the concerns turn to the timing of offshoring.

The fourth phase is developmental. Here, the organization becomes increasingly boundaryless and managing business development and continuous improvement of internal activities can even become part of offshoring/outsourcing arrangements (Hätönen & Eriksson, 2009: 152). Management takes the form of portfolio management, as many internal activities are project-oriented. Yet, longer-term perspectives of external sourcing are employed, even as a ‘lifecycle’ perspective. This implies that the main theory applicable is RBV according to Hätönen & Eriksson (2009).

The studies reviewed show that, by 2012, almost any part of a classical hierarchical organization can be subjected to offshoring and provide a range of examples. Most longitudinal studies occur in the service sectors (Finance, IT and engineering; Hutzschenreuter et al., 2011). They cover R&D, Engineering, IT development, HR support functions and more (Jensen, 2009, 2012; Lampel & Bhalla, 2011).

The longitudinal studies do not equivocally comply with Hätönen & Eriksson’s (2009) framework. Firms offering low-cost service products continually use offshoring with a strong cost focus (Lampel & Bhalla, 2011). Even when the companies achieve high-value core activities, they may be forced to continue outsourcing and offshoring to stay in their market segment and keep their overall costs low. Lampel & Bhalla (2011) offer this type of case in telecommunications. Over a six-year study period, the company offshored more and more and struggles with increasing coordination (employees travelling back and forth) to handle this. Activities offshored include customer services, software development of an internet order portal, a billing system and a triple-play system (offering customers TV, broadband and telephone). Offshored core value-creating activities have to be tightly coupled to the main firm. Lampel & Bhalla (2011) use configuration theory, combining strategic positioning and organizational design elements; however, their analytical result remains close to the rich longitudinal case, which is thus implicitly viewed as unique.

Jensen P. (2009, 2012) combines RBV, activity-based and international business network to cover internal and external elements of offshoring outsourcing. He study three cases, two financial and one engineering consulting firm. In two of three cases, the longitudinal scope is three and five years (Jensen, 2012), while the third covers one year (Jensen, 2009). All three

longitudinal cases show a high level of interconnectedness between the Danish firms and their Indian offshoring partners. They use project organization as the first organizational instrument, in the collaboration with the Indian software providers. Jensen (2012) finds that the company emerges into viewing offshoring as a new strategic opportunity. One firm realizes a quick expansion of the first offshored project, and soon several hundred Indian consultants are involved, 30% of them at the Danish site. After the transfer of a first project, another firm even experiences a rather quick development through project expansion (resource seeking) to a transformation of strategy (Jensen, 2009), due to the Indian partner's European customer portfolio, which provides a strategic expansion option for the Danish firm to the European market. Both the two longer-term case companies establish IT development centers at their Indian partners' facilities and station expatriate managers at these centers. These expatriate managers facilitate coordination and communication between the Danish and Indian parts of the cooperation.

Summarising, the literature study on longer term offshoring development conducted, reveals varying responses to the long-term pattern. Bengtsson & Berggren (2008), Hätonen & Eriksson (2009) and Vivek et al. (2009) find a shift from transactional relations to relation-based approach and complementarity. Lampel & Bhalla (2011) and Piera & Anderson (2012) find continued focus on transactions and low cost. On this basis, it is not possible to follow Hätonen & Eriksson (2009) and Vivek et al. (2009) in their claim that transaction cost economics is becoming obsolete to the benefit of the resource-based view and other complementary resource-oriented theories.

3.3 Engineering and Construction

Within engineering and construction one can find a similar tension between companies that continue to focus on the single project cost when collaborating with domestic and global partners, and others that change their business strategy and enter a transformative and developmental mode (COE 2008, Jensen 2009, 2012, Messner 2008).

The committee of offshoring engineering, COE (2008), suggests a distinction between engineering, procurement and construction (EPC) and Architecture, Engineering and Construction (AEC). Where EPC have considerable experience and practice within offshoring, in their delivery of civil engineering, infrastructure and large plant facilities, AEC is –suggests COE- focused on dwelling and residential housing. COE (2008) finds that 62% of the EPC companies were using offshoring for many projects in 2004. Also some AEC companies consider offshoring but to a far lesser degree than EPC companies Messner (2008). The EPC sector often require many hours of engineering work, much of it related to detailed engineering (Messner 2008). Messner provides examples like the sizing and routing of piping; the design and location of electrical conduits and wiring; and the detailing of structural elements (Messner 2008). He claims that this type of repetitive, detailed engineering work makes offshoring more attractive than in some other design practices, because it appears possible to systematize this type of work and it requires less direct communication between the designers.

Messner (2008) points out that most EPC companies appear to have international offices and are participating in multi-office execution strategies for the delivery of projects. Many of them have offices in low-cost engineering locations, such as India, China, Czech Republic, Russia, Romania, Poland, Mexico, and Taiwan (Messner 2008). Some of these offices were established specifically to provide low-cost engineering services for company projects. Others were developed to perform specific design tasks for domestic construction projects. STD (2010) points out however that business models of consultancy firms encompasses many that cut across EPC and AEC. The STD study points at a group of companies that are multidisciplinary and other that are more specialized. The largest companies however at a time exhibit multidisciplinary regional proximity to Scandinavian markets and a multinational more narrow profile, such a Norconsult within hydropower or COWI within large bridges. These companies thus combine multidisciplinary and multinationality (Koch 2004).

When offshoring is carried out on the basis of single projects, it provides other conditions than in longer term alliances or in captive subsidiary arrangements. Jarvenpaa and Keating (2012) study a project based collaboration between a US engineering company and its Indian collaborator occurring as first several consecutive projects and then as a captive arrangement realised through the US company acquiring its Indian partners. The suggested pattern by Hätänen and Erikson (2009) was in this respect refound. On the other hand the engineering firm set up also included a Romanian company which recurrently had projects with the US company yet remained independent.

The project collaboration studied by Jarvenpaa and Keating (2012) involved design of parts of a processing plant including components such as piping, pumps, foundations, and meters. It involved coordination of multiple engineering disciplines (e.g. piping, structural, instrumentation, and electrical). Detailed design representing 30–60% of the project was completed while engineers worked geographically apart. The coordination demands were highest in relation to the operations in India and Romania, where expat engineers either were not used on the project team, or were used only for brief periods and which therefore relied on technology mediated communication. Although co-location of the onshore and offshore engineers happened in the beginning of the project in the context of kickoff meetings, afterwards only occasional and brief travel occurred between the sites.

Jarvenpaa and Keating (2012) find outspoken project member articulation of need for more communication. Project plans and task allocation between onshore and offshore are frequently changed during the project. This trigger overwork at the Indian party and formalisation from the Romanian party, whereas the US party appears to lack behind in additional follow up planning. The set up come to exhibit asymmetric trust where the offshore teams are forced to trust the onshore team, whereas the opposite is not quite the case (Jarvenpaa and Keating 2012:76). The use of technology mediated communication changes communication from informal and de-central to formalised and centralised. It is difficult for the teams to use formalised roles and rules as unrecognised formal and informal hierarchies of the participating organisations “intervene”. The managerial practices of the project managers exhibit a range from dominance to coaching, where Jarvenpaa and Keating (2012: 81) observe that the coaching oriented management role appear most effective.

It can be noticed that both EPC and AEC construction frequently uses constellations of new team members where swift trust and occupational stereotypes are important (Koch and Thuesen 2011). And where mechanisms parallel to the ones found by Jarvenpaa and Keating occurs. Even if offshoring scholars like Bunyaratavej et al. 2011, Hutzschenreuter et al. (2011) and Hätönen & Eriksson (2009) expect offshoring relations to mature, the construction industry is “used” to the costs of excessive transactions and projectbased offshoring might therefore prevail.

4. Case

The case study discusses a Danish owned multinational consulting engineering enterprise, a regional and international firm with main office in Denmark (called ConsultCo). Main activity areas comprise engineering consulting on energy, environment, infrastructure, building and operations, construction management, economics, general management and information technology. These areas are organised in nine strategic business units (SBU) supported by a general services department encompassing the IT organisation and staff. Major part of business development occurs within the SBUs. The company employs some 2000 in the parent company in Denmark, and its international organisation. Some 50% of the turnover is generated in Denmark.

The company has for long followed a strategy of globalisation combining leading edge expertise in selected products within civil engineering with a broadband regional presence in Northern Europe. This strategy has led to a number of mergers and acquisitions as well as offshoring of engineering design and other activities. Civil Engineering is a strong business area involving presence and engineering activities at a range of sites and countries around the world. The mergers and acquisitions have several times involved integrating captive units in low cost countries. Some routine engineering tasks have thus been produced in India in a fully owned subsidiary over around 30 years. The whole set of expansive activities has required integrative managerial actions.

A new wave of offshoring activities commenced roughly ten years ago. Initially SBUs throughout the company were hesitant and for this reason only small project works were offshored from time to time. A director stated:

“We cannot force our managers and staff to engage in offshoring to India. They must have a real incentive to do it, and it is therefore crucial that we are able to show good examples and positive results from offshoring that can create this kind of incentive across the organization”

However the offshored projects showed good results. The works was of good quality and documented cost savings were around 40%–50% in some types of projects, and between 20% and 30% in others. This gradually diffused across the various managerial levels and catalyzed an internal strategy development process about how the company could exploit the opportunity.

By 2012 Consultco's strategy is based on integrating the Indian units in its business. Some 450 employees in India encompasses 70 within detailed engineering design and it's an

strategic aim to continue growing the Indian unit. This implies however an interdependence and the Indian engineers are by now perceived by HQ to be demanding in terms of wages and task content. A Liaison officer responsible for contacts between Danish based and India based employees in Consultco puts it this way

“The Indian engineers knows exactly what they want. They ask critical questions, are voluntarily suggesting ideas and are clearly stating that they want to be along on the demanding tasks rather than just entering data”

The need for competence development, HR policy and practices is thus outspoken. The liaison officer continues

“Many of (the project members offshore at) our infrastructure projects are senior engineers, and several have requested to be part of the design of the motorway itself rather than just the exit ramps. We have tried to provide that”

The liaison officer is backed up by a senior manager pointing at the possibility of winning contracts of Indian infrastructure based on the companies competences, improving their attraction as work place for Indian engineers.

5. Discussion

First the case, then the sample of large Scandinavian consulting companies are discussed. The case company Consultco combines local and global presence and cover both EPC and AEC. It appears however that its offshoring activities are mostly related to its EPC activities. Its overall growth are by now dependent of a much differentiated performance of different business areas. Some are negatively impacted by the crises (the local Danish market), whereas others (India and civil engineering) are successful. The case shows how consulting engineering companies in Scandinavia can transform their business based on long term presence in India. The case shows a high level of interconnectedness between the Danish firm and their Indian offshoring partner. They use project organization as the first organizational instrument in the collaboration. After the transfer of a first project, the firm experiences a rather quick development through project expansion (resource seeking) to a transformation of strategy (Jensen, 2009), also because of the Indian partner's European customer portfolio, which provides a strategic expansion option for the Danish firm to the European market. The firm station expatriate managers at their Indian subsidiary' facilities and also use a liaison officer to enable the coordination and collaboration. Expatriate managers and liaisons officers are seen as facilitating coordination and communication between the Danish and Indian parts. Moreover the strategic transformation also implies that the two companies engage in a mutual dependency where retention of employees at the offshored unit also becomes an issue for the west European company.

Jensen P. (2009, 2012) raises the question of what impact offshoring professional services will have on the core company's resources, referring to the risk of 'hollowing out' the core company. His engineering consulting case exhibit surfacing of new opportunities rather than hollowing out.

Other Scandinavian companies such as Ramboll, COWI, and Thyréns have followed this pattern, and there are some who follow the project set up pattern (for example ÅF). The preliminary screening of the largest Danish, Norwegian and Swedish companies shows moreover that many (Alectia, EK Jørgensen, Sweco, WSP Sweden), and especially some of the Norwegian do not operate offshoring at present (Asplan Viak, Hjellnes, Multiconsult, Norconsult). Hammarström et al (2012) interviewed nine CEOs of Swedish consulting engineering companies and find that they observe and follow the IT-companies offshoring practice, yet refrain from practising it themselves. Compared to large multinational engineering consultancy this status can be seen as ambivalent supplication to offshoring (STD 2010). Among the companies following a long term strategies of offshore presence there is infrastructure engineering companies who have operated worldwide with punctual presence for a much longer period than the last wave of offshoring reflects (such as Niras and Norconsult). They have thus long term experiences being multinational and can operate offshoring like arrangements internally. Offshored tasks encompass BIM design, design of standard bridges, motorways and even larger infrastructure projects. There was no examples of back office tasks like travel accounting, recruiting or other business processes being outsourced/offshored (re Pereira and Anderson 2012). The differences between firm strategies in using offshoring shows elements of in-house reliance on the regional market, and project or transformational offshoring set up, either as outsourcing, or captive local investment. Future research will have to address the particularities of project based construction companies in offshoring.

6. Managerial Implications for Scandinavian Consulting Engineering

Both amongst theorists and practitioners there are continued divergence as to whether offshoring should be a short term controlled exercise (project by project) or a long term transformation. Sehgal et al (2010) take the most initial point of departure in discussing the managerial approach to the very first project to offshore. Their advice is fivefold:

1. Choosing the Right Project
2. Identifying the Appropriate Business Model
3. Teaming Up with the Right Vendors
4. Creating Iron-Clad Performance Metrics
5. Establishing a Strong Governance Structure

They recommend not taking the most business critical and/complex projects, to go beyond the dichotomy of either outsourcing or establishing a captive unit (a subsidiary). This recommendation goes along with the results of the literature study where many variants of set ups were found. While the recommendation of creating iron-clad performance metrics might sound attractive in addressing a core company manager's anxiety of risks of spending in vain. Jarvenpaa and Keating (2010) and the case reminds us of other -side- effects of establishing rules and regulations for carrying out engineering work. Jarvenpaa and Keating (2012) results underpin that strong governance might imply soft management, such as Consultco's Liaison officer also reflect. When recommending scrutiny of possible vendors

Sehgal et al (2010) suggest going beyond price and look into the vendor's capability and other experiences. This can be tackled through bidding procedures they claim.

However in focusing on the very first project in an offshoring relationship Sehgal et al (2010) seem to fall short of relating to the longer term strategic choices that are involved. Experiences in and outside construction point at emergent journeys of offshoring (Jørgensen and Koch 2012, Lampel and Bhalla 2012, Pereira and Anderson 2012). This insight puts the first project in another light. Then it's more of an initial probe of a possible future strategic partner, than a single business operation to be terminated as such.

7. Conclusion

The aim of this contribution was to investigate Scandinavian based consulting engineers' experiences using offshoring. The study is of exploratory nature and came to focus on a single case supplemented with a preliminary status of the 30 largest consulting engineering companies in Scandinavia, i.e. Denmark, Norway and Sweden. Through a literature review of offshoring in general and a compilation of studies of engineering offshoring it has been made indicative that offshoring involve significant strategic choices and are not sufficiently dealt with if understood as single project endeavours. Moreover, even within the project frame, trust, communication and proper (soft) management are important. There are indications of an ambivalent hesitation among the companies concerning offshoring. Consulting engineering firms in Scandinavia entering offshoring are suggested to exercise openness for a longer term learning and strategic engagement even if the collaboration might start and end with a single project.

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