Supply network effects of offshoring – consequences of sourcing and producing in low cost countries

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Abstract

'Offshoring' is an issue at the top of today's management agenda in most firms in the western world. Offshoring means sourcing from vendors in low-cost countries and/or producing in low-cost countries. The aim of this work-in-progress paper is to explore the supply network consequences of these sourcing and producing strategies. The paper begins with a literature review illustrating the occurrence and the variety of offshoring operations. This review is followed by empirical illustrations from three ongoing case studies of sourcing and producing operations in low cost countries. The literature review and the preliminary findings from the case studies provide the platform for a tentative framework for analysis of supply network consequences of offshoring. The paper concludes with the formulation of three broad issues for further research.

Keywords: sourcing, supply chain, efficiency, outsourcing, offshoring

Introduction

Outsourcing has been a major management issue for a couple of decades. By specializing on a limited part of an activity chain companies have been able to improve the performance of their internal activities (Quinn 2000, Ellram and Billington 2001, Kakabadse and Kakabadse 2005). In addition, many cases of outsourcing have built on transfer of activities to suppliers working on larger scale, thus making even these activities more efficient.

Currently many firms are involved in taking a second step in this outsourcing process. By changing from suppliers in Western countries to vendors in low-cost countries a buying firm might be able to reduce costs of purchased material even further. Therefore, for companies in Western Europe sourcing in low cost countries has become a strong trend in recent years as part of their global sourcing strategies (Byrne 2005, Matteo 2003, Fang and Axelsson 2005, Trent and Monczka 2005).

Many companies go even further in their attempts to benefit from economizing on low cost in other countries. They do so by moving operations from the home country to foreign countries with lower costs of labour. These operations involve for example call centers, soft ware activities and R&D (Venkatraman 2004). Moreover, manufacturing activities are today increasingly moved to other countries (Vestring et al 2005).

A common denominator for these transformations is 'offshoring' which is most often defined in the following way (Hogan 2004:75):

> Offshoring means buying from a vendor in a low-labor-cost country instead of a vendor in the US or some other high-wage country, or establishing a manufacturing operation in a low-labor-cost country that replaces a facility in the US or another high-wage country.

These efforts are undertaken mainly in order to reduce the costs of purchased materials and assembly and sometimes these cost differentials are substantial. But these advantages do not come without other economic consequences. Transportation costs will increase since the distance between buyer and supplier increases. The geographical distance to low cost sources also has consequences for supply chain co-ordination. Longer delivery lead times may also give rise to other effects such as the need for inventory investments.

It has been questioned, therefore, (i) if outsourcing has gone too far in general (e.g. Greco et al 1997, Gadde and Håkansson 2001; Berggren & Bengtsson 2004), and (ii) if the efforts in relation to low-cost country offshoring really provide the benefits they are supposed to do (Purchasing 2004).

Aim and scope of the paper

The aim of this work-in-progress paper is to explore the supply network implications of sourcing and producing in low-cost-countries. The paper begins with a literature review followed by a description of preliminary findings from three ongoing case studies of offshoring. On the basis of the review and the cases a tentative framework for analysis of supply network effects of offshoring from low-cost countries is presented, including issues for further research.

Literature review

Offshoring in terms of sourcing and producing abroad is a major strategic issue for many companies. A US study showed that more than 80% of the companies in a survey indicated that shifting activities to low-cost countries is a high priority and nearly two-thirds of the firms have launched significant off-shoring initiatives (Vestring et al 2005). Another study, by a consultancy firm, showed that the number of firms that expected to send more technology jobs overseas increased from 32% to 86% between 2002 and 2004 (Bronfenbrenner and Luce 2004). These offshoring efforts represent great variety in terms of what company operations are involved. For example, the Boeing Co has established a center for design and technical work in Russia, Proctor and Gamble has its taxes done in Costa Rica, and General Electric has built an R&D center in India with a staff of 500 people (Vestring et al, p. 29). It is

important to realize, however, that it is not only the cost advantages that direct these changes. Russia is a country with deep aerospace engineering skills. Costa Rica has a strong cadre of workers with accounting skills and the GE staff in India consists to one third of locals with doctorates. Once large firms become involved in offshoring efforts like these, the basis for division of labour may change completely. For example, China is now the the third largest R&D performer in the world (Manufacturing Engineering 2005).

This short review illustrates that there is a strong trend towards increasing offshoring activities by firms in western countries. There are obvious short-term labour costs to gain from such transformations. On the other hand, the total economic effects and other long-term consequences are less well known as illustrated by the following quote (Hogan 2004: 76):

> If you take a a careful look and calculate the total cost of offshore outsourcing, the Answer may be surprising. Oftentimes the cost benefits are calculated solely on the basis of the incredibly low labour cost. Other costs, both tangible and intangible, are rarely taken into consideration.

Similar arguments are raised by other authors. One common example seems to be that many companies overestimate the savings from going abroad since the importance of direct labour is declining rapidly in many industries (Venables 2005). The problems related to long lead times are expressed by many authors (e.g. Venables 2005, Mucha 2003, Trunick 2004). King (2005) points to issues related to risk assessment and management, arguing that the risks involved in performing critical functions in third world countries “have not been fully recognized” (ibid p. 2). Moreover, some products are in fact not suited for offshore manufacturing (Mucha 2003). For example, a couple of products of Reptron Manufacturing Services incur huge opportunity costs because their weight makes air shipment too costly in terms of actual dollars and sea shipment too costly in terms of loss of schedule flexibility. These conditions have made the company reconsider previous decisions and reevaluate these products for domestic production (ibid p. 28).

However, insourcing activities that once were outsourced is a tricky thing and associated with high costs (Hogan 2004). The main reason being that products that are offshored normally “do not have best-in-class design”, because cheaper manufacturing rates makes it possible to use a poor design. Ta take such a product back imposes great problems according to Hogan (2004), because producing it competitively requires the design to “be reworked from scratch, reducing parts and materials to compensate for higher labor rates” (ibid p. 81).

Empirical illustrations

Telecom Inc

Telecom Inc. is involved in design and manufacturing of communication devices that are produced on a large scale and sold on a global basis. The products consist of hundreds of components that are supplied by around 250 vendors from all over the world. In 2001, the company started to source two of these components from China owing to substantial unit cost differentials. These components were previously delivered by suppliers from Sweden, Denmark and some other European countries. The factors considered in the decision to source from China were product price, packaging and transportation costs. Since the product price accounts for 95% of total cost the price rationalization potential through offshoring was the main determinant of the decision.

The benefits achieved from the sourcing of the two components made Telecom decide on a more systematic approach to sourcing from China and so the company considered buying other products from 2004. Quotations from China indicated a price reduction amounting to 40-50% compared with the offerings of European suppliers. Telecom then decided to source six other products from China. The information in this case is based on a master thesis (Jian and Xuewen 2006) supervised by one of the authors of this paper.

In 2004, 80% of the volumes of these six components were supplied by Chinese vendors while the remainder was delivered by 'back-up' suppliers in Sweden. These six products and their main features in terms of price reduction, quantities, deliveries and lead times are described in Table 1.

Product type	Price reduction	Purchase quantity/year	Delivery frequency	Delivery lead-time	Production lead-time
Die-casting	Around 40-50% price reduction.	16,000 sets	Twice or three times per month	9 weeks excluding the production lead-time	2-3 weeks
Cassette		7,000 sets			2 weeks
Mechanical machining		1,200 sets			2 weeks
Cable		1,200 km			4 days
Screw		60,000 pieces			3-4 days
PCB	More than 50% price reduction	300,000 pieces	Twice per week	5 days	2 weeks

Table 1. Products subject to sourcing in China

Table 2 provides an overview of the suppliers in terms of location, start up year, port of loading and modes of transport used for the respective products.

Chinese supplier (product)	Supplier's location	Start up	Port of loading	Transport modes
Supplier A (Die-casting)	Chongqing	November 2004	Shanghai port	By truck and river in China, and by sea from China to Sweden
Supplier B (Cassette)	Chongqing	Early 2005	Shanghai port	
Supplier C (Mechanical machining)	Chongqing	November 2004	Shanghai port	
Supplier D (Mechanical machining)	Nanjing	November 2004	Shanghai port	
Supplier F (Cable)	Shenzhen	Early 2005	Guangzhou port	By truck in China, and by sea internationally
Supplier G (Screw)	Shenzhen	Early 2005	Guangzhou port	
Supplier H (PCB)	Shanghai	The year of 2001	Shanghai airport	By truck in China, and by air from China to Sweden
Supplier I (PCB)	Shenzhen	The year of 2001	Guangzhou airport	

Table 2. Telecom's Chinese suppliers and their features

Telecom has extended its offshoring operations gradually. The company has set up a facility in Chongqing in the centre of China, where around 60 persons are employed including 37 assembling workers. Some of the components are bought by this unit and assembled into larger 'systems' that are delivered to the final assembling unit in Sweden. Three of the suppliers (suppliers A, B and C in Table 2) are located in this region and handled by Telecom China. For the rest of the suppliers, all communication and deliveries are handled by Telecom Sweden. Hence, there are both direct and indirect deliveries. Products that are sourced directly, e.g. part of the PCBs that are not assembled into

larger modules, are produced in automated processes with very little quality variations and defects. For products based mainly on manual production methods the quality is checked in Telecom's Chinese facility before shipment to Sweden.

Telecom uses a logistics provider to whom all logistics operations are outsourced. This company has a worldwide coverage and is responsible for the transportation all the way from the Chinese suppliers to the Swedish final assembling unit. The services include transportation, warehousing, materials handling and logistics planning. Container shipment on boat is the main transportation mode both inland in China and across the sea.

Owing to the long lead-times, inventories have to be kept both at suppliers and the Swedish facility. In addition, the Chinese assembling facility also stock some components. Since sea transportation takes 8 weeks security stocks are required. Moreover, the volumes are somewhat unpredictable and Telecom also has to meet urgent demands. In China the inventories amount to about two months of demand of which Telecom China stocks 20% and suppliers keep the remaining 80% of inventories.

Other consequences experienced by Telecom are increasing risks and uncertainties. For example, the long lead times impose problems when it comes to facing-in new products and facing-out old ones. Moreover, many Chinese suppliers have financial problems or can foresee such problems. It is difficult for Telecom to scrutinize the financial state of suppliers since these are considered to be good at 'cooking the books'. Another problem relates to increasing raw material prices. Telecom China signs long-term contracts with suppliers with fixed prices. In spite of this, problems tend to appear when raw material prices increase, because it is not always possible for Telecom to put pressure on the suppliers concerning these conditions. Uncertainty concerning exchange rates and product quality are also offshoring consequences experienced by Telecom.

In addition the assembly operations in Sweden have been affected a lot by the sourcing from China. Over the years Telecom had put in massive efforts to make its manufacturing system 'lean'. They had adopted the common lean supply chain approaches like just in time in order to be able to reduce inventories and shorten delivery times. These principles had be abandoned when the company wanted to benefit from the low prices of Chinese suppliers. One of the representatives of Telecom actually described the changes in the inbound operations of the Swedish assembly unit as 'going ten steps backwards'.

The price differentials between Chinese and European suppliers have been reduced over time. When Telecom in 2006 make inquiries for new products from China the prices tend to be only 20-30% lower than those charged by European suppliers. Moreover, the products Telecom has been sourcing from China are now available at almost the same price levels from Swedish suppliers. Owing to these conditions the share of Chinese sourcing for these supplies has decreased from 80% to 50%. The reason behind these changes is that Swedish suppliers are sourcing from China as well.

The changes in the supply conditions make Telecom hesitate about too much involvement with Chinese suppliers. For the moment the company is not willing to make further investments in relation to Chinese suppliers since they do not want to be locked into these relationships. If price differentials continue to decrease it might be tempting to avoid the long lead times and supply uncertainty related to the sourcing operations in China.

United Rubber

United Rubber is a supplier to the automotive industry. These customers for long time have put pressure on their suppliers to seriously consider offshoring to low-cost countries. During the last year, however, these requirements have been somewhat moderated and now the cost advantages for offshoring operations are recommended to exceed 40% for such decisions to be taken.

In the spring 2006 United Rubber is involved in implementing two offshoring operations. One of these concerns the movement of assembly operations to Estonia, while the second deals with moving production to Poland. The assembly operations involve lots of manual work, which makes the cost advantages of Estonia considerable. The Estonian operations are managed by a Swedish company with its headquarter located not too far away from United Rubber. The business partner initiated its

activities in Estonia about ten years ago and in 2005 they established its own facility. The venture with United Rubber is interesting to the company because it increases the scale of the assembly operations. In addition economies of scale will appear in transportation to and from Estonia, which will benefit both companies. United Rubber is serviced once a week with supply of assembled products from Estonia and at the same time the supplier picks up components for transportation to Estonia.

On the negative side is noted that the lead-time will increase with three weeks thus affecting the capital tied up. Two weeks are required for transportation and assembly and an extra week is added for security reasons. A related problem is the increasing requirements for packages, which also ties capital. This is necessary because the assembled products have to be customer packed in Estonia.

The Polish operations concern transformation of production activities. In this case two machines are moved from Sweden to the supplier in Poland. Six machines of the same type that are used more for automated operations will be kept in Sweden. There will be no economies of scale in the machining activities in Poland since these facilities cannot be used for other operations. The cost advantages relate to savings in manual labour, which is quite substantial in this manufacturing process. Also in this case the offshore operations are conducted by a Swedish firm. And again this company is located some 100 kilometer from United Rubber, in turn implying cost advantages in transportation.

Applied Textiles

Applied Textiles is involved in fabricating textile-based products for the consumer market. The company from the beginning outsourced 'assembly' operations and sewing activities to other firms thus focusing on product design and marketing. The early reliance on Swedish suppliers was abandoned for two reasons. The first was the opportunities for reaping cost advantages in low cost countries, while the second stemmed from the fact that many Swedish textile suppliers actively outsourced their operations to other countries.

The first steps towards offshoring were taken around the new millennium together with a supplier in Rumania. These changes were undertaken at the same time as Applied Textiles' sales volume expanded substantially (about 50% yearly). By combining the resources of the Rumanian supplier and a Swedish firm Applied Textile managed to handle the pressure related to the expansion. As time passed, however, it became obvious that the cost structure of the Swedish supplier made further offshoring necessary. After careful search Applied Textile found a suitable supplier only 40 kilometer away, with its sewing operations located in Latvia. The establishment of the relationship with this supplier made it possible to close the business with the Swedish supplier.

The suppliers in Rumania and Latvia functioned well and were able to handle the continuing growth of Applied Textiles. From a strategic point of view, however, the long term ambitions of the company was to rely on a three-legged supplier base where China was considered a necessary supplement to Eastern Europe and the Baltic States. It appeared also that the relationship with the Rumanian supplier was entering a new phase. Applied Textiles used to be a prioritized relationship for the supplier, even dedicated with an exclusive line. Over time, however, large retailers like H&M were increasingly approaching the Rumanian supplier which changed its priorities. Applied Textiles could foresee future problems with the control of the operations of the supplier and started to look for alternatives in this part of the world.

The research in Eastern Europe led Applied Textiles all the way to Turkey and its well established textile industry. Firms like H&M have used suppliers in this country and contributed to the development of their capabilities. Through its international connections Applied Textile was able to identify a suitable supplier and the tests of this vendor showed that they had found an interesting business partner. At the same time the efforts to find a Chinese source continued. The first contacts were established at a trade fair in Shanghai and resulted in test runs of minor volumes proving that one of these suppliers was qualified for the sewing operations of Applied Textiles.

After these efforts Applied Textiles are using three suppliers located in different economic zones:
- China; with the responsibility for the bulk of the operations that are featured by low uncertainty
- Latvia; handling the unstable demand volumes requiring flexibility and handling of variety
- Turkey; representing a mixture of the two others, can be used both for volume and variety

The cost advantage for the sewing operations considerably favours the Chinese facility, which works at about 25% lower costs than the others. However, there are considerable costs associated with supplying this facility with fabrics. For quality reasons Applied Textile sources fabric In Europe which then needs to be transported to China. Turkey, on the other hand, is a 'textile country' in itself and is supplied through domestic sources mainly. The cost differentials in this respect, however, are less than could be expected. Owing to unbalance in inbound and outbound transportation the freight rates to China are most favourable. According to Applied Textiles it is in fact cheaper to transport textiles from Sweden to China than it is to Italy.

The dynamics of offshoring are illustrated by the long term expectations of Applied Textiles. Representatives of the company believe that within five years there will be no sewing operations left in the Baltic states, owing to increasing labour costs accompanying the closer integration between these countries and the European union.

Analytical framework

Our point of departure is that companies in their decisions to source from low-cost countries seem to apply a narrow scope when it comes to financial and economic consequences. Developing a framework for analyzing the implications for supply network effects of offshoring requires an expansion in scope and time from the actual transaction towards a perspective taking (i) total costs and (ii) impact on revenues into consideration.

The first step in this process is to expand the scope from the focus on price in the individual transaction. The price paid by the buyer is only one of the economic consequences of a business transaction (see Figure 1). Price is one of the buyer's *primary costs* for the transaction together with other acquisition costs, such as transportation costs, insurance costs etc that can be directly connected to this transaction.

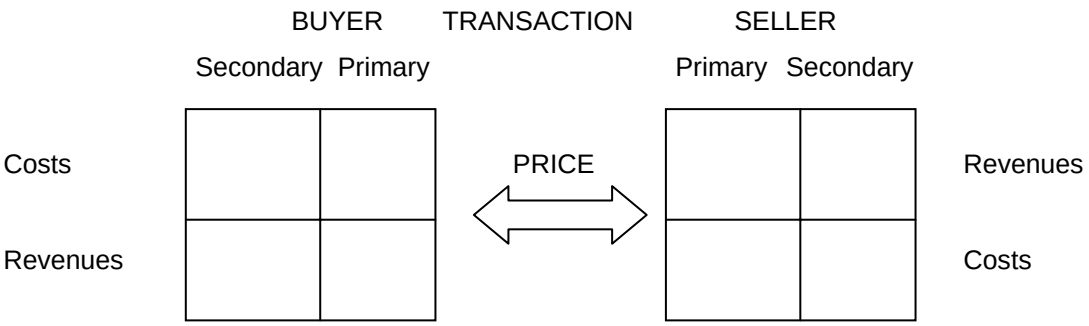

Figure 1: Costs and revenues in business transactions (Gadde, Harrison and Håkansson 2002)

Secondary costs involve those costs imposed by this transaction on the buyer's internal operations, as well as on the buyer's transactions with other suppliers and customers. It is important also to consider the impact on the buyer's revenue side. The benefits to the buyer consist of the revenues generated by operations wherein the purchased items are used. Also, here it is relevant to make a distinction between primary (direct effects for the buyer) and secondary effects. The secondary benefits include, for example, increased revenues and/or reduced costs in the buyer's transactions with other firms..

This first step of the analysis is thus to place the transaction in its relationship context. When dealing with the secondary effects the analytical scope needs to be further widened. What is going on between the buyer and supplier in Figure 1 has consequences also for the customer of the customer and the supplier of the supplier thus making a supply chain perspective relevant. Particular issues in this respect deals with the coordination of serially interdependent activities (Thompson 1967). The consequences of offshoring for supply chain coordination may be considerable. Over the last decades integration of production and logistics processes has been a top priority for most firms (see e.g. Pfohl and Buse 2000; White and Pearson 2001; Christopher and Towill 2001; Garcia-Dastugue and Lambert

2003). One of the main features of these processes is the increasing interdependence between activities owing to the reduction of inventories previously serving as buffers. Disintegrating activities and moving operations to new business partners might impose severe challenges for the functioning of these processes. Therefore, exploration of the consequences for the *activity structure* of the network is crucial for the analysis of the effects of off-shoring. Examples of issues to handle are:

- What are the the consequences of offshoring of production and sourcing with respect to:
  - Changes needed in logistics activities
  - The linkages between logistics and other activities on the supplying and using sides respectively
  - Implications for network performance in terms of costs, services, and flexibility
  - The requirements on planning systems in order to reduce vulnerability and uncertainty

For these types of analyses useful tools and concepts are provided by Richardson (1972; Dubois 1998; Dubois et al 2004). In this way the efficiency in a particular supply chain is determined by its 'internal' coordination. In addition, however, its performance to large extent is dependent on its connections with other supply chains (Christopher 1998, Gadde and Håkansson 2001). This, in turn, calls for a network view of the consequences of offshoring, thus bringing in also the resource and actor dimensions of the network.

Turning then to the *resource structure* of the network a first crucial issue relates to the requirements on the basic infrastructure for logistics. In low-cost countries this structure is normally less developed in comparison with the previous 'home-based' structure. For example, McKinsey Corporation concluded that in spite of the fact that many developing countries are improving their logistics structures considerably, problems occur when it comes to terminals and transportation vehicles that are crucial elements of the resource structure for logistics operations. McKinsey's study showed that in an Asian market around 25% of deliveries were delayed and that up to four per cent of the goods was destroyed during transportation (Dobberstein et al 2005). Efficient and effective logistics build on systematic combining of resources (Jahre et al 2006). This combining involves designing resource combinations where single resource elements are well adapted to each other. These adaptations develop through the successive recombining of resources and modifications over time of the interfaces between resource elements. A framework for analyzing resource combining in these terms is developed in Gadde and Håkansson (2006).

Offshoring to low-cost countries implies changes also in the *actor structure* of the network since it means abandoning established relationships in the current structure and the building of new ones. Also this seems to be an area where companies underestimate the requirements imposed by offshoring. For example, King (2004) argues that many companies have been surprised with negative results owing to shortcomings in this respect. To be successful in these efforts it is required that companies are aware that "close attention must be paid to everything about the client-vendor relationship, from the criteria of selecting a vendor, to the details of the outsourcing contract, to the frequent monitoring of progress, to the level of control exerted over the vendor, to the level of trust that is developed in the client-vendor relationships" (King 2004: 2). Crucial issues in the actor structure thus include the numerous investments in buyer-seller relationships to establish communication patterns, quality control systems etc. At the same time previous investments in efficient supply chain practices are made obsolete, such as just-in-time and customer order driven production systems. Managerial issues for the buyer to handle include how to link individual supply chains and especially how to align low cost offshoring initiatives with well developed buyer-supplier relationships. The analytical tools and concepts for these analyses are available in, for example, Håkansson and Snehota (1995) and Ford et al (2003).

Issues for further research

Our exploration of offshoring has shown the relevance of a network approach for analysis of the consequences of sourcing and producing in low-cost countries. Each of the three network dimensions provide its specific contribution to the understanding of the effects of offshoring. The pre-study has evoked three issues deserving further research.

First, there is a need for analysis of the offshoring decision. Previous studies indicate that these decisions tend to be taken on insufficient analysis, primarily focusing short-term financial effects, while more long-term consequences often are neglected.

Second, previous research illuminates the crucial role of the implementation phase. It seems as if companies underestimate the problems in establishing functioning solutions. Particular problems are related to the coordination between the offshored operations and those remaining within the company in the home country.

Third, there is limited knowledge of the consequences of offshoring. Enhanced understanding of these effects would improve conditions for both decision-making and implementation.

These three research issues will be guiding our further studies of offshoring.

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