Supply strategy and network effects — purchasing behaviour in the construction industry
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Abstract
Partnering with suppliers and networking are increasingly used as means to improve company performance. This paper explores the occurrence of network effects in the construction industry. Benefits from network effects arise when firms adapt to one another in terms of technical solutions, logistics or administrative routines. The study finds such effects to be unusual in the construction industry. The main reasons for the absence of adaptation are found to be the current focus on the efficiency of individual projects and the competitive tendering procedures used. It is concluded that these characteristics are having a hampering effect on both efficiency and innovation in the industry today.

Keywords: Network effects; Construction efficiency; Purchasing behaviour

1. Introduction

The supply side is of increasing strategic importance in most companies today. This change reflects a new awareness of the benefits to be gained from better utilising resources from beyond the boundaries of firms. The advantages of partnering with suppliers have been particularly emphasised (see e.g. Carlisle and Parker, 1989). Reaping partnering benefits requires a shift in atmosphere and behaviour from traditional arm's length relationships. For example, short-term focus on efficiency in the individual transaction needs to be replaced with longer-term-oriented relational exchanges based on close buyer–seller relationships. The benefits of these constellations are obtained partly from better use of individual suppliers, partly from network effects derived out of the combined efforts of a number of suppliers (Hakansson and Snehota, 1995).

The construction industry is heavily dependent on subcontractors and suppliers of building materials. One feature of this industry is “the practice of subcontracting portions of a project to special trade contractors by primary contractors” (Eccles, 1981a). For example, in Swedish construction the level of subcontracting has increased substantially over time. The three major Swedish primary contractors are good illustrations of what has been identified as “quasi-firms” (Eccles, 1981b), a trend that has increased substantially in recent years. Purchased materials and services account for about 75% of total costs in these firms. This makes construction ahead of most other industries in terms of outsourcing. However, in other industries increasing specialisation have made buying firms able to improve efficiency and effectiveness by changing the nature of relationships with suppliers. The aim of this paper is to explore how firms within the construction industry take advantage of their opportunities to make use of external resources through co-operation.

2. Supply strategy and network effects

Studies of customer–supplier collaboration have shown that major benefits may be achieved when firms make adaptations to one another (Hines, 1994; Spekman et al., 1999). Three main types of adaptation may be distinguished (Gadde and Håkansson, 1994). First, technical adaptations connect the production operations of supplier and customer. These adaptations have to do with the technical content of the products exchanged.
A customer may find it appropriate to ask a supplier to develop a product that will be a perfect fit for the needs of the buying firm, either in terms of technical content or physical features. Another form of technical adaptation is related to the material flow between supplier and customer. Sophisticated logistics systems, such as just-in-time delivery, may enhance efficiency of operations. The second type of adaptation is in administrative routines. Business transactions are characterised by a great deal of information exchange, regarding inquiries, tenders, orders, delivery notifications, invoices, etc. Adaptations in terms of integrated information systems are intended to improve the efficiency of administrative operations and bureaucracy. The third main type of adaptation is knowledge-based. In close, long-term, relationships customer and supplier develop considerable knowledge about one another’s operations. In well-developed partnerships, skills on both sides tend to be connected and not easily separable. These mutual adaptations tend to bring the firms together and have a particular significance for joint efforts in technical development.

Häkansson and Snehota (1995) present a framework for analysing the characteristics and consequences of adaptations in buyer-seller relationships. The most important dimension of a relationship is its substance. The substance stems from the adaptations undertaken. There are three different kinds of substance that connect the parties in a relationship. The first has to do with the linking of the activities of the firms. Activity links connect the production, logistics and administrative operations of the companies. The best known examples of the benefits of activity linking concern the integrated supply-chains in the automotive industry (Lamming, 1993; Hines, 1994). The second substance type relates to the resource ties between the companies. The relationship ties the resource elements on both sides. These resources may be physical facilities, such as machines and equipment, or human knowledge. Resource ties create substance that promotes joint technical development. Benefits of supplier involvement in product development have appeared in many industries (see, for example, Wynstra, 1998). The third type of substance is created through interaction between people. Actor bonds are important determinants of trust and commitment, which are, in turn, prerequisites for investments in activity links and resource ties.

The substance of a relationship also has an economic aspect. Adaptations are investments that can be used for improving efficiency in day-to-day operations, as well as for promoting development. Long-term relationships make successive refinement of activities possible. Adaptations thus contribute to enhanced performance. These adaptation effects make close customer-supplier relationships important in themselves. Furthermore, they provide links to other relationships, which can, in turn, produce even greater benefits. Therefore it is relevant to consider industrial systems as networks of connected relationships (Cook and Emerson, 1978). To an increasing extent, buying companies encourage collaboration not only with suppliers but also among them. The notion of supply networks is very much in vogue today. Long-term interaction with a network of suppliers should make it possible for a customer to stimulate mutual adaptations and thus network effects beneficial to the performance of the whole system. Eccles (1981b) observed that primary contractor–subcontractor relationships in the US construction industry are fairly stable over time. These relationships are described as “recurrent series of transactions with a small number of subcontractors” (Eccles, p. 351). In other industries these conditions have been the breeding ground of network effects.

The first research issue is concerned with the kind of relationships there are between primary contractors and their suppliers. The second deals with network effects achieved through adaptations in the supply network of a primary contractor. Researching these issues should provide fundamental insights about efficiency and effectiveness in the construction industry and increase our general knowledge about which network effects can be attained by applying specific supply strategies. As explained by Cox and Thompson (1997), most academic work in these areas has been concerned with “widget” production within controlled factory environments “where the supply of goods is merely a repeat process off a production/assembly line” (p. 128). Construction work has other characteristics. Therefore, the results of the study add to our knowledge of network effects in general.

3. Methodology and data-set

The main empirical basis of this study has been developed from a major case study examining a combined new construction and renovation project. The construction site was located in central Gothenburg (Sweden), which implied some special requirements in terms of logistics and physical distribution. For various reasons the project was under severe time pressure, which affected some of the important decisions. This study can be characterized as a retrospective case study covering a four-year period from the first planning stages through completion of the building. Most interviews were undertaken in the final stage. The first part of the data set is an extensive mapping of the suppliers, installation contractors, consultants, and other actors involved in the project. This was carried out in co-operation with representatives of the primary contractor (mainly the project leader and purchasing staff). The total cost of the project amounted to a sum corresponding to USD 10 million. All in all, the primary contractor used 14 subcontractors and 10 material suppliers.

The second part of the empirical data consists of sub-cases where the roles of five main suppliers are analysed.
Grasping the complexity of the supply processes in the construction industry required application of deep-probing methodology. The cases provide in-depth analysis of the supply chain for five selected inputs (the frame, insulation, plasterboards, windows and electrical installation). These sub-cases were developed through interviews with material producers, distributors, specialised contractors and the material producers’ suppliers. The materials were selected to represent variation in a number of respects, as illustrated in Table 1. Together the five supply chains accounted for 25% of the total costs.

Data collection was based mainly on personal interviews. A total of 27 interviews were made with 29 informants, representing 11 companies. The interviews were focused mainly on the particular construction project. However, the interviews also captured similarities and dissimilarities of the project in comparison with other projects in which the suppliers was, or had been, involved. This approach made it possible to discuss and evaluate different ways of organising supply chains and analyse the potential network effects. The interviews contained a mixture of structured and semi-structured questions and responses. A detailed, standardised questionnaire was used to collect information concerning the products and services exchanged as well as the adaptations undertaken among firms. The semi-structured questions aimed at revealing more qualitative and subtle opinions concerning the connection between the firms’ purchasing behaviour on the one hand and the corresponding network effects on the other.

The scope of this paper makes it impossible to present detailed information from the database and the cases. Instead, general findings from the study as a whole have been condensed into four different themes. The first theme deals with standardisation and adaptation in construction materials supply. The level of standardisation of activities and resources, in turn, affects the roles of the actors, which is the second theme. An actor in a network can either be specialised or broad in terms of activity scope and resource collection. The mixture of the actor structure impacts on what kind of network substance can be generated. The third theme relates to the consequences of one of the most fundamental organisational characteristics in construction: a construction project is a temporary organisation. It can also be regarded as a temporary network within the larger permanent network of the construction industry as a whole. The temporary network thus activates the permanent network in one way or another in every construction project. The way it is activated has a profound impact on the potential network effects. A particular aspect in this respect is the nature of the exchange processes applied. As mentioned, two main types of exchange can be distinguished — transactional and relational. The fourth theme of the discussion concerns conditions for substance development depending on the type of exchange implemented.

4. Theme 1: Standardisation versus adaptation

The basic research issue was to analyse the occurrence of network effects. These effects arise from the development of network substances that stem, in turn, from adaptations in the relationships. Adaptations may enhance efficiency in relationship performance. On the other hand, adaptations may lead to the kind of interdependencies some firms try to avoid. Furthermore, adaptations are always costly — they require investments of various kinds. For this reason a customer has to make a choice between adapted (customised) solutions and standardised ones.

One main finding from the study is that supply of building materials is primarily characterised by exchange of standardised products. In this project only a few customised solutions were used, the most obvious being the frame, which is more or less unique for every construction project. However, even the frame is composed of different combinations of standardised components. This low degree of customisation seems to apply to construction projects in general. It is quite unusual that material

<table>
<thead>
<tr>
<th>Products:</th>
<th>Degree of product adaptation</th>
<th>Contacts with material producer</th>
<th>Supplier active on site</th>
<th>Buyer–seller interaction</th>
<th>Co-ordination with other suppliers</th>
</tr>
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<tr>
<td>Frames</td>
<td>High</td>
<td>Direct and substantial distributor</td>
<td>Yes</td>
<td>High</td>
<td>Substantial</td>
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<tr>
<td>Plasterboards</td>
<td>None (standardised)</td>
<td>Direct and through distributor</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Insulation</td>
<td>None (standardised)</td>
<td>Direct and through distributor</td>
<td>No</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Windows</td>
<td>Mix of standardised and adapted products</td>
<td>Direct and through distributor</td>
<td>Marginal</td>
<td>Average</td>
<td>Low</td>
</tr>
<tr>
<td>Electrical installations</td>
<td>High</td>
<td>No</td>
<td>Yes</td>
<td>High</td>
<td>Substantial</td>
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producers develop products for particular construction projects or a specific primary contractor. Cox and Thompson (1997) mention some examples of adapted solutions but consider construction to be “inherently a site-specific ‘project-based’ activity” (Cox and Thompson, 1997, p. 128). The strong focus on the project and its economy entails a rather short-term perspective emphasising competitive bidding as the main tool in supplier evaluation.

Consequently, customer–supplier relationships in construction are generally of the arms-length type rather than being partnerships. This finding is in accordance with Cox and Thompson (1997) who concluded that competitive tendering assures that sub-contracting is “procured to the lowest-price supplier with little or no guarantee (or even incentive) to future work” (Cox and Thompson, 1997, p. 129). Making use of the price mechanism in this way requires that the buying firm refrains from adaptations to individual vendors and relies on standardised solutions. At first glance this standardisation may seem confusing since a construction project is characterised by a “unique combination of input factors required to complete the project” (Eccles, 1981b, p. 338).

Stinchcombe (1959) observed the strong reliance on standardised products in a comparison of the construction industry and the automobile industry. He argued that mass production is dependent on standardised tasks while construction projects are characterised by utilisation of standardised parts. This means that the uniqueness of the particular building must be created at the construction site, resulting in situations where “operative decisions are still very important at the work level [...] modifications of tools for special purposes is done by workers” (Stinchcombe, 1959, p. 182). In addition, Gann (1996) analyses similarities and dissimilarities between industrial housing and car production in Japan. A major finding is that manufacturing principles derived from the car industry have been successfully used to produce customised homes. But, there are limits to which such techniques can be applied to manage the assembly of wide varieties of components and parts. Managers must trade off the need to achieve economies of scale in the production of standardised factory parts with economies of scope in various stages of assembly (Stinchcombe, 1959, p. 437).

A huge number of actors are involved in the modifications and adjustments at the construction site. Shirazi et al. (1996) found the main characteristic of construction organisation to be the co-ordination of specialised and differentiated tasks at the site level (p. 209). Therefore, the interaction between the actors tends to be quite intense. Their joint efforts are mainly focused on developing solutions to problems in the particular project. Where development of resources and activities for purposes other than the specific project is concerned, however, the interaction is apparently limited. This finding is in accordance with Hellgren and Stjernberg (1994), who found that “activities are orientated towards responding to problems usually in ways that could be described as seeking the simplest and most straightforward solution” (Hellgren and Stjernberg, 1994, p. 167). Modifications at the site can be onerous and costly, in many cases so costly that the savings gained from competitive tendering are more than outweighed by cost increases at the construction site. Love et al. (1999) have analysed the occurrence and consequences of reworking in construction.

The lack of attention to quality by the design consultants was costly in time and money to all parties in the supply chain. For example the site management typically spent up to 30–35 hours a week for the first 10 weeks of the project checking the architectural and structural drawings to ensure that dimensions etc. coincided with one another. When errors were found the designers had to typically re-design and re-schedule the necessary elements.

(Love et al., 1999, p. 8)

The conclusion of this discussion is that the resource ties between the resource collections of specific firms tend to be weak in the design phase of a project since adapted solutions are seldom developed. A similar pattern has been identified regarding activities and their inter-linkage. Most activities are integrated through fairly standardised links, which also seem to have been established as norms and common routines for the entire industry.

The low level of customisation, however, does not imply that manufacturers of materials have avoided adaptations to customer requirements. On the contrary, very few other industries are so entirely devoted to a specific, homogeneous group of customers. In comparison with industries such as the steel and wood industries (characterised by substantial end-user heterogeneity) the difference is clear. Standardised products and systems have been developed over time, partly through interaction among the actors in the construction industry, partly as a result of norms and rules laid down by government authorities. In this way the construction industry is characterised by certain ‘collective’ adaptations. Thus, there is great similarity between the product offerings of different suppliers, both in terms of product features and in terms of price and other commercial conditions.

The general pattern is thus that activities in production and distribution are standardised rather than customised, but in parallel to this pattern a slowly increasing trend towards customisation can also be observed. According to Cox and Thompson (1997) there is growing interest among actors in the UK construction industry in developing collaborative relationships. They state that partnering has gained popularity. Similar observations are reported by Baden-Helland (1995), Bennet and Jayes (1995), Cox (1996) and Dorée (1997). So far these efforts have not been very successful, although “the search for
more collaborative contractual relations has become a contemporary theme in the construction industry” (Cox and Thompson, 1997, p. 129). Similar tendencies were observed in this study. Both the plasterboard case and the insulation case provide insights into the benefits that can be reaped from using customised materials. In both these cases different kinds of prefabricated solutions have been developed. They illustrate that, in some situations, performance is enhanced when activities are moved from the site backward in the supply chain.

Adaptations in the construction industry are typically collective and project specific rather than relationship specific. A particular feature of these collective adaptations is strong reliance on contracts. However, according to Thompson et al. (1998), most standard forms of contracts actively encourage non-collaborative behaviour. Rather than being a mechanism to unite buyer and seller “the contract was being used as a wedge to drive distance between them” (Thompson et al. p. 36). Contracts thus impact on the degree of standardisation as well as on the role of the actors.

5. Theme 2: Specialisation and role of actors

According to Eccles (1981a, p. 449) two prominent characteristics of the construction industry can be identified. The first is “the organisation of the production work force into a variety of trades”. The second is “the practice of subcontracting portions of a project to special trade contractors by primary contractors”. These characteristics are related, and Eccles shows that specialisation of industry is an important determinant of subcontracting. As mentioned above the construction industry is, in general, characterised by a substantial degree of specialisation.

In terms of the role of the actors, however, the situation is somewhat different. The division of labour among the actors varies greatly from project to project and the role of an individual firm can be very different depending on the project. The cases showed that the contractual form chosen for the project is an important determinant of the organising of actors and, accordingly, of the division of labour in the design and implementation activities.

Clients may choose to subcontract activities such as purchasing of installations and materials to a primary contractor. Sometimes, however, clients prefer to take on these activities within their own regime. In doing so, they may outsource the co-ordination of the activities on site either to an installation contractor or a material supplier (in this study the frame producer was an example). Primary contractors are also faced with a number of different roles. They may use their own workforce on the site, or they may subcontract the activities to various trade specialists (bricklayers, plumbers, etc.).

Installation contractors sometimes only install, but they may also be responsible for designing the systems to be installed. The design work may then be undertaken by their own personnel or purchased from consultants. Moreover, there is some overlap between different types of installation contractors. Some of the activities on site affect the systems of several installation contractors (e.g. joint solutions for cables, tubines and pipes). Therefore, one installation contractor might take on activities that are undertaken by another contractor in other circumstances. Consultants may be assigned by various actors, e.g. clients, primary contractors or installation contractors. Depending on which assignment they are engaged in the purpose and direction of their activities may change.

Manufacturers of materials often supply standardised components only (as in this case). Through prefabrication they may also take on or replace activities that are otherwise undertaken on site. Manufacturers are also involved in physical deliveries — a service normally handled by distributors. Sometimes the materials producers’ personnel are engaged in assembling activities on site, for instance when specific skills are required. Finally, distributors are involved in other activities than physical distribution. Sometimes they are responsible for materials supply at the construction site. Distributors are also active in certain forms of pre-fabrication and customisation, such as cutting of materials into specific lengths.

The main conclusion from this discussion is that the roles of the different actors are characterised by substantial variation. This also means that their roles are somewhat diffuse. The activity scope of an individual actor tends to be broad, including design, production and distribution in various combinations, which may also vary between different projects. In fact, Hellgren and Stjernberg (1994) have observed that “many actors may be partners with one another in some respects and competitors in others” (p. 166). The industry as such is characterised by specialisation in different sub-trades. In spite of this, individual firms seem to have quite a low degree of specialisation. One important determinant is the contractual form that determines the roles of the contractors. This, in turn, may be the result of the extensive use of tendering procedures in the procurement process.

There are certain consequences regarding potential network effects owing to these characteristics. One observation is that tasks in projects seem to be divided into functional disciplines that operate quite independently. The actors develop their own objectives, goals and value systems without considering the impact on others or the effects on project performance (Love et al., 1999, p. 1). Furthermore, the contractual form determines the roles of the actors. However, the main role of the contract does not seem to be to co-ordinate the operations of the various actors. According to Cox and Thompson (1997)
the standard forms of contracts are “nothing more than instruments used by the parties to seek strict liability and attach blame to events as they occur” (Cox and Thompson, 1997, p. 132). The authors argue that when such contracts are linked with the prevailing adversarial culture the parties are easily led away from trust towards self-interest.

6. Theme 3: The network within the network

The most significant characteristic of the construction industry and the construction process is the project organisation which has been described as a “temporary multiple organisation” (Cherns and Bryant, 1983). The organising of actors and the contractual forms applied have profound effects on the division of labour in design and implementation, as well as on the roles of the actors. The impact of the project organisation, however, is even more far-reaching.

In the foregoing section it was mentioned that one effect of the prevailing division of labour is that two firms may be both partners and competitors. Within a specific project, however, the situation is very different. In the project the actors involved are partners in a larger context, the common objective being to erect a specific building within a set time frame. When the project network has been established it seems that the requirements of the project and the partners become even stronger than those emanating from the firms. The interdependence within the project organisation tends to be strong, while it is quite weak among the firms in the permanent construction network.

Therefore, it may be appropriate to consider a project as a specific temporary network within the permanent network. In Fig. 1 firms A, B and C are involved together in a construction project. They provide input in terms of people, equipment and other resources (A1, B1 and C1). At the same time A, B and C are involved in other projects. The characteristics of the construction process as presented above then imply rather strong interdependencies among the activities and resources of A1, B1 and C1. None of these actors will be able to fulfil its tasks without the support of the others. Therefore, throughout the project, co-operation between A1, B1 and C1 must be strong to handle the interdependencies. For the people from A involved in this project the relationships with people in B and C seem to be more important than those with other people in A. In fact, the relation between A1 and A2 may even to some extent be competitive if these require the same resources at the same time.

Two major reasons seem to explain the strong interdependence in the project. First, as discussed above, substantial adjustments have to be undertaken on site. In addition, the bulk of products delivered are standardised. Therefore, the participating actors need to interact and compromise extensively to be able to make the necessary adjustments. The second cause of interdependence is related to time. In most construction projects there are severe time restrictions. For some projects time is clearly the dominant restriction.

The conditions observed in this study seem to be relevant to construction projects in general. According to Eccles (1981b) time is an important determinant of the unique input factor combination of individual construction projects. The need for adjustments is also affected by “unpredictable site conditions”, and Eccles concludes that “on-site production exposes the production process to environmental conditions” (Eccles, 1981b, p. 338). The uncertainties posed by these conditions are taken as arguments for extensive use of subcontracting (Eccles, 1981a, b). However, they may also be relevant in explaining the need for interaction and adjustments among the subcontracting firms.

This section on “the network within the network” has brought up two important issues for further discussion. The first is related to the fact that there are two network layers to consider when network efficiency is to be analysed. One layer is the “permanent” network of actors and resources. The other is the temporary network formed around each construction project. The project net-
work activates resources in the permanent network to perform the activities required for completion of the building. According to our observations the permanent network is characterised mainly by standardisation in terms of products and routines and, consequently, a low degree of interdependence among individual actors. In the project network, on the other hand, there is a substantial degree of interdependence and a consequent need for intense interaction among the actors. Both network layers impact on the efficiency of a project. The permanent network imposes restrictions regarding the way it can be activated. Within these limits, however, many different alternatives are available.

A number of authors have argued that more co-ordination among the firms in the permanent network would enhance productivity and performance. Love and Gunasekaran (1998) advocate concurrent engineering as a means for improving development processes. Agapiou et al. (1998) illustrate the benefits of logistics management and conclude that these systems need to be based on “partnering-type” arrangements (p. 136). Low and Mok (1999) studied a construction project where just-in-time principles were applied. The case study shows that it is possible to apply various just-in-time techniques to improve productivity at the site. The main problems concerned the roles of suppliers and subcontractors. The authors conclude that it takes long time to develop a long term and trusted relationship with a supplier “who is able to cater from all the needs of the company, including numerous meetings, committees and staff other than those in the purchasing department” (Low and Mok, 1999, p. 667).

The second issue concerns the complexity of individual projects as well as the construction industry in general. The resources of a firm are simultaneously activated in a number of projects. Both resources and activities therefore need be co-ordinated. Four dimensions of co-ordination can be identified in Fig. 1. First, individual projects must be co-ordinated — that is the co-ordination between A1, B1 and C1. Second, each firm has to co-ordinate its activities and resources among the different projects in which the firm is involved (A1, A2, etc.). According to Kornelius and Warmelink (1998) a main problem for contractors “lies in the fact that many of its participants work in several projects simultaneously, and set their own priorities regarding the use of capacity and/or materials” (p. 201). Third, some activity and resource co-ordination takes place on the firm level, i.e. between A, B and C, and is thus not related to specific projects. Finally, co-ordination is needed between these sub-contractors and their suppliers, for example supplier C and supplier D. This study showed that the most prominent co-ordination dimensions are the project level and the firm level. The relationship level has not attracted as much interest as in other industries, but would merit further exploration.

7. Theme 4: Relational exchange versus transactional exchange

One of our main findings is that transactional exchange is the dominant form of business in the construction industry. Thompson et al. (1998) made similar observations and concluded that the business exchange tended to be contractual rather than relational. Furthermore, Gann (1996) found that management of supply chains in traditional craft housing production are often “typified by market-based, short-term interactions between independent businesses” (p. 445). The underlying reason for this is the heavy reliance on tendering procedures. Supplier competition in each transaction is assumed to be the most appropriate means of securing efficiency in operations. However, competitive tendering has other effects as well. The prevailing procedures guarantee that the actor constellations change all the time, making it difficult to utilise experience gained in previous projects. According to Cox and Thompson (1997) this “creates particular cost inefficiencies for the client as a new learning curve is climbed by the supplier each time” (Cox and Thompson, 1997, p. 128). It is always argued that each construction project is unique. It should be observed, however, that this uniqueness develops to some extent because of the purchasing behaviour of primary contractors. According to our findings the focus on individual projects and competitive tendering makes each project far more unique than is necessary.

The supply strategy chosen thus clearly present contractors with certain drawbacks. In spite of this it has a very strong foothold throughout the industry. Purchasing behaviour based on arm's length relationships is supposed to make it possible to take advantage of the "market forces". However, there is some doubt as to whether this is really the case. Most supply "markets" show few signs of being real markets, because in many cases only a few suppliers are available. Furthermore, the network as a whole is burdened with substantial costs for playing the market. The prevalent tendering procedure represents considerable sunk costs owing to the huge number of hours spent on design, planning and calculations that are never used. Some of our informants stated that, on average, they are able to win one tender out of 10. In one way or other the costs of the remaining nine have to be paid for. Other firms estimated that they spend between 4 and 7% of their turnover on tendering. In addition, market mechanisms may be appropriate when there are no interdependencies among the solutions applied, but in construction solutions from different suppliers have to be adjusted and combined into specific buildings on every occasion. Owing to this interdependence, products cannot be developed and exchanged independently.

There is a strong connection between how companies buy and what they can buy. In a long-term perspective it
is important to recognise that purchasing behaviour determines product development and innovation (Araujo et al., 1999). Strong reliance on standardised products and standardised interfaces between firms clearly does not foster technical development. When standardised products are used in a context where interdependence among them prevails this problem is accentuated. Therefore, it is not surprising that the only traces of product development found in this study were related to the input side of the material producers. The raw materials used for two of the products (plasterboards and insulation) had been changed considerably — without any impact on the functionality of the products. Such changes can be undertaken without problems since the manufacturing of materials is independent of the rest of the construction process. As long as the standardised interfaces are not affected the content of the products can be changed. On the other hand, changes impacting on the interfaces to other products used on site would necessarily require adaptations by other firms and are therefore avoided. Therefore, it is most likely that current co-ordination mechanisms hamper product development. On the other hand they provide benefits in other respects. Kornelius and Warmelink (1998) discuss the general development of industry towards specialised firms and “virtual corporations”. Their conclusion is that industry in general will have no choice but to evolve co-ordination mechanisms “similar to those that have existed in construction for long time” (p. 200).

In the construction industry thus the co-ordination of projects is emphasised while co-ordination among firms is left to transactional exchange. Focusing on one single dimension of efficiency while neglecting others may cause problems because some aspects of relevance for total efficiency are never considered. Torvatn (1996) discusses the importance of system limitations in general. He argues that problems tend to appear when certain system boundaries are chosen and then used for too long time. Kreiner (1995) points out the danger of a one-dimensional view, stating that “the fact that projects occupy only a bracket in time and thus have neither history or future, allows evolutionary processes little scope for improving performance” (p. 345). In a similar way Uzzi (1997) highlights the need for alternative units of analysis. His main argument is that when using the relationship as the unit of analysis the focus is shifted from the qualities of the transaction to the qualities of the relationship.

Recently a number of studies have pointed out the need for variety in supplier relationships. Spekman et al. (1999) observed that “not all suppliers are treated equally, nor should they be” (p. 114). Bensaou (1999) found that firms balance a portfolio of different types of relationships rather than relying on one type. In the same vein Dyer et al. (1998) advise firms to avoid a “one-size-fits-all” strategy for procurement, and advocate supplier segmentation. Variety in relationships is important because customers can make use of different skills and capabilities of their suppliers, and cope differently with different interdependency situations. This is of particular importance where embedded networks are concerned. It is interesting to observe the differences between the prevailing type of exchange in the construction industry and the sample of 22 supply chains in five selected industries studied by Spekman et al. (1999). They conclude that “true supply chain partners have abandoned their unilateral, win–lose perspectives and advocate an approach that favours mutual gain, shared value and total system costs” (Spekman et al., 1999, p. 113). However, the main managerial conclusion of the authors is that different contexts demand different types of exchange. They argue that “some supplier relationships are still best managed as an ‘open-market’ exchange” (Spekman et al., 1999, p. 114). What seem to be exceptions in other industries thus tend to be the norms in the construction industry.

If the potential benefits of different types of relationships were recognised by primary contractors the prerequisites for adaptations and development of network substance would be considerably enhanced. Efforts to increase involvement with suppliers should encourage co-operation among suppliers as well. In a study of learning effects in a construction project it was shown that the extent of firm learning was highly correlated with the existence of connections between different relationships (Hakansson et al., 1999). However, the importance to unlearn the old habits has also been stressed. Shammas-Toma et al. (1998) analysed the obstacles to implementation of total quality management systems in construction. Their main recommendation is “to unlearn the habits of competitive tendering, to take a holistic view of the process which is at odds with the current situation where a set of fixed and finite requirements is expected to be passed from party to party in the delivery chain” (p. 189).

8. Concluding discussion

The aim of the study was to analyse the occurrence and consequences of network substance in the construction industry. For this purpose it was found appropriate to make a distinction between two network layers — one permanent and one temporary. The permanent network is characterised by long-term recurrent exchange of products and services among a limited number of firms. However, relationship adaptations in terms of activity links and resource ties still seem to be negligible in comparison with other industries. The implication is that there is little network substance to benefit from. This has also been observed in the UK construction industry where the conclusion of one study is that the firms “traditionally paid very little attention to the relational elements of business transactions” (Thompson et al., 1998, p. 36).
In the temporary network, on the other hand, co-ordination is substantial. The activities on the construction site require massive interaction among the actors. The adjustments and modifications undertaken provide huge opportunities for joint learning. These conditions should provide a breeding ground for network effects. This study discovered seeds of network substance in terms of jointly adjusted solutions that facilitated work for several parties on the site. However, there is little benefit gained from this shared learning as long as relationships are confined to the duration of the individual project. This observation is also in accordance with findings from UK construction (Thompson et al., 1998), the main reason being that the constellation of firms involved in a temporary network does not have joint plans beyond the project.

The conclusion of the study is that the prevailing focus on transactional exchange hampers the development of network substance both in the permanent and the temporary network. Increasing reliance on relational exchange would enhance conditions for adaptations among firms in the permanent network. Customised products and services could improve both efficiency and innovation for all actor categories. Firstly, adapted solutions would reduce the need for adjustments thus increasing efficiency of site operations. Secondly, customised solutions would stimulate development of differentiated offerings. Increasing relational exchange would impact on the temporary network as well. This type of involvement implies that firms recognise joint plans beyond the individual project. If they do so, it is likely that they will find ways to make better use of the incipient of network effects that appear in the temporary network.

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