FEATURES OF ALTERNATIVE FORMS OF INTERMEDIATION – A CASE FROM THE CONSTRUCTION INDUSTRY

Work-in-Progress paper

Abstract

This paper deals with features of alternative forms of intermediation, illustrated by a case from the construction industry. Three intermediation principles are identified. Firstly, *market exchange* with conditions of exchange of standardized products, short-term focus and independent businesses. Secondly, *cooperation* with suppliers, thus moving from arm's length relationships to closer collaborations. The third form, *industrialization* captures opportunities to reduce massive adjustments at the construction site and move these activities into a more industrialised environment. The analysis shows that the forms of intermediation applied have significant consequences for the performance of industrial operations. Each type of intermediation provides its particular impact, depending on the way activities, resources and actors are connected. However, none of the intermediation approaches is superior to the other. What is perceived as the 'best' alternative depends on the particular situation of the company. This analysis must take the whole network into consideration and identify how other actors, resources and activities are impacted in the three situations. Furthermore, most companies are likely to use a combination of the three intermediation principles.

Keywords: intermediation, construction, market exchange, cooperation, industrialization

INTRODUCTION

Network structures change continually. Firms with new capabilities and resources enter and existing actors may become less significant. Technical development makes new activity arrangements feasible and changes the logic for the division of labour and affects the nature of business relationships. These dynamics have been identified as modifications in the principles for 'intermediation' in the business landscape (Sundquist and Gadde, 2010). Changing conditions may make established structures more or less obsolete and thus favour disintermediation of current compositions, which are then replaced by new structures modified through re-intermediation. Basic principles for such intermediation cycles are discussed in Chircu and Kauffman (1998) and empirically illustrated through studies in the PC-industry (Morris and Morris, 2002), electronics (Shunk et al., 2007) and the health care sector (Eysenbach, 2007).

This paper deals with intermediation in the construction industry. In recent years considerable efforts have been made in order to "stimulate radical improvements in the construction industry in terms of value for money, profitability and reliability" (Beach et al., 2005:611). The underlying reason for these actions is a general opinion that construction is characterised by "inefficient business processes which feed through as overheads to total project costs" (Bresnen and Marshall, 2000:230). One particular criticism is that firms in the construction industry have failed to adopt recent managerial principles that have improved performance in other industries. While other businesses have moved towards collaborative relationships and customisation, the construction industry features exchange of standardised products (Cox and Thompson, 1997) often "typified by market-based, short-term interactions between independent businesses" (Gann, 1996:445).

The aim of this paper is to analyse some central consequences of this form of intermediation and make a comparison with alternative principles for intermediation.

THREE INTERMEDIATION PRINCIPLES

The dominant form of intermediation in construction is best characterised as *market exchange*. Three basic conditions of this approach are mentioned above: standardised products, short-term focus and independent businesses. All these features reflect a striving for efficiency since the ambition is to avoid the classical perception of the problems inherent in dependence on individual business partners. Such dependence is generally supposed to impose risks in terms of transaction uncertainty, constrained technological flexibility and reduced opportunities to play the market (see, for example, Gadde and Hakansson, 2001). The short-term focus follows from the emphasis on decentralisation of responsibility to individual projects, which favours a narrow perspective on efficiency in both time and scope. This form of organising makes competitive tendering a relevant mechanism for business exchange since the approach assures that the supply of building materials is secured at the lowest price possible (Cox and Thompson, 1997). An important consequence of market exchange intermediation is that the standardised supply must be adjusted to the local conditions at each construction site. Therefore, it is claimed that construction is "inherently a site-specific project-based activity" (Cox and Thompson, 1997:128), which requires substantial coordination and interaction (Shirazi et al., 1996). The 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).

Over time this intermediation logic has become increasingly questioned. The 'inefficient business processes' mentioned in the Introduction tend to manifest in "cost overruns, late deliveries, conflicts, quality problems, claims…" (Crespin-Mazet and Portier, 2010: 230). It is generally claimed that construction has been slow to adopt land-winning approaches introduced in other industries, such as just-in-time deliveries, quality management, customised solutions and supply chain management. These business processes call for inter-organisational cooperation – an alternative form of intermediation that has been advocated in the last decade under the 'partnering' label. The underlying principles of partnering with suppliers in construction, outlined twenty years ago (CII, 1991), show clear similarities with the high-involvement relationships described in the industrial network literature (e.g. Gadde and Hakansson, 2001). Cox and Thompson (1997) identified a growing interest in partnering among many firms in the UK construction industry. In the following decade a huge number of studies have analysed the state-of-the art of partnering in various firms (for a substantial overview of this literature – see Bygballe et al., 2010). However, "despite great interest, efforts to implement the partnering concept in the construction industry are yet to yield the positive effects that have occurred in other industrial contexts" (ibid. p. 239) and the authors conclude that prevailing views and practices in construction actually contradict the original intention with partnering. Partnering is obviously difficult to combine with short-term interaction and competitive tendering which tend to foster adversarial relationships (Bresnen and Marshall, 2000). Another explanation is to be found in the 'project-based mind-set' that leads to an "overly narrow project focus that constrains the process" (Ingirige and Sexton, 2006:521). Since these conditions are central features of construction it is unlikely that full-fledged partnering will get a strong foot-hold in construction in the near future (Gadde and Dubois, 2010). For this reason the authors conclude that a differentiated approach to partnering is required, involving various forms of supplier-client cooperation to improve conditions on the supply side of companies. Reorientation of purchasing and supply are identified as important means of overcoming performance problems in construction. For example, Wood and Ellis (2005:31) claim that it is necessary to apply "radically different approaches to procurement", while Naoum (2003:71) associate problems with construction efficiency to "failure of traditional procurement methods". Moving from arm's-length relationships to closer collaboration with suppliers is thus a strategic opportunity for firms in construction and therefore we identify *cooperation* with suppliers as the second approach to intermediation.

The third form of intermediation is derived from opportunities to reduce the massive adjustments that are necessary at the construction site. Moving some of these activities from the site to a more industrialised environment would affect the conditions for intermediation. Such rearrangements would impose that "the building site will change from being a place of traditional craftsmen's work into a place of assembly" (Byfors, 1999:17). This is only one of the arguments for increased industrialization of construction. Other benefits of this approach are expressed as "rationalization of tasks along a production line, specialized tooling and handling equipment, better quality control and bulk purchasing of raw material due to the single delivery point" (Richard, 2005:444). Furthermore, "on-site production exposes the production process to environmental conditions" (Eccles, 1981:338) which can be avoided through increased industrialization. Other advocates of this approach are Maas and Gassel (2005) and Girmscheid and Scheublin (2010) who provide a substantial state-of-the art review. The idea of industrialization is not new. For example, it has been applied in house-building in order to improve performance in three respects: increasing economies of scale, improved technical possibilities to develop and deploy capital equipment, and enhanced opportunities for managerial control (Gann, 1996). Some of the goals with these arrangements have been to reduce the reliance on craft practices and to maximise the use of equipment. However, according to Gann (1996) there is little systematic evidence of the overall gains resulting from prefabrication of components and system building. The ambition to apply car production techniques and management in house-building was not as successful as expected since "housing producers need to cope with wider degrees of flexibility relating to customer choice, regulatory environments and local site conditions" (Gann, 1996:448). Therefore, industrialization of construction never materialised in the way expected. However, as mentioned above, there is again a claim for increasing factory work at the expense of site activities. Thus, the third form of intermediation is concerned with *industrialization* of construction activities.

The above exploration identified three forms of intermediation. The current emphasis on market exchange was supplemented with two alternative forms. The first of these takes the point of departure in the relationship with suppliers and is based on more involvement with individual business partners under the label of cooperation. The second form aims at moving activities from the construction site to an industrialised context. In order to achieve potential benefits in terms of economies of scale this approach requires the construction firm to take on these activities rather than relying on suppliers and sub-contractors. In this way industrialization is often combined with insourcing of activities.

AN INDUSTRIAL NETWORK APPROACH TO INTERMEDIATION

Analysis of intermediation and re-intermediation requires a holistic perspective since these actions impact on the whole network. Often intermediation has been concerned with the connections between firms, for example, the presence and absence of middlemen in distribution channels. But, as discussed by Gadde and Ford (2008), the role of intermediaries and middlemen in business exchange is a function of the resources they can access and the activities they are able to conduct more efficiently than two other businesses can do by themselves. Therefore, a thorough analysis of intermediation must consider the connections in all three network layers, i.e. connections between resources, between activities and between actors. For the analysis of intermediation in construction we rely on a framework suggested in a paper at the previous IMP-conference (Sundquist and Gadde, 2010). The space does not allow for a full description of the framework. Below we outline the main issues in intermediation in each of the three network layers.

Intermediation in the *activity layer* is concerned with how one specific activity connects to other activities. This connection is critical for the efficiency of whole activity structures since "the execution of any activity is dependent on other activities" (Hakansson et al., 2009:96). This dependence takes two forms: serial and parallel. Serial dependence occurs because some activities have to be undertaken in a specific order. Such activities are identified as 'complementary' activities (Richardson, 1972) and puts some specific constrains on the composition of activity structures and thus on intermediation. In cases where a particular activity results in an end-customer specific feature the serial dependence is identified as 'closely complementary'. This is the case for just-in-time deliveries and build-to-order production which require substantial coordination of related activities. Another issue related to intermediation in the activity layer is concerned with the efficiency in the undertaking of individual activities. This efficiency is strongly contingent on the economies of scale of the activity which in turn depends on its resource exploitation. The concept to apply in this analysis of so called 'parallel dependence' is 'similarity'. Two activities are similar when they rely on the same resource for their undertaking (Richardson, 1972).

Intermediation in the *resource layer* is highly significant for network performance since "the value of a resource is dependent on its connection to other resources" (Hakansson et al., 2009:71). The types of connection between resources are identified as 'interfaces' (Hakansson and Waluszewski, 2002). Interfaces take different forms owing to the actual combining and adaptations among resources. Adaptations improve the joint performance of two resources since the two will fit better together. Intermediation among resources is particularly critical since it affects how resource heterogeneity can be exploited. A resource can be exploited without adjustment which leads to standardisation and economies of scale, in turn minimising heterogeneity. On the other hand substantial adaptations may occur, resulting in differentiated exploitation. A crucial issue in resource intermediation is therefore to balance the trade-off between standardisation and differentiation (Hakansson et al., 2009). The actual interface between resources impacts not only on capacity utilisation and heterogeneity exploitation. Moreover, the way resources are connected determines the evolution over time of the features of the individual resources (Hakansson and Waluszewski, 2002).

The *actor layer* in the network is central for intermediation since the interaction among actors is a prerequisite for successful coordination of activities and combining of resources (Hakansson et al., 2009). Interaction takes place in connected business relationships that evolve over time and determine the position of each actor in the wider network context (Ford et al., 2003). This content is defined as the substance of a relationship and contains the social and organisational bonds between the two actors, the ties among their resources and the links between their activities (Hakansson and Snehota, 1995). From an actor layer perspective two issues in intermediation are important. The first is concerned with the positioning of the actor in the activity and resource layers, i.e. what activities to conduct within the firm and what resources to control through ownership. The second issue regards the relationship between the focal firm and those undertaking connected activities in the division-of-labour and controlling resources that needs to be accessed.

In summary the crucial issues for exploration with regard to intermediation are the following:
Activities: coordination; interdependence; efficiency; similarity and complementarity.
Resources: combining; interfaces; adaptations; standardisation and differentiation.
Actors: connecting; position; relationships; division-of-labour.

EMPIRICAL STUDY

The aim of this study is to compare the central features and consequences of three forms of intermediation identified above. Grasping the complexity of this evaluation calls for a holistic perspective and in these situations case studies are considered the appropriate approach (Eisenhardt, 1989; Dubois and Araujo, 2007). We needed thus some building materials where all three forms of intermediation can be observed and selected reinforcing bars for the case study. Reinforcing bars are fundamental in almost any construction project whether it is concerned with house-building, roads, civil engineering projects or other types of infrastructure. The amount and type of reinforcing bars are specified on drawings. Steelworks produce and deliver long steel bars (normally 8m or 12m). Before they can be used in the actual application they go through cutting and bending to get the appropriate dimensions regarding measures and profiles. Some dimensions are very common whereas others are quite rare. Standards are determined in terms of stress tolerance since the bars function as bearing elements in various constructions. In addition, reinforcing bars may have to be stainless or acid tolerant.

The case study involves a construction company that decided to set up its own factory for cutting and bending of reinforcing bars. The objective was to increase the efficiency in these operations in comparison with adjustments at the construction sites. In addition, savings were expected in procurement since long bars now could be supplied directly from steel works rather than from wholesalers. Moreover, previously some cutting and bending had not been possible to undertake at the site so these activities were conducted by the steel service centre of a wholesaler. Also here cost reductions were expected owing to the elimination of the wholesaler. This means that intermediation regarding reinforcing bars can be analysed in three situations with diverse conditions: cutting and bending can be undertaken: (1) at the construction site, (2) in the steel service centre of the wholesaler, or (3) in the factory of the construction firm. The location of the cutting and bending operations (C&B) will impact on other activities (such as transportation), on the resource utilisation and on the relationships between actors.

Data has been collected mainly by site visits and interviews at the head quarter of the construction firm, at the reinforcing bar factory and at a pile factory, which is supplied with components from the reinforcing bar factory. In addition, secondary data such as brochures, flow charts etc. have been used.

CENTRAL FEATURES OF THE THREE INTERMEDIATION FORMS

The main characteristics of the three situations are described in Figure 1.

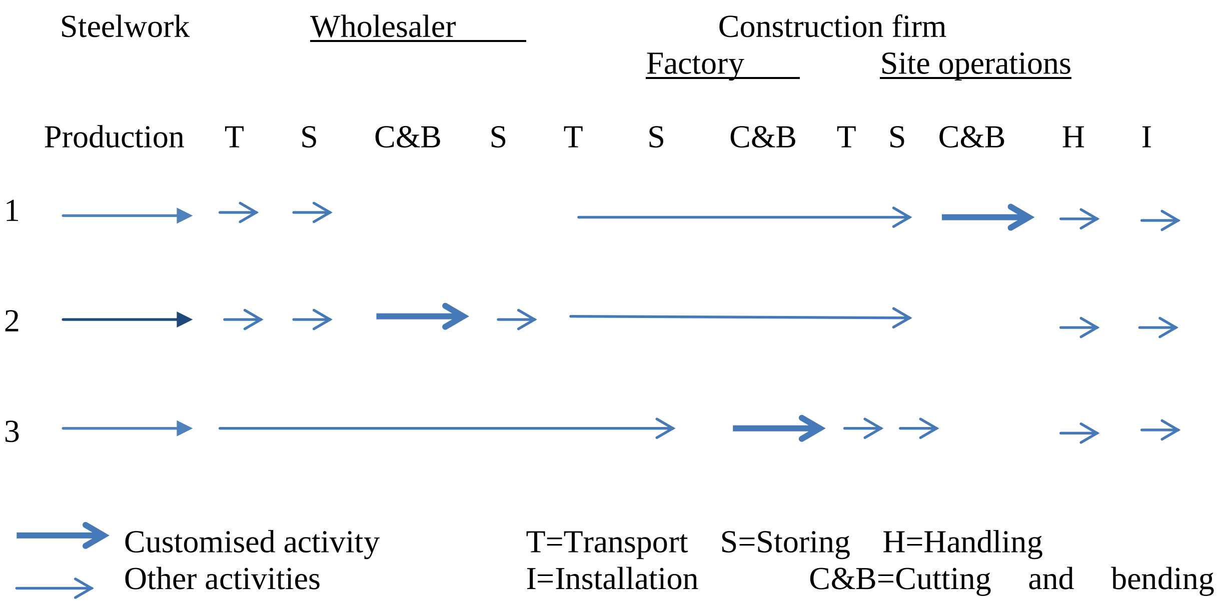

Figure 1. Main characteristics of the three situations of intermediation.

Situation 1: cutting and bending at the construction site

Long steel bars of 8 or 12 meters are produced by steelworks. In situation 1 these bars are bought, transported and stored by the wholesaler and then transported from the wholesaler to construction sites and stored there. Transportation of steel bars is problematic because of the length of the bars and a special vehicle is needed. In some cases roads have to be closed off for other traffic since the transport takes up so much space. The long bars can seldom be delivered at one point in time, since this would require too much space at the site. In situation 1 cutting and bending take place at the construction site, which means that a work station has to be set up. Large space is needed for this machinery and for storing the long steel bars and the adjusted reinforcing bars. Constructions sites are often very crowded and it is difficult to find space for such arrangements. Moreover, cutting and bending at the site produces a lot of waste which is problematic in terms of costs, sustainability and handling. The building crane at the site has to be used for moving incoming bars and finished bars which constrains the utilization of the crane in other applications. In addition the movement of the heavy machinery to and from the site is problematic. Usually cutting and bending is undertaken when workers have time for these operations. The finished bars are either installed immediately or held in stock until they are needed.

Situation 2: cutting and bending in the steel service center of the wholesaler
Situation 2 implies that the production of long steel bars at steelworks, and the transportation and storing of these by wholesalers are exactly the same as in situation 1. But in situation 2 cutting and bending are undertaken in the wholesaler's steel service center. The adjusted reinforcing bars are then stored until they are transported to the construction sites. This situation concerns what is labeled 'ready-to-install' reinforcing bars (ILF). At the site adjusted bars are stored until they are handled for installation. The price of ILF is higher than the price of long steel bars. On the other hand working hours are saved at the site and waste is reduced. Normally the wholesaler is responsible for keeping stock at the site and make sure that ILF is available when needed. Also in this situation the total volume of reinforcing bars must be split and delivered at several occasions to avoid overstock at the site. Delivering ILF to constructions sites is less complicated than transport of long steel bars, since reinforced bars have been cut into shorter lengths and the ILF is bunched in packages. Either the vehicle can have a crane for unloading of bars or the building crane at the site is used.

Situation 3: cutting and bending in the factory of the construction firm
Also in the third situation long steel bars are produced by steelworks. These bars are purchased by the construction firm and transported to its factory. Steel bars are standardized commodities, supplied by several competing firms, and featured by considerable price fluctuations owing to demand and supply conditions. When prices are low, large volumes of steel bars are purchased by the construction firm and then stored in the factory. The construction firm is responsible for the transportation of the steel bars into the factory where cutting and bending are located. Extensive production planning is required, and orders from various construction sites are combined in order to improve the utilization of the capacity of machinery and reduce set up times for alternative measures and profiles. Planning is also needed to minimize waste in the cutting and bending operations. Central agreements have been settled that direct all purchases of reinforcing bars to the factory. Adjusted bars are then transported to the sites, through a mix of owned vehicles and services provided by transportation firms. These operations are coordinated to enable co-loading and reduce the frequency of transports into sites. At sites, bars are stored until handled and installed into their particular applications. Reinforcing bars with special features, such as being stainless or acid tolerant, are purchased from the wholesaler, stored in the factory and then transported to the construction sites together with the reinforcing bars adjusted in the factory.

ANALYSIS

In the *activity layer* steel-making; cutting and bending; handling; and installation are serially dependent and have to be undertaken in this specific order. Thus, these activities are complementary in the same way in all the three situations. However, the points where the series of activities become closely complementary (performed specifically for a single customer) are different. In situations 1 and 3, cutting and bending are undertaken on the basis of an individual customer's order, implying that the following activities are closely complementary with cutting and bending. In situation 2 the point of close complementarity is located in the wholesaler's store and it is the following transportation activity that directs the reinforcing bars to the respective customers and sites. Also with regard to similarity and economies of scale the situations differ. At the construction site, cutting and bending takes place when 'there is nothing else to do'. Hence, in this situation there is no strong attempt to benefit from similarity among activities; instead the actual need at that point of time is directing the undertaking of these activities in terms of measures, profiles and quantity. In the steel service center of the wholesaler and in the factory the intention is to keep the machines for cutting and bending running, with few stops and little waste of material. This is accomplished by coordination through production planning and combining of orders (at the wholesaler from several customers, in the factory from several construction projects). These arrangements increase similarity among cutting and bending activities for the various end-users, which in turn leads to enhanced performance. The steel service center of the wholesaler enjoys greater economies of scale than the factory. The wholesaler serves many customers in comparison with the factory and the steel service center is used also for other types of prefabrication of steel. The same logic applies for transportation of reinforcing bars in situation 3, from the factory to construction sites: bars that are aimed for the same site are co-loaded and transported together, thus achieving efficiency gains from enhanced similarity of activities. The wholesaler in situation 2 also relies on the same basic principle. Despite this fact some transportation activities feature low similarity for individual orders. It is very important to plan the deliveries of ILF (from wholesalers or the factory) so the right product is available at the right time at the construction site.

Concerning the *resource layer* in the three situations the machineries for cutting and bending can be used for different measures and profiles. The demanded features and the interfaces of the resources are quite standardized, although there is variation in the utilization of these resources. By undertaking cutting and bending at the construction site, any adjustment can be made in accordance with the specific situation at the site, for instance additional bars can easily be adjusted if this is needed. However, there is a trade-off between these opportunities for adaptations and the economies of scale that can be gained from more standardized resource utilization. In contrast, the resource utilization at the steel service center of the wholesaler and in the construction firm's own factory are characterized by greater similarities and thus enhanced economies of scale than the operations at the sites. The wholesaler is mainly producing for stock which implies limited differentiation in relation to individual customers. In the construction firm's factory orders from various sites are combined for cutting and bending in an attempt to achieve high utilization of the capacity of these machineries. In this way differentiation to individual customers' needs directs this resource utilization. Regarding reinforcing bars with special features, such as stainless or acid tolerant, only the wholesaler can achieve the required economies of scale since many of its customers demand these features. The building crane is an important resource at any construction site. The utilization of this equipment differs in the three situations. When reinforcing bars are made at the site the crane has to be used for unloading of long steel bars, for carrying bars to the machineries and also for carrying finished bars from the machineries to be placed in stock or for installation. In the case of ILF, either from the wholesaler or the factory, the crane is needed only for unloading packages of ILF from vehicles, and placing finished bars in the store or for installation. Thus, less crane capacity is needed at the site when ILF is used. Since the crane is often simultaneously needed for carrying out many tasks at the site, this is one of the benefits when using ILF.

Regarding the *actor layer* the position of the individual actor is determined by its connections in the activity and resource layers. When bar adjustments are made at the construction site the activities are controlled by the decentralized project organization. In this situation the economy of the individual project is emphasized. Intense coordination of activities is required at the construction site since the operations needed for the reinforcing bars must be coordinated with numerous other activities in order to fulfill the project task at the site. When activities related to reinforcing bars are moved from the construction site into an industrialized context, as represented by the steel service center of the wholesaler or the construction firm's factory, the activity structure is controlled by the central organization of the construction firm. In this way staff at the construction site can focus on installation and thus become more specialized. This is an advantage since construction workers normally are involved in a multitude of activities requiring different capabilities. Buying ILF from one wholesaler improves the efficiency of purchasing activities since central purchasers can be more professional because also they are specialized. In addition, the concentration of purchases to one specific wholesaler increases the opportunities for joint development of reinforcing bars. Moreover, in this alternative the construction firm is not at all involved in adjustments of bars which is also a dimension of specialization. In the third situation, the construction firm is engaged in centralized adjustments of bars. Running such large scaled operations seems to be outside the current core competence of the construction firm. The three forms of intermediation thus provide their specific conditions for the division-of-labour among the actors involved.

The differences in the activity layer are mirrored in the resource layer and manifest in diversity in resource control and the combining of resources. For example, adjustments at the site require the building crane resource to be combined with numerous other resources since it is utilized for many operations. Outsourcing of adjustments from the site will thus free this resource for other tasks. On the other hand, the third situation with an in-house factory calls for considerable investments in new resources and requires a continuous attention to the technical development of these resources. The main benefit in comparison with adjustments at sites is the improvements in the scale of activities. The least resource demanding alternative is when ILF is purchased from the wholesaler. At the same time this form of intermediation provides the construction firm with almost no direct resource control.

The position of the firms in the activity and resource layers impact on the connections in the actor layer and thus on the relationships among firms. In situation 1 the most important relationships are the ones between people in the project organizations at sites and their respective suppliers. In general these relationships are quite distant since the buyer prefers freedom from close relationships to enable exploitation of market forces in each purchase. In the specific project, however, there is intense interaction with the wholesaler in order to coordinate the activities at the site. In this alternative there is no contact between the construction firm and the steelworks, since the wholesaler serves the construction firm from its warehouse Also in situation 2 the wholesaler is responsible for the relationships with steelworks. In this case there is much more involvement between the construction firm and the wholesaler. This cooperation takes place at two levels. On the one hand the central organization of the construction firm is involved with the central organization of the wholesaler for discussions of the long term business including specific product adaptations to the needs of the construction firm. The second form of involvement is the same type of project based coordination that was discussed for situation 1 above since the cutting and bending at the steel service center of the wholesaler has to be linked with handling and installation at the specific construction site. In situation 3 there is no relationship between the construction firm and the wholesaler. Instead purchasers at the factory are in direct contact with steelworks. In this case the construction firm has to negotiate prices, be responsible for transportation etc. for long steel bars. There is also a critical relationship between the factory and the various sites. The construction firm needs to establish resources for the coordination between the cutting and bending activities at the factory and the handling and installation at sites. In this case intensive interaction is needed to connect the internal activities and resources in the factory with those of the steelworks and the construction sites.

CONCLUDING DISCUSSION

The above analysis shows that the forms of intermediation applied have significant consequences for the performance of industrial operations. Each type of intermediation provides its particular impact, depending on the way activities, resources and actors are connected. The 'market exchange' approach residing in situation 1 is clearly advantageous when it comes to opportunities for adaptations in relation to the unique conditions of each construction site. At the same time it requires intense interaction at the construction site and lacks the economies of scale featuring the other approaches. The 'cooperative' approach of situation 2, based on increasing involvement with a specific wholesaler, is the most cost efficient one since the wholesaler works at largest scale. By consolidating various purchases to this counterpart the construction firm may even further reduce supply costs through joint logistics arrangements. On the negative side, this approach makes the buyer dependent on a particular supplier which obviously contrasts traditional perspectives on efficiency in this industry featured by strong emphasis on competitive tendering. The 'industrialization' approach of situation 3, manifested in the factory of the construction firm, reduces the problems perceived in relation to powerful counterparts and secures the availability of reinforcing bars irrespective of market conditions. Moreover, this investment enables large-scaled purchasing through direct contact with steelworks. One problem with this insourcing approach is that the construction firm extends its operations outside their previous core competence which impose new requirements.

The above discussion indicates that none of the intermediation approaches is superior to the other. What is perceived as the 'best' alternative depends on the particular situation of the company. This analysis must take the whole network into consideration and identify how other actors, resources and activities are impacted in the three situations. Furthermore, most companies are likely to use a combination of the three approaches. For example, 'our' construction firm relies heavily on its own industrialized factory, but this supply strategy must constantly be supplemented by the other forms of intermediation. The cooperative approach is necessary for the reinforced bars that require specialized treatments (available only from the wholesaler in focus) and procurement of standardized bars from the warehouses of wholesalers are necessary since each construction project calls for minor adjustments to the particular conditions at the site that are not always possible to foresee.

This is an ongoing study and data collection will continue with interviews of additional actors to capture their positions and perspectives. In this way, principles of intermediation can be further explored regarding different features, including implications for individual actors and the network as a whole.

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