

# CHANGING SUPPLIER-CUSTOMER INTERFACES IN DESIGN-CONSTRUCT CONTRACTS?

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It is often proposed that by bridging the gap which so far has been common between design and construction, productivity and innovation can be increased. Therefore, experimentation with innovative, integrated contract forms has been carried out. In such contracts, the focus is on changing the interfaces between clients and contractors; however, they also open up for the possibility of changing interfaces between contractors and their suppliers. With the framework by Araujo *et al.* (1999) regarding supplier interfaces as the point of departure, we investigate the changes in supplier-customer interfaces between manufacturers of prefabricated concrete elements and their customers in the Netherlands. We identify three types of interface profiles: traditional, innovative and balanced, and we suggest that suppliers may benefit from continuously monitoring and purposeful managing their customer interface profile.

Keywords: Dutch policy, integrated contracts, relationships, procurement, strategy.

## INTRODUCTION

In several European countries, there is ongoing experimentation with innovative forms of procurement. In some countries, the government has taken the initiative to stimulate the use of new procurement forms. In other countries, private parties have taken the lead in bringing about change in procurement. In the Netherlands the program 'Innovative Procurement' was initiated in 2000 and will run till 2005. This program aims at changing the contractual arrangements used by public clients. In particular, it has spurred a change from traditional design-bid-build contracts to innovative forms such as 'Public-Private-Partnerships', 'DesignConstruct', 'Performance Contracts' and 'Building Team'. It was expected that new, innovative forms of procurement could lead to e.g. closer co-ordination of design and realization which, in turn, could contribute to substantial savings in terms of time as well as costs; development of better innovative capabilities of contractors; and long-term improvement of efficiency and effectiveness in the construction industry (IBO, 1999). As reported in Boes *et al.* (2002), several public projects have been procured according to the 'Innovative Procurement' program with DesignConstruct being the most widely used form of innovative procurement. These new procurement forms are primarily aimed at changing the relations between client and contractors, but they may also change the relations between contractors and their suppliers, which may be (come) responsible for the design and/or engineering of a specific part of the construction. The purpose of this paper is to: (1) investigate which types of relations there are between contractors and their suppliers and which changes, if any, have come about as a result of the

Innovative Procurement programme and (2) identify factors which may help us explain and understand the possible changes of relations between contractors and their suppliers.

## THE MAIN LOGIC OF INNOVATIVE CONTRACTS

The reasoning underlying innovative contracts is that

*“the client uses as much as possible of the knowledge, creativeness and skills of the tendering firms. Extending the degrees of freedom, generates process and product innovations, combined with allocation of risks to the most suitable party, better efficiency can be created” (Boes et al., 2002).*

This means that increased efficiency as well as increased innovation is seen as possible to gain from dividing and co-ordinating design and construction activities among companies in new ways. The dividing of activities among firms has been discussed for centuries since Smith (1776) suggested that efficiency as well as innovation could be boosted by an extensive division of labour. Later, the coordination of divided activities has been paid increasing attention, and many different analytical frameworks have been suggested for analysing and understanding how activities are (and may be) divided and coordinated across the boundaries of companies. Until the 1950ies, two main co-ordination forms were discerned: firms and markets. Competitive markets were assumed to coordinate the outputs of firms by means of the price mechanism. Firms, on the other hand, were increasingly recognized as useful when the costs of using the price mechanism were too high (Coase, 1937). Especially, when there were uncertainty regarding the possible future use and value of resources, it was argued that co-ordination inside a firm was superior to that of markets (cf. Coase (1937) and Alchian and Demsetz (1972)). Later on came the recognition that a third co-ordination mechanism might exist. This mechanism was coined co-operation (Richardson, 1972), quasi-integration (Blois, 1972), quasi-firm (Eccles, 1981) or business relationships (Håkansson (ed), 1982). What all these mechanisms have in common is that they focus on a type of co-ordination across firm boundaries that do not consist of buying and selling amounts of goods with fixed properties, only. The recognition that a type of co-operation – or more dense co-ordination - across firm boundaries may be beneficial has lead an increasing number of researchers to investigate *how* co-ordination was made across firm boundaries and *why* such co-ordination is beneficial.

Although the latter type of co-ordination mechanism has increased in recognition during the last decades, the former two types have not been abandoned. Competitive markets are still seen as useful for co-ordinating some types of exchanges between buyers and sellers – especially the infrequent exchange of standard products in small amounts. Similarly, firms are still seen as a useful mechanism for enabling specialization and development of distinctive capabilities. Hence, what has changed is the (now obsolete) view that there are only two distinct types of co-ordination mechanisms to consider. In particular, it is now widely acknowledged there are alternative ways of co-ordinating activities across firm boundaries. This, in turn, implies that the issue of *how a firm should access and use the capabilities of other firms* has increasingly been scrutinized. A company may be related to many different sorts of other firms acting in the roles of suppliers, customers, competitors etc. This means that the issue of accessing the capabilities of other firms can be related to many different types of counterparts. One type of counterpart, which increasingly has been

singled out as important to reconsider a firm's access to, is suppliers. The importance of suppliers has been stressed, for example, due to increasing specialization and a higher share of purchasing costs of turnover (Gadde and Håkansson, 2001). Within the field of purchasing and supply management, different types of supplier relationships have been identified as useful mechanisms for using the capabilities of suppliers. In this paper we focus on one such contribution on 'Managing Interfaces with Suppliers' by Araujo, Dubois and Gadde (1999) that pays particular attention to different ways a company can use its suppliers and their capabilities, and the different benefits associated with these.

## MAIN THEORETICAL BASE

Araujo *et al.* (1999) focus on two issues: (1) where the boundaries of a company are situated in relation to its suppliers and (2) the nature of these boundaries. Where the boundaries of a company are situated relates to issues of make-or-buy – i.e. which activities does a company carry out and which does it leave up to its suppliers. The nature of the boundaries concerns how the company co-ordinates its activities with the activities of other companies – in other words, how a company accesses the capabilities of its suppliers. Araujo *et al.* (1999) pay particular attention to the *nature* of the boundary between a customer and a supplier and, in particular the nature of the boundaries related to the objects of exchange: products. They term such boundaries *interfaces* and suggest that it is useful to distinguish between four types of supplier interfaces: standardized, specified, translation and interactive.

### Standardized interface

A standardized interface implies that the customer buys a standard product from the supplier. Such standard products may be either (1) products which comply with *de jure* standards such as BS, DIN, CEN etc. (2) products which comply with *de facto* industry standards, or (3) products which comply with the supplier's company standard. In any case, the "*supplier does not need to know about the user context nor does the customer need to understand the producer context*" (Araujo *et al.*, 1999, p.499). The customer chooses among the standardized products of the supplier, and no technical or organizational adaptations are required between the two companies regarding the features of exchanged product – only logistical adaptations are possibly made between the two companies regarding where, when, and how much of the product should be exchanged.

### Specified interface

A specified interface implies that the customer buys a customized product from the supplier and that the customization is based on the customer giving the supplier quite detailed technical "prescriptions regarding the characteristics of the product and/or how it is to be manufactured" (Araujo *et al.*, 1999, p.499). In a specified interface, the customer directs the supplier on the basis of its knowledge of how the product is going to be used, and the supplier does not need to know anything about the context in which the customer will use the product. However, if the customer also (partly) prescribes how the product is going to be produced, the customer (may) need(s) to have some insight into the production capabilities of the supplier. In any case, the degrees of freedom of the supplier are limited by the detailed specifications made by the buyer.

**Table 1:** The four types of interface

Involved in/carries out detailed design/engineering of product for a particular exchange?	Customer		
	No	Yes	
Supplier	No	Standardized interface	Specified interface
	Yes	Translation interface	Interactive interface

### Translation interface

A translation interface implies that the customer buys a customized product and that the customization is based on the customer's functional specifications (or a reference design) and how the supplier translates these into detailed technical specifications that it uses for producing the customized product for the customer. This implies that the main functionality of the product is described on the basis of the customer's knowledge of the context in which it is going to use the product, but that the supplier knowledge of the context in which the product will be produced is used when translating the functional specifications into technical specifications. In this case, the degrees of freedom available to the supplier are increased and so are, supposedly, the ability of the supplier to capture economies of scale and scope.

### Interactive interface

An interactive interface implies that the customer buys a customized product and that the customization is based on "open-ended dialogue based on how the buyer and the supplier can join their knowledge of user and producer contexts and develop the specifications together" (Araujo *et al.*, 1999, p.499). Whereas the three former types of interfaces require none or only one of the counterparts to have (some) insight into the context of its opposite number, an interactive interface requires that the counterparts have enough insight into each other's capabilities in order to enter into a dialogue on how the capabilities of both parties can be beneficially used. Hence, an interactive interface requires that the counterparts are, or become, partially familiar with each other's capabilities and contexts, and that the counterparts are willing to use time and efforts on relating these to one another. The assumed benefits from an interactive interface are increased efficiency but, in particular, that innovation may (also) come about across the companies' respective specializations.

Based on the discussion of Araujo *et al.* (1999) it seems possible to develop a matrix in which the four types of interfaces are placed according to whether or not the customer and/or the supplier is involved in the detailed engineering of a product (see Table 1).

In Table 1, the four types of interfaces appear as quite distinct types. However, in reality they may be (and often are) overlapping, i.e. it may be difficult to classify concrete empirical examples on the basis of the categorization. For example, if a customer buys a standard product which is adapted to the customer in a marginal way – as when a product is pre-cut to fit the customer but all other features of the product remains unchanged – and when the customer and the supplier have brief direct contact with each other regarding the length/width/height of the product, do we classify this interface as standardized, specified, translation, or interactive? Therefore, it is important to recognize that an exchange may contain elements of all four types of interfaces and therefore, that the classification of an exchange will depend on which of the four types is most predominant. Such classification difficulties are, naturally, inherent in all types of classifications that rely on identification of polar types instead

of the continuum in between the poles. In other words, whether a product is classified as standard or customized, whether interaction is classified as absent or present, and whether counterparts are classified as having no or comprehensive insight into each others capabilities will (often) depend on which aspects are put into focus and which point of reference is used by those making the classification.

Araujo *et al.* (1999) focus on the four types of interfaces from the point of view of the customer. Consequently, the implications they give and the suggestions they make relate to the customer – i.e. which benefits in terms of efficiency and innovation can a customer reap from having different types of interfaces to suppliers. Firstly, they argue (1999, p.505) that all four types of interfaces may be beneficial for a customer in terms of productivity, but that benefits for the customer in terms of innovation rise the more interaction there is between the parties and/or the more degrees of freedom are allowed to the supplier. Secondly, they suggest (1999, p.505) (1) that a customer needs a variety of supplier interfaces, (2) that a customer should consider that it may be beneficial to change supplier interface type over time, and (3) that a customer should continuously monitor and purposefully manage supplier interfaces.

## PURPOSE AND METHODOLOGY

The framework by Araujo *et al.* (1999) forms the point of departure for our investigation of DesignConstruct contracts. One main reason for choosing this framework is that its four categories are in alignment with the types of interfaces that are considered in relation to DesignConstruct contracts. That is, the standardized interface and the specified interface correspond to the traditional types of procurement in construction which supposedly can be avoided by DesignConstruct contracts; the translated interface and the interactive interface correspond to the innovative types of procurement which should be enabled by DesignConstruct contracts. With the framework as the theoretical point of departure, we focused our empirical investigation on the interface between contractors and suppliers of prefabricated concrete elements. Furthermore, as opposed to Araujo *et al.* (1999) who focus on interfaces from the point of view of the customer, we investigated the interfaces from the point of view of the supplier. Thereby, we can now, more precisely, formulate the purpose of the research underlying this paper as to: (1) investigate which types of interfaces suppliers of concrete prefabricated elements have to their contractor customers and if/which changes have come about as a result of the Innovative Procurement programme and (2) identify factors which may explain the (possible) changes of interfaces. These issues were addressed on the basis of (a) our general insight into the Innovative Procurement Programme, (b) literature search related to changing relationships between companies in the construction industry, (c) unsystematic observations related to changing interfaces between clients, contractors, technical subcontractors and suppliers in the Netherlands, Norway and Denmark, (d) a systematic qualitative study of five Dutch suppliers of prefabricated concrete elements. The latter study was carried out by a master student under supervision of both authors and consisted mainly of personal interviews with representatives of five of the main manufacturers of prefabricated concrete elements in the Netherlands. In table 2, the five manufacturers are described along a number of the dimensions, which initially were considered useful for understanding the companies and their interfaces. For more details on the empirical investigation see Mulder (2003).

**Table 2:** Description of the five prefab concrete manufacturers

<b>Manufacturer</b>	<b>Type of customers, % of turnover</b>	<b>Focus on sub-sector</b>	<b>Engineering, Technology Development and/or Product Development</b>	<b>Co-operation with contractor inside company group</b>
Firm A	Contractors 98%, Clients 2%	No focus	Engineering	Occasional
Firm B	Contractors 85%, Clients 15%	No focus	Engineering Technology development Product development	N.A.
Firm C	Contractors 100%	Housing and other buildings	Engineering by external company Technology development	Occasional
Firm D	Contractors 60%, Clients 40%	Infrastructure	Engineering	N.A.
Firm E	Contractors 80%, Clients 20%	Housing and other buildings	Engineering by sister company	Occasional

**Table 3:** The manufacturers' customer interfaces and roles

<b>Manufacturer</b>	<b>Type of Interface</b>			<b>Interface and Role</b>		
	<b>Standard</b>	<b>Specified</b>	<b>Translation</b>	<b>Interactive</b>	<b>Traditional</b>	<b>Innovative</b>
Firm A	10	40	40	10	50	50
Firm B	4	1	75	20	5	95
Firm C	10	50	10	30	60	40
Firm D	0	80	10	10	80	20
Firm E	0	50	30	20	50	50

\* all numbers within the table are percentages

## RESULTS AND ANALYSIS

Firstly, it was crucial to get an overview of the types of interfaces the supplier had to their customers. Having provided the informants in the different companies with the different definitions of the four types of interfaces, and having discussed the different types of interfaces with the informants and how changes had occurred in relation to the 'Innovative Procurement' programme, the informants were asked state how large a percentage of their turnover was related to each type of interface. Since it was important that the percentages could be compared across companies, we paid particular attention to possible differences among informants' interpretations of the four types of interfaces. By asking the informants to describe actual projects in which the different interfaces had been employed, we tried to ensure that interpretation differences were kept to a minimum. The results appear from Table 3 (column 2-5).

Firstly, we can observe that none of the manufacturers of prefabricated concrete elements had only one type of customer interface. All had three or four types of customer interfaces and did not specialize in one type of interface and consequent role regarding design. Secondly, we can observe that there is a widespread variety among the firms' interface profiles – i.e. the percentages of the different interfaces differ

across the companies. For simplicity's sake, we joined the four types of interfaces into two types: (a) interfaces and roles which comply with the traditional forms of procurement and (b) "innovative" interfaces and roles which comply with the new forms of procurement where suppliers participate in the design and/or engineering process (see row 6-7 of table 3). Doing so enabled us to identify three different profiles regarding customer interfaces that we coined: Traditional, Balanced and Innovative. With these results from the study, and our general insights into the subject matter, we were able to construct table 4 (overleaf) which contains characteristics and descriptions of the different ways in which suppliers of prefabricated concrete elements at present handle interfaces to customers. From table 4, we can observe a number of aspects related to the three different interface profiles (or specializations). Firstly, it appears that different profiles are associated with different views regarding 'benefits of creative interfaces and roles'. Companies with a *traditional interface profile* stress the necessity of being able to play innovative roles in addition to the traditional roles - however; they seem to play such roles reluctantly. Furthermore, the companies' emphasis on production efficiency and economies of scale make them stress the interruptions of the planning of production and engineering work that the innovative roles bring along. Companies with this profile tend to view the Innovative Procurement programme as an experiment which will probably not revolutionize the relations between suppliers and customers in the Dutch construction industry - hence, it is not essential to embrace the new types of interfaces and roles. Companies with a *balanced interface profile* also stress production efficiency and traditional roles but, at the same time, they appear genuinely interested in (also) fulfilling the innovative roles. Such roles are regarded as challenging and important for the companies' technological development - but the companies find it too risky to mainly focus on the innovative roles. Instead, the companies stress the importance of the cross-fertilization between the traditional interfaces and the innovative interfaces. Companies with a balanced interface profile tend to view the Innovative Procurement programme as an experiment which may change some of the relations between suppliers and customers in the Dutch construction industry - hence, it is important for the company to gain some experience with the new types of interfaces and roles. Companies with an *innovative interface profile* have chosen to specialize in the new roles. They seem to embrace DesignConstruct contracts and envision the future according to the ideas underlying the Innovative Procurement programme. Furthermore, even in traditional design-bid-build contracts such suppliers often, in cooperation with a contractor, offer alternative designs to the clients. Secondly, and in accordance with the interface profiles, the companies explicitly aim at developing new capabilities. Whereas companies with a *traditional* interface profile have not focused on developing new capabilities, and companies with a *balanced* interface profile aim to improve their design and engineering skills quite incrementally, companies with an *innovative* interface profile, on the contrary, have taken an active stance towards the development of new capabilities. They have invested in organizational changes and hired new types of employees with capabilities that support the carrying out of the innovative roles.

**Table 4:** Customer interface profiles

<b>Interface Profile</b>	<b>Focus on</b>	<b>Benefits of innovative roles</b>	<b>Challenges with innovative roles</b>	<b>Capability changes</b>
Traditional	<ul style="list-style-type: none"> <li>- Mainly traditional roles</li> <li>- Production efficiency</li> <li>- Status quo</li> </ul>	<ul style="list-style-type: none"> <li>- Enables creation of distinctive capabilities</li> <li>- Pleases the customer</li> <li>- Acquire projects where new roles are required</li> </ul>	<ul style="list-style-type: none"> <li>- Higher uncertainty and risks</li> <li>- Difficult to achieve steady capacity utilization of design department</li> </ul>	
Balanced	<ul style="list-style-type: none"> <li>- Traditional as well as innovative roles</li> <li>- Production efficiency and some development</li> <li>- Reactive behaviour</li> </ul>	<ul style="list-style-type: none"> <li>- Enables creation of distinctive capabilities</li> <li>- Enables influence on design and manufacturability</li> <li>- More challenging and more freedom</li> </ul>	<ul style="list-style-type: none"> <li>- More responsibility</li> <li>- Higher bidding costs</li> <li>- Higher uncertainty</li> <li>- More risks</li> <li>- More difficult timing and production planning</li> </ul>	<ul style="list-style-type: none"> <li>- Some focus on maintaining and improving design and engineering skills</li> <li>- Learning how to trust</li> </ul>
Innovative	<ul style="list-style-type: none"> <li>- Mainly innovative roles</li> <li>- Effectiveness and technological innovation</li> <li>- Proactive behaviour</li> </ul>	<ul style="list-style-type: none"> <li>- Enables creation of distinctive capabilities</li> <li>- Involved in, and captures, more 'added value'</li> </ul>	<ul style="list-style-type: none"> <li>- Higher uncertainty and risks</li> <li>- Higher bidding costs and higher complexity of projects</li> <li>- Requires that people in the company learn to think differently</li> </ul>	<ul style="list-style-type: none"> <li>- Employment of new employees with skills in risk analysis, risk management, and project management</li> <li>- Developing skills for cooperation and partnerships</li> <li>- Creation of separate product development department</li> </ul>

Although we did search for factors which might be able to explain the possible (lack of) changes of interfaces between suppliers and customers, we were not able to come up with any which corresponded with the interface profiles we identified. That is, even if some factors correlated with the profiles – such as ‘occasional co-operation with contractor inside the company group’ and ‘balanced interface profile’ – we could find no causal relation between the factors. Hence, on the basis of our present data and analysis, we are not able to explain the emergence of the different interface profiles.

## CONCLUSIONS, IMPLICATIONS AND FURTHER RESEARCH

The research and results presented in the present paper are but a first attempt at increasing our awareness and understanding of changes which, at present, are taking place in the relations between companies in the construction industry and, consequently, in the companies *per se*. Therefore, the results are preliminary and may primarily be used as one point of departure for further research and theorizing on the



issue of changing inter-company interfaces. However, we put forward that, in particular, the following issues may be considered in future research.

The Innovative Procurement Programme has resulted in changing interfaces between clients and contractors; however, interfaces between manufacturers of prefabricated concrete elements and their customers have, so far, not changed radically. At present the innovative interfaces coexist with traditional types of interfaces. However, it is possible to discern three different customer interface profiles, which represent different 'strategies' as to how suppliers of prefabricated concrete elements relate to the changes envisioned in the Innovative Procurement Programme. This means that, at present, there seems to be three different specializations in, respectively, traditional interfaces, innovative interfaces and a mix of traditional and innovative interfaces. Only the specialization in innovative interfaces seems to be accompanied by more radical development of, and investment in, new capabilities. It is naturally too soon to draw any firm conclusions regarding the types of interfaces suppliers of prefabricated concrete elements may develop to their customers in future. Over time, the present mix of interfaces may change into less or more specialization. Such changes, in turn, may be a consequence of if and how the Innovative Procurement Programme is used in the period of its duration and what happens after its expiration. In the longer term, it may or may not be advantageous to be unspecialized i.e. 'stuck in the middle'.

Naturally, the preferences of clients and contractors influence, which interface types, will be used in the Dutch construction industry. However, suppliers (of prefabricated concrete elements) may benefit from considering more explicitly which types of interfaces it wishes to engage in – that is, if it intends to specialize in traditional interfaces or innovative interfaces, or if it aims to engage in a broad range of interface types. Until the Innovative Procurement Programme was instigated, suppliers did not have the opportunity to 'choose' among a number of different interface types. However, this situation has changed and we suggest that by paying more attention to the fact that a choice is possible to make is beneficial for a company – some direction must be chosen, at least of a period of time. Development of new capabilities in support of the new interfaces implies investments and uncertainty, and suppliers may benefit from considering whether or not they are willing to make such investments and learn to operate with new types of uncertainty. At present we have no basis for suggesting if being specialized or unspecialized in traditional or innovative interface profiles is a strength or a weakness. Therefore, we propose that further research should address – empirically as well as theoretically – the benefits, which may be captured from different types of interface specializations. Of particular interest would be to investigate such benefits in different contexts, for example in different sub-sectors of construction, in different national contexts etc. Until further knowledge has been gained we suggest that suppliers ought to continuously monitor, analyse and purposeful manage their interface profile.

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