Subcontracting and innovation in the construction industry
The increasing importance of the orchestrating function

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Summary
Offshoring and outsourcing of production are hot issues in the current policy debate. In fact this trend is not new but is simply the consequence of continuing national and international specialisation which contributes to an increase of (labour) productivity and therefore to economic growth. This article shows, in a case study for the Netherlands, that also at home, in the construction industry, a form of outsourcing, namely subcontracting becomes more and more a widespread phenomenon. The part of the work that contractors performed themselves declined in the building industry in the Netherlands with about 16%-points of total turnover in the last 10 years. In the infrastructure section it was about 20%-points. The management staff of general contractors, which is involved for an important part in the orchestrating and subcontracting functions, increased in the period 1990-2001 with 80%. This shift in the way firms in the construction industry operate requires that management becomes aware of the importance of its orchestrating function. The empirical analysis of this article shows that this awareness is still lacking.

Keywords: subcontracting, orchestrating function, purchase (procurement) function, construction industry, innovation.

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1. Introduction

Specialisation and division of labour are essential sources of economic growth and increases in welfare. This argument was already elaborated by Adam Smith in his well known example of the pin factory. However, division of labour and specialisation imply that the products and services have to be traded, orchestrated and assembled. Formally such trade means that there is a transfer of property rights. However, such trade is not costless but involves all kinds of transaction costs (see box). Partly these transaction costs are made to define and protect the property rights. Think for example of employment contracts, but also of arrangements and conditions with respect to activities and quality of products to be delivered in the case of subcontracting. For a major part the costs that stem from the division of labour, can be seen as co-ordination costs. These costs set a limit to the possibilities of exploiting specialisation and trade. That’s why a reduction of the transaction costs implies that more specialisation can take place which enhances new, innovative products and processes, productivity and welfare. Moreover such reduction of transaction costs will lead to lower costs of existing trade so that prices will fall and products become cheaper. This also has a favourable effect on welfare as it enhances the consumer surplus.

Certainly in a country like the Netherlands with a rich history in trade, the ability to reduce transaction costs is an essential condition to raise productivity and economic growth (WRR, 2003). Innovations which lead to an improvement of coordination and therefore to lower transaction costs are at least just as important as innovations which directly lead to a (technological) improvement of products and production methods. Yet, in innovation policy this argument remains, up to now, somewhat underexposed, at least between economists. In this perspective the aim of this article is to illustrate the importance of the transaction costs and, what we can call the trade or orchestrating function, for the construction industry, which is part of the traditional production industry. At first sight the trade function and transaction costs would not seem relevant for this sector of industry. But the analysis in this paper shows the contrary. The major research question is to what extent the orchestrating function gains importance in the construction industry, and to what extent the growing importance of this function is recognised by the management of contracting companies. With respect to this last question it appears that the perception of the management does not catch up with actual market developments. Too much the emphasis is still laid on the technical knowledge and the knowledge of construction itself, instead of on the knowledge of how to coordinate and subcontract various tasks in the production chain of the construction industry. This has consequences for the management policy, for process management, for the personnel policy and for the way IC technology is implemented in the production process. It also means that the purchase function gets too little attention and should be better integrated into the production chain. This article discusses these market developments and gives suggestions on how the management of construction companies (can) anticipate on these changes in market circumstances. In doing so the article provides an example of how the increased importance of the trade and orchestrating function should be, in a more general way, be accounted for in industries which are traditionally reckoned to be typical ‘production industries’.
Box
Transaction costs are costs connected with purchase and sale, i.e. all transfers of property rights. They comprise

1. The direct costs of acquisition and performing committed tasks, and of transfers of property rights in that respect, such as risks, quality guarantees, contracts, information costs etc. and the costs which are connected with logistics, coordination and consistency of the different tasks in the production chain;

2. Investments in ‘trade capital’ such as the building up of trust and reciprocal confidence in trade relationships, a transparent legal framework and case law, and an ICT which supports communication, time management and quality control in the operational relationships between possible players in the production chain.

3. Investments in knowledge and education with respect to transaction costs control and value creation in the production chain.

2. Industrial organisation in the construction industry

The construction industry is a good example of a chain economy. The bulk of the enterprises is small and medium sized and operates locally or regionally. In the production chain activities with respect to purchase, sales and actual production are split up in various parts, where each part adds value to the end product. The strategic question for enterprises is how and where to position itself in this chain. In the complex processes of construction work, such as the design, the realisation, the management and demolition is it impossible to keep the production in each part of the chain in own hands. Therefore the construction industry has a long tradition in working in cooperation with specialists who handle their own components of the chain. The way in which this cooperation is organised, is continuously prone to change due to market developments.

The key question is how the coordination, targeted at the control of costs, time, quality and risks, takes place in linking the various components and specialists’ tasks of the production chain. One possibility is a consortium of cooperating companies, another possibility is one company that produces parts of the production chain itself and coordinates. The extreme situation is that such a company exercises complete control over the whole production chain with respect to design, finance, purchase, production sales and after sales, but commits the actual work on all parts of the chain to specialised subcontractors. In that case orchestration is the only role of the company.

Actually, as the next section will empirically illustrate, there is a tendency towards more and more subcontracting in construction. Its cause lays to a considerable extent in the larger complexity of the construction process, with specialisation as direct consequence. The main contractor has more and more the role of orchestrator, whereas the actual activities are carried out by specialised subcontractors, or have been out placed to the prefab industry. This subcontracting, outsourcing and the ensuing coordination problems bring about transaction costs. Here subcontracting implies the main contractor buys products and services from suppliers and specialised companies. Formally it can be seen as a transfer of property rights, which brings about
transaction costs. This tendency to more subcontracting is in line with the overall pattern in the ‘production’ (or ‘make’) sectors of industry. The trade and orchestrating function gains more and more importance. In this way, contractors in the construction industry transform from mere executors of work to information and communication intensive, orchestrating enterprises with a sheer ‘trade function’. It can be argued that the skills in keeping transaction costs low and therewith exploiting the possibilities for advanced specialisation, determines to a large extent the innovative capacity of construction companies.

3. Subcontracting in the construction industry

Empirical data for the Netherlands provide ample evidence for the trend in the construction industry that components of the work and activities are more and more executed by subcontractors. Data collected by the Economic Institute for the Building industry (EIB) show that the number of specialised companies increased over the last 25 years with approximately 13%, whereas the number of general construction companies has decreased with approximately the same percentage (see Sijpersma, 2004). It must be said that the split up of the data between general and specialised construction companies does not entirely corresponds with the distinction between main contractors and subcontractors - a specialized company acts sometimes as a main contractor and a general construction company can be involved in subcontracts - but in general the information in these data is, indicative for the increasing importance of subcontracting. The trend becomes also clear when looking at the average share of value added in gross turnover of general companies in the building sector. This share decreased of approximately 25% in the period 1987-1991 to almost 21% in the period 1997-2001. It implies a reduction of the own production of 16%. In the infrastructure construction sector the fall of the share was still larger, namely from 35% up to 28%. This means a reduction of own production with 20%.

According to evidence from surveys conducted by the EIB with the main contractors, the major reason for subcontracting is the increasing specialised character of the activities and the knowledge and risks connected with it. Another important argument is that by subcontracting variations in availability of production capacity can be smoothed. The construction companies in principle prefer to make use of an established network of specialised subcontractors. These preferences of the construction companies are also reflected in the most important selection criteria when choosing a subcontractor. The selection is in the first place made on the basis of the requested quality of the work and the (insured and/or trusted) guarantees that the subcontractor can offer. Earlier experiences with the subcontractor and his proven reliability play an important role in the selection process. It shows that trust formation and establishing a reliable network are important elements for the reduction of transaction costs, including failure risk and communication errors.

These data emphasizes the importance of the transaction costs at subcontracting. Specialised firms can deliver a quality product which the main contractor cannot or only at very high costs. The gains of specialised firms delivering quality products more and more outweigh the transaction costs so that subcontracting increases to be profitable. A steady relationship with subcontractors and suppliers, that already have acquired a reputation of reliability strongly contributes to keeping transaction costs
low. In order to remain competitive it is important, however, to keep the subcontractors and suppliers "sharp" and always have a fall back option or alternative in negotiation processes.

In addition to the results of the EIB surveys, the practice of the construction industry indicates that at present there is, at least in the Netherlands a tendency towards a reduction of confidence and hardening of the mutual relations. A reason is stricter regulation with respect to collusion and commissioning of contracts. The result is a hasher competition on price and less attention for cooperation and quality. This tendency is a consequence of the shrinking construction market and of the increasing distrust between principal commissioners and contractors, following a parliamentary enquiry on collusion and illegal actions of construction companies in the Netherlands. A result is that the number of contractors applying for work in open tenders increases. It may lead to an increase in transaction costs and has also direct consequences for the relationship between construction companies, their principal commissioners and the subcontractors and specialised firms. This development can be considered as a possible illustration of U-shaped relationship between the degree of competition and the innovative strength in construction. On the one hand the tightened rules for open tenders in (government) contracts may contribute to the fact that by means of subcontracting and specialisation the fixed production capacity available for construction can be used in a more flexible manner. On the other hand the strict tender rules should reckon with the fact that the production capacity cannot rapidly be extended or scrapped so that the production demand should be matched to available productive capacity in an efficient manner. Much attention should still be paid to the design of an adequate tender system for the construction industry.

The tendency of increased subcontracting and specialisation is also reflected in the composition of the staff of the construction industry. Kok (2004) has calculated using labour market data of the EIB that the personnel in executive, technical and administrative staff functions (so called UTA-personnel) in construction has increased in the period 1990-2001 with more than 20%. In the same period the increase in the number of personnel directly involved in production at the construction sites increased only with 10%. This increase of the UTA-personnel can be attributed to a large extent to one category, namely the coordinating staff functions. Here the increase amounted to 80%. This is a direct consequence of the extension of the number of tasks with respect to acquisition, calculus, project preparation, organisation, coordination and administration/accounting. Obviously the gains of subcontracting more than compensate these higher staff expenses. More in general, this shift from sheer production to executive to coordinating functions, or, to put it in another way, from ‘making’ to ‘coordinating and trading’, can be observed all over the industrial sector. For instance, De Beer (2001) shows for the Netherlands how changes in the professional structure are related only partly to shifts between sectors – from agriculture and industry to the service sector. Major shifts between production workers and managerial and coordinating staff in administration, accountancy, policy support etc., can be observed in a great variety of sectors of the economy. It shows that the increasing importance of the trade and orchestrating function is underestimated when one only looks at shifts in types of employment between sectors.
4. Purchase policy

Usually the trade function and good trading skills are associated with sales and exports. From a macroeconomic perspective trade and exports are seen as the driving forces behind the economic growth. Trade missions commonly focus on export promotion. However, for being a good "trader" more skills are required than being a good salesman. For trade, and for doing transactions at low costs, it is equally important that one is good at all aspects of purchase, for instance by keeping good and consistent relations with suppliers. Logistical and coordination costs are likewise important in this respect. This emphasis on the purchase side of trade is especially true for companies in the construction industry. Here the share of purchased (intermediate) products and services sometimes amounts to 60% or 70% of total turnover. Research by Van Megchelen and Van Eijk (2004) shows that in medium and small sized building companies the importance of purchase in the production process is much underexposed and underestimates. The research was conducted for a group of about 3500 construction companies with on average about 50 employees. The main concern of these companies appeared to be sales, acquisition and technical realisation of construction work. The research also indicates that there was little to none attention for transaction costs and the orchestrating function with respect to purchase policy. The construction companies are hardly aware of the possible influence of the purchase function on the company result.

The purchase function can be split up into three components. The first function is the strategic purchase function which makes a contribution to formulating company strategy using the knowledge of the purchase market. Thereby the choice between “do it ourselves” or subcontracting (outsourcing) is determined by the needs of the company in relation to its suppliers. Thus this function, among others, looks at how essential the products and services to be purchased will be for the company, and at which is the best policy to be pursued in this respect. Secondly there is the tactical purchase function which specifies in more detail the needs of the company, which makes the selection of products, services, and suppliers and subcontractors. Contracts are also negotiated, drafted and signed in this function. The third function is the executive purchase function. This function is concerned with logistics and the timely delivery of materials and services according to the conditions agreed in the contracts. Moreover financial management of purchase orders is part of this function.

Obviously each of these purchase functions is related to transaction costs. These transaction costs can be kept low both by good management within the functions and by a good coordination between the functions. So-called failure costs, (several calculations pointed out that these costs amount to about 10% points of the building costs) are a major component of the transaction costs in the construction industry. These are the costs of repairing errors due to lack of coordination with suppliers and subcontractors, and due to wrong communication on materials, delivery times and services.

Good purchase techniques are an adequate tool for reducing transaction costs. They can be classified in three categories:

(i) The first category concerns timely exploiting knowledge and experience of suppliers and subcontractors. In doing so, risks and alternative possibilities can be detected in time. It enables strategic changes in planning and purchase decisions at an
early stage so that these changes are easier to be made and transaction costs are low (less failure costs)
(ii) The second category aims at developing fixed routines and patterns. In this way transaction costs can be reduced and quality be raised. Examples of this are working with an established group of reliable subcontractors, favoured suppliers and/or favoured materials, which can contribute likewise to reducing the transaction costs (including failure costs)
(iii) The third category of purchase techniques aims at monitoring and analysing the quality of the purchase function. This monitoring can consistently contribute to efficiency and quality improvements of purchase performances. From the research on the sample of 3500 companies, referred to above, it is clear that still only a small part of the companies in the building industry performs such monitoring and measurement systematically with respect to the purchase function and analyses it in order to come to improvements.

Almost no use is made of quantitative measurement and indicators in the total purchase function in terms of (own) costs, time and quality, by the companies of the sample. It implies that the companies do not avail of data on time which is spent on purchases, on the total volume that is bought, on the number of suppliers and subcontractors, and consequently on the supply characteristics in terms of time, continuity and wrong communication. The result is that these companies hardly have any information on the actual situation and therefore have little possibilities for a timely reaction and improvements.

This research conducted at individual construction companies suggests, that the transaction costs can be reduced further. As yet the importance attached by the management to the purchase function has been small, and an overall policy framework for the purchase function is lacking. The function is also often split up within the construction companies in many parts without coordination. Employees carry out their own purchase tasks just as dictated by force of circumstance where everyone has his or her specific vision on purchase. Consistency in the purchase functions will lead to efficiency gains in particular when more attention is paid to the planning of logistics. Another possibility is to reach arrangements with groups of subcontractors and suppliers on combining supplies and deliveries, so that the number of small supplies can be diminished and delivery periods can be shortened. Limiting picking up supplies can also reduce logistical costs. A further possibility is to make appointments with suppliers and subcontractors on early notification and fast identification of changes in agreed project contracts. This knowledge enables a more careful calculation and risk management, and hence better priced offers. More standardising and a smart use of ICT can provide much support. Improvements in the purchase function can reduce transaction costs so that the advantages of specialisation are better exploited. This may imply that commissioning customer can obtain a better quality/price ratio and that construction companies witness (further) productivity increases.

5 The gap between perceptions (way of operating) and facts.

At construction companies that carry out large part of construction production by themselves, the management has other core activities than when the actual activities are mainly outsourced to subcontractors. In the latter case the activities of
the company focus on orchestrating and coordination. In case of much do it yourself production, the management will mainly be reactive. The focus of the company lies at techniques and most of the tasks are sheer production tasks. On the other hand, when the company finds (and considers) itself at the other side of the spectrum, and when most of the activities are outsourced to others, a proactive management is required which is focussed at orchestration of the building process. Then it is essential to be skilful and knowledgeable to organise the activities which are all interdependent and which should be connected smoothly. In that case the focus of the management lies at matching the different activities and results. Here that kind of understanding and technical knowledge is required (and constitutes a critical success condition), which keeps the transaction costs in this matching process as low as possible. The actual technicalities are then left to the specialists. In this modern way of management the main task of the orchestrating general contractor is to realise and fulfil the wishes and expectations of the commissioning customers and consumers by means of organising the construction process and by means of connecting the various activities in the construction process logistically.

In order to make the transition from the production oriented to the orchestration oriented way of management profitable for the construction company, it is essential that the CEO’s, directors and managers are aware of this development of transformation. It requires a major change in the emphasis, attitude and the philosophy of the management. The management itself has to focus more and more on the customer, the orchestrating and trade function. In order to examine the extent to which this change in attitude has taken place in practice, ten Dutch companies, which have been made anonymous here, were asked where they would place themselves on the scale between “do it yourself” and full outsourcing and subcontracting. Then we have calculated, using actual financial data of these companies, which position they took in reality on the scale. Table 1 gives the results of this exercise. The outcomes show that at many construction companies there exists a considerable discrepancy between the position on the scale where a company places itself and the actual position of the company. The perception clearly lags the actual development. It implies, for instance, that the construction companies put, in their management, still too little emphasis on their coordinating and orchestrating function, and still too much emphasis on the technical and production side of construction. This picture also emerges when we look at the way ICT is used. This use is in most cases restricted to calculation and administration, whereas the monitoring of subcontractors and suppliers is done mainly by tel. and fax. Hardly any use is made of electronic business devices and of electronic monitoring of logistic processes.

This confrontation of the actual data with the perceptions can contribute to more awareness of the construction companies of their position in the production chain. It may induce the management to lay more emphasis on the orchestrating and trade function of the company. This confrontation of the actual position on the scale between do it yourself and outsourcing and subcontracting proves to be an important tool for the management of (construction) companies. When the management of the construction companies was faced with the difference between their perception and actual position on this scale, it has, in a number of cases, effectively inspired to a (start of) a strategic repositioning of the management functions.
Table 1. Perception and actual position of a sample of 10 building companies in the Netherlands on the scale between “do it ourselves” and “orchestrated outsourcing”

<table>
<thead>
<tr>
<th>Company</th>
<th>Extent of orchestration Perception</th>
<th>Actual</th>
<th>Gap</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>21</td>
<td>38</td>
<td>17</td>
</tr>
<tr>
<td>B</td>
<td>27</td>
<td>62</td>
<td>35</td>
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<tr>
<td>C</td>
<td>32</td>
<td>60</td>
<td>28</td>
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<tr>
<td>D</td>
<td>31</td>
<td>73</td>
<td>42</td>
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<tr>
<td>E</td>
<td>33</td>
<td>58</td>
<td>25</td>
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<tr>
<td>F</td>
<td>47</td>
<td>73</td>
<td>27</td>
</tr>
<tr>
<td>G</td>
<td>36</td>
<td>75</td>
<td>39</td>
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<tr>
<td>H</td>
<td>55</td>
<td>63</td>
<td>8</td>
</tr>
<tr>
<td>I</td>
<td>26</td>
<td>51</td>
<td>25</td>
</tr>
<tr>
<td>J</td>
<td>21</td>
<td>55</td>
<td>34</td>
</tr>
</tbody>
</table>

Source: own measurement of performance on purchases and market analysis of ten building companies (Van Megchelen, 2005 offers an elaborate report – in Dutch).

Explanation data on extent of orchestration:
- 0 – 20 focus on own production without feel or understanding for orchestration;
- 20-50 focus on own production with feel or understanding for orchestration;
- 50-100 focus on orchestration with feel and understanding for own production.

6. Be aware of transaction costs in the construction industry

Both the macroeconomic analysis and the case studies of this article show that the role of outsourcing / subcontracting, and with that of the trade function, becomes more and more important in the construction industry. The management is slow to catch up with these developments. It implies that in construction still considerable productivity gains can be realised by saving on transaction costs in coordinated subcontracting. In order to integrate this "awareness of transaction costs thinking " better in the management of construction companies, more attention to the following aspects would be warranted:

(i) **Purchase policy:** (see section 4) the purchase policy must be upgraded to play a major instead of a minor role in the orchestration function of the management. The construction company should hold a central position as a principal commissioner in obtaining realistic and innovative offers of suppliers and specialists. This involves a larger awareness of the
importance of the purchase policy, where offers should be negotiated in a more proactive way and where there should be ample communication with potential suppliers. This communication reduces the transaction costs (among which the failure costs). It is also warranted that in the relation with the subcontractor not only the price of the materials and sheer production costs are decisive for commissioning, but the integrated cost, including all transaction costs to be made by the company itself.

(ii) Product policy: more focus on consumers wishes and innovative products are possible, because the technological legacy and functional risks will also be outsourced to subcontractors (and manufacturers);

(iii) Personnel policy: the competences / abilities of the staff should gradually change from knowledge and skills in routine production and technical aspects towards supervision and coordination skills. Here a proactive instead of a reactive approach is warranted. Of course, for the matching and coordination of activities, a good insight in technical possibilities and pitfalls remains essential.

(iv) ICT policy: good exploitation of the possibilities of ICT may very well contribute to a further reduction of transaction costs. More efforts should be made for an efficient use of ICT, where it should focus on external instead of internal relationships (directed at cooperation and proactive steering), and on a change from fixed to mobile devices.

(v) Strategic policy: the transition to the orchestrating and trade function should be well planned and targeted, with realistic time schedules in order to avoid high transition costs (also a part of transaction costs). These investments in “trade capital”, which keep transaction costs low on the long run, partly bring about positive externalities. Therefore it is important that such investments are made with (regional) colleague companies: One can think of benchmark companies for best practices, education, ICT, keeping up the reputation of the industry (which was important in the Netherlands after the very critical parliamentary enquiry), standards for quality and legal standards with respect to purchase and sales conditions.

A further recommendation is to share experience and know-how with colleague companies by means of a common database. With all these suggestions to move further to the creative orchestrating and trade function and thereby reduce transaction costs, it remains important to keep a full understanding of technical matters and maintain know-how on new developments in this respect. In the construction industry (like anywhere else) there is no place for selling hot air.

7. Conclusion

The construction industry is predominantly considered as a traditional part of the production industry. Moreover it has been part of the sheltered sector which is not much exposed to international competition. As yet, this article argues that in this sector the possibilities of a productivity improvement by means of innovation and specialisation are to be found particularly in reducing the transaction costs in the production chain. This emphasis on the orchestrating and trade function enables to implement technological innovations in the construction process at relatively low costs and at a larger scale. In this way the productivity gains from a further division of labour can be exploited as well.
More in general the reduction of transaction costs by paying more attention to the trade and orchestrating function obtains little attention in the economic analysis of innovation and productivity. Nevertheless this example of the construction industry shows that there are good chances for productivity increases by innovations in the trade function and by value creation along these lines in the production chain. The recent trend of "outsourcing", "offshore sourcing" or "global sourcing", and in this way exploiting the (international) division of labour, indicates the increasing importance of the trade function, even within the sectors which are traditionally considered as the ‘production’ industry. The innovation debate still pays too little attention to these economic mechanisms (see e.g. Jacobs and Theeuwes (eds.), 2004). A major reason is that empirical analyses of productivity increases in industry mainly consider expenditures on research and development (R&D) in technological sense as driving force. Innovation policy also mainly aims at this type of technological knowledge. The arguments of this article on how innovations in the trade and orchestrating function in the construction industry may lead to lower transaction costs and hence to productivity increases, calls for a broader look on R&D expenditures and their role in innovation policy.

**Literature**


