

QUASI-FIRMS FOR REAL INNOVATIONS

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Abstract

The construction industry is notorious for its (lack of) innovativeness. Many papers, reports and articles have been written on this subject already for more than three decades. The explanations presented can be summarized by such terms as fragmentation, segmentation and segregation when referring to the industries' structure and by qualifications such as opportunistic, hostile, antagonistic and conflictive when referring to its culture. In this paper it is argued that the main reason for the innovation status quo is the fact that the construction industry, when compared to other industries, lacks real producers- producers who develop products and compete with each other in terms of these products. It is particularly this kind of competition which is identified as a source to stimulate innovation. In construction, *production* capabilities are tested on the market and not *product* capabilities. As a result, design decisions are not tested on the market. It is this flaw which is examined in this paper, and possible improvements are suggested. Endurable strategic alliances, as quasi-firms, are proposed as the equivalent of producers. Essential herein is the pivotal position of design. An organizational innovation as such could change the way business is done in the construction industry. It would alter its structure as well as its culture.

KEYWORDS: Construction industry; Innovation; Producer; Quasi-firm.

INTRODUCTION

Innovation in the construction sector is seen as beneficial and at the same time problematic. The theme of the conference illustrates this perspective. To enhance the innovativeness of the industry, the relationships between procurement and innovation are addressed. Two hypotheses have been put forward to canalize the discussions: one hypothesis concerns the role and

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action of the building owners, and the other pertains to the behavior within the industry. The way in which these hypotheses are presented, one might think that the lever to stimulate innovation would be found either on the demand side (the owners) or on the supply side (the industry). Holding on to this contraposition however would be an unfortunate misunderstanding. Owners and industry co-exist. Procurement sets the rules that bind them together and regulate their interactive behavior. It will be argued in this paper that both sides are needed to attain a long term sustainable change in this construction business environment in order for innovation to thrive. The exploration of the problematic nature of innovation in construction industry will be approached by contrasting with trends in other industries (especially ship-building). The lessons learned indicate that owners as well as businesses in industry should both change their respective roles and change their outlook on each other's role; ergo both have to redefine their businesses.

CONSTRUCTION INDUSTRY LACKS REAL PRODUCERS.

What can be said about the innovative capacity of the construction sector when measured up against other industries? Factors often suggested as important differences are the fragmented nature of the construction industry, the project-based production, the production on site, and the production by altering ad-hoc coalitions; these factors have frequently been put forward and for quite some time now². But one important factor may well be overlooked. The most significant distinction might be the absence of the dominant producer in the construction industry; a producer who as an economic agent, selects markets, develops products, attaches a trademark (branding), tries to influence demand, bears the risk of production and other investment costs, and is held liable for defects in the final product. This producer invests, develops a product, and sells it on a market. In a competitive state, failing to innovate, while the competitors do, may put this producer out of business. Therefore innovation becomes an important factor in the producers' survival strategies.

For the construction arena, the above mentioned activities and responsibilities are usually attributed to owners, but there is a striking difference. Owners do not compete with other owners as producers do with other producers. Owners do not place their facilities on the market for sale. Although owners perform a producer role, they generally do not intend to sell their newly built facilities, and they therefore operate on the demand side of the market instead of the supply-side (as producers typically do)³. Hence owners do not feel market discipline, and subsequently miss the straight market incentive to innovate.

² Just think of publications as the Emerson report [1962], the Banwell report [1964], the work of Marian Bowley [1966], Koskela [1992] and Latham (1994) Dutch counterparts by Haselhoff and Rijlaarsdam [1988], Jacobs et al. [1992], Van Tongeren [1996].

³ Unless the projects are in the hand of project developers of course. Much of the project development in the Netherlands concerns housing; since there is a shortage, especially a lack of building locations, this can be characterized at the moment as a sellers-market.

Since owners enter the market on the demand side, knowing what they are looking for and specifying their needs in extensive documents, the construction industry is forced to compete on production capabilities, instead of product characteristics⁴. As a result, the companies on the supply side of the market hardly feel any compulsion to actively influence the mechanism of supply and demand to their advantage in terms of products. These businesses are capacity and capability driven, trying to innovate their production tricks, because their tricks are their products. Furthermore, owners are often reluctant to act as guinea pigs for new production tricks. Because there is too much at stake for them, they urge the contractors to stick to proven technology. Since they cannot accept any eventual error, they prefer to avoid the attempt. The contractor-competitors have to subordinate their behavior to the clients' wishes and corresponding product specifications, doing what one might call 'old tricks' better (cheaper and faster) than before, rather than offering new products. If not they may bring themselves into the bankruptcy danger zone. Profit margins are often too small to allow experimentation.

THE INNOVATION STATUS QUO

In explaining the innovativeness of the construction industry, when comparing it with other industries, this producer elision seems to be the most significant difference. It explains the absence of the innovation incentive. On the one hand the owner acts as the producer, but a very specific one; a producer who operates on the demand side of the market and does not experience direct competition (with other clients). On the other hand, a supply side consisting of businesses which are forced to compete on production capabilities in response to the clients' prescribed needs. Only in limited segments of the construction industry are products developed and brought to a competitive market (predominantly referred to as project development). In the construction sector most companies are condemned to occupy reactive market positions.

We see that owners, through their procurement behavior, express little trust in the product development capabilities of construction companies, by only involving them after the design is finished (the design having been contracted out to specialized design and engineering firms. We also see that construction contractors, by defining their core business as construction, express little trust in their market possibilities as product developers; only very little design and engineering (if at all) is permitted within their companies. Since firms dedicated to design and engineering thrive on this situation, one might deduce that the construction market, and the players within it, find themselves in a status quo - a status quo without a real producer, without competition in terms of products, and subsequently without the market incentive to innovate.

⁴ In the Netherlands, over 95 percent of civil engineering works are procured in the traditional way (design-bid-build).

CONTROLLING MARKET POSITIONS

In the traditional industries such as consumer electronics, and the automotive and the aerospace industries, markets are dominated by a relatively small number of producers. The market dominance is generally determined by a number of factors. First and foremost, certain financial characteristics (equity) count. Market power is normally held by the party in the value chain which directs the flows of material, equipment and work force - in other words where the large turnover and/or high added value is achieved. These large producers develop a financial base on which they can afford to invest heavily in the development of new products. They stay ahead of competition by being able to allocate more money to new products, and by utilizing better networks to distribute them. Through their size, they can 'sweat out' fierce competition longer than smaller competitors.

After a certain time, concentration occurs on the supply side of these markets. The number of producers decreases. Smaller players step out, or are taken over by the big players, bigger players may merge. In all these cases, the producers possess the capabilities of responding to the needs of the customers primarily through the control of the design process, combined with control of the logistics processes. Segments of production and assembly may be brought in or contracted out, but design and marketing are concentrated and concerted, to meet and further develop according to customers' demands.

These industries are so-called self-creating industries. Here the design process lies at the heart of product development. This design can be described as an iterative process, interacting with other disciplines such as production, marketing, purchasing, research and distribution. Generally these different disciplines all belong to one hierarchy, the organization of the producer. Information is sucked in from, and pumped out to, other organs of the same company. Although back-to-core business and down-sizing strategies have changed the face of industry, the crucial position of design has not shrivelled. Large molochs are broken down; instead, networks of producers and co-makers have grown up in industry. A project-related approach is more often being chosen for product development. The management of these projects is the task (and responsibility) of the producer. The producer who at the end of the day will have his trademark on the product, is held liable and bears the large part of the market and financial risks. Therefore the conceptual design, being at the heart of product development, also has to be the responsibility of the producer, who may call on support in the form of co-design and co-engineering, but may not delegate control of the development process. Without control of design, a producer will certainly lose control of his market position.

At present, design and engineering provide more than solely form and function to the product. Thanks to CAD-related software development, the entire production process will also be directed from the design process (CAM, CAE, CIM). Product and production process are co-designed, in a concurrent manner. This apprises a second important condition for dominance: the control of the conceptual design and consequently control of the product development. Controlling the design process implies controlling decisions concerning the characteristics of the product, and therefore the interplay with customers' demands and values. A producer will not achieve dominance through financial power alone; a producer needs to command the de-

sign process. This producer may be a single "one firm" entity, but may also be a quasi-firm⁵, a cohesive network of firms working together orchestrated in a certain product-market-technology niche.

SHIPBUILDING AS PARALLEL

A case of shipbuilding poses an interesting example of this quasi-firm phenomenon. Shipbuilding is the industry which, from the production and operations standpoint, has the most resemblance, or the least difference, with the construction industry: project based production, on client specification, high cost per product, small number of products per producer, labour intensive, design intensive, production lay-out by fixed position. The main difference is that ships are built on a producer selected site, and delivered to the client when finished, while the construction industry distributes the production apparatus to a site selected by the client.

These shipbuilders, together called The Central Industry Group, located in Groningen in the north of the Netherlands, form a co-makership network of 17 shipyards. These companies are organized to be lean and mean and to develop added value through market development, purchasing and subcontracting. Two design/engineering firms participate in the network as well as a software supplier, a steel production company, mechanical and electrical engineering companies, a timber company, firms of painters and material suppliers. Internal supplies account for approximately 40% of the turnover, a large part of which is generated through exports. The shipyards help one another in production and they work together in sales. Between 1975 and 1995 they were able to reduce price levels, on an indexed basis, by a half. This implies a tremendous increase in productivity. A number of improvements (innovations) lead to this impressive advance in productivity.

The organizational improvement, which required a great deal of effort, was based on the introduction of 3D-integral design and engineering. The 3D-form and -structured database provided opportunities, from both a design and a production perspective, to arrive at a much better designed vessel as well as a vastly improved construction and assembly process. Improving interaction and coordination of customer, yard and suppliers proved to be necessary. Because 3D-engineering defines a complete production design of the vessel more quickly, production activities could be brought further forward in the development process. Sub-assembly in standard units came within reach and welding robots could be used more effectively.

Of course this process took some time to build up new experience, because traditional demarcations changed, including the commercial process. Even so, each of the players in the network had to produce, in the awareness of the market discipline, and strive to expand his market share. The management spokesman of the shipbuilding network in question expressed it as follows:

⁵ This term was first used by Robert Eccles in 1981. He introduced this term to describe contractor-subcontractor relationships. This type of strategic alliance is also referred to as *virtual-organization*. One might argue that virtual *firm* or virtual *company* might better capture the essence of the phenomenon.

"A great advantage of the network is that the companies are so attuned to one another that a relatively large amount of work can be done without extensive paperwork. However, at this point I should mention that I am not trying to paint a romantic picture of idyllic business relations. Day by day the hard rules of economics dominate this network. Every company partaking in this network is striving to be the best every day and in every project. If you are not the best the project will be awarded to the competitor. It is precisely this mechanism that keeps the network of the shipbuilding industry in the North of Holland so extremely sound, efficient and innovative" (Tienpont 1995).

This exciting development in the shipbuilding industry underlines the view that the design process lies, and must lie, at the heart of the business. It is on the one hand a rich medium for supporting pro-active market development, and on the other hand it serves as a basis for the further improvement of the efficiency of the production process. Furthermore, the co-makership atmosphere means that the disadvantages of the ad-hoc project coalition (such as ineffective communication, opportunism and disputes) are better mastered. Compared to ad-hoc contracting, transaction costs are reduced substantially (less paperwork). Through better communication, better co-ordination and resource pooling, productivity is further improved. This quasi-firm model has indeed turned out to be feasible in the shipbuilding industry.

LESSONS FOR THE CONSTRUCTION INDUSTRY

Reflecting on this shipbuilding case, let us consider what lessons can be distilled for the construction industry. Remember, production only starts in both shipbuilding and construction after the product (on paper) has been sold. Since the entry barrier in construction is very low, it is (and will continue to be) very difficult to gain and defend market dominance through sheer financial strength. In order to create a maintainably strong position on the market, it is necessary to satisfy the condition of control of the logistical and construction process, and even more important the control of the design process. After all, it is the design process which is the linking pin between the concept development process, in accordance with owners' demands, and the efficiency-oriented development of the physical construction process. The design process is at the heart of the total development-production chain. In the context of the analogy with the human body, we can also refer to this function as a heart with two chambers; a design chamber and an engineering chamber, the design chamber to feed the circulation of the market development process, the engineering chamber to feed the circulation of the construction process. The design process is implicitly the heart of product development at company level. Control of the design process is therefore a requirement for market development in the construction sector. Here we see the predicament of today's construction industry. There is no connection between market, product design and production (again: absence of the producer).

The diversity and range of products also demands management and control of the design process in order to establish an efficient scale of production. Through scale economies as well as learning curves, entry barriers can be obtained and market positions can be maintained. Only then can we imagine a producer who will lend his trademark to his products and will

consequently be liable for those products. However, in the construction industry at present, design is usually carried out by the owner, or in his reign by an independent party (with its own business objectives). These production conditions therefore deviate significantly from the conditions outlined for industrial product development. While the design firm can derive market power in the position which has been provided through the agency function, the innovation power remains very limited. In construction, the design function therefore does not act as an integrating component of an enterprise-oriented industrial product approach.

Productivity improvements are essential for the industry. These improvements will have to take root in the design process. The opportunities that information technology and data communications are providing us with, will have to be gradually explored in the design domain. After all, design is the most integrating activity in the development and value chain. The example from the shipbuilding industry shows how change in the integrated design process at the quasi-firm level can be the start of dramatic changes in the logistical and production process. Firstly the process had to prevail over structure so that the technology-embedded information 'blood' circulation could commence. The logistic and transaction structure had to be adapted to the desired course of the process. This has resulted in significant improvements in productivity. The construction industry has its complications, such as widely dispersed production facilities and substantial design diversification, but these complications are not expected to be permanent barriers to the type of developments found in the shipbuilding industry. In the Netherlands, we see some examples of this new trend: long-term maintenance contracts which establish long term cooperation and coalitions, and off-the-shelf coalitions for certain cautiously-developed and niche-marketed products, such as refurbishment of homes for the elderly.

QUASI-FIRMS MAY CREATE A NEW INNOVATION CONTEXT

The Dutch civil engineering contractors opt for the role of producer. But the Dutch procurement practice forces them to do so predominantly outside the Netherlands. In those cases, the design/engineering is construction-driven, applied mainly to supporting the construction activities, and not aimed at creating more value for the owner. The influence of design on the companies' culture is therefore limited. The companies still breathe a typical contractors' atmosphere. What continues to be missing - compared with industry - is a fully integrated approach to design and construction at a company level. In a market-driven enterprise, this integration must implicitly be a part of the complete product development process and penetrate throughout the entire hierarchy.

In a rapid changing society, such companies are needed. New concepts for living, working, transport, energy and recreation will emerge. The construction spectrum associated with these aspects ranges from high-rise to underground construction. Shortening the life cycle of structures and reducing production lead times can easily conflict with durability requirements. Add to this the current developments in materials as well as advances in information technology and data communications and it will be clear that technology must be at the heart of

product innovation. This area of tension enforces the combined product and process development.

It will also be true for the construction sector that the capacity to innovate will largely depend on the mutual strengthening of the two cycles, namely of market (concept) development and production (process) development. Both processes are elements in a double blood circulation. The design of the end-product has to answer the needs of consumers and the client. The producer must therefore secure design power. Using this integrating design capability, the producer can in turn articulate the demand for product development by the supply industry. Experience with the prefab industry has shown that there is much in the interactive innovation process which can be improved. The producer with such a professional design function also has the capability to give substance at a professional level to the functional integration with the external architect.

These days, industry usually organizes production, with reduced vertical integration, through a quasi-firm as a collaborative form. Inevitably the mechanism of the production process for an innovating construction industry needs more integration of design and construction at a company level. Because the financial risk makes the holistic "all-functions-in-one-firm" improbable, the quasi-firm is expected to develop under pressure from productivity as well as from creativity and flexibility requirements. Here the design function will supply the central function.

The contractors, installation firms and supply industry are the parties which control the logistics and the production process, and thus the high turnovers. Depending on the circumstances, any of these parties can develop the role of producer in this quasi-firm model. The opportunities for this can vary from one segment of the market to another. Firms of consulting engineers, while they have modest 'financial power', can also follow a growth pathway starting from 'design power' in view of the rapidly increasing complexity of the public-private concept development processes. When it comes to the actual development of structured dominance, in terms of capabilities combined with financial power, it seems to me that the construction company is in the best position to co-ordinate the quasi-firm.

CAN QUASI-FIRMS BECOME A REALITY?

The emergence of quasi-firms will depend on their role and position towards the owner, and even more crucially on the position the owner takes towards this new type of supplier. Who will act as producer? Will the producer act from the demand or from the supply side of the market? After all, the owner/client retains the financial power. In our opinion however, innovation requires a producer on the supply side. What about the clients' role then? Despite contracting out functions in the field of planning, design and management, the client can still aim to maintain expertise in these areas. Moreover professionalism can be developed in contract definition, project management and product development. The innovation status quo for the sector will thus only be stimulated when new definitions of the roles of the client/game-maker and the contractor/game-maker are simultaneously developed. The chicken and egg

situation and the subsequent innovation status quo, must be resolved through combined action. It will, on both sides, be a matter of selecting and sharing.

For the time being, however, there are still countless obstructions before this can occur. The construction market is very specific. The functional role which architects need to fill in society, the diversity among public and private clients, the intertwining with political and administrative decision making, the dependence on the regulating complex and, last but not least, the variety of financing strategies, all make the construction industry an economic sector in which industrial structures have not developed, at least not to any appreciable extent. All parties are participating, as capacity driven companies, in short-term coalitions at project level all the time. A 'polygamous' economic sector will have difficulties with partnership at a company level! It is by no means straightforward to turn a capacity driven construction company into a producer. The most important impediment to innovation, however, lies in competition on price, which the sector still keeps within its grip. This imperfection needs to be eradicated. Quality and innovation must become order winning criteria.

CONCLUSIONS

In this paper several issues are discussed. First it was stated that, at present, the construction industry finds itself in an innovation status quo. This was primarily due to the ambivalent position of the owner. The owner performs the role of the producer, but does so without being exposed to the discipline of the market. As a consequence, the industry, primarily capacity-driven, is forced into a reactive market position. Both lack the incentives to innovate. The control of product design and production process design are distributed over separate entities, and are not linked with market development processes. In such a scattered situation, none of the entities in the construction industry can develop the dominance needed for combined product and process development. Since products do not compete for the owners' favor, innovation only limps forward. As it is not expected that market dominance can be reached by concentration on the supply side, other strategies have to be pursued. A case history taken from shipbuilding showed that strategic alliances may plot a way forward: the quasi-firm, a network of companies, a quasi-firm with the design process as a pivot, aimed at serving a specific product-market-technology niche in a design/construct design/build manner. In this niche it will compete and subsequently must innovate. Due to financial and thus liability constraints, contractors are in the best position to commence, coordinate and direct such quasi-firms.

Will the construction industry develop in such a direction? Not by itself. Such a shift requires that owners and contractors redefine their roles and positions. To overcome the status quo, the current inertia of the industry, it is expected that coordinated effort of owners as well as industry is required. Best suited for this task seem to be the professional public cli-

ents/owners, the larger and mid-size construction contractors, and the associations of contractors. In the past this has proved to be a fertile coalition⁶.

Referring to the two hypotheses formulated to direct the discussions for this conference, owners must create the opportunities for the industry to develop towards a situation in which (quasi)-firms can develop their markets in terms of products. Competition must be focused on quality and innovation. The industry cannot afford to lose this opportunity. The industry has to rearrange its priorities and surpass its current antagonistic and production-oriented culture. Product champions must supersede the production champions. Both sides of the innovation status quo have to be addressed. Strategies for the supply and demand side have to be discussed, but discussing one side of the market, the effects and actions for the other side must not be ignored. After all the construction industries' clients are never anonymous.

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⁶ Examples of this are the standard documents which were originally developed by the ministries and by now are used throughout the industry.