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A century of innovation in the Dutch construction industry

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In recent years, the number of publications on innovation in the construction industry has increased. Many of these documents address qualitative issues, e.g. policies for innovation and present case studies. A more quantitative approach is taken in this paper, which is the continuation of a previous study. It focuses on main types and sources of innovation in the construction industry, and includes an analysis of 55 years of publications in two leading Dutch professional journals. The results show a recent increase in innovation, with two-thirds of innovations coming out of supplying industries. Construction companies contribute mainly in process innovations. Innovation in construction remains to be technology- rather than market-driven. Regulations have a surprising impact, as over one-third of all counted new innovations are related to new regulations.

Keywords: Construction industry, innovation, management

Introduction

Many business drivers point to the need for the construction industry to put a stronger focus on innovation. A series of documents illustrates the recent attention that has been paid to this subject (Gann and Salter, 1998; Slaughter, 1998; Winch, 1998; Atkin, 1999; Gann *et al.*, 2000; Koskela and Vrijhoef, 2001). A consultation with the ARCOM abstract database, with 'innovation' as keyword, produced 26 hits in the last 5 years and only four hits in the years prior to that.

Quantitative data on innovation in construction industry are rare. Often, discussion is based on a restricted number of cases. This note provides a quantitative insight into the innovative performance of the Dutch construction industry.

Objective, method and sources

The main objective of this note is to track the changes in the level of innovation in the Dutch construction industry. It is the continuation of previous research (Pries, 1995). Important questions were: what were important types of innovations; who were the main innovators; and how did the innovative behavior vary in time? The information for this analysis was collected in three ways:

- Literature search: renewal in the Dutch construction industry is fairly well documented until World War II, mainly by Priemus (1970).
- An analysis of 55 years of publications in two leading Dutch professional journals (BOUW and Bouwwereld). The characteristics of every innovation mentioned were recorded (type of innovator, year, sort of innovation, etc.). A database was compiled to perform statistical routines and analysis. The analysis is restricted to residential and non-residential building to reduce heterogeneity. Such a dataset is typical for the Dutch construction industry. Using professional journals as a source causes a methodological problem. The journals portray the industry. When editorial policies change, this portrait alters: not because the industry changes, but because it is projected differently. Shifts in the data might therefore be the result of publishers' interpretation, rather than an actual industry change.
- The results of this above-mentioned analysis (the findings concerning the innovative behavior of

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the sector) were therefore validated in four cases (anhydride pouring floors, cast concrete, the sand-lime industry and the use of information technology in the construction industry).

Results

The majority of innovation is incremental and process oriented

An incremental innovation (Lundgren, 1991) is defined as a single innovation (scale) that brings minor changes (scope). Per period, the number of incremental innovations can be five to nine times higher than radical innovations (often consisting of 'families' of incremental innovations). When we consider the relative concealed nature of this type of innovation (radical innovations are often more explicitly documented) the reality will show an even greater importance of these small innovative steps (Pries, 1995).

Innovation in the construction industry is mainly incremental, due most probably to the fact that in general construction firms are more inward-looking with regard to improving their technology and related processes. The market is perceived as price- and cost-driven. Many small and medium-sized firms produce similar products with similar technology and similar materials. Their focus is mainly on projects and project control (Gann & Salter, 2000). Business continuity is understood as securing a workload and utilization in addition to lowering operational cost.

Sources of innovation

Of 492 relevant innovations, 70 could not be attributed to a particular party (Table 1). In the other 422 items, the supplying industry (within the construction industry and external) proved to be the main source of innovation, producing 65% of all registered innovations and almost 80% of all product innovations. The supplying industry works with higher up-front investments in technology. Given the risks of losing these investments they feel compelled to 'create' their market niches and subsequently a stronger need to innovate. The contractors' role to innovation, although limited and restricted mainly to process innovation, seems to be on the rise.

Table 1 Parties and types of innovations

	All innovations	Process innovation	Product innovation
Contractor	10.9%	18.2%	3.4%
Supplier	64.6%	50.9%	78.4%
Architect/consultant	8.8%	10.7%	7.2%
Miscellaneous	15.7%	20.1%	11.1%
$n=$	422	214	208

The sources of innovations were also categorized by industry sector. The influence of supplying industries from other branches is considerable. About 40% of all innovations originate from other industries, of which 40% originate from the chemical industry.

Seaden (2001) states that firms have a choice of having their future shaped by processes and technologies developed elsewhere (e.g. equipment and material suppliers) or they can be 'market makers'. Our analysis does not provide the ultimate answer to this question, but it seems defendable that the construction industry is highly dependent on other industries and that there are few 'market makers'.

Innovation seems to be on the rise

Several unique periods can be distinguished in the history of innovation in the construction industry. After 1945 the postwar reconstruction in the Netherlands led to the development of various ('industrial') building systems. Starting in 1964, large-scale concrete precast systems became very popular. These systems achieved a market share of over 50% in just a few years. Because of changing production (more variation and on average smaller projects) starting in the mid-1970s, small-scale stacking elements (blocks and bricks) became the most popular building systems. In particular, the sand-lime became very popular, starting from the mid-1970s. They reached a market share of almost 70% within one decade. Pries (1995) states that this success is due mainly to their innovative policy.

Recently, construction output in the Netherlands has become more varied and projects have become smaller in size. As the housing market slowed down (prices reached a maximum level; in some Dutch regions a demand-market emerged) many construction companies and especially property developers invested in new consumer-oriented housing concepts. This has contributed to a serious increase of the share of construction companies in the number of innovations (Figure 1).

Innovation as an art of co-operation

The degree of collaboration in the innovation process was defined as a variable:

- Individual enterprises;
- Two or more enterprises working together;
- Collective R&D (sector, national).

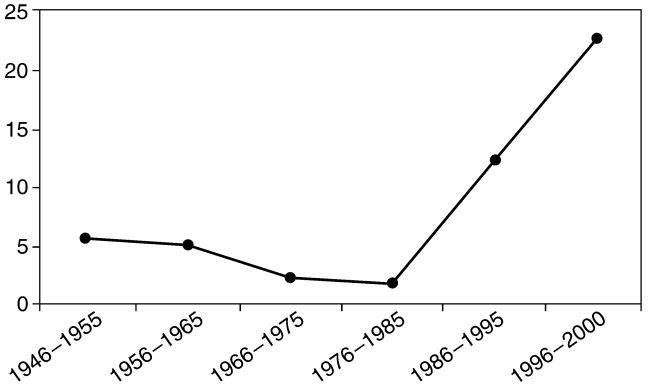

Figure 1 Average number of documented innovations per year, n=421

The analysis shows that most innovations are the result of enterprises operating individually (Figure 2). Starting from the beginning of the 1980s (until the present day), cooperation has become more popular; 50% of all innovative activities are the result of some kind of collaboration. This co-operation is to be characterized mainly as co-operation between firms, on one hand and (sub-)sector activities on the other hand. The image emerges that innovation activities take place within one firm, or between a small set of enterprises and that collective programmes play a modest role. This is in line with the findings of Seaden and Manseau (2001), who state that most of the currently available public policy instruments in support of innovation have not been of great use to the construction industry.

Size of enterprises does matter, but not much

Are smaller firms better innovators? Schumpeter first believed large companies could not innovate; he later changed this view (Martin and Scott 2000). The EU innovation policies focus strongly on small and medium-sized firms.

Innovations were analysed based on the size of the enterprises involved. In most periods the majority of the innovations emerged in the smaller enterprises (about 60–70%). Hence, smaller enterprises (<100 employees) play an important role (Figure 3).

On the other hand, it cannot be concluded that small companies play a dominant role, because about 88% of all construction companies in the Dutch construction sector have less than 10 employees (Statistical Yearbook, 2002).

Smaller enterprises tend to be more involved in process innovation while the larger firms have a stronger track record in product innovation. This makes sense as process innovation (new equipment and organizational on-site renewal) in construction has more small-scale characteristics than product innovation.

Motives for innovation, the role of market needs and regulations

Throughout the period studied the primary motive for innovation was to improve productivity (75%). Only 25% of innovation was in response to specific market demands. Innovation in the construction sector is most often a function of productivity considerations. Although in the last period considered the market motive is growing, it still is relatively unimportant. The construction industry continues to be inward-looking; customer needs are rarely recognized.

MacMillan (2001) points to the central role that governments have in supporting innovation via the regulatory framework. Our analysis shows that this role of governmental regulation is indeed a very important one (Figure 4). Innovations are labelled in relation to changes in Dutch governmental building regulations or building codes. It shows that over 30% of all

Figure 2 Collaboration in the innovation process per period, n=331

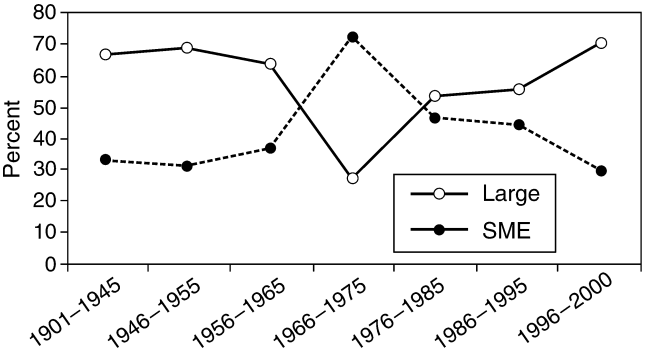

Figure 3 Size of enterprises and share in number of innovations per period, n=328

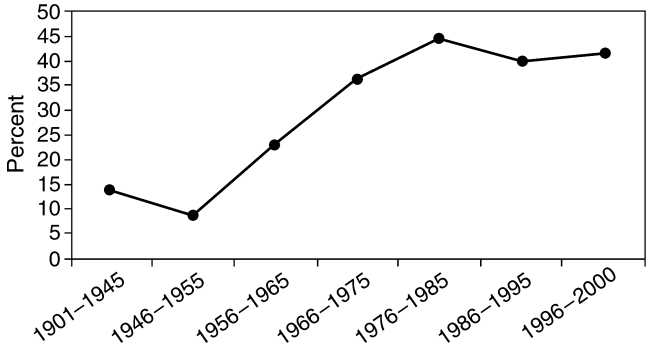

Figure 4 Share of regulation as a motive for innovation per period, n=309

innovations are the result of new regulations. Until 1975 just over 20% of registered innovations were related to new regulations. Since 1975 this has risen to almost 40% of registered items. The regulations concerning the safety and environmental impact have been particularly dominant in the last two decades, but also labour conditions are an important factor. Gann *et al.*, (1998) look at different ways to draft regulation. They make a case for performance-based rules. This will allow firms to innovate in a project-unbound (and thus repetitive) manner.

Conclusion

In several countries initiatives are being taken to awaken the industry from its inward-looking traditional patterns. For most firms it will be of prime importance to understand demand and supply drivers in their business environment. Their challenge has to be to connect understanding of their markets, the (ever)-changing regulations and the technology of their suppliers and partners. Those firms will have the opportunity to lead the industry to a higher performance standard.

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