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Innovating the Dutch construction industry

How to change?

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Abstract. *The environment of the(Dutch) building industry is increasingly turbulent. There are many cges for the building industry. Innovative tendering, better marketing, openness and transparency are examples of this. A strong reduction in failure costs (estimated at between 10 and 25% of the total costs) and an increase in quality are also necessary. Lastly, the declining inflow of young people has to be mentioned. The image of the building industry is not particularly good and students prefer to choose other industries.*
The building industry therefore has to change and, so far, everyone agrees. Evidently both the building industry and its environment are very keen to change; the sincere will is there, and money and energy are available, but it seems that efforts are not proceeding in a very planned or coordinated manner at present. And this is causing fragmentation and, therefore, sub optimisation.
How does sectoral change proceed and how is this process to be managed? That is the central question in this paper.

1 INTRODUCTION

The radical renewal of an industry is also sometimes called a system innovation or transition. A 'major' innovation of this kind incidentally always consists of a 'cloud' of smaller product and process innovations[1]. It is comparable with an avalanche; a certain critical mass is needed to set things in motion.
Not all sectors are the same; so we cannot refer to "the" building industry. Civil engineering is a different sector from, say, industrial building and mass-produced housing is a different sector from the building of luxury homes. The objective of this paper is to combine notions from different theories about the way the innovation of a sector works. The first part of this paper reviews a number of much used theoretical models, which can be divided into two groups: first, models relating to the forces needed to promote innovation and, secondly, a limited number of models which deal with the structure of innovation programmes.
A brief practical observation is followed by the description of a revised model, combining the previously mentioned theoretical models and practical observation. The intention is incidentally not to set up a ready-made input-output model, but primarily to streamline the discussion on industry change.

2 ANSOFF; THE RELATIONSHIP WITH THE ENVIRONMENT

In his research into 'the reason why firms succeed or fail' Porter[1] reaches the conclusion that success is determined by two factors: 'firm success is a function of two areas: the attractiveness of the industry in which the firm competes and its relative position in that industry'. Porter also emphasises the importance of the business environment, although the latter can scarcely be influenced by the individual business. Ansoff[2] examines explicitly the

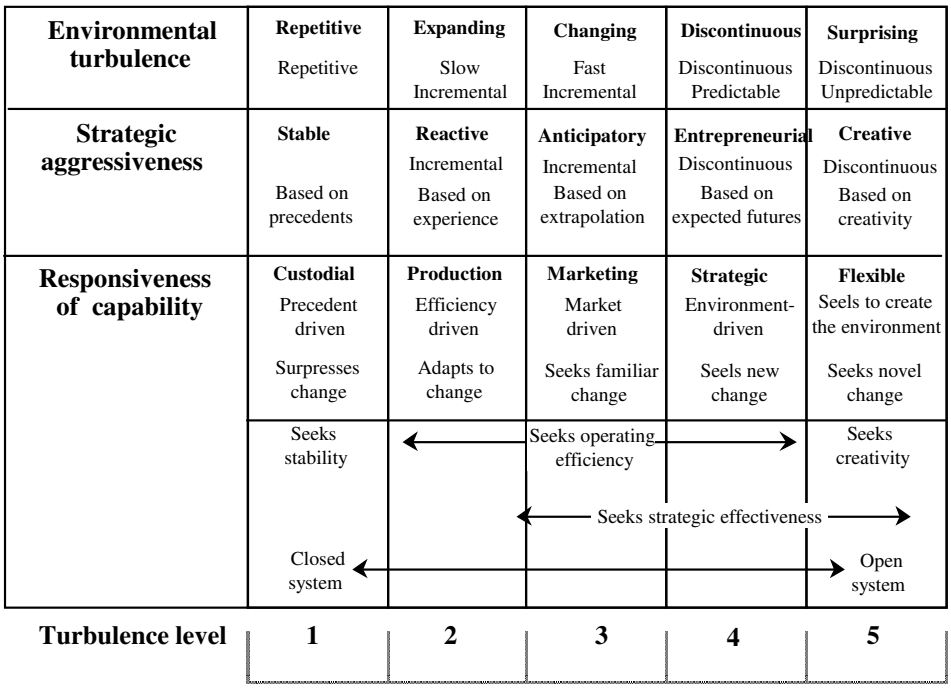

Figure 1: The relationship between the environment and the business, according to Ansoff.

relationship between the environment and how individual companies operate in it.
A company's policy and therefore also its *'strategic aggressiveness'* must match the turbulence of the environment. The latter is partly determined by the degree of continuity or discontinuity of the company policy and partly by the moments at which the company places new products on the market, in comparison with the competition. Level 1 will scarcely occur in practice. The environment cannot be characterised as stable and unchangeable, although some building firms still behave on that basis. At level 2 there is a slowly and steadily changing environment. A company can allow itself to follow a reactive course. Its policy will be aimed at making small changes in the production process and at minimising costs and price competition. The company is introvert and turned in on itself. Little attention is paid to the environment, because it is assumed that minimisation of costs

automatically leads to success. Thus little attention is paid to marketing or the formulation of strategic policy: production is the central function. The most important management task is the enhancement of production efficiency. At level 3 the environment is more turbulent. Changes occur more quickly, although they are still relatively small in magnitude and therefore reasonable foreseeable. Companies' attention must therefore be more extrovert. The company strategy is based on recognising the needs of the market. This level 3 is the environment in which part of the building industry now finds itself. Firms will try to identify these needs and the changes in them quickly and to incorporate this knowledge into their policy. It appears possible to base future policy on extrapolation methods at this environmental level. Marketing is the central function at this level. At level 2 technology is the central issue.
Level 4 is characterised by frequent and discontinuous change, so that forecasting is possible only to a limited extent. Companies will therefore devote a lot of time to *'monitoring'* their environment. They will try to identify economic, social or technological changes at the earliest possible stage. Companies which operate in a type 5 environment will try to create their own environment. At this level there is no interest in traditional forecasting methods (such as extrapolation) because the affiliation with the past is absent. They start from innovation and creativity as driving forces.
To sum up, we may say therefore that an important relationship exists between the environment and the attitude which a company adopts. The more turbulence and changes in its environment, the more attention the company will pay to studying its environment and looking for innovatory ways of increasing its competitiveness. Large parts of the building industry can be placed in turbulence level 2 (adjustment to its environment, efficiency driven by existing and known processes). A limited, although growing, part can be placed in turbulence level 3, which is characterised by a somewhat greater passion for the market.

3 ROGERS

Rogers[3] has done a lot of research into the manner in which a new technology is "taken up" by the market (business and consumers). The diffusion (and acceptance by the market) of a new technology is dependent on a number of things. Rogers distinguishes:

- Not only the advantages, e.g. financial benefits, but also prestige (corporate image), convenience, etc. These include not only objectively measurable quantities, but also advantages as they are perceived;
- The compatibility of a technological renewal with the prevailing culture within an organisation. Has the company had good or bad experiences and does a particular renewal fit within the technological path, etc;
- The complexity gives an idea of the extent to which a new technology can be understood by an organisation;
- The 'triability' or experimental possibilities of a particular technology; if experiments can first be carried out on a small scale, an introduction can proceed better and more gradually and with fewer risks;

- The visibility of a new technology indicates the extent to which a new technology 'proves' itself. When a new technology offers clear advantages it will be rapidly adopted.

A number of successes and failures in the building industry can be explained with reference to this set. For example, the slowness of the building industry to adopt 3D cad can be largely explained not only by its "incompatibility" with the prevailing culture, but also by the fact that the financial benefits are not clear to many people, or accrue to other parties. One will therefore definitely have to take these aspects into account when setting up innovation programmes in this area.

4 PORTER; (NATIONAL) SYSTEMS OF INNOVATION

The systems approach was central in the literature on innovation at the beginning of the 1990s [4, 5]. These systems occur at different levels, with the national level as the 'highest'. These *'national systems of innovation'* are important for understanding differences in the number and types of innovation in the individual countries. The national systems consist of a conglomerate of influencing factors and actors which play a role in innovation processes (e.g. the role of government, the market, the available technology and raw materials, etc.). An important element of these systems are the different networks existing between companies. Networks are formed by groups of companies and institutions which work (or fail to work) on renewal on the basis of common agreements. Different motives can be advanced for this cooperation, so that networks occur in many kinds and sizes. An important author in this field is Porter[6]. One important conclusion is that the behaviour of individual companies is insufficient to explain the phenomenon of innovation, but that innovation at different levels is influenced by the environment in which these individual companies operate. This environment is thus an important factor in the study of innovation.

The strategy literature traditionally deals with the manner in which individual companies can achieve a competitive advantage. Many authors (e.g. Ansoff, Porter) make a connection between companies and their immediate environment, i.e. the sector in which they operate. It is a question therefore of the relationship between the micro level (companies) and the meso level (the branch of industry). Porter draws attention to the relationship between the meso level and the macro level, i.e. the relationship between branches of industry and countries. A sector analysis employing Porter's diamond model was used to see which strengths and weaknesses of an industry corresponded with strengths and weaknesses in the culture and structure of a country. Strengths and weaknesses are expressed in a number of factors:

- Production factors; in which Porter makes a further distinction between *'basic factors'* (such as raw materials, climate, location, level of skill of workers) and *'advanced factors'* (such as communications infrastructure and academic institutions);
- The home market, where it is a question of the size and growth of the domestic market, the qualitative composition of the demand and the level of internationalisation;

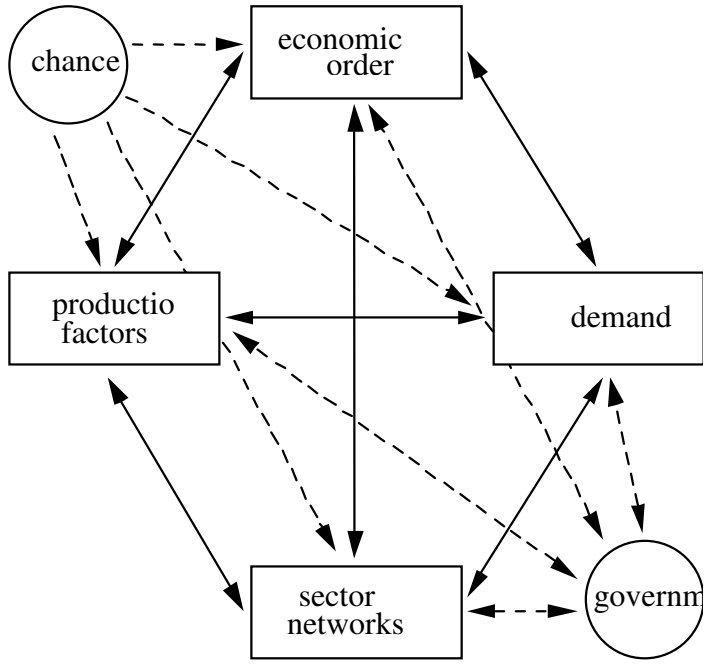

Figure2: The diamond model according to Porter.

- Networks, the extent to which locally operating companies have access to new information and technology, the extent to which there is cooperation with related sectors (R&D, manufacture, logistics, marketing, services);

- Economic order, the context within which there is competition on the national market, the number of competitors, the competitive basis, the extent of cooperation, etc.

Two further variables are mentioned besides these four central factors. In the first place, the government. This party (perhaps it is better to speak of a conglomerate of parties) influences the dynamism between the central factors. Second, there are the chance factors. These concern unexpected effects, such as: inventions, abrupt exchange rate changes, wars and natural disasters. These phenomena can have an unpredictable effect on the competitiveness of a particular country or a particular region.

Jacobs[7] explains the Dutch situation using Porter's diamond model. Although over 15 years old, the conclusions appear to have lost none of their force. For example, he gives a number of production factors which are of importance for the building industry. In particular, the geological situation in the Netherlands, the situation on the sea and the delta of the great rivers and the wet and windy climate, have a great influence on the industry. This results, for example, in solid, windproof dwellings, the use of mainly bricks and tiles as building materials, a great knowledge of foundations on a weak subsoil, advanced dredging and coast protection technology. Wage costs in the Netherlands are relatively high, but so also is the productivity. The level of vocational training is good, while the working conditions and consequently the inflow of new employees form a possible bottleneck.
Competition on the Dutch building market is mainly on price. The technical knowledge of exporting building firms is hardly used, thus blocking innovation. Cooperation in the building industry can be characterised as coalitions which change for each project. This results in rivalry and ad hoc relationships, thus impeding the building of knowledge.

5 GANN: DRIVERS OF INNOVATION IN THE BUILDING INDUSTRY

The models of Porter, Ansoff and Rogers referred to above are of general effect. They are applicable to various sectors and types of companies. More specifically directed to the project-oriented companies in the building industry, the work of David Gann should not go unmentioned. Gann[8] shows in his work that the pressure to innovate is greatest in times of great technological or economic change. From the mid-19th century to the 1960s innovation in the building industry was concerned largely with the replacement of labour by machines. During this period buildings and building processes were mainly influenced by the demands placed on them by rapidly growing industry. The emphasis lay on the employment of new materials and the replacement of manual labour to facilitate faster construction. There was a significant relationship between the discovery of new materials and their use in buildings. Machines and industrial production replaced many traditional labour-intensive techniques. After this period, in about the 1970s, another development arose alongside the mechanisation wave. The digital age changed the requirements placed on buildings and the building process.

Not only with respect to the direct influence on the design, for example, such as the application of data networks and the like; the client or the user also changed. The client wants more influence and is asking for flexible and consumer-oriented building.
Thanks to this desirable influence, clients and end users can also greatly influence the degree of innovation[9]. The manner in which clients impose their demands on the market affects the manner in which the tendering parties respond, both in respect of the product and the process. Clients who wish to build more quickly or cheaply also exercise a certain innovation pressure on the industry. Life-cycle performance and the demand for flexibility ask for different future-oriented tenders with a different quality/price ratio. It makes a great difference whether clients place the demand for the design and the realisation of a building with different companies or ask for an integrated solution.

Gann's analysis of these historical developments shows that there are two important actors in the "environment" of project-oriented companies who help to determine changes or innovation: the suppliers and the client. Gann & Salter list the actors who play or can play a role in innovation in the building industry[10].
Besides the important role of the suppliers and the clients mentioned above, Gann picks out the legislator and the technical and scientific educational institutions, such as universities, trade organisations, research institutes, etc. According to Gann's model, academic and other educational institutions influence the project-oriented companies either directly or through users and suppliers. The same applies to the legislation and regulations.

Gann's contribution is of great significance for drawing up innovation programmes in the building industry. Gann's model is in fact a sectoral filling in of the ideas of Ansoff and Porter, which also point to the strong influence of the environment. Gann's model shows on the one hand that, in stimulating innovation, one must think not only of the design and implementing (project-oriented) companies. The environment proves to be an important impulse to change. On the other hand, Gann's theory illustrates that the results of research by technical and scientific academic institutions can be implemented only through parties involved in practice (i.e. the suppliers, the project-oriented companies themselves and the clients). This means that a strong interaction must be realised in an innovation programme between these academic institutions and the companies in the sector.

6 THE DEVELOPMENT AND MANAGEMENT OF AN INNOVATION PROGRAMME

An important conclusion arising from the preceding sections is the fact that innovation does not "simply" occur. There must be an occasion for it (environment) and it is also important that initiatives should fall on fertile soil. It is therefore important to take these aspects into account when drawing up an innovation programme for the building industry.

Dewulf and Noorderhaven[11] analysed the existing literature in the area of the development and management of innovation programmes and, more in particular, innovation programmes

within a network of public and private parties. They reached the conclusion that the successful management of an innovation programme should satisfy a number of requirements:

1. The network must be based on a tight network of practitioners and researchers. The building up of involvement and dedication takes a lot of time;
2. Networks are dynamic, which means that the innovation programme must be able to adapt to changing circumstances;
3. A combination of good leadership and the right programme management methods.

A lot of research has been carried out by Van de Ven and Johnson into how to create a tight network between practice and research[12]. They make a plea in the first place for the central question of a research programme to be related to a problem encountered in practice. This means that the research is not driven from an academic question, but is inspired by a problem experienced by people in the field.

Van de Ven and Johnson also indicate that it is important to allow academics, practical researchers and people in the field to collaborate on parts of the research. It should be a co-production, which is carried at a single communal site. In other words, place the researchers with the building firms or architectural bureaus! To this end, work has to be done on creating trust between the two groups. Lastly, Van de Ven and Johnson state: give it time! Getting onto the same wavelength costs time! (see also the conclusions of Dewulf and Noorderhaven above). Finally, Van de Ven and Johnson advise not choosing a single research method, but employing different research methods at the same time within the research programme.

7 SUGGESTIONS FOR FUTURE PROGRAMMES: LESSONS FROM THE PAST

In the Netherlands, a number of major change-oriented programmes have been active or are still active currently and in the recent past. Examples include PSIBouw (Process and System Innovation in the building industry), the IFD (Industrial, Flexible and Dismountable Construction) subsidy scheme and the Innovation Platforms. Much has been said about these programmes, but there has been little structural evaluation. In addition, current or recently completely programmes generate a measure of emotion. We have based our analysis in this section on an analysis of IOP-Bouw (Innovation-oriented Research Programme for the Building Industry). This programme ran in the 1980s and incidentally had almost exactly the same objectives as the present innovation programs. The results of the IOP-Bouw programm was frankly disappointing. The output consisted mainly of a considerable volume of reports and documents, but the building industry had little use for them. Why was that? What mistakes were made? What can we learn from them, what are the success factors in paths of change? In order to analyse this, in 2004 some twenty interviews were held with people involved in the IOP-Bouw programme[13]. This, in combination with the literature analysis described above, has led to the following recommendations:

The importance of the environment

- The environment of a sector has a dominant influence on the direction of change in a sector. A desired direction of change must be fully compatible with the actual needs of the environment. It is therefore of the greatest importance to identify these needs and to involve important stakeholders (such as clients) closely in both the programming and the implementation of a programme. This is incidentally a traditionally weak point of the building industry;
- Thus organise renewal around building industry clients (launching customers). The best ideas for renewal always originate from the people who have to use your products every day. The good thing is that a great many people would very much like to deal differently with the building industry. Innovation is incidentally not a goal in itself for clients. People are interested when there is a demonstrable advantage in it for them (see the adoption criteria of Rogers).

Change is not easy

- There is not one standard model or an always successful manner of programme management. A programme aimed at changing the industry is doomed to failure. Aim at the different sectors in the building industry. There is a great difference between civil engineering construction and house building. It is a misunderstanding to think that a single innovation programme can exist for the building industry. Change is always custom-made;
- Change is incidentally also a discipline. Often programmes resolutely dive into the content. Certainly in the building industry this is a great danger. A programme should start from a vision of the process to be followed in the perspective of change and the content will accordingly adapt;
- Change also takes time! Place the necessary steps in a framework of many years. In a lot of cases a programme is scheduled with a duration of a few years, while structural change (in the absence of an outside threat) takes many decades. Anticipate a programme therefore of long-term financing from the companies concerned. Subsidies can strengthen this, but should not form the basis. Also do not arouse any unreal expectations, as this will quickly lead to demotivation.

The relationship with practice

- Entrepreneurs perform a central role in renewal, so allow these people to define in advance what they want to achieve and how it should be done. In the past the programming of research and experiments was often carried out by academic institutions. They did the things which they found interesting, or they are good at, instead of the things which were necessary;
- Place researchers of different origins (academics and practitioners) together.

How to organise?

- A small, spirited, facilitating core, which is at the service of the above. An innovation programme must be flexible and able to adapt to changing circumstances. A programme that is "fully booked" two years in advance offers insufficient scope for this. Renewal must be given space and should not be organised down to the last detail;
- Change must always reckon on resistance, Machiavelli already knew that centuries ago. Change is achieved only under pressure (when it must; an outside threat) or if it has a real advantage for the people concerned. So invent an icon for the ultimate goal that one has in view. A beckoning prospect in which the advantages are interpreted for the people concerned is highly inspiring;
- Design a form of programme management which has room for different kinds of research;
- Store the experiences gained and show good examples. This also implies, for example, evaluating an innovation programme
- Distinguish between innovation in companies and the innovation of an industry. Innovation in companies has to do with competitiveness: aim research and implementation primarily at enhancing the innovative strength of the companies. As far as the industry is concerned, aim research and implementation at the environment: clients, as a driving force behind changes.

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