

SEEPING IN? EMBANKMENT OF PRODUCT INNOVATIONS IN URBAN RENEWAL

Christian Koch¹and Rolf Simonsen

Construction Management Department for Civil Engineering, Building 115, Technical University of Denmark, 2800 Lyngby, Denmark

There seems to be a widespread consensus that the buildings sectors ability to handle innovation will be crucial for its future. This paper reports on ongoing research into getting new products, which are intended for urban renewal, implemented and embodied in actual urban renewal projects. Three different approaches to the journey of new ideas and new products into a sector are discussed, namely buying behaviour, innovation networks as well as actor networks and political processes. A specific focus is given to processes of embankment, which is understood as the normalisation into the engineering and design culture of the companies responsible for design in urban renewal. Embankment is beyond implementation, which is the first use of a new product. Implementation is often given special attention, whereas embankment is often forgotten. Case findings from an ongoing study of three products developed with support from the Urban Renewal Company of Copenhagen are presented and discussed. One, the centrally placed heating system is used as primary example. A mapping of the design and production network within urban renewal in Copenhagen show a relatively small group of engineers, architects and contractors as recurrent. Drawing on the three theoretical perspectives, different explanations occur for the lack of even implementation, but also lack of embankment of the products. Prices, tradition in choice of solutions, competing products and lack of leadership are some of the explanations. Suggestions for improved embankment include the strengthening of non-commercial intermediaries, such as professional associations. It is argued that the seeping in of an innovation in a sector cannot be carried out solely on a commercial basis. Rather personal networks are crucial.

Keywords: diffusion, innovation, political processes, product development, urban renewal.

INTRODUCTION

The buildings sectors ability to handle innovation attracts considerable attention from its players and it is widely understood that innovation will be crucial for its future (Bale 2001, Erhvervsministeriet 2000). Much less emphasis is given however to discuss and analyse the social, cultural and technical mechanisms needed for embedding the many good ideas, innovative products and processes that are actually developed in the sector as well as around instead of outside it.

This paper report on ongoing research into getting new products implemented and embodied in actual urban renewal projects. Three different approaches to the journey of new ideas and new products into or within the sector are discussed: Buying behaviour, (Larsson 1992, Emmitt & Yeomans 2001), innovation networks (Koch *et al.* 1999) and actor networks and political processes (McLoughlin *et al.* 2001). In the

¹ ck@byg.dtu.dk

subsequent case analysis the three perspectives are used in a mutually complementary manner.

Three product innovations have been investigated: a centrally placed heating system, an installation shaft and a “light” front facade extension. All developed within the framework of a public development program, called “project renovation”. The paper is structured so that the centrally placed heating system is described and used as the primary case, whereas the two others are only referred to in the discussion and analysis.

At least two public authorities are regularly referred to; “By- og boligministeriet” and “Erhvervsfremmestyrelsen” mentioned by their Danish names. By- og boligministeriet, was until 2001 the ministry of housing, now merged with the ministry of industry, Erhvervsministeriet. One of the important departments in the ministry of industry is called “Erhvervsfremmestyrelsen”, which is the department for industrial development. This department changed name and activities by the end of 2001, and is today called Erhvervs- og Boligstyrelsen.

The paper is structured as follows: After some methodological considerations, a section discusses the three theoretical approaches used here. Then the case section deals with an example of product innovations, the centrally placed heating system. In the discussion part results from the investigation of all three innovations are drawn upon. The conclusion follows, including tentative recommendations for future handling of product development at the Urban Renewal Company.

METHOD

The paper emerges out of an ongoing research financed jointly by the Technical University of Denmark (DTU) and the Urban Renewal Company of Copenhagen. The project employs Rolf Simonsen, a research assistant at DTU, for four months and involves Lone Zeeberg from the Urban Renewal Company as active cooperator as well. Tenna Tuchsen, of the Urban Renewal Company of Copenhagen and Christian Koch are also members of the project group.

It is recognised that the independence of the research could be constrained by the close cooperation with and partly financing of the Urban Renewal Company of Copenhagen. It is assumed however that the cooperation gives unusual good insight in the projects studied as well as the urban renewal/ refurbishing market. Second, the potential occupational bias from the authors towards the players in construction could become a problem (see Loosemore and Tan 2000). It can be noted that both DTU-participants share the professional background as engineers with a multidisciplinary education and training in management and organisation, whereas the participants from the Urban Renewal Company both have backgrounds as architects, with administrative and public servant experiences.

The overall approach taken is interpretive sociology. The theories mobilised draw on various types of innovation studies, ranging from the classical linear model of innovation diffusion (Rogers 1995), through its critics (Clark & Staunton 1989, Fleck 1993 a.o.) to newer sociological and economical theories of innovation networks (the former includes sociology of innovation such as Latour 1997, Callon 1991& Law 1991, the latter Hakansson 1987, Freeman 1991, a.o.). And finally innovation processes seen as political processes (McLoughlin *et al.*, 2001, Elg & Johansson 1997). These positions are used in a juxtaposed manner.

The three products were selected out of five considered which all participated in a competition arranged by the Urban Renewal Company of Copenhagen. Initially a preliminary mapping of promoting actors related to each product was carried out and an descriptive analysis of the content of the product innovation based on existing material and knowledge in the Urban Renewal Company (URC) (By- og boligministeriet 1999a, 2000, 2001).

A series of interviews as well as two focus group interviews have been the main body of the empirical work. The interviews covered promoting as well as observing actors related to the three products, or in other terms members of the network around the three products as well as from the urban renewal and refurbishment sector. The focus group interviews was designed with one with a focus on architects and one with a broad set of representatives of the players of the sector including component manufacturers, and applied science institutions. The final report will contain a model for evaluating future projects as well as recommendations for enhancing embankment.

THE TRAVEL ROUTES OF PRODUCT INNOVATIONS

Studies of innovations in construction have argued for distinct travel routes for product, process and management innovations (Winch 1998, Koch 2002). Product innovations are often driven by component manufacturers, which in the architect and consulting engineering company organisation seep in via the projects (Winch 1998, Emmitt 2000). In contrast to management and process innovation, which often seep in via corporate management in architects-firms, consulting engineering- or contractors companies. Among the others channels of diffusion for Product innovation one needs to be mentioned here: The link to the contractor role when the latter might suggest alternative products to those specified by architects and engineers. The product innovation is thus dependent on bonding between manufacturers architects and consulting engineers and contractors. The bonding consists not only of communication and information channels, but also of economic relations like rebates and purchasing agreements.

Three different approaches to the journey of new ideas and new products into a sector is discussed below, buying behaviour, (Larsson 1992, Emmitt & Yeomans 2001), innovation networks (Koch *et al.* 1999) actor networks and political processes (McLoughlin *et al.* 2001). For each perspective some aspects of the product innovation travel are discussed. These aspects are the understanding of the travel of the product innovation, barriers, the understanding of the content of the innovation, the role of competing products/ social networks and the understanding of the stabilised use of the product, the embankment. Since the embankment notion is central we will initially define it: we understand embankment as the normalisation into the engineering and design culture of the companies responsible for or contributing to design. Embankment is beyond implementation, which is understood as the first use of a new product. Implementation is often given special attention, whereas embankment is often forgotten.

Buying behaviour

In buying behaviour approaches the focus is often on one person, who is perceived as the prime specifier (Larsson 1992, Emmitt 2001). In Larsson's case of process innovation at the building site, the site managers are understood as the central decision-maker. In Emmitt & Yeomans account, architects are viewed as "licensed specifiers", as the dominant party in the specification process (Emmitt 2001:2).

Larsson, Emmitt and Yeomans build their understanding of the travel of the innovation on Rogers classical work (Rogers & Shoemaker 1971, Rogers 1995). The understanding is thus that innovations travel is characterised by three distinct phases, invention, diffusion and adoption. The authors do not discuss the equally classical critique of Rogers (Clark & Staunton 1989, Fleck 1991). But what make Emmitt and Yeomans especially interesting is their empirically grounded account of product selection during building specification. They present the architects as being constantly bombarded by marketing material and information sent by building components manufacturers. The main travel of product innovation is therefore from the manufacturers, over their trade representatives and marketing material, through gatekeepers in the architect's office and finally reaching the principal specifier. It is described as a travel from Awareness, to Considered, Specified and finally to Confirmation (embankment). The architects studied thus keep a list of approved products as well as prohibited ones. Confirmation can thus be followed as, when products not only enter the list of approved products, but also get used again in another project. Emmitt & Yeomans moreover describe an important "side story" related to how contractors can initiate substitution of specifications and their bonds with building merchants might act as a strong promoter for alternative solutions. Some architects use "or equal" or "or equal approved" in their specifications and thereby open up for contractors entrepreneurship, promoting their own merchant partners. Finally Emmitt (2001) describe how urban planners as a third party became important players in a specification of a product. There are thus the contours of alliances and networks in the analysis. Although the impression is that an overemphasis is given to architects offices as the corona of events and manufacturers of products are seen as distant actors.

In Emmitt 2000 and Emmitt & Yeomans 2001, version of the Rogers framework innovation is largely black-boxed and fixed. Sociologists of innovation and critics of Rogers would argue that on the contrary the content of innovation is of outmost importance for the understanding of the travel processes and moreover for the negotiations over the innovation, which usually will change it as it travels. In Emmitt's version the specification process is described as rational, and not political or interpretative it seems. There is thus a need to enlarge and develop the Rogers framework used by Emmitt

Innovation Networks

Many companies and innovation researchers argue that contemporary innovation is best conducted through network relationships (see McLoughlin *et al.* 2001 for a discussion). Gann (2000) for example underlines that construction innovation and knowledge are becoming increasingly complex and multifaceted, which in our understanding leads to that fewer and fewer construction companies will be able to carry out innovation by themselves. Some kinds of partner alliances are needed. Perspectives on innovation networks range from institutional and evolutionary economics on one hand over organisational analysis/theory to sociologically grounded constructivist positions on the other. Convergence between these apparently diverse positions in the study of innovation networks has also been developed (Coombs *et al.*, 1996 Green, *et al.* 1999). The central argument of innovation networks is that by pooling resources and creating a climate of trust the companies can develop a new organisational form suitable for carrying out innovation. In the broad understanding used here the links in the network is mediated through personal relations but are also relations between firms (in contrast to Hakansson's classical network between firms

understanding). The links might be formalised through contracts but the might equally be of informal character.

The building of a new network around and with a new product often draws on and is embedded in an existing production network (Koch 2002). Comparing the status of innovation network studies with the critique given above of buying behaviour approaches, innovation network studies predominantly still blackbox the innovation and also the network building process. This calls for the third perspective.

Change processes

Introducing actor networks and political processes in innovation studies means an emphasis on the interpretative and political acts of the participants as well as an understanding for content of the innovation (McLoughlin *et al.* 2001, Frost & Egri 1991, Elg & Johansson 1997). Again very different approaches have been developed. There is thus quite some distance from Van de Vens *et al.* (1999) attempt to built normal science to Latour's relativistic social constructivism. It is however beyond the paper to tackle these differences, they are seen here merely as sources of inspiration.

In a change process- or political process view, innovation processes are characterised by negotiations over the content of the innovation and direction of the innovation process. The innovation is under continual scrutiny, it is understood differently by different actors, there is an interpretative flexibility (Bijker 1995) and it is central for its development that actors assign productive meaning to it. There is a direct interaction between the innovation content and coalition built around it (Latour 1997). This coalition can be understood as a change coalition of promoting actors, in a context of other actors and coalitions. Building the change coalition involves change leadership (Van de Ven *et al.* 1999, Kotter 1996). No matter what the content is however, there is a need to create a feeling of urgency (the push perspective). Van de Ven describes as crucial, that leadership is diffused on several actors and that one role of disperse leadership should be that of the "critic", a role involving asking the painful questions on the innovations feasibility. The embankment is in this position understood as discursive closure, irreversibility and that the innovations has been embedded in culture (Kotter 1996, McLoughlin 1999).

The juxtaposition of the three positions

In the current project these three perspectives are used to develop a method for characterising the product innovation, the co-development of an actor network and the product and the process, with the end goal of embankment. The content of the innovation is characterised by the following dimensions: systemic or component (Winch 1998), visible or non visible, technical functionality, installation requirements, alternatives, effect, social networks, networks around competing products, aesthetics cultural, building and housing styles.

CASES: CONTENT OF THE INNOVATIONS

The three cases all operate in a context of the refurbishment market of dwelling housing in Denmark. There is an overlap with actors operating in other parts of refurbishment and developing new buildings, this is not discussed further here. In the Copenhagen area there seems to be a relatively small set of consulting engineers and architects operating in refurbishing, maybe around thirty. The patterns within contractors have still to be investigated.

The three products aim at refurbishing of multi-story dwelling housing, typically with small apartments. The products represent incremental innovations. The development has been partly financed by public funding and the budget for development has been limited as well as the organisation behind. In all three cases large parts of the product represents a rebundling of existing components or variants of existing products (such as a larger radiator with unusual measures, but in a way that make it immediately producable by a radiator manufacturer).

The three products chosen for the investigation are the following

1. A centrally placed heating system. The system consist of a special routing of heating pipes, installed in the old chimney, which is internally treated with a “sock”, a centrally placed large radiator and special ventilation (using the chimney as fresh air channel), and noise protection. The innovation contains both visible and invisible elements and it is systemic since it combines routing of pipes, with the special radiator, with ventilation and noise protection.
2. Installation-shaft. This product is a vertical shaft for pipes and other installations making the installation process more swift and smooth. But also enable easier maintenance. The shaft is placed in a kitchen cupboard in the apartments. This is a component product and is predominantly invisible.
- 3.”Light” front facade extension. This product is a metal construction mounted on the facade of the multi-storey house and extended each apartment with extra balcony-like space. To carry this a lattice girder is mounted on the rooftop. This is predominantly a component innovation and indeed very visible.

The centrally placed heating system

The centrally placed heating system has been developed in two versions, or generations, which has both been supported by the Urban Renewal Company. The first version, starting in 1997, involved development of a prototype of the radiator, and measurements of thermal comfort (temperature and air quality). The second, starting in 1999, involved using the existing chimneys for vertical routing of the pipes and incorporating noise protection in the innovation.

The final report from the first project argues that the main effect of this innovation is reduced heating costs, less problems with draft, better air quality and avoidance of the placing of radiators underneath the windows (which is a widespread and therefore “normal” placement) (By og Boligministeriet 2001)

The promoter coalition

The change coalitions around the centrally placed heating system, include two architect’s firm, two consulting engineers, sample of users in two dwelling housing (one for each generation), a manufacturer of radiators, a ventilation company, various contractors , two associations for inhabitants, a building society, and the Urban Renewal Company. Central driving actors seem to have been the architect’s firms and the consulting engineers, whereas the manufacturers of radiator, ventilation and the chimney-sock and the contractors seems to have been enrolled more or less on a contract basis, without being expected to promote the innovation. A central reason for commencing developing this product moreover seems to be the possibility of obtaining public funding.

The innovation has not – so it seems- been reported in the professional press or in professional associations. It has however been part of the program “project

renovation”, which provides a website, printed project summaries, reports and events such as an evaluation event called “product seminar” held in 1999 (By- og boligministeriet 1999b, Nielsen 1999). We have so far anecdotal data on another consulting engineering firm using the centrally placed heating system in another case, without assigning much success to it.

The existing production networks competing product

The main competitor to the centrally placed heating system is a well-embanked network around pipe routing close to the facade of the houses and radiators placed under the windows. This network is for example underpinned by engineering and architectural practices/cultures, which -so it seems-perceive the “window solution” as having better thermal comfort than the centrally placed system or at least known thermal comfort). Moreover wholesalers and manufacturers of radiators are bonded with contractors, especially heating system contractor by purchasing agreements, rebates etc. In Denmark three major wholesalers of heating components have 75% of the market.

Embankment?

The centrally placed heating system has matured in two phases including solidifying the claim of the innovation with thermal measurement. These measurements weaken the competing network’s argument on the window-placed radiator along with the social arguments on aesthetics. Moreover at least one other company outside the promotion coalition has specified and used the innovation. Further investigation will reveal whether there is a broader awareness of the innovation in the refurbishment sector. Since the centrally placed heating system is a systemic innovation, it is more suited to travel through the main specifiers, that is, the architects and engineers. This travel can in principle be enhanced by owners, authorities and manufacturers, but this has not been the case here, apart from the Urban Renewal Company obtaining public support for (part of) the development costs. It is less likely that contractors will suggest substitution of the specified in the production stage (whereas more component oriented products are more inclined to have an alternative travel through wholesalers and contractors, secondarily through owners, authorities)

It should be noted that the manufacturers and wholesalers are rather peripheral actors in the project phase. After developing the initialising project, the embankment phase needs other resources than the public funding. Where the central actors of the promoting coalition are likely adopters of the innovation, the further travel to other urban renewal projects has to occur by other intermediaries or actors. Manufacturers of the components could play a central role in the embankment and further travel, in this case especially the manufacturer of the radiator.

DISCUSSION: SLEEPING IN?

The three products have obtained different levels of embankment. The centrally placed heating system is the only one with a certain embankment, whereas the others seem not to have been reused. It is interesting that a systemic product innovation, which is also partly visible, and therefore is assumed to be the most troublesome type, obtain this embankment. As described by Winch and Emmitt and stated by the interviewed actors, it is on the other hand to be expected that the light front extension, which is extremely visible, made by complex components and also a very designed product, would not be reused by other specifiers. It seems that there is a need to be a flexibility of expression of, or impact for, the next adopters. The three networks,

promoter coalitions roughly contain the same types of typical actors in a construction setting. In all three networks however, the manufacturer is a latecomer and they even stay loosely coupled after the first implementation. The building merchants are not directly involved in any of the cases. Moreover, only the installation shaft have received critical reviews in the professional press, whereas all three have been part of the communication activities provided by the public program “project renovation” as already mentioned. (By- og boligministeriet 1999b, Nielsen 1999). This coverage is by some sector actors been interpreted as a pro-innovation bias however.

The Urban Renewal Company is an important frame setter for innovation in renovation projects. As the owners counsellor, they have developed an explicit and relatively precise set of design demands. In this role of counselling the politics of product specification is relatively cautious. At the same time however, the company also acts as promoter of innovation in refurbishment. This goes for product as well as process innovations. In this role the company is in a more risk-taking position. There is thus a tension between these two roles.

In the documentation about the products, the prices given for these solutions indicate that they are competitive. Nevertheless at least one observer finds that the price should be further reduced to improve competitiveness (By- og Boligministeriet 1999b)

We further find that tradition in choice of solutions, competing products (such as it is the case with centrally placed heating) and lack of leadership, especially the critical type are some of the further explanations for the restricted embankment.

CONCLUSION

Drawing on the different theoretical perspectives, several explanations occur for the lack of even implementation, but also lack of embankment. We have found little evidence of commercial marketing of any of the three products. The prices and economy seem to be competitive, but tradition in choice of solutions, strength of competing products and lack of leadership (especially critical leadership) are some of the explanations. The suggestions for improved embankment include

Manufacturers of the new products have to perform more actively in the development phase in order to stand a central actor in the subsequent embankment phase. This could be seen in direct prolongation of the next suggestion:

The public funding should demand specification of implementation and embankment plans. This could include organised communication of the results and the “offer” of the new product as well as embedding the product in marketing from manufacturers and wholesalers.

Different strategies could be followed concerning component respectively systemic innovations. Where components might get embodied by traditional market mechanisms, systemic needs further awareness and knowledge to be embodied. Presenting the innovation in the professional press and in professional associations and allowing other professionals to review the innovation could lead to further enrolment of actors in a change coalition.

The Urban Renewal Company acts as counsellor for owners and as promoter of innovation in refurbishment. These two roles are not easily coordinated. In the role of counsellor the politics on product specification are relatively cautious, some might call it conservative, whereas the company in the other role actively has promoted a long row of development projects. It could be considered to demand from specifiers, that

they consider the new products as alternative to the existing (i.e. facade routing of pipes and radiators at the window versus centrally placed heating) and that they are obliged to give calculations to underpin their choice.

The project could be obliged to develop the critical leadership role (Van de Ven *et al.* 1999). For example the project group should obligatory organise one or several external professionals to act as critics. Giving critique of the new product ideas should be seen as a motor for developing them.

An important implication of our considerations and findings is that the seeping in of an innovation in a sector cannot be carried out solely on a commercial basis. Rather personal networks and non-commercial intermediaries, such as professional associations are crucial. The pure commercial “route” from manufacturers to architects and engineers is a necessary travel of the stabilised innovation, but to pave this way, other paths have to be there to support it.

REFERENCES

- Bale, J. (2001) Creating a climate for innovation by re-defining construction as A knowledge-based Industry. *Keynote address to the First International Conference on Innovation in Architecture, Engineering and Construction*, Loughborough University, UK, July 2001.
- Bijker, W.(1995) On Bakelite, Bulbs and Bicycles. Boston: MIT press.
- By & Boligministeriet (1998) Analyse af renoveringsmarkedet i Danmark 1990-2008. Projekt Renovering. København: By-og boligministeriet.
- By & Boligministeriet (1999a) Komponentløsning med lette stålkonstruktioner. Projekt Renovering, nr 008. København: By-og boligministeriet.
- By & Boligministeriet (1999b): Referat produktseminar Projektrenovering. København: By- og boligministeriet.
- By & Boligministeriet (2000) Præfabrikerede installationskakte. Projekt Renovering, nr 142. København:By-og boligministeriet.
- By & Boligministeriet (2001) Industrielt design og udvikling af centrale placerede varmeanlæg. Projekt Renovering, nr 242-01. København: By-og boligministeriet.
- Callon, M. (1991) *Techno Economic Networks and Irreversibility*. In J. Law (ed.) A Sociology of Monsters: Essays on Power, Technology and Domination. London: Routledge.
- Coombs, R., Richards, A., Saviotti, P. & Walsh, V. (eds.) (1996) *Technological Collaboration: The Dynamics of Co-operation in Industrial Innovation*. Cheltenham::Edward Elgar.
- Elg, U. and Johansson, U. (1997). Decision-making in inter-firm networks as political process. *Organisation Studies*, **18** (3) 361-384.
- Emmitt S (2001) Technological gatekeepers: The management of trade literature by design offices. *Engineering, Construction and Architectural Management*, **8**, (1), 2-8.
- Emmitt S. & Yeomans D. (2001) Specifying Buildings. A Design Management Perspective. Oxford: Butterworth-Heinemann.
- Erhvervsfremmestyrelsen (2000) *Byggeriets Fremtid – Fra tradition til innovation*. København: Erhvervsministeriet.
- Fleck J. (1993) : Configurations:Crystallizing Contingency. *The International Journal of Human Factors in Manufacturing*. Vol 3. Wiley & Sons

- Freeman, C. (1991) Networks of innovators: A synthesis of research issues, *Research Policy*, **20** (5), 499-514.
- Frost, P and Egri, C (1991) The political process of innovation. *Research in Organisational Behaviour*. 13, 229 - 295.
- Gann D.(2000) *Building Innovation. Complex constructs in a changing world*. London: Thomas Thelford
- Green, K., Hull, R., McMeekin., A., Walsh., V. (1999) construction of the techno-economic: networks vs. paradigms. *Research Policy*.
- Hakansson, H. (1987) *Industrial Technological Development: A Network Approach*. Croom: Helm.
- Koch, C., McLoughlin I., Dickson K and Manske F (1999) Highflying or Embankment in Innovation networking -Spatiality and timing in the age of cyberspace. Paper prepared for the *Regional Innovation Systems in Europe NECSTS-99 Conference*.
- Kotter, J. P. (1996) *Leading Change*, Boston: Harvard Business School Press:
- Larsson, B. (1992) *Adoption af ny produktionsteknik på byggarbetsplatsen*. Report 30. Institutionen för byggnadsekonomi och byggnadsorganisation. Chalmers University of Technology. Göteborg.
- Latour, B. (1997) 'On Actor-Network Theory - A few clarifications'. *Soziale Welt*.
- Loosemore M and Tan C.C. (2000) Occupational bias in construction management research. *Construction management and economics*. 18, 757-766.
- McLoughlin, I., Koch, C. and Dickson, K., (2001) What's this "Tosh"? Innovation Networks and new product development as a political process. *International Journal of Innovation Management* .5 (3). 275-298.
- Nielsen O (1999) Produktudvikling. København: Projekt Renovering.
- Van de Ven A. H., Polley D, Garud R.& Venkataraman S., (1999) *The Innovation Journey*, New York:: Oxford University Press.
- Winch, G. (1998) Zephyrs of creative destruction Understanding the management of innovation in construction. *Building Research & Information*