

THE PROJECT BOUNDARY AND HOW IT AFFECTS RENEWAL WITHIN CONSTRUCTION

Håkan Håkansson

hakan.hakansson@bi.no *Norway Department of Innovation and Economic Organisation, BI Norwegian School of Management*

Malena Ingemansson

malena.ingemansson@sts.uu.se *Sweden Centre for Science and Technology Studies, Uppsala University*

Åse Linné

Sweden Centre for Science and Technology Studies, Uppsala University

WIP

Abstract

This paper addresses the relationship between project organization and renewal in the construction supply chain, and proposes an investigative framework for studying this matter further. In an earlier study of innovation in the Swedish construction industry we reached some interesting conclusions in regard to the degree and variation of renewal. (Håkansson&Ingemansson, forthcoming) The study was based on a survey including 440 companies and was also complemented with a dozen CEO interviews, where the survey was used as a basis for the interviews. We found that a substantial part of the companies, 61%, had engaged in renewal during the last five years, and while this is certainly an encouraging result, it also means that 39% of the companies had done very little or not engaged in any renewal activities at all. This suggests that there is a renewal pattern which needs to be investigated further. We also concluded that it was mainly larger companies and business units within larger corporations that had engaged most in renewal, which appears to be related to the access of an extended internal network of other business units and earlier/ongoing projects, and to an external network of suppliers, customers and other collaborators which this in turn provides. This access creates learning and development opportunities through a continuous knowledge and resource exchange. (Håkansson&Ingemansson 2011, Håkansson&Ingemansson forthcoming)

Still, a second finding was that even if renewal seems to take place both in regard to customers and suppliers it is mainly the internal network (staff and other units within the corporation), besides customers, that is regarded the most important driving force of renewal. This indicates that the forming of relationships with suppliers, subcontractors or specialists is not considered very important for renewal. One important explanation for this seems to be the way that the construction industry is organized, namely that the main part of the activities takes place within time-limited projects. Every project introduces the single construction company to new local conditions, a new constellation of actors and the necessity to create new and specific solutions. This result in efficient ways of adapting to new conditions and creating temporary solutions but complicates the forming of long-term relationships and therefore to learn collectively. If construction companies generally do not engage in close relationships with their suppliers and subcontractors they probably do not have a very deep understanding of how these supplying companies work internally or how they engage in

renewal. Thus, there might be a lot of renewal activities going on in the supply chain which is more or less hidden to the construction companies and the customers, or which the construction companies fail to take notice of since it does not necessarily affect their internal processes.

Consequently, an important result from the study is that there is probably both direct and indirect renewal happening in the construction supply chain, which means that in relation to construction activities the definition of renewal, i.e. what it means and how it happens, is not really obvious. And therefore it is not obvious how renewal is brought into and affects the single project. Based on these results we argue for a continued study taking the project as an organizational unit of analysis in examining the industry's opportunities (or lack of opportunities) for renewal. What we will study is thus the project organization in relation to renewal activities. The boundaries of the project and the renewal which is brought into the project can be characterized in relation to its interfaces. The first interface is in relation to the construction company or joint venture that has the final responsibility. The project is anchored in relation to this organization in terms of some personnel, some routines, and some resources/assets. The second interface is in relation to the customer/user. This interface is obviously important and can be defined in relation to type of agreement and the way the customer want to be involved during the project. The third interface is in relation to used suppliers and other entrepreneurs. Again the agreement with those can be designed in different ways and they can be more or less involved in the renewal activities. The fourth interface is with other projects that are more or less related to the focal one. It can be projects already conducted, it can be contemporary projects or it can be projects that will start in the future. The project organizing emphasize that these interfaces should be distinct and clearly managed. In this way the management becomes important for the renewal activities. The single project is free to make changes but all changes have to be managed through the interfaces. None occur in a simple organic way. These interfaces can represent direct renewal, and indirect renewal through the association to other interfaces in the supply chain. Therefore, it is not clear where the boundaries of the project, i.e. of the renewal effects influencing the single project, lie and which direct and indirect interfaces that the project include.

With the project organization as a primary unit for studying renewal within construction the intention is to go deeper into the issue of what type of interfaces (to counterparts and their resources) that drives and hinders renewal activities within this particular industry.

Keywords: construction, supply chain, renewal, project boundary, resource interfaces

INTRODUCTION

The aim of this paper is to examine the relationship between project organization and innovation, or renewal, in the construction supply chain, and to propose an investigative framework for studying this matter further. In an earlier study of innovation in the Swedish construction industry we reached some interesting conclusions in regard to the degree and variation of renewal. (Håkansson&Ingemansson, 2011) The study was based on a survey including 440 companies and was also complemented with a dozen CEO interviews, where the survey was used as a basis for the interviews. We found that a substantial part of the companies, 61%, had engaged in renewal during the last five years, which according to them had led to their customers getting a more valuable product. Considering that we have experienced quite a severe financial crisis during the same time period this is a surprising result in terms of showing a higher degree of renewal than we expected. It also challenges the view of the construction industry as non-innovative and conservative, and perhaps leaves room for a different interpretation of what innovation is and how it is carried out within this particular industry. If nothing else it certainly calls for a deeper investigation of the matter. Nonetheless, the results of the study also show that 39% of the companies state that nothing or very little has happened in terms of renewal during this period, and that the customer basically is provided with the same product as before. This suggests that there is a variation in the construction network; some companies are more renewal oriented than others, and there is thus a renewal pattern which needs to be investigated further. From the study we concluded that it is larger companies and local business units belonging to larger corporations which are the most renewal prone companies, and which have also conducted more substantial type of renewal, such as the development of technical platforms and increased international purchasing of material and services. Smaller, independent companies do not have the capacity to carry out such types of development, nor do they have the same opportunity as business units within larger corporations to interact with an extended internal and external network in terms of other business units, earlier and ongoing projects, suppliers and customers and so on, and thereby engage in a more encompassing type of exchange of knowledge and other resources. The network position of the company thus seems to have an effect on how it needs or can engage in renewal. (Håkansson&Ingemansson 2011, Håkansson&Ingemansson forthcoming)

This opens up questions regarding the interaction pattern in the construction network; how do the different actors within the construction network interact and how does this affect how renewal takes place? What the study showed, and which is also indicated in several other empirical studies (e.g. Akintoye et al 2000, Dubois & Gadde 2002), is that construction companies tend to put a lot of focus on their customer relationships but very little effort is put on achieving the same type of interaction with the supply side. This does not rhyme well with the fact that suppliers of both materials and services (sub-contractors) usually account for 60-70% of total volume (Dubois & Gadde, 2002). We believe that this inconsistency, or unbalanced manner in which the different relationships are managed, has effects for how renewal happens and is viewed, both within and outside the industry. If construction companies generally do not engage in close relationships with their suppliers and subcontractors they probably do not have a very deep understanding of how these supplying companies work internally or how they engage in renewal. Thus, there might be a lot of renewal activities going on in the supply chain which is more or less hidden to the construction companies and the customers, or which the construction companies fail to take notice of since it does not necessarily affect their internal processes. Our study showed that the construction companies mainly stated renewal which concerned their own processes, such as increased quality of project work, improved planning and increased number of partnering

relationships with customers. This is direct renewal which the construction companies have engaged in themselves, but a reasonable assumption is that there is a lot of *indirect* renewal in the construction supply chain which becomes embedded in the construction process and in the finalized product, but which for different reasons might not be obvious to the construction companies. This leads us to the purpose of our continued study; to further investigate how renewal takes place in the construction supply chain in terms of both direct and indirect effects.

Areas of investigation

We have identified four areas which pose particular complexity issues in regard to construction, and in which we will look for interfaces between involved actors and resources that might account for renewal themselves, or work as hindrances or driving forces for renewal. These areas are:

1) *The organization.* The construction business is organizationally fragmented in terms of construction activities being organized in separate projects and the supply chain also involves a great number of different actors. The results of our survey show that many of the fundamental aspects of handling the project organization are also areas in which construction companies have focused their renewal activities, such as increased quality of project work, improved planning and increased number of partnering relationships with customers, which was mentioned above. Interestingly enough, looking at the most renewal oriented companies it is the effects of being a project organized business which are also pointed to as the most important hindrances to renewal. This means that companies which have actually engaged in substantial renewal, and therefore are familiar with the process of trying to implement new methods, products and processes, view the basic difficulties of project organization as also the most important impediments for industrial renewal within construction. That every project is unique as well as the problem of not being able to capture new knowledge and experiences gained during the project were two such aspects. Not enough time for planning the projects was also seen as a great barrier to renewal. In regard to the number of different actors in the supply chain our study indicates that the share of subcontractors and specialists hired by the construction companies, as well as the share of prefabricated materials, has increased during the last five years. Put together, there are reasons to conclude that the boundary of the project is a crucial aspect in the process of renewal. It is both a sign and an important tool of handling the complexity in combining a great number of different relationships in an efficient way.

2) *The process.* The construction process encompasses a number of different sub processes which include several different actors and activities which inevitably are interrelated. This means that any decision that is made in one such sub process most likely will affect other sub processes and consequently the construction process as a whole. In our study the most renewal prone companies stated that they had increased their development and use of technical platforms during the last five years. Such platforms represent not only standardization of construction elements and modules but also of the sub processes that bring about the physical platforms, which in turn affect how the entire construction process is carried out. This also affects which actors that are involved in the projects and how. Another common form of renewal among these companies was increased use of virtual construction models for project work, which is a software technology that highly affects the initial stages of the construction process and also how the following process is handled. The process aspect of construction activities thus seems to be a focus area for renewal which affects both physical and organizational resources possessed by the involved actors, and how they are activated in the projects.

3) *The object.* The construction object, or the product, contains a number of different components which need to fit together, and which also need to fit into a using environment. The object needs to possess a number of different functional aspects for it to be livable house or a safe road, but it should also have an appealing design and at least some aesthetic value. In order to produce these basic functions of the product, and also its design, several different actors and competences need to work together and the different resources they use have to represent a minimal amount of clashes. Otherwise, the project and the finalization of the object will fail. By standardizing different components and modules in the objects and thereby creating a fit between these different actors and resources through long term development, the use of technical platforms is an effort to move away from such clashes. Also, engaging in partnering relationships, which seems to be a highly prioritized type of renewal within the construction industry, is an attempt to better understand the requirements of the user and which demands that are put on the product within its using environment. The construction object thus represents a number of different renewal hindrances and opportunities, both in regard to the supply side and the customer side, which makes it a relevant area of investigation in this study.

4) *The context.* Any construction project, processor object needs to adjust to and fit into a local context, alongside with perhaps being connected to global actors and resources. Although most of the larger construction companies try to standardize as many processes and construction elements as possible, the local character of the projects tend to create specific conditions which the companies and the products have to adapt to. In our CEO interviews several examples of how local norms and standards in different municipalities have required changes to otherwise fixed technical modules and standards were brought up. Also, many examples were given of how specific construction locations have required very sophisticated planning and logistical solutions in order for the construction to be carried out without too much interruption of the surrounding activities. Construction is thus a very locally bounded business. At the same time, our study indicates that larger construction companies are becoming all the more dependent on suppliers and subcontractors, not least internationally, which indicate that construction companies are becoming all the more affected by also a globalised network of actors representing both technical and organizational solutions. There thus seems to be an ongoing development creating tension between *the local* and *the global* which we find highly interesting for further investigation in regard to how renewal takes place.

THEORETICAL BACKGROUND

The commonly presented view of innovation in the construction industry, in both the public debate and in the construction literature, is that the industry is not progressing in the same pace as other industries and that there is an obvious productivity problem. Common measurement tools to underline this view are R&D expenditures, number of patents or new products, where the construction industry generally scores low. (Egan, 1998, Miozzo&Dewick, 2004) There are however sceptics of the view of this industry as non-innovative, some of which propose the need for a view of organisational processes as also being object to innovation, which is harder to measure but highly relevant in the case of construction companies as they often function as coordinators of different activities (Seaden&Manseau 2001), and some of which suggest the need for a general understanding of innovation as a very complex process, both in construction and other industries, in terms of entailing a number of different actors and resources needing to fit together in the creation of something new. (Hammarkvist 1976, Harty 2008, Bengtson&Håkansson 2008) This

undermines any attempt of using simplistic measures of what innovation is and of the direct and indirect effects it results in (such as R&D expenditures or number of patents).

As innovation is about something new being used on a wider scale, and thus creating effects outside of the focal organisation, the relationship between producers and users must be taken into account when assessing innovation opportunities or hindrances. Empirically-based research shows that when innovation processes result in widely used solutions, it is often due to the existence of established producer-user relationships. (Harrison & Waluszewski 2008, Håkansson et al 2009) In these instances the knowledge exchange between producers and users (in the producer-user interface) has resulted in learning opportunities of what works in the user environment and how the producing setting can benefit from the particular kind of usage; the new solution is adapted to both the producing and using setting and can thus create benefits for both sides. (Håkansson & Waluszewski 2007) If this type of more comprehensive knowledge exchange does not take place, the achievement of successful innovation becomes more difficult. (Håkansson & Ingemansson 2011)

This proposes some interesting investigation possibilities of the construction industry in terms of innovation and renewal efforts in the construction supply chain. Construction companies are both *producers* of construction objects, such as buildings and roads, and *users* of various materials and services provided by suppliers, subcontractors and other specialists. This means that there are a number of different interfaces to be handled in attempting innovation and thus for new solutions to actually become developed, produced and used, and in addition create value for all parties involved. Traditionally, while there is quite a strong focus on the customer side, construction companies do not engage in close downstream relationships with the supply network and there are numerous studies suggesting that the industry should adopt more efficient supply chain management methods, such as “lean production”. (Akintoye et al 2000) There are however critics that suggest that this is an inappropriate model for construction as there are fundamental differences between being a process-based and a project-based industry, and that there is need for a deeper understanding of the organizational challenges in the construction industry (London & Kenley 2001) Also, while construction is far from the only project-based business, there seems to be an inherent complexity in the construction process which poses particular challenges.

The project as an analytical unit is far from a new approach when investigating supply chain arrangements or innovation attempts within construction. (London & Kenley 2001) However, often when this is done the connection to the wider context outside the focal project and historical events preceding it are excluded. (Kreiner 1995, Engwall 2003) The boundary between the project and its context/environment is not problematized. This is a weakness as a firm from an inter-organisational perspective always is influenced by the environment (in terms of other projects, existing business units and existing business relationships) in which it exist which means that an exclusion of circumstances surrounding the focal project, in regard to both temporal and spatial aspects, limits the analytical value of what sets the conditions for the single projects, which in our case is about investigating opportunities and hindrances to renewal.

On both project and firm level construction business units are mainly acting in business to business situations and in a highly inter-organisational environment. Therefore, in order to investigate what main opportunities and hindrances there are for renewal in the single projects, and in the construction industry, we propose to use an industrial network approach in order to identify and characterize the project boundary.

Summing up, this study is based on two theoretical starting points. The first is that the construction project is the central organizational unit and the primary investigated unit. The

second point is that we have an interactive way of identifying the boundary of the project which requires that we identify all who are activated by the project. Thus, the project is seen as an activated network of actors, activities and resources that together in an interactive way are initiating the use of the resources of a whole set of actors performing activities within or related to the project. All activities needed in order to perform the project are included.

By combining a project and a network view we will see the project as a designated activated network of actors, resources and activities coming out of a basic complex network of units using a lot of different resources. It also means that renewal can appear in a large number of different places within the whole network. It can be in the facilities used to produce components, materials or the whole object, it can be in terms of changes in all the different products needed to put the object together or it can be in the way the different parties work together. And it can be in the competence needed by the actors.

One way to identify more precisely all these places where renewals can appear is to use the 4R-model developed for studies of innovations in business networks (Håkansson&Walusewski 2002). This theoretical model helps us to identify a large number of resource interfaces that can be changed and where renewal that is affecting the total process can appear. We can separate out technical interfaces where different technical resources are combined in different ways from organizational interfaces where organizational units and business relationships are combined. Finally we have mixed relationships where technical and organisational resources are combined. New resources as well as changes in the use of the resources as in new combinations of resources will be covered.

A METHODOLOGICAL FRAMEWORK

The basic methodology is to identify and characterize the most important interfaces in a number of construction processes. The starting point is given by the most important business relationships. All these will be investigated from both sides. One part of these interviews will be focused on the identification of related interfaces – especially technical ones - that are important. It can be on either side of the business interface. The business relationships that will be investigated are

- a) relationship with the customer
- b) relationship with three of the most important sub-contractors
- c) relationship with the most important (technology) consultant
- d) relationship with four of the most important suppliers of components

All these business interfaces will be investigated from both sides. Consequently, we will start out from the "project" and through a couple of interviews with project manager and site manager get a picture both of these counterparts as well as of related technical, organizational or mixed interfaces. Thus, we will try to also cover important other business relationships in relation to the focal one. These interviews will also include questions about the project organization and resources/systems used for doing the project design – technical as well as administrative. There will also be questions regarding the way the counterparts have been mobilized in relation to the project and also an evaluation of renewal in products and processes.

The interviews with the counterparts will be building on the interviews with the project managers but also have unique parts. Especially, we will investigate indirect effects. This will be done through identifying the key technical, organisational and mixed interfaces related to the project. How "new" these interfaces are in relation to the age of the used resources and the

features of the interface in relation to other projects. This includes covering dates for important changes in the products as well as facilities. It further includes the way the actor is cooperating with other actors both on the supplying as well as buying side and how this has developed over the last five years. At the same time we will also ask about the interface with the "project" – the characteristics of the relationship and how the interaction has developed (i.e. in relation to how it has affected resources). We will also try to find indications of how the counterpart is viewing renewal issues in this relationship compared with other – especially to other industries.

Using the 4R model we will thus trace how different direct and indirect interfaces (technical, organizational and mixed) affect how the project is handled, in terms of processes and methods that become affected, and the finalizing of the focal product, in terms of used components, materials and the using context it needs to fit into. (See figure 1). One important result will be – as indicated in the figure – the configuration of the project boundary.

We plan to include three different types of construction projects. These are residential houses, commercial buildings (offices, hospitals, schools etc) and infrastructure projects. The ambition is to cover ten projects of each ending up in a total number of 300 interviews. All these have not to be done face-to-face so the plan is to mix personal with telephone and internet interviews. With the main focus of investigating how the type and design of the interface affects the way processes and used resources are renewed as well as the configuration of the project boundary, we hope to find some interesting variation in relation to

- type of project
- type of project planning model/project organization
- type of counterpart
- type of interface

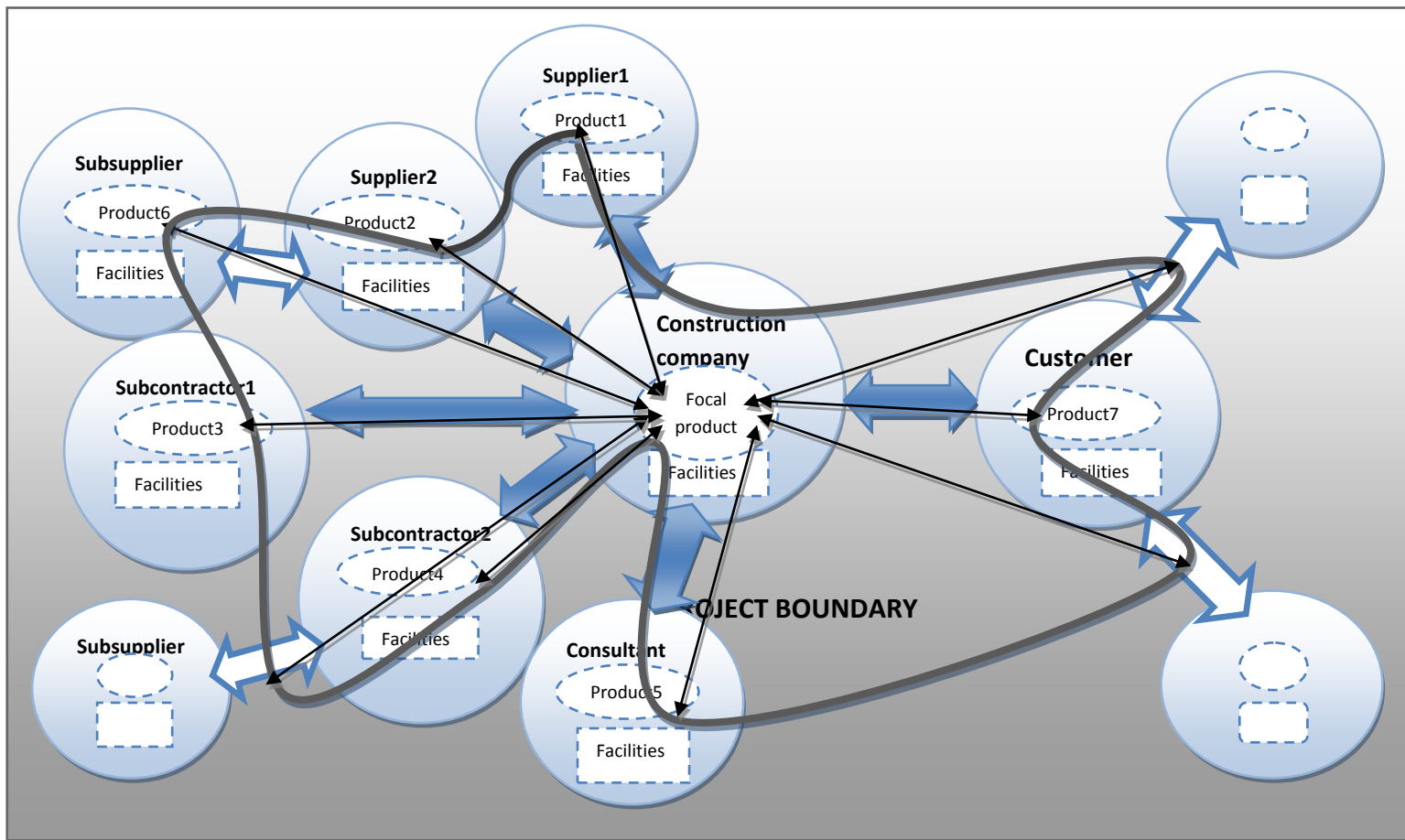


Figure 1. Resource interaction in the construction supply chain illustrating how technical and organizational interfaces on both the supply side and the customer side can have direct and indirect effects on the project as well as the focal product. The black arrows exemplify these effects which as a consequence also set the boundaries of the project.

DISCUSSION AND CONCLUSIONS

The research issue we started out from in this paper was based on an earlier study identifying the difficulties with analysing and evaluating the renewal in the construction industry. The basic reasons was found to be the complexity of the construction process in terms of the number of actors involved in the process, and all the resources they use in performing required activities. Another factor increasing the complexity was due to the large variation of projects – these are varying both in technical and commercial dimensions. A third factor found was the variation and the importance of context – both the construction process as well as the construction object is embedded into a larger context. Renewal can in this way take place in a lot of different places within the total process and it can also take many forms. As a consequence the final construction can be influenced by all these renewals in several different direct or indirect ways. The ambition with this new suggested study is to try to identify the most significant renewals that have affected the final construction both directly and indirectly in a number of construction projects.

In order to direct the empirical study we have chosen to start out from projects but these are approached with an industrial network approach in order to problematize the earlier so clear defined boundary. Thus, we see the project as a temporary network in itself but that is embedded into a larger and more long term business network. By applying the 4R model we will identify a set of important interfaces – technical, organizational and mixed – and their characteristics in terms of when the resources in these were designed and produced. The basic idea is that the more unique the interfaces are, or the younger the resources used in the interfaces are, the larger the renewal effect will be. Resources that have been designed especially for the project or resources that have been newly designed or produced in newly designed production processes will have embedded many of the developed features in the larger network.

A number of key business relationships are identified out from the project and are planned to be investigated from both sides. Some of the interfaces will be identified only by one of the sides and this is one of the variations we are looking for. Another expected variation is in relation to different type of relationships. The broader and deeper the interaction in these are the more of renewal can appear. A third expected variation will be in relation to type of project. The plan is to include three types – residential houses, commercial buildings and infrastructure objects (roads) – in order to get a variation both in technical and commercial terms.

Two other types of variation are the size of the construction firm and the size of the project. In the latter case we are planning to keep the project within a certain size. Thus, we are not attempting to identify and analyse this dimension. However, in relation to the construction company there will be a systematic variation. The plan is to have three types – single independent company, business unit within large company and joint ventures.

The ambition is in this way to try to relate patterns of renewal to some specific influencing factors. These patterns are interesting both from the involved companies point of view as well as influencing actors such as industrial policy makers. Some of the factors are directly manageable (such as type of interaction and activation of different counterparts) and some can be influenced in an indirect way (type of project and project organization).

REFERENCES

- Akintoye, A., McIntosh, G. and Fitzgerald, E. (2000) A survey of supply chain collaboration and management in the UK construction industry, *European Journal of Purchasing and Supply Management*, Vol.6, pp.159-168.
- Bengtson, A., Håkansson, H., 2008, An Interactive View of Innovations: Adopting a New Timber Solution in an Old Concrete Context, *IMP journal*, 2:3, 19-35.
- Dubois, A. & Gadde, L-E. (2002) The construction industry as a loosely coupled system: implications for productivity and innovation, *Construction Management and Economics*, vol. 20:7, 621-632.
- Engwall, M. (2003) No project is an island: linking projects to history and context, *Research Policy*, 32, 789-808.
- Hammarkvist, K-O., (1976) *Köpprocessen för nya produkter på byggmarknaden*, Economic Research Institute, Stockholm School of Economics.
- Harrison, D. & Waluszewski, A. (2008) The development of a user-network as a way to re-launch an unwanted product, *Research Policy*, 37, 115-130.
- Harty, C. F. (2008) Implementing innovation in construction: context, relative boundedness and actor-network theory, *Construction Management and Economics*, 26:10, 1029-1041.
- Håkansson, H., Ford, D., Gadde, L-E., Snehota, I., and Waluszewski, A. (2009). *Business in Networks*, Chichester, UK: Wiley.
- Håkansson, H. & Ingemansson, M. (2011) Construction Companies and How They Acquire Knowledge through Business Interaction, *IMP Journal*, 5:2, 67-78.
- Håkansson, H. & Ingemansson, M., *Industrial Renewal in the Construction Network*, forthcoming.
- Håkansson, H. & Waluszewski, A. (2002) *Managing Technological Development*, London: Routledge.
- Håkansson, H. & Waluszewski, A. eds. (2007) *Knowledge and innovation in business and industry: The importance of using others*, London: Routledge.
- Kreiner, K. (1995) In search of relevance: project management in drifting environments, *Scandinavian Journal of Management*, 11:4, 335-346.
- London, K.A. & Kenley, R. (2001) An industrial organization economic supply chain approach for the construction industry: a review, *Construction Management and Economics*, 19, 777-788.
- Miozzo, M. & Dewick, P. (2002) Building competitive advantage: innovation and corporate governance in European construction, *Research Policy*, 31, 989-1008.
- Seaden, G. & Manseau, A. (2001) Public policy and construction innovation, *Building Research & Information*, 29:3, 182-196.