

Clients' strategies for driving innovation in low energy building

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Summary

In Sweden, construction of energy efficient new buildings using passive standards or other low energy solutions has increased remarkably. What not long ago were considered as difficult to realise now seem realistic and feasible. This research project focuses on the role of the construction client in development and innovation of sustainable construction. Although construction clients can have a key position and strong influence on the propensity for innovation of the entire industry, relatively few clients have so far chosen to assume a strong position in the innovation system of the construction industry, and the rate of innovation in construction is low compared to for example manufacturing. The paper is based on case studies of three different client organisations which all have the ambition to make low energy construction part of their normal production: one large, nation-wide government client with a long tradition, one special purpose municipally owned organisation, and a small, innovative private developer and owner of energy efficient residential buildings. The purpose is to describe and discuss the clients' directives, strategies and drivers to engage in low energy construction, their methods and processes to reach objectives and their continued challenges. A short theoretical framework uses theory from construction innovation and project-based organisations.

Keywords: construction clients, innovation, demonstration projects, low energy buildings

Main findings

The municipal client is an unconventional hybrid between a semi-public city planning agency and a construction client. They are driven by political directives, and by strong personal and organisational commitments to keep and extend their commission from the city and to be leading in the field of sustainable building. They have successfully engaged in several low energy demonstration projects. At present they widen their interest to include other aspects of sustainable construction as well as the urban level which has set them in a position where they have to develop new competences. They aim to engage other clients in innovation for sustainable development by setting the sustainability requirements for parts of land to be developed in the city.

The government sector client is driven by political directives to engage in sustainable and low energy construction and management. They perceive a responsibility to be a competent client in order to fulfil their directives and to be attractive as an employer, but have no long history of innovation. Their objectives for sustainable and low energy building are restricted by their specific and heterogeneous property stock and a highly politicised decision process for new investments.

The private developer has strictly commercial drivers to low energy construction, but exploits opportunities created as municipalities seek to promote low-energy and low cost rental housing. For them, innovation is strictly commercial, but on a market shaped by political concerns. The private developer's business strategy fits well with the one of the municipal urban developer.

The three companies give examples of different processes to handle innovation. The governmental client is in a process of slowly rebuilding its client function after the 1990s downsizing. It can be seen as a process of regaining an absorptive capacity. To some extent, collaboration with external organisations seems to replace internal resources. They are mainly top-down governed and processes are slow. The agency gives their personnel a high freedom in initiating development work and participating in industry activities, but compared to the municipal developer top management support is passive. The culture emphasizes competence, efficiency and reliability rather than innovation. In order to avoid uncertainties, they engage in longer investigations before proceeding to actions. The governmental client resembles the private developer in stressing operational needs and performance as the primary basis for innovation.

The municipal developer ability to reach high ambitions seems to rely on high competence among their personnel, support from top management and financial resources. They share similarities with the private developer in ambitions and competence. However, firm level control is much less developed and project level freedom is high. Their rate of innovation could be regarded as higher than what would be commercially wise. However, their ambitions are also constrained by the market since it is only when there is a high interest from investors that they are able to put up high formal requirements. Their strategy to be a role model and invest in development projects is hard to reconcile with high retention. Their high internal competence to identify and absorb external knowledge enables them to successfully retrieve knowledge through networking, collaboration with academia etc. and by carrying out innovative projects. However, these competences are dependent on individuals and informal knowledge sharing. Their progression is much more evident in terms of building energy performance compared to urban planning which is more complex.

In the private company, the organisation is small and formal routines are not well developed, but many project management routines are embedded in the technical system. Also, the product is repetitive and there is a long term relation to a contractor, reducing needs for formalisation. Interestingly, development work is carried out on the firm level while project-level initiatives are not welcome. While the municipal client seeks continuously to raise and extend their ambitions for sustainable construction, the private developer's ambitions are conditioned by external demands and project profitability.

Concluding remarks

The study suggests that construction clients can take a leading role in innovation for low energy and sustainable building. The clients in the study experience that they stimulate development among consultants and contractors through their procurement of low energy buildings. In the case of the municipal client, they also influence other property developers. The results might challenge the view that the slow pace of innovation in construction can always be attributed to conservative and risk averse clients. Further, contrary to findings in many previous studies of demonstration projects and innovation in project-based industries, these clients have strategies that extend beyond the individual project and allow for step-by-step testing and development. The case studies show that a combination of political initiatives supporting sustainable building and ambitions developed within the client organizations can be highly effective in driving change. Also, different clients may fulfil partly complementary roles in this process as they do not function as traditional companies in the sense that they directly compete with each other. This implies that barriers to collaboration and knowledge spill-over between clients and projects should be low, and that different types of clients may have partly complementary roles within a wider innovation system. However from a long term perspective, the client leadership could be challenged by political decisions that could set an end to their activities, and by the fact that innovation in these organisations is highly dependent on personal knowledge and ambitions.

Finally the study points to the fact that a limit for energy efficiency on the building level might have been reached at about 45 kWh/m²/year, under present conditions and with available technology. The next challenges for sustainable development of the built environment are on a larger urban scale, have to address social and cultural issues, and should include energy issues in a wider perspective including material use, resource efficiency, transports etc.

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Summary

In Sweden, in the last decade, construction of energy efficient new buildings using passive standards or other low energy solutions has increased remarkably. Low energy buildings that not long ago were considered as difficult to realise now seem realistic and feasible. This paper is based on case studies of three different client organisations which all have the ambition to make low energy construction part of their normal production: one larger government sector client, one municipal client and one private housing developer. The purpose is to describe and discuss directives, strategies and drivers of these clients to engage in low energy construction, their methods and processes to reach their objectives and their achievements and continued challenges.

The government sector client is driven by political directives to engage in sustainable and low energy construction and management. They perceive a responsibility to be a competent client in order to fulfil their directives and to be attractive as an employer, but have no long history of innovation. Their objectives for sustainable and low energy building have been restricted by their specific and heterogeneous property stock and a highly politicised decision process for new investments. The municipal client is driven by political directives, but also by strong personal and organisational commitments to keep and extend their commission from the city to be leading in the field of innovative sustainable building. They have successfully engaged in several low energy demonstration projects. At present they widen their interest to include other aspects of sustainable construction as well as the urban level. They also aim to engage other local clients in innovation for sustainable development by setting the sustainability requirements for some parts of land to be developed in the city. Finally, the private developer has strictly commercial drivers to low energy construction, but exploits opportunities created as municipalities seek to promote low-energy and low cost rental housing. The municipal client seeks continuously to raise and extend their ambitions for sustainable construction, while the private developer's ambitions are conditioned by external demands and project profitability.

The clients in this study experience that they stimulate development among consultants and contractors through their procurement of low energy buildings. In the case of the municipal client, they also influence other property developers. The results might challenge the view that the slow pace of innovation in construction can always be attributed to conservative and risk averse clients. Further, contrary to findings in many previous studies of demonstration projects and innovation in project-based industries, these clients have strategies that extend beyond the individual project and allow for step-by-step testing and development. The case studies also show that a combination of political initiatives supporting sustainable building and ambitions developed within the client organizations can be highly effective in driving change. Also, different clients may fulfil partly complementary roles in this process.

Keywords: construction clients, innovation, demonstration projects, low energy buildings

1. Introduction

In recent years, energy efficiency has been high on the agenda in the Swedish building sector. New production of low energy housing, defined as using 25% lower energy use than the building regulations require, has increased considerably, especially in Western Sweden where new production of low energy multi-family housing was 24% of the total production in 2010 [1]. The number of new construction using passive house technology, i.e. buildings with high insulation levels, tight building envelope and controlled air-flows, is also increasing [2].

The breaking point for low energy construction corresponds with the strengthened building regulations from 2006, but is most likely the result of several correlating factors. In Western Sweden, the regional authorities have sustained the development through a programme for energy efficient construction since 2007. One of the projects they have supported is the opening of Sweden's first passive house centre in Alingsås, inaugurated in late 2007. Other influencing factors are the increased collaboration between public and private actors and research institutions, and numerous successful low energy projects using passive house technology where the first was built in Lindås in 2001. Still, a Nordic comparison claims that regarding the totality of new constructions, Sweden lag behind Norway and Denmark in number of low energy construction [3]. Western Sweden has a slightly higher percentage of new low energy construction than Sweden in average. With the upcoming strengthened European directive on energy efficiency (European Directive, 2010/31/EU) the building sector faces major challenges. This especially concerns renovation projects which lag behind contemporary actions for energy savings taken in new construction [4].

1.1 Aim, approach and research questions

This research project focuses on the role of the construction client in development and innovation of sustainable construction. In construction, the client specifies product requirements, decides the organisation of the design and production process and, often, plays an important part in leading and controlling this process. Through their key position, the construction client can have a strong influence on the propensity for innovation of the entire industry [5], [6] However, relatively few clients have so far chosen to assume a strong position in the innovation system of the construction industry, and the rate of innovation in construction is low compared to for example manufacturing [7].

In this paper we discuss client strategies to handle contemporary challenges set by political objectives for climate change and sustainable development. We take a broad perspective on the concept of innovation, recognising that it is an industry where much (although not all) technology and service content can be considered mature.

The empirical basis consists of case studies of three different types of clients: one large, nationwide government client with a long tradition, one special purpose municipally owned organisation which is a combination of a client and an urban developer, and a small, innovative private developer and owner of energy efficient residential buildings. The case studies are based on interviews, documents and presentations by the organisations at workshops within the research project. The directives and driving forces that these organisations have to engage in low energy building are analysed, as well their strategies and processes to handle these issues and their wider contribution to development. A short theoretical framework uses theory from construction innovation and project-based organisations.

2. Innovation in project-based environments and in firms

In many industries, projects are seen as tools for enhancing and organising innovation. Thus, it may seem as a paradox that the rate of innovation and R&D expenditure in a project-based industry such as construction is low [7], especially since many studies have shown that impressive results may be reached within individual project [8]; [9]. However, it is typical for project-based industries such as construction that much innovation and development work is carried out within the projects and it is common that projects are designed specifically to develop or demonstrate new technology. Organisational structures for driving innovation in the permanent organisations,

on the other hand, tend to be less elaborated and employees develop their competences primarily in their project-based assignments [10]; [11]. Information dissemination and retrieval has been found to be strongly linked to individuals and their networks, while it is difficult to spread knowledge to a wider audience [8]; [9]. Further, links between temporary project activities and more long-term, continuous processes in the permanent organisations involved in a project are also weak [12]. This implies that the system for learning from project experiences is seldom well developed. Individual employees and organisational units, perhaps supported by external funding agencies and industry-level organisations, may easily initiate innovation in projects, but the commitment on a general management level to learn from and implement the results is often lacking. Similarly, top management initiatives often face considerable difficulties in influencing project level operations [10]. Decentralisation allows project managers to resist or pay lip service to management initiatives that they do not approve of. Thus, the same organising principle that allows new ideas to flourish also prevents their diffusion [12].

Clearly, the problems of construction are related to remembering rather than to generating knowledge [13]. There seems to be a general lack of systematic evaluation in the industry, so that good practice and technology is not distinguished from bad experience. In effect, there are examples of new solutions which have gained very quick and wide acceptance but which have later been found to be hazardous or unsustainable, resulting in very high remediation costs. It has been argued that the project focus has been too prominent and that the role of firm level processes and strategies needs to be put in focus if we wish to understand and enhance sustainable innovation in the construction industry [14]; [10]. However, despite that user influence and co-production is often emphasized and the long-term risks are often born by clients, previous studies of project-based organising have primarily focused on supplier firms [10]; [11].

The general innovation literature often builds on the resource-based view of the firm, focusing not so much on market drivers for innovation as on the on the ability to identify, assimilate and commercially exploit knowledge from the environment. This absorptive capacity [15] is seen as a byproduct of the firm's own R&D activities. Through research and development, employees acquire domain-specific knowledge which allows them to identify new knowledge in the environment that is important for conceiving and designing future products. Over time, a firm develops processes and policies that facilitate knowledge acquisition, sharing and exploitation. Thus, routines are here seen as the fundamental building blocks and memory of the organisation, forming organisational capabilities. The higher the rate of change in the environment, the more vital is it for a firm to develop dynamic capabilities for systematic modification of routines to continuously assess and update the operating routines [16]. For the purpose of this paper, we primarily need to establish that there are aspects of both exploration and exploitation in knowledge evolution, and that the process can be described as a repetitive cycle involving external stimuli and feedback, generation of variation, evaluation and selection, replication, and retention/routinization.

3. Case studies

3.1 Älvstranden Utveckling AB

Älvstranden Utveckling AB is a municipally owned developer with the purpose to develop land and properties that formerly belonged to the harbour in central Gothenburg, now owned by the city. Älvstranden has 38 employees and acts both as an urban developer agency and as a construction client. They have developed a successful model where they work in close collaboration with the planning administration, private and municipal clients and developers, and from early stages in the planning process. Over time, Älvstranden has become responsible for a wider geographic area, also outside the harbour.

3.1.1 Directives and strategies to deal with sustainability

Älvstranden acts on directives from the city of Göteborg, their owner. The directives say that Älvstranden should position the harbour area as a strategic area of growth, have a comprehensive

view on development issues and focus on long-term value and a sustainable society. They should actively search for new knowledge, analyse trends in development and actively share their experiences. The city's objectives for a good urban environment guide their work. These are translated into a strategic plan and specific objectives. Älvstranden actively works on their company branding which describes the passion to develop the harbour areas into something that the citizens can be proud of.

3.1.2 Development and innovation processes

Älvstranden's interpretation of the owner's directive is that they should act as a role model and catalyst for change. Still, they have no specific R&D department, manager or budget. The construction project division is actively engaged in development and the employees find the directives open to their own initiatives and interpretations. The construction project division has as their informal strategy to always take a step forward in each new project in order to develop their own competence and set an example for other developers. Most of their development work takes place in projects. Through three consecutive demonstration projects between 2004 and 2008 they have managed to go from standard production, according to current regulation, to passive house standard. The construction project division has 8 employees, six engineers (manager, project leaders and environmental manager), one urban planner and an environmental coordinator. The division has strong environmental competence but recognises a lack of competence to meet the increasing involvement in urban planning, notably concerning social issues.

There is also a real estate management division which carries out development work, e.g. regarding energy efficiency and decreasing carbon dioxide emissions but also develops routines for the technical property management. There is sometimes a conflict between the objective to test new innovative technologies in construction projects and the long-term management of stocks, which is facilitated if building systems are similar and standardized.

The employees recognise a lack of resources to properly capture, document and communicate experiences from their development projects. Much is up to the non-formalised but well functioning internal personal communication within a small organization.

3.1.3 Methods and processes to address sustainability

Älvstranden has no explicit innovation policy dictating what areas, what knowledge or which technologies to develop. All employees take part in scanning the environment. They collaborate with research institutes, universities and government initiatives in different kinds of projects. The employees are encouraged to network, take part of activities and also initiate such. There is extensive communication with citizens and other actors, both by information events and through a blog.

The process of elaborating new ideas for development projects is a combination of scanning of the environment, discussions in which they make use of their extensive networks, and trials in student master thesis. If there is good result from a master thesis, Älvstranden can proceed to develop the idea in a construction project. In this way, Älvstranden has systematically developed their knowledge and competence through demonstration projects. In each new demonstration project only a few aspects are unknown, thus limiting the risk of the project and allowing for evaluations.

In their first sustainable demonstration project, Älvstranden took a starting point in the environmental ambitions for construction set up in the Building/Living dialogue, a governmental initiative to set ambitions for sustainable building in collaboration with the industry. All materials were to be environmentally declared and the goal was to have an energy ambition of 35% lower than the regulations, which was achieved. A main result from the project was that Älvstranden needed to improve their knowledge in LCC in order to be able to question the calculations of the consultants and the contractor.

For the second demonstration project, the results from a master thesis showed that a better

climate envelope, windows and walls, for higher energy efficiency was supported by LCC. The thesis also indicated a potential for heat exchange, but Älvstranden decided to delimit the demonstration project to the building envelope, leaving the heat exchanger to the third project. The third demonstration project was based on two master theses studying different building types from an LCC, LCA and energy perspective, and also local renewable energy systems. From these results Älvstranden decided to enhance the building envelope from the earlier project even further, and complement with heat exchangers, and leave out the radiators. The result was one of the first, and the largest multi-residential blocks built according to passive house principles in Sweden.

3.1.4 Further challenges

At present Älvstranden extend their ambitions from individual energy efficient buildings to sustainable urban planning. They claim that energy use in individual buildings could be lowered from about 60 kWh/m² and year to 45 kWh/m² and year, but that further efficiencies on the building scale would not be optimal from a local energy system perspective. Instead, Älvstranden collaborates with the local energy provider to develop an optimal system making use of buildings to stock and balance heat demand (energy smart buildings). Älvstranden also has the ambition to develop LCA and material use in coming projects. In the urban development, Älvstranden faces challenges to deal with new issues such as water management, bio diversity etc., as well as social values in the built environment.

Älvstranden has the ambition to support innovation for sustainable and climate friendly construction locally and nationally. Through their model for commercial urban development, Älvstranden can have direct influence on what is constructed on their land, as they set the conditions for the developers. This has been possible as their land is attractive, and as they involve the developers early in the process. However, Älvstranden has also been able to influence the development of more sustainable building in Gothenburg on a wider level. They have been involved in the development of voluntary programmes for environmental construction in the city, a process in which their experiences have been very valuable. At this stage they search for solutions to engage other local municipal clients more actively in innovation and development.

Älvstranden earned considerable attention for their 'passive house', which they were not prepared for. Still, they experience that compared to other Swedish initiatives they do not really get the wider national and international attention they merit for their advances in energy and environmental issues. Thus, they feel that they would need external support to externalize and disseminate their experiences.

3.2 The Swedish Fortifications Agency

The Swedish Fortifications Agency is one of the largest real estate owners in Sweden, with a history dating back to the early 17th century. Their main role is to manage the Swedish defence estate such as buildings, airfields, naval bases and training areas. Their property is very diverse and ranges from statutory protected national heritage buildings to modern special purpose defence facilities. The stock they manage has however been substantially reduced in the last two decades as a result of downsizing and changes in the Swedish defence organization. Property investment decisions for projects over € 2 Million are made directly by the Swedish Government, and the building volume varies significantly between years as a consequence of political decisions. However, there are always smaller refurbishment projects going on. The Fortifications Agency has about 700 employees, of which 24 are found in the construction project division.

3.2.1 Directives and strategies to deal with sustainability

The Fortifications Agency receives a governmental appropriation with directions each year. Their directives are to supply the Swedish defence with high quality built infrastructure in a cost and resource efficient way. As for other government real estate owners, consideration should be given to sustainable development and environmental values (the 16 national environmental objectives) and architectural values (as described in the government policy for architectural quality). The overall goals do not indicate that the Agency should have a leading role in development.

Based on these directives, the Fortifications Agency decides upon a strategic plan. A new plan has been developed in the autumn 2010 with objectives for 2012 – 2019. One of the new objectives is that the agency shall develop their role as construction client in order to support increased efficiency and quality in the construction sector. Other specific objectives are to develop LCC, environmental issues, energy efficiency, renewable energy resources, and eco-cycle adapted use of resources. The agency works actively to be attractive as an employer as they face a large generation shift in the coming years.

3.2.2 Development and innovation processes

The agency does not have any specific R&D manager, department or budget. Still, the construction project division perceives a strategic will to engage in development and top management support for their operational level initiatives. They also feel that engaging in development is a part of their responsibility as a public client.

The interviewees at the construction project division identify three types of development projects related to different drivers. First, there are initiatives originating from political decisions, such as energy efficiency and architectural quality. Second, some development initiatives are part of the Agency's long-term strategic plans and initiated by the board, such as eco-cycle adaptation of buildings, and projects to cut costs. These two kinds of development projects are formalised and monitored by top management through steering group and reference groups, are granted a budget and results are posted on the website. A third category of smaller development projects are initiated by the managers at the construction project division and reported in the annual business plan, for example, BIM, low-energy projects etc. Further, due to the technically advanced and specific character of some projects, development and innovation is also carried out in construction projects in collaboration with contractors and material suppliers.

There are few formalised procedures to capture and disseminate knowledge and experience in the organisation. Within the construction management division, knowledge exchange is informal. They also have division meetings twice a year and sub-division meetings four times a year. The division is small and project managers know of each others' projects and exchange experiences about various defence-specific constructions. There is also some specialisation, so that similar projects are assigned to the same manager. The whole Fortifications Agency, however, is a large organisation covering a vast geographic area, and information exchange between the construction management division and the real estate management divisions is difficult. There are specific development leaders appointed both in the real estate divisions and in the construction project division, but their contacts with top management and each other are largely informal and there is no system for making the results of their work known to the rest of the organisation. Only the large development projects are reported on the intranet. Thus, there are many local initiatives in the real estate management divisions that are not disseminated.

3.2.3 Methods and processes to address sustainability

Employees at the construction management department have established contacts with numerous industry level organisations in Sweden and within the Nordic countries, but they co-operate with research institutes and universities mainly through master theses and recruitments. They sometimes organise courses which are open for external participants, and the interviewees think the Agency is generous in supporting their employees with continuous education.

The construction project division has engaged in defining objectives set up by top management, interpreting what eco-cycle building and sustainable building actually means for their activities. They have had the ambition to try out a low energy building concept since a few years. The dependence on political decisions however makes it difficult for them to plan development more long-term, and they had to wait for more than a year to find a suitable project to test and demonstrate low energy building technology. In addition, the Fortifications Agency has a heterogeneous stock which is a challenge both in a technical respect and to the replicability of experiences from demonstration projects. Another issue that counteracts the ambitions of the

Agency, is that their client, The Defence, has not showed interest in low energy building or energy efficiency measures in the existing stocks. The Defence does not have any political directives or economic incentives to save energy.

In 2010, the Agency started their first low energy projects, a garrison with housing for soldiers and a rescue station. In the garrison, the ambition was to reach an energy consumption of 55 kWh/m² and year. An important issue was how to set requirements and find ways of incentivising energy performance within the limitations of public procurement.

3.2.4 Further challenges

The Fortifications Agency is still at the beginning of their development process towards more sustainable building. Their challenges remain on how they can define sustainable building for their diverse stock and their activities, when most existing knowledge in the building sector is related to residential buildings and office premises. Another main challenge related to implementation of results from their first low energy projects. Although the experiences from the demonstration project of the garrison were to be applied on coming projects, the representativeness of this project is still questioned by the managers of the construction project division.

3.3 The Company

The Company is a private property developer in the housing sector. They only build and own rented apartments in fast growing parts of larger Swedish cities. The Company was founded in the early 1950s as a construction contractor firm and developed into a commercial property owner with large holdings in a middle sized Swedish town. Since 2005, the Company has transformed into a developer and owner of residential property, in order to respond to business opportunities created by shortage of residential flats for rent. This process has been led by the managing director, who has a background as an architect and also has experience of working abroad for several years. The company currently has 18 employees.

3.3.1 Directives and strategies to deal with sustainability

The Company is owned by an US holding company. The objectives are to be one of the leading real estate managers in the rented apartment market in metropolitan areas in Sweden, and to double their capital every fifth year. The company finds that they in short time have been successful in their development towards these goals, something which they attribute to three areas of strength: capital, energy efficiency and environmental focus, and 'conceptual' building. The 'conceptual' building method is an internally developed industrialised building method with standard apartment layouts, prefabricated parts and short construction periods. These layouts are designed to be very functional in terms of user qualities, thereby allowing for lower rents. In developing technical solutions, the managing director relies on his personal experience of energy efficiency reaching back to the 1980s. They have invested considerable capital in development and used non-conventional methods to reach their goals. For example, they sometimes have to take the full responsibility for new technical solutions that contractors or consultants will not guarantee. Initially the company has had an over-capacity in management, but intention is that there will be a balance as the production and development of stock increases in coming years. Further, the company has knowledge of foreign markets and they manage to procure building components as well as contractors to competitive prices abroad. For construction they have signed a long term Design-Build contract with one contractor.

3.3.2 Development and innovation processes

The company has few employees and there is a close interaction between the top management and other levels of the firm. They have not set up any formal processes for knowledge management and internal communication is mainly face-to-face .

All employees are engaged and interested in development, and the level of education is high. Notably, project-level development is discouraged, and all development work is carried out on the firm level. Employees take courses primarily in management. They have received some support from government and industry associations for measuring and evaluating the performance of their buildings. Otherwise, they do not collaborate with universities or engage in national networks. At one time, they wanted to become involved in an industry-wide initiative (the Building/Living dialogue) but were considered too small. This has however changed and they are now invited to such arenas. However, while they have initially been open with dissemination of their experiences as a way to get publicity, the Company has recently decided to change their strategy for external communication to protect their business.

3.3.3 Methods and processes to address sustainability

The high ambitions for energy efficiency and environmental performance are strictly commercial and have both strategic and financial backgrounds. First, when municipalities distribute land and building rights there is often a competition, and to be allowed to participate a small and unknown company has to present a more innovative proposal than the established actors. Second, the investments in low energy technology generally have a short payback time. The Company is currently constructing a new low energy multi-family residential building on land distributed by Älvstranden.

The low energy concept the Company presently uses resembles passive house ideas (called "Egenvärmehus") and has been developed based on the managing director's earlier experiences. In order to scan the environment for new possible areas to invest in, they invite external consultants to study specific areas. They have investigated renewable resources such as solar energy but so far this has not been found commercially interesting.

3.3.4 Further challenges

The Company's plan for the future is to grow and stay competitive. They have developed a low energy concept that works and does not have any incentives to go further in terms of energy efficiency (their new low energy buildings use about 45 kWh/m² and year). Incentives to develop other environmental issues (renewables, material use etc.) could come from municipalities, competitors proposing more sustainable building, or demands from customers.

4. Discussion

4.1.1 Directives and strategies to deal with innovation in general and sustainability

Älvstranden Utveckling is an unconventional hybrid between a semi-public city planning agency and a construction client. We may understand their existence in the context of the widespread criticism to traditional expert-based planning regimes, calling for new processes and institutions better adapted to collaboration with commercial developers and other actors e.g. [17]. Älvstranden is highly dependent on political decisions. On the company level, their ambitions for innovation seem to originate in a company culture to be leading, as means to safeguard and extend their commission from the city, but also driven by personal interest among employees. Their increased involvement in urban development has set them in a position where they have to develop new competences in fields they do not master, an issue they currently work on.

The Fortifications Agency represents a traditional type of Swedish government sector client. Its development mirrors the general downsizing of client functions during the 1990's, further accentuated by the reduction in the Swedish defence. This might explain why, contrary to some other large government sector clients, the Agency does not have any organisation explicitly orientated towards R&D activities. Last years, the Agency has received more explicit political directives to engage in environmental protection. They have no official directive to be leading. However, they feel a responsibility as a large public client to be a competent client also to attract new staff and provide interesting working tasks.

The Company builds on a strong Swedish tradition of owner-builders, but is significantly more innovation-orientated than these usually are. This allows the organisation to compete also on a national level, and their ambitions for growth are higher than those of the traditional local owner-builders. Accordingly, the proportion of firm-level staff (in relation to project-level staff) is significantly higher. In terms of innovation drivers, the Company has much in common with commercial firms in general, since they are dependent on their ability to establish a sustainable competitive advantage. For this to be possible, however, it is not sufficient to demonstrate high quality and low costs to potential tenants. The Company first has to obtain land in attractive locations, and is thus dependent on local governments rewarding high energy performance. For them, innovation is strictly commercial, but on a market shaped by political concerns. The Company's business strategy fits well with the one of the municipal urban developer Älvstranden.

4.1.2 Development, innovation and methods and processes to address sustainability

The three companies give examples of different processes to handle innovation. The Fortifications Agency is in a process of slowly rebuilding its client function after the 1990s downsizing. It can be seen as a process of regaining an absorptive capacity. To some extent, collaboration with external organisations seems to replace internal resources. However, knowledge from contemporary examples of low energy and passive house projects is of smaller value for the Agency, since they have a heterogeneous building stock which calls for a wider repertoire of models to address energy efficiency as well as sustainability. The Fortifications Agency is mainly top-down governed and processes are slow. The Agency gives their personnel a high freedom in initiating development work and participating in industry activities, but compared to Älvstranden top management support is passive. The culture emphasizes competence, efficiency and reliability rather than innovation. In order to avoid uncertainties, they engage in longer investigations before proceeding to actions. The Fortifications Agency resembles the Company in stressing operational needs and performance as the primary basis for innovation.

Älvstrandens ability to reach high ambitions seems to rely on high competence among their personnel, support from top management as well on financial resources which might explain why they can involve in more uncertain projects. They mainly carry out innovation in projects. Älvstranden share similarities with the Company in ambitions and competence. However, firm level control is much less developed and project level freedom is high. The rate of innovation at Älvstranden could be regarded as higher than what would be commercially wise. However, their ambitions are also constrained by the market since it is only when there is a high interest from investors that Älvstranden is able to put up high formal requirements.

Regarding knowledge management, Älvstranden have a high capacity regarding all stages in the knowledge evolution cycle except for knowledge retention/routinization. The strategy to be a role model and to further invest in development projects is hard to reconcile with high retention which work in opposition to efficient property management. The importance of a high internal competence to identify and absorb external knowledge can be understood when comparing Älvstranden's strategies regarding low energy technology and urban planning. Their progression is much more evident in terms of building energy performance compared to urban planning which is more complex. In the case of urban development they seek to replace internal sources with external ones.

The high internal competence of Älvstranden enables them to successfully retrieve knowledge through networking, collaboration with academia etc. and by carrying out innovative projects. These competences are dependent on individuals and informal knowledge sharing. The absence of routines for retention and repositories of knowledge makes the use of experiences and contributions to development in the building sector at large vulnerable, not only to changes in staff but also to political decisions that could change their directives or even put an end to their activities.

In the Company, the organisation is small and formal routines are not well developed, but many project management routines are embedded in the technical system. Also, the product is repetitive and there is a long term relation to a contractor, reducing needs for formalisation. Interestingly, development work is carried out on the firm level while project-level initiatives are not welcome,

illustrating and confirming the proposition of Dubois and Gadde [12] that a tighter coupling between firm level strategy and project activities constrain project level freedom. The company covers all stages in the knowledge evolution cycle.

5. Concluding remarks

This research project provides insights in innovation and development processes in Swedish construction client organisations. Our studies have had a more general approach to innovation and development among clients. An observation is that ambitions for low energy construction and sustainable building have a prominent role in their objectives.

The study suggests that construction clients can take a leading role in innovation for low energy and sustainable building. Client leadership for low energy and sustainable building has an impact through procurement of consultants, contractors, downstream suppliers, and as in the case of the municipal developer through contracts with other developers and clients. However, clients can also manifest their leading position by constructing demonstrating examples, and, once again in the case of the municipal developer, by involving in the development of local ambitions for more sustainable building together with local authorities and in dialogue with other local municipal and private client organisations.

Our study shows that client leadership for innovation is utterly dependent on political decisions but also on market conditions and on organisational characteristics. The governmental and the municipal clients in our studies are directly dependent on political decision for their activities. The private developer is mainly driven by commercial interests but is indirectly dependent on political decision regarding requirements for land use and its effect on the property market. The municipal developer has high ambitions for innovation and wants to be leading in the field. Their high ambitions are almost an over-interpretation of their political directives driven by employees. The level of innovation they can require from investors as a municipal land owner will be dependent on the market. As long as their land is attractive they can keep the ambitions high. Regarding organisational characteristics that can support innovation, the municipal developer favours project-level initiatives which seems difficult to comply with high retention, while the private developer favours firm level development with focus on high retention and replicability. Top-management support for innovation will be important in either case. It could be argued that in the case of the private developer, as in the case of the governmental client, too much top management can be restrictive for project level initiatives which will work against innovation.

The conditions for client leadership for low energy and sustainable development in a long-term perspective will be challenged by political decisions but also by the fact that innovation in these organisations is dependent on personal knowledge and ambitions. A developer as Älvstranden, will be important for the development in the sector as a whole. The private developer will not push the limit further than what is financially interesting at present, but together with Älvstranden they could be complementary in a wider innovation system. A basic assumption in innovation literature is that the driver for innovation and knowledge development is to gain sustainable competitive advantage, and that the core competencies of a firm therefore are those that are the most difficult for others to imitate. However, few construction clients function as traditional companies in the sense that they directly compete with each other. In the absence of competition, we could rethink the incentives to innovate, as well as the implications for knowledge sharing between clients and projects, and that different types of clients may have partly complementary roles within a wider innovation system.

Both Älvstranden and the private developer agree that the limit for energy efficiency on the building level has been reached at about 45 kWh/m² and year under present conditions and with available technology. The processes to develop new building practices are slow. From the first initial idea to retention and further development of new innovation areas there is a time span of several years. Älvstranden have shown example of a rapid development relying on LCC and energy calculations. Energy use in new construction is an area with limited complexity and short pay off. To proceed in sustainable development of the built environment the next challenges are on a larger scale, the neighbourhood and the city, have to address social and cultural issues that are more difficult to

define and handle, and should include energy issues in a wider perspective including material use, resource efficiency, transports etc. What would be needed is more explorative approach to innovation, as we could see in the 1990s projects for sustainable building. The development today has reached good results regarding energy but has developed in a technology lock with passive house concepts regarded almost as the only possible solution. The problem is that explorative and experimental property development is not very compatible with efficient property management. Such challenges could be tackled by a developer like Älvstranden and by using their step-by-step method to delimit the uncertainty of the unknown variables. Älvstranden would then prepare the way for stronger political directives.

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7. References

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