SUPPORTING DEVELOPMENT TOWARDS MORE SUSTAINABLE BUILDING: PERSPECTIVES ON THE DEMONSTRATION PROJECT AS A STRATEGY FOR CHANGE

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Summary

This paper explores the mechanism for development towards more sustainable building in Sweden. The proposed mechanism is based on a retrospective study of the evolution of more sustainable building practices during the last decades, with focus on the west of Sweden and using elements from theories on ecological modernisation as a way to understand change. The retrospective study presents actors, networks and important break-points. Three conceptual pairs have been used to discuss factors that make sustainable building practices progress: governance and learning, exemplifying and legitimising, and symbol and performance. It is argued that we might experience a shift towards governance and voluntary action developed through practical experiences. Catalysing successful demonstration projects lead the way, set up visions and goals and influence development of policy and regulation. The focus on energy efficiency has led to a broad acceptance with a rebound synergistic effect back to other building qualities. However, it is important to look beyond current achievements and to reconsider other important aspects of sustainable building: water and material issues, renewable energy and social issues.

1. Introduction

The aim for this paper is to contribute to a framework for understanding the evolution of sustainable building practices, and eventually to support these processes. The focus is on learning processes at a building project level and the system boundary is the building. The study underlines the importance of experiments and demonstrations for the development.

A tentative retrospective study of sustainable building practices in Sweden from the 1960s until today outlines important events, identifies actors and networks and recognizes institutional, societal, political and individual motivations to engage in more sustainable building. The study draws on the authors' personal experiences and their research on sustainable building in Sweden (e.g. Rubino, 2007, Eden 2008), on interviews with influential actors (Femenías, 2004), and on literature studies. Our theoretical framework draws on theories of innovation in construction (e.g. Fernie et al, 2005), ecological modernization (Fudge and Rowe, 2001; Jensen and Gram-Hanssen, 2008); and social theories (e.g. Guy and Shove, 2000). The study has a normative approach to sustainable building recognising environmental limits and natural carrying capacity, demand management, environmental efficiency as well as social welfare issues and equity (Fudge and Rowe, 2001). A systems approach provides an understanding of the continuous (exogenous and endogenous) processes of change and development. The study does not take a normative approach to ecological modernisation which is used as a means to understand change.

2. The Building Sector in Sustainable Development

The slow uptake of energy efficient measures has been discussed in Sweden (e.g. Nässén and Holmberg, 2005) and in other parts of the world (e.g. Lovins, 1992). These articles point to the

potential for increased efficiency, although a gap still persists between what is achievable through best available practice, and that which is considered mainstream building practice. New technologies are available but are not adopted on a larger scale. The reasons behind this slow uptake are numerous and complex referring to widely differing factors from problems inherent in the organisation of work in the building sector, i.e. heterogeneous actors in unique project settings, to low-energy prices or contemporary non-sustainable architectural ideals. The perceived impression is that the sector is unable to handle the necessary changes and that change can only be through incentives and stronger regulation. However, it has become widely accepted that the implementation of sustainable building is not only a technical question but is also dependent on social acceptance and institutional factors (Guy and Shove, 2000; Jensen and Gram-Hanssen, 2008).

2.1 Reconstructing Building Practices

The building sector, in Sweden and other countries, has in recent years been in focus for general reconstruction programmes initiated by the perceived image of the sector as inefficient and reluctant to adapt to modern demands. It is interesting to observe that the sector was described in the same way in 1947. A document of that year, SOU 1947:7, states that the Swedish building sector is not investing in research and development by their own means and suggests governmental funding for building related research as this will have strategic importance for the society as a whole.

> Building activities produce mainly articles to be used during a very long time. It is therefore understandable that clients and contractors show some reluctance to try new and relatively unknown materials and methods, and prefer to proceed under known conditions and with known materials. Considering these foundations, the building industry could with good reason be characterized as one of the most conservative of industries.
> SOU, 1947:7, pp 10-11, (in Swedish, the above is the authors' translation from Swedish)

The above should be placed in a historical perspective. At the time of the establishment of the Royal Swedish Academy of Sciences in 1739, scientific research was focused on everyday practical implementations of results (www.kva.se). The development through the industrial revolution led to a distinct separation and in many cases antagonism between science and practice. Many of the epoch-making industries were the result of practical developments combined with good organisation and management. However, scientific research has since become increasingly important for industry. Early governmental investigations point to the problem of transferring laboratory results to practice, a process that will profit from small scale experiments and later full-scale tests before being diffused in practical implementations. Based on a neo-classical economy perspective of markets, the persistent idea has been that scientific results automatically will lead to innovation (e.g. TSERC, 1987). This instrumental approach to energy efficiency has not been efficient and is partly explained by the R&D chain in the building sector seldom being chronological or linear and that development is seldom triggered by science but through the search for solutions to problems in practice.

2.2 Ecological Modernization in Sweden

The Swedish government has since the late 1990s developed a policy framework based on ecological modernisation as a means to respond to environmental pressure and the need for a socio-economic revival (Fudge and Rowe, 2001). Ecological modernisation is described as a framework to explain increasing environmental considerations in society and the changes caused by these processes. Ecological modernisation is often linked to the mainstreaming of sustainable development based on continued economic growth and the use of environmental technology without fundamental changes to individual actions and beliefs. The concept can be a paradox as structural changes are argued to be necessary while only selective remedial measures are promoted (Hajer, 1995 quoted in Smith and Kern, 2007). Jensen and Gram-Hanssen (2008) see no link between ecological modernisation and models for weak or strong sustainability arguing that ecological modernisation can lead to either depending on the actual actors and processes.

Fudge and Rowe (2001) in their study of ecological modernisation in Sweden found this process to be mainly codified as environmental protection and that norms may favour unduly expert

focused and even ‘technocratic’ paths to the pursuit of sustainable development. The industry has always been a key player in Sweden’s pursuit of sustainable development and the building sector has been given a key role in the aim to rebuild society for sustainable futures.

Fudge and Rowe (2001) refer to three major stages in the maturation of ecological modernization, which are recognized in Sweden although not chronological. The first stage focuses on technological innovation, a critical attitude towards the state, and a bias towards market solutions. The socio-economically successful economic expansion in the late 1980s and early 1990s had a strong technological and environmental drive. The second stage, from the late 1980s to the mid-1990s, took a more moderate view on technological innovation, the state, and the market instead emphasizing on institutional and cultural dynamics supported by the emergence of the ‘Brundtland report’ in 1987. The second stage has in Sweden found difficulties gaining support in the conservative and rather expert-led governmental institutions. In the third and current stage the debate has broadened to include the role of consumption and global processes, in which market dynamics and economic agents are increasingly important. At the same time the nation-state is transformed towards a more decentralised and consent style of governance. The third stage thinking, which can be identified in governmental aims and policies, has proved to have difficulties in practice. The relatively few enlightened individuals have not been able to catalyse the broader shift.

Similar critics of an overly technocratic ecological modernisation have been made in the Netherlands (Smith and Kern, 2007). What is now observed in the Netherlands is a transition discourse to reinvigorate ecological modernisation, a process based on a more reflexive approach that institutionalises processes for deliberative social choice between alternative scenarios of development. This transition approach combines long-term visions, policy learning, and adaptive governance. The transition discourse proposes: multi-stakeholder civic arenas for debate and progress towards sustainable socio-technical systems; practical niche elements for exploring potentials; institutions that promote social learning; and supportive policy development and innovation. The innovation model is based on evolutionary economics and perceived as more institutionally complex and varied and results less automatic, than in technology push-models. The transition approach has not managed to influence radical change and reinvigorate the Dutch ecological modernisation. Incremental reforms persist and older discourses seem solidified.

3. Reconstructing the ‘History of Sustainable Building’ in the West of Sweden

As a background to this tentative history of sustainable building the comparatively good quality of the Swedish building stock seen in an international perspective must not be underestimated, both in terms of environmental and social aspects. Already in the 1950s the Swedish building regulations prescribed 10 cm of insulation in outer walls. And when other European countries only just start to discover the advantage of exterior insulation of walls (instead of interior insulation) this had been praxis in Sweden for decades. Another example is car free housing areas which have been built in Sweden since the 1960s. Social perspectives on housing and living qualities for everybody has been studied and implemented through governmental policy and regulation since the 1930s as part of the ‘Folkhems’ project of making Sweden a modern state.

3.1 The 1960s – The Seeds

The environmental movement of the 1960s can be linked to the social movements of the era. The publication of Rachel Carson’s book *Silent spring* in 1962 is widely accredited to be one of the starting points of the environmental movement in western countries.

Nature as source of inspiration in architectural design and vernacular building traditions can be traced back long in history. Architects such as Frank Lloyd Wright have been renowned for their environmental inspiration. However, the claim that all good architectural design is essentially ecological has been proven weak if implemented as the single strategy to achieve a resource efficient design. Still, these ideas of an environmental architecture taught to architect students in Sweden in the 1960s are the seeds of current development (Interview with Hans Eek, 2001 – the architect of Sweden’s first passive housing and founder of The Passive House Centre in Sweden).

3.2 The 1970s – The Experimental Era

The 1970s were marked by the oil crises resulting in a broad awakening for energy issues. In Sweden, the energy crises led to massive governmental campaigns which aimed for oil independence and resulted in strengthened building regulation, subsidies, and low interest loans for up-grading of building envelopes. National programmes funded experiments and demonstration projects for developing energy efficient building and renewable energy technology. The strategy was to replace oil mainly with electricity (direct heating in buildings) or nuclear power (for district heating). The decision to invest in and continue to use nuclear power is still debated.

The period is usually described as an era of experimentation. Inspired by developments in USA, France and Germany., Swedish pioneering architects became involved in low-energy building, solar buildings and in socially responsible architecture. Experiments received finance through national programmes but they were also the result of individual investments. One of the pioneers at the time, Hans Eek made important experiences in Mrs Henriksson's house. Mrs Henriksson decided to support the development of ecological building by asking Hans Eek to design a highly experimental private house. Mrs Henriksson's house was very unsuccessful – the many and untried technical solutions never worked. Hans Eek says that the main problem was the architect behaving as a miserable engineer.

In 1972, the first and pioneering UN conference on human environment was held in Stockholm. The conference laid the framework for future international cooperation on environmental issues. In the summer of 1976 an influential exposition was held in Stockholm. The ARARAT (Alternative Research in Architecture, Resources, Art and Technology) exposition, organized by a group of architects, displayed and discussed alternative technologies and ecological housing experiments.

3.3 The 1980s – The Transition Era

The early 1980s experienced a backlash for the broader interest in low-energy building and renewable energy caused by an economic downturn and the election of conservative governments in many countries. A reduction in demand and an overproduction of oil also resulted in falling energy prices. In the US, Jimmy Carter was succeeded by Ronald Reagan who basically stopped the experimental era in low-energy technology. In 1987, the publication of the Brundtland report re-launched the politically driven development and contributed to a wider use of the concept of sustainable development as a new approach to environmental policy. The key was to link environmental concern with socio-economic development and this opened the door to the coming transition from low-energy to sustainable buildings.

The Swedish Government continued to invest in experimental and demonstration programmes for energy efficient building concepts in the 1980s. The well-known Stockholm project involved the construction and monitoring of some 200 apartments between 1983 and 1985 (Guy and Shove, 2000). The project provided exemplification through cases, but without any practical implications.

As a contrast to such mainstream and more realistic approaches, the grass-roots and pioneers of the 1980s contributed to the emergence of the Swedish eco-villages. In 1991 the Swedish National Board on Housing, Building and Planning made a definition of the concept eco-village stating the importance of local perspective, small scale, social aspects as well as an eco-cycle perspective on material and energy resources (e.g. www.ecoby.org). The eco-villages have a strong grass-roots perspective engaging the community in the realization of the project. The first eco-village built in Sweden was Tuggelite, completed in 1984. The eco-village can be seen as emerging from the collectivist movement of the 1960s and 1970s, as reactions against contemporary urban and semi-urban lifestyles (Jensen and Gram-Hanssen, 2008).The initiators of the first eco-villages experienced a lack of documented knowledge and practical experience which led to problems. Several Swedish eco-villages has reported high energy use but claimed other less tangible qualities such as every-day aesthetics and strong social networks.

The Swedish National Housing Exhibition, Bo85, opened in 1985. Inspired by ecological influences of the time Bo85 promoted individual conservatories, combining passive energy and social space. However, this resulted in poor energy efficiency. In 1987, an important experiment with air-solar collectors was completed in Göteborg (architect Christer Nordström), in the refurbishment of a housing block from the 1950s. The project showed good results in terms of

reduced energy use and important experiences were made connected to the social benefit of a collective green house attached to the house, but not part of the energy system. The project remained a one-off project partly due to the reorganisation of the public housing company.

During the 1980s the sick building syndrome highlighted the problems of building materials with emissions to the indoor environment and the problem with ineffective ventilation which probably contributed to the increased interest in naturally ventilated and ecological buildings.

3.4 The 1990s – The Eco-Cycle Era

The 1990s marked a broader awakening to environmental issues and ecology. The Rio de Janeiro Earth Summit 1992 and the resulting Agenda 21 document led to a shift from ecological building to sustainable building, which has proved to be a more broadly acceptable concept, turning to resource efficient technological solutions and not primarily life-style changes. During this decade environmental issues gradually became institutionalised and part of the daily routines in Swedish construction through voluntary environmental management systems and through deregulation of construction. Larger architectural offices, developers and contractors built up in-house environmental expertise. Some measures, such as waste separation, became praxis.

In the 1990s new examples of ecological building emerged based on eco-cycle ideas for recycling of wastewater, the use of locally produced and natural materials, and an increasing interest in naturally ventilated buildings. The scale of the examples that are built is still single-buildings and housing but the decade also revealed an increasing interest in urban issues. A wave of naturally ventilated schools was initiated through the example of Fredkullaskolan built in 1992. In 1995, the eco-village Understenshöjden outside Stockholm was completed. The project received significant attention for its living qualities and aesthetics. Later the project was subject to a partly erroneous and biased accusation of large energy use and technical problems in the Swedish media (Gluch and Femenías, 2002). This was probably to be the last project where non-professional actors (the community) had the main influence in planning and realisation.

At the end of the decade a number of larger public housing companies and building contractors engaged in environmental issues and produced a number of demonstrational projects without great influence on mainstream practice. The projects mixed tested and untested technology, usually in relation to occupant behaviour. The lack of systematic thinking in briefing, planning and follow-up and the lack of performance indicators make those experiences difficult to systemise.

The Swedish Government has also invested in large demonstration programmes to stimulate environmental technology. The Local Investment Programme, 1998 – 2002, supported several retrofit projects of housing from the 1960s and 1970s in relation to socioeconomic regeneration of the areas. The results from these projects show good results in environmental terms and social sustainability with less vacancies and satisfied tenants. However, due to insufficient planning for learning, among professional actors and tenants, and diffusion of experiences the investments have not contributed to long-term change (Stenberg et al, forthcoming).

3.5 The Current Decade – The Passive House Era

The new decade has shown the continued legitimacy of sustainable building practices. An important feature of this evolution is the governmental initiative, Building-Living Dialogue a cooperation between leading private and public organisations with voluntarily agreements to take concrete measures for sustainable building and educational actions towards practitioners. A vision was established in 2000 with goals for reduced energy with at least 30% by 2025, goals for reduced use of fossil fuels, declaration of building materials and phasing out of chemicals.

In the early 2000s two larger flagship projects were built: Hammarby Sjöstad in Stockholm and Bo01 in Malmö, aiming at sustainable housing on brownfield close to the city centres. Although using programmes and assessment tools, the projects failed to reach high environmental performance although resulted in other lasting qualities, including a good urban design.

Recently a new upswing of the local development of sustainable building in Göteborg has occurred, with public-private investments and co-operation between research and practice. One example is Universeum, which is a science centre (completed in 2001) with innovative technology

for cooling/heating. The project planning involved researchers and practitioners building local capacity for continued design. The spectrum of environmental measures in Universeum include urine-separating toilets, local wastewater treatment, renewable building materials and solar energy. Two projects in Göteborg (completed 2000 – 2001) have been of large national and international importance: First, the retrofitting of a housing area from the 1970s in Gårdsten, addressing social and environmental issues (design by Christer Nordström). The project has resulted in 40% less energy use and 30% less water use and socio-economic benefits, and received the World Habitat Award in 2005. Second, Sweden's first passive housing, a terrace housing project in Lindås (initiator Hans Eek). Measurements show that both projects approach the energy goals for 2025 set by the Building-Living Dialogue. The factors for success include committed clients, the early involvement of actors, education of all actors to understand set goals, cooperation with researchers, and the focus on performance, evaluation and dissemination of results. After a few years without follow-ups, the projects seem to be catalysts for the wave of interest in energy-efficiency and passive building methods which Sweden is experiencing today.

An on-going research project Demo04/06 at Chalmers University of Technology connects researchers and a network of professional actors involved in five local case studies with demonstration capacities. Demo04/06 provides an arena for mutual exchange and learning, on the one hand between practitioners and on the other hand between practitioners and researchers, and reaches beyond the arena boundaries. Two of the evolving cases connected to the arena develop the passive house concept. The Harbour house is a new multifamily housing project by a commercial developer owned by Göteborg municipality. The developer and all their consultants are engaged in the Building-Living Dialogue. Brogården in Alingsås, outside Göteborg, is a retrofit and regeneration project with social ambitions of housing from the 1970s. Important factors in that project is a strong political engagement in the municipality, an enlightened client, Hans Eek as consultant, and partnering contracts for involved actors. Both passive house concept projects have goals for energy use below those set up in the Building-Living Dialogue vision for 2025.

4. Discussion

Jensen and Gram-Hanssen (2008) in their study of sustainable building in Denmark base their discussion on three elements: governance (new types of cooperation and roles for actors), standardisation (use of standards, tools to define and legitimize) and visibility (measurement of energy and material flows). Governance and visibility can be traced as important elements in ecological modernization processes. The authors define standardization as a central concept for construction and for the modernisation of processes in general. Based on our retrospective study, we have found three pairs of elements important to the Swedish development: first, governance and learning; second, exemplifying and legitimising; third, symbol and performance.

4.1 Governance and Learning

The study shows that development of sustainable building in Sweden has a strong basis in bottom-up activities even though with time these activities have benefited from government support. It is the individual project and the learning produced by practice that has pushed development forward. Seen in a wider perspective than that of immediate commercial success, the contribution of earlier projects to the development, although often unsuccessful as individual projects, cannot be underestimated. Later years show a clear shift from government driven processes towards market led governance for change. Important thresholds have been reached through the intensified focus on energy efficiency and the success of contemporary demonstration projects which has legitimised the interest in sustainable building practices.

Some elements inherent in a reflexive ecological modernisation described as transition (Smith and Kerr, 2007) can be observed in recent development in Sweden with voluntary agreements and multi-stakeholder arenas for exchange and progress. It could be discussed if the strong reliance on government actions in earlier decades created dependence and a weakened innovative force. Further studies will be needed to see if the current development will manage to overcome commercial competition and sustain a self-supporting evolution.

Experimental activities and demonstration projects have an important role in the development even though these investments could be more efficient. Evaluations of government support for earlier experiments and demonstrations claim positive advance in the accelerated introduction of new energy efficient technology although recognising deficiencies in explicit knowledge accumulation and dissemination (e.g TSERC, 1987). The transfer of results over organisation boundaries will also need a process of experimentation in which the external and explicit evolution of knowledge will have to be internalised by new actors and tested in a new context. However, the implementation gap, i.e. insignificant impact from demonstration projects on mainstream building practices, is more than a knowledge problem. There has often been an overestimation of the influence of key individuals and rational choice on decision-making. This overlooks the complexity and unpredictability of the implementation process and fails to provide reliable explanations regarding the relationship between practice, performance and context (Fernie *et al.,* 2006, Rubino, 2007).

4.2 Exemplifying and Legitimating

What this paper highlights is that sustainable building is defined through practice, through building projects. Contemporary successful commercial projects show what is possible and consequently legitimise those kinds of investments. New visions and goals for the advance of sustainable building are formulated in innovative projects, not in policies or through regulatory systems. Contemporary projects prove that considerably higher energy efficiency can be reached than is prescribed in current Swedish building regulations.

This retrospective study reveals different approaches to sustainable building. Even if different approaches, by different actors have been emphasized in different historical periods, these varying approaches co-exist at the same time. Jensen and Gram-Hanssen (2008) argue that the lack of a common definition of green building is not necessarily bad. Instead, a variety of approaches can be useful as it can motivate different kinds of actors and more easily adapt to differing project contexts. However, it could also be argued that these varying and sometimes competing approaches have impeded development as pioneers and more realistic actors have acted independently and have not wanted to learn from each other.

The study also point to the importance of emerging tools for legitimising more sustainable building practices, including building material declarations, environmental programmes, environmental policies and life cycle costing. Furthermore, the study reveals a shift from solution fixed and closed concepts of sustainable building towards function, quantitative performance and systems thinking. This is supported by a change in Swedish building regulation s from prescriptive solutions to system goals. The strong sense of place, local solutions, and homogenous and closed concepts in earlier examples has limited the broad transferability. This development also points to a shift from product issues to process issues recognising the importance of good quality process ingredients, i.e. the participation of a larger range of actors and stakeholders through all stages of a project in an integrated approach and the recognition of extra time for innovation, in the making of successful sustainable building. However, one should probably not overestimate the unduly positive outcome of a specific process or ideal design process.

4.3 Symbol and Performance

What can be considered as more sustainable building? The definition is evolving through time and as was discussed earlier it has to be defined in relation to normal praxis or norms in each national or regional context. In Sweden, some measures e.g. water-efficient appliances are normal procedures and do not have to be emphasised as part of sustainable building practices.

The importance of tangible dimensions of sustainable building has often been discussed, as a means to raise awareness that will lead to action (Guy and Shove, 2000; Jensen and Gram-Hanssen, 2008). Recently, the tangibility of sustainable building has gone from the often criticized symbolic attributes to performance indicators, a shift that has further supported the legitimacy of sustainable building. However, there are still problems connected to indicators such as kWh/m^2, and in the comparison between different locations (e.g. difficulties in delimiting flows or including household electricity use or not) and their accuracy to actually indicate sustainable development (e.g. in relation to the increasing space occupied per person). It has also been observed that individual measurement of energy as a means to stimulate lifestyle changes is not as effective as was planned as occupants experience difficulties in understanding the figures (Stenberg *et al*, forthcoming).

5. Concluding Remarks

This explorative study points to increasing governance in developing more sustainable building in Sweden and this may be an indication of a transition to a new phase in the ecological modernisation of Swedish building practices. The successful performance of contemporary low-energy buildings should not be seen as the ultimate goal of this development, we have to proceed beyond the passive house era. Energy, even though important, is not the only aspect of sustainable building. We see a need to reinvent and further study other important aspects of sustainable building such as water use, building materials, transport, renewable energies etc. as well as health, well-being and social issues linked to democracy and participation (Stenberg *et a*l, forthcoming) qualities in the built environment that are more difficult to assess, defend and motivate. Furthermore, the sector should be encouraged to innovate more, invest in experiments and demonstration to learn and establish new routines. The Government has to rethink their role in these processes, how they could support bottom-up initiatives and learn from them. Finally, the holistic approach in this study is motivated as sustainable building cannot be seen as one technology, which makes it more difficult to study but in fact responds to a complex reality.

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