



A Strong Research Environment for Sustainable Renovation Established in Sweden

Speakers:

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Abstract: *Sweden, as many other nations, faces large-scale, urgent need for renovation of post-war building stocks which have past their technical service life. To ensure the quality and effectiveness from different perspectives, environment, economy and the social, and enhance professionalism of the renovation process, a concretization of models for integrated sustainable renovation and development are needed. Such models will be developed within a research environment for Sustainable Integrated Renovation (SIRen) in Sweden. The approach is inter- and trans-disciplinary involving researchers at universities and institutes, actors in the construction and real estate industry, and relevant authorities, but still with a solid basis in disciplinary research. The research focuses on complex issues of renovation and redevelopment of existing buildings and urban areas conforming to objectives for reduced climate change, altered demographics and increased focus on democracy in planning, which are among the most important challenges for modern society.*

Key words: *Sustainable integrated renovation, research environment, collaboration*

Specific objectives and aim of the research environment

The recently established strong research environment for Sustainable Integrated Renovation, SIRen, gathers scientists from natural and social sciences and real estate economics at a large number of academic institutions and institutes in Sweden together with committed industry and public actors. SIRen focuses on the complex issues of renovation of existing buildings and redevelopment of urban areas conforming to objectives for reduced climate change, altered demographics and democracy in planning which are among the most important challenges for contemporary society to be handled within the economic context of construction without involvement of national subsidy. The approach is inter- and trans disciplinary, with a solid basis in disciplinary research. We challenge contemporary practices which fail to integrate societal objectives with environmental protection and aim at producing support to increase the sector's ability to deliver sustainability. The research integrate technical, environmental, economic, architectural, and cultural issues in renovation with a starting point in the social dimension and focus multi-value approaches and multi-stakeholder involvement. SIRen has the overall aim to gather knowledge, to change national practice and to strengthen Swedish competitiveness for renovation practice and research internationally. Specific aims are to:

- Establish a knowledge base
- Document and analyse earlier and on-going cases of renovation
- Test and speed-up diffusion of innovation through demonstration and Living Labs
- Develop model/s, methods, tools for integrated sustainable renovation



- Communication, dialogue and dissemination of results

The strong research environment will function in collaboration with the recently established National Centre for Renovation established at Lund University, and form a basis to develop additional research, innovation and attract new funding. After five years SIREn will pursue its activities and be a recognized partner for government, academy and industry in renovation. Other specific results are: a resource bank of up-to-date knowledge; inclusive model/s for integrated sustainable renovation including specific methods and tools; Living Lab and demonstrations; a platform for a Triple Helix dialogue to support sustainable renovation; and a basis for developing education in the field. Results aim to maximize the probability of replication of models and methods and trigger large-scale uptake market, targeting similar blocks and buildings and districts in Sweden or in Europe in need for renovation.

Overview of the research and problem area

Tackling refurbishment of existing buildings is a top priority in order to reach climate goals. In 2011, the Building performance Institute Europe's (BPIE) emphasised the critical role of refurbishment, when considering various pathways to achieve the 2020 decarbonisation goals [1]. To reach the 2050 target, renovation must be doubled or tripled compared to the current situation. Sweden, as many other nations in Europe, faces large-scale, urgent renovation of post-war building stocks which have passed their technical, economic and service life. The government or the building sector is not prepared for these challenges. We lack policy to handle housing shortage and affordability at the same time as regulations push for reduced energy use. In the building sector, knowledge in renovation is highly fragmented, difficult to access for professionals, and production of new construction is normative. There is also an identified lack of manpower, and new competences are needed to handle complexity. The pragmatic reality of the market, the political visions and objectives, the municipal and private services, and the needs of inhabitants and citizens, all have to reconcile to create socially, environmentally and economic sustainable built environments. A short term and reductionist view favouring costs and efficiency could lead to devastating and irrevocable losses of existing and functioning social values and architectural/cultural historical qualities.

Five research areas

We have identified five areas for development of knowledge.

1. Dynamics of property management and the role of client

This area will build knowledge regarding: The renovation process/cycles from technical and economic perspectives and their social framing. Few scholarly papers have focused renovation and its specific challenges in relation to sustainability [2]. Compared to new construction, renovation is a process framed by uncertainties and risks. Last decades, renovation and energy efficiency has been neglected and not prioritised because of low energy prices. Existing methods for facility and property management does not reflect the complex reality. Current practices are reactive rather than proactive, knowledge of long-term effects of renovation/maintenance strategies are lacking. The other area is: The changing role of client to deliver integrated renovation. A main challenge for integrated renovation is the necessity



for the client to manage a broader involvement of stakeholders representing different ‘stakes’, interests and power for action e.g. local authorities, residents, the local community, the property owner etc. The role of client should be expanded to include the users to address complex settings of current construction [3].

2. Integrated holistic design and effective renovation process

In renovation, it is necessary to analyse the building as a whole, including users, managers, technical systems, cultural aspects and economy [2]. This regards not only to the choice of technologies, but also renovation methods, design and socio-economic issues. The design phase affects the whole value chain. Energy-saving should be a natural factor to consider when prioritizing between different renovation actions. It is rare that renovation is preceded by necessary analysis. At the same time there exist methodologies that analyse energy optimization with profitability, life cycle assessment, life cycle cost and indoor environment [4]. Furthermore, renovation is not without risks. Even simple actions can alter the building function, affect moisture balances, cause comfort concerns and affect housing aesthetic qualities [5]. Another area is energy equipment and systems with focus on advanced heating and cooling as well as domestic hot water solutions. Technique is evaluated but there is a need to integrate result into a holistic design. A multi-scale cross-disciplinary approach fostering interactions among players need to be set up. A validated cross-disciplinary ‘design for affordable sustainability’ framework may support refurbished construction projects [6].

3. Economic challenges concerning renovation

Economic challenges regards contemporary practice to calculate profitability and the incentive structure for sustainable and energy efficient renovation and to overcome an energy-efficiency gap if there is one. The design of policy tools in relation to decision making is an identified research questions, based on knowledge of how decisions are made and on what basis they are taken [7]. Other important questions relate to the timing of decisions. In order to reduce economic burdens during a specific period the question of when certain renovation and energy savings measures should be applied.

4. Citizen/tenant empowerment and democratic decision-making

In recent years, the importance of the social dimension to realise sustainability has been emphasised. Contemporary housing renovation lacks a relevant discussion related to affordability, housing shortage and social stability and cohesion in housing areas, resulting in social exclusion and gentrification [8]. Dissatisfaction with traditional approaches has led to an interest in involving citizens in design and planning. Social inclusion issues closely relate to ‘empowerment’ – a process where inhabitants/tenants gain knowledge and skills to play a meaningful role in decision-making with the purpose of improving the environment and thus turned into producers rather than mere consumers of the urban environment. Improving a dialogue to the point of empowerment however requires more than mere tool development. It implies system changes in e.g. planning offices and housing companies which entail a need of including also such institutions as knowledge producers in research [9].

5. Innovation and learning

A usual problem in construction is that good practices are not taken-up on a broad scale, another that broader visions for sustainability are seldom a goal in renovation. In order to support implementation of integrated sustainable renovation there is a need to understand the building sector in relation to innovation. There is a need to enhance understanding of innovation in construction, with focus on the innovation system and different actors' potential complementary roles. Learning and innovation should be understood with respects to social and cultural perspectives [10] and organisational capabilities [11]. There is need to rethink roles of all actors, from management down to the construction workers. New construction is normative, also in the training of new professionals thus defining training and education which emphasise learning and collaboration will be important.

Approach and methodology

This research proposal includes inter- and disciplinary knowledge building as important complements to trans disciplinary research. In traditional academic research, knowledge is often fragmented in its relation to theory and practice, whereas in action-oriented, trans disciplinary research approaches, the aim is to link research and practice and create new theory, tools and practices. A transdisciplinary approach implies joint knowledge production where all involved actors are considered producers, carriers and users of knowledge [12]. Implementation is therefore an integral part of the research process.

Realisation, performance and methods

The work will be carried out in five parallel work packages (WP) that are intertwined with the research foci (Figure 1).

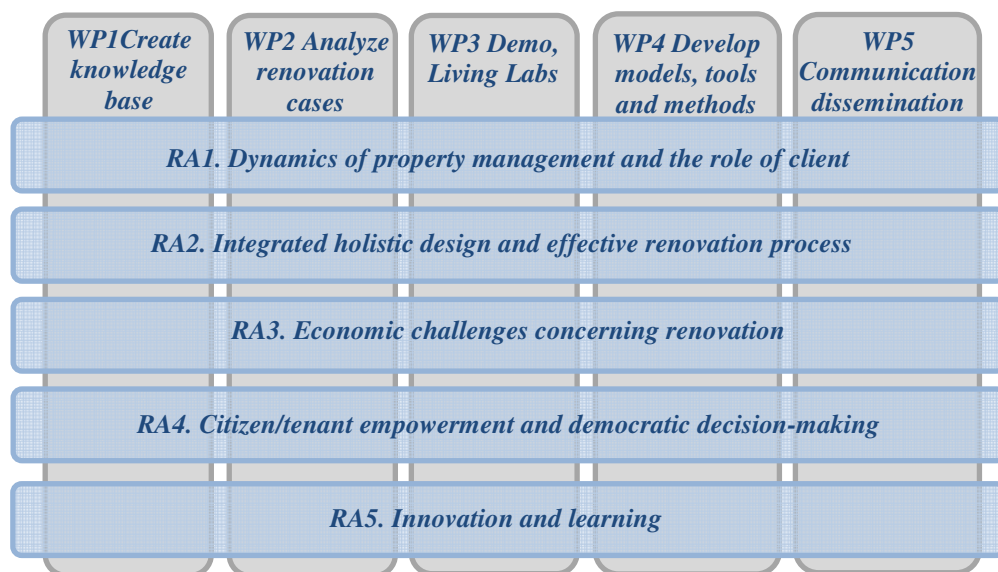


Figure 1. The connection between the five research areas (RA) focused on in SIRen and the work packages (WP).



Results so far

The initiative came from a group of researchers from different disciplines and with different background and experience. More researchers were invited to participate in a core/steering group, and others were invited to join a resource pool of expertise. In November 2013, the research environment was granted 2.5 M Euro for five years by the Swedish Research Council on the condition that Swedish construction industry took part and contributed in form of in-kind resources corresponding to an equal amount of money. During 2014, a lot of effort has been made to convince the industry to write contracts and join the research environment.

At present SIREn consist of 11 researchers in a core and steering group and additionally 16-20 researchers invited in the expert pool to contribute to the work. Participants belong to: Lund University, Chalmers University of Technology, The Royal Institute of Technology, Luleå University, SP Technical Research Institute of Sweden, Umeå University, University of Dalarna, Gotland University, Malmö University. The researchers belong mainly to the fields of engineering and architect but also to economics, innovation and social sciences related to construction.

In May 2014, no less than 27 companies and organisations have joined the initiative:

- Four municipal housing owners of which one is a Mother concern for all municipal housing in Göteborg. Together they own and manage over 100.000 apartments.
- Two large nationally and interationally operating contractors (Skanska and NCC).
- Eight consultancies; two large technical consultancies one large architect consultancy and one small, one consultancy in the built environment, one specialised in renovation and one in post-war housing stock, and a small design consultancy.
- Three suppliers: one of solutions for facades, one for ventilation and one for bath- and kitchen renovation concepts.
- Sector organisations: The Swedish Client Construction Forum, The construction industry's organisation for R&D, The sector organisation for ventilation and plumbing companies, and the Swedish Tenant's Association.
- Municipal agencies: The city of Malmö, The Energy Agency of Skåne, The City Museum in Göteborg and The Region of Västra Götaland (division for heritage).
- Governmental agency: The National Board of Housing, Building and Planning.

The first kick-off meeting was held in May 2014 with around 40 participants from academia and industry. During two days we discussed and agreed on the most relevant research questions to start working with reflecting interest in the group and sub ordained to the pre-defined working packages. Working package leaders have been appointed and the participants have formed smaller trans disciplinary groups to take the ideas one step forward. The smaller groups will meet several times a year and the larger group of all participants 1-2 times a year. The kick-off was a large success and a new larger meeting is planned in 6 month.

An assistant has been attached to the project to administrate the research environment. A web-site has been attached to the National Renovation Centre (renoveringscentrum.lth.se).



One of the first results of the environment is a debate article in which no less than 11 of the involved researchers participated.

Concluding discussion

Sustainability in the built environment calls for the coordination of a variety of actors and processes of interaction and negotiation, and institutional changes. The discrepancy among stakeholders, diverse and sometimes contradictory discourses, agendas and interests create communicative barriers and has been identified as one of the most significant barriers to the realisation of sustainable practice [13]. This research environment focuses on integration between different disciplines, actors and stakeholders in renovation. Studies show that multi-actor and stakeholder involvement can lead to self-reflection which will facilitate the sharing of different world-views and disciplinary standpoints [14]. From a pragmatic view, broader stakeholder participation can enable solutions that are better adapted to local conditions and create empowerment among citizens and engagement. But most important, a broader collaboration will ideally lead to social re-valuation and initiate profound social learning: a necessity to sustain systemic and radical changes to deliver sustainable renovation.

The strengths of SIRen is the broad interdisciplinary setting gathering a large number of researchers and expertise in Sweden and strong industry commitment, as well as the large network connected to all parties. The setting provides an established platform for complementary research and innovation bidding in national and European calls. Common workshops and seminars have so far resulted in personal connections supporting informal knowledge exchange and a basis for spin-off activities. The involvement of industry enhances the relevance and usability of research, and will support up-take in the sector. The presence of municipality and governmental agencies potentially shorten the link between practice, research and policy making.

There are also a number of challenges for the research environment. While the strength is the broad participation, this also leads to challenges regarding coordination, administration and ethics of work. The ethics of sharing of knowledge and ideas, and the collaboration in publications has been illuminated and guidelines for behaviour for research have been presented at several occasions. The involvement of academia and practice presents challenges regarding reporting where outcomes need to be adapted to academic relevance being measured in scientific publications and the need of industry relevant reports and innovation support.

Further, the broad distribution of resources among institutions reflect the inter- and trans disciplinary approach but further funding will be needed for in-depth studies. At present, the research environment focuses mainly on housing and post-war stock, reflecting contemporary societal challenges but also the competence among researchers and participating property owners which represent housing owners. This has been brought forward as a limitation by some industry partners. A broadening of the scope will be solved mainly by future additional projects and funding.



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