

# Challenges for Sustainability Innovations in Real Estate and Construction Industry

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## Abstract

The study was set to investigate what the challenges of sustainability business innovations (SBI) in built environment are and how they differ from the challenges of general innovation. First, a thematic framework for SBI in real estate and construction (REC) industry is utilized to identify relevant themes, and then several professionals from public and private venture financing organizations and REC industry companies are interviewed to increase the understanding of challenges specific to SBI in REC industry. The main findings of this paper suggest that the SBIs in REC have several industry specific major challenges. The key challenges mentioned by all of the interviewees appear to be complex REC industry value network, team building, and R&D and commercialization management.

## 1 Introduction

The climate change mitigation is one of the greatest challenges of sustainable society. Climate mitigation has boosted the fastest growing new investment market in the world with over 140 billion dollars yearly investments [1]. Inside the market, built environment and especially the real estate and construction (REC) industry is assessed to have the largest potential for profitable environmental burden reduction [2-3]. This offers a wide scope of opportunities for cost effective

sustainability business innovations (SBI) – innovations that bridge the gap between business, social, and environment factors to achieve sustainability. Perhaps the most challenging aspect of the climate mitigation is the short time frame for corrective actions, specifically in built environment for example to produce almost zero energy buildings by year 2021 – in ten years. Paradoxically, the latest research suggests [4] that despite the sustainability opportunity there is little SBI activity in REC industry. In particular, there is a lack of fast customer-oriented radical innovations that are expected in sustainability markets. In addition, the very few radical SBIs already in the market face great challenges in being accepted by investors and other stakeholders [5].

A key aspect of sustainability is how companies and policy makers can stimulate innovation in built environment in order to move from incremental to substantial environmental improvements. In spite of the high priority, the characteristics of SBI and innovation processes in REC industry is a relatively unexplored area in earlier literature. In contrast, earlier studies on general innovation processes and life-cycle management (LCM) are numerous providing an interesting platform for research on SBI processes in REC industry. Similarly, the traditional R&D processes in REC industry have been studied rather extensively.

The general innovation process and management literature has demonstrated that the improvement in innovation process can reduce the time-to-market for innovations and facilitate the application of new technologies. During the last 20 years, the focus of the academic and industrial discussion on innovative activity has shifted from closed innovation systems and traditional R&D processes to open innovation systems [6] with radical service-dominant and customer-oriented innovation processes [7-9].

The key step in stimulating SBI in REC industry is to develop and implement assessment tools to improve the measurability of the environmental impact of company operations active in SBI. In effect, the scientific community of LCM has already developed systematic, holistic, objective tools to evaluate the environmental burdens associated with a product or process and provide the rationale for environmental labels and declarations [10-12]. Moreover, some studies [13] have already presented comprehensive environmental contribution analyses for companies. It appears that companies could gain added value by using life cycle assessment in determining not only the significant environmental impacts of their operations but also innovation.

The study was set to investigate what the challenges of sustainability business innovations in built environment are and how they differ from the challenges of general innovation. First, a thematic framework for SBIs in REC industry is utilized to identify relevant themes, and then several professionals from public and private venture financing organizations and REC industry companies are interviewed to increase the understanding of challenges specific to SBI in REC industry.

The paper is divided into three sections. First, we briefly review the key themes of innovation challenges in earlier literature. Second, the empirical data from interviews and observations are discussed. Finally, the key research implications are presented with suggestions for future research.

## **2 Challenges to innovations**

In this section, we will review some of the earlier literature on innovation challenges relevant for this study to create a grounding structure of theme interviews. The relevant literature for this study can be divided into three main directions. First, we concentrate on general business innovation challenges. Second, we review the studies that investigated REC industry specific innovation challenges. Third, the scarce but interesting field of literature is the emerging field of SBI in REC industry.

General business innovation challenges have been widely studied. Our literature review revealed that key challenges to innovation are related to team building, innovation strategy and processes, organizational culture, and lacking resources for innovation. For example, West and Callagher [14] have documented that the key challenges of innovative companies are building and motivating the best and brightest team, exploring a wide range of external sources for innovation, integrating those sources with company's resources and capabilities, and maximizing returns on intellectual property. Moreover, several studies [7-9] have investigated business innovation processes and suggest that a low level of customer and value network integration into the innovation process represents a challenge to business innovation, especially service-oriented radical innovations. Holmström [15] argues that large size of the organization per se is a great challenge to business innovations as it often leads to bureaucratic internal organization of the firm and myopic management behavior due to concerns for reputation in the capital market. Therefore, small companies innovate

disproportionately compare to large companies, and contrary incumbents often fail to innovate due to their bureaucratic organizations that compromise innovation incentives. Moreover, Chesbrough and Crowther [16] have identified not-invented-here (NIH) syndrome and lack of internal commitment as main hampering factors of business innovations. Koudal et al. [17] found that innovative companies do not invest adequate resources on business innovation even though investing in innovation has proven to be profitable. Moreover, Kortum and Lerner [18] suggest that low availability of venture capital (VC) finance for innovation hurts especially radical innovation and new business formation.

Several studies suggest that there are various challenges to innovation in REC industry. Construction innovation is traditionally identified as technical innovation that increases the feasibility and quality of construction projects, thereby producing social and environmental benefits that would otherwise have been unachievable [19-20]. Innovation in the REC industry is often classified as a cost-intensive investment with very indefinite returns due to the risks associated with R&D and great variations in both demand and profits [21-22]. In addition, innovation in REC industry is constrained by complex value chains and project-based operations. For example, innovations are often “hidden” at the project level and remain undetected by conventional measures. In addition, recent studies [21-23] suggest that the lack of innovation management competencies and tools – especially related to promoting new ideas and making conscious strategic decisions about the direction of the firm's innovation activity – present a challenge to innovation in REC industry. Innovations in the REC industry have a tendency to be incremental in nature, and lead to radical transformations only over the long-term.

Earlier literature does not contain extensive studies concerning SBI in REC industry, and the studies have focused on the role of the regulatory authorities. For example, Dewick and Miozzo [24] research the relationship between innovation and regulation in the context of energy efficiency and REC industry. They find that besides the inherent conservatism in the REC industry, additional barriers inhibiting the diffusion of new SBI include capital costs, the failure of the market to account for social and environmental costs and savings, and the perceived cost-effectiveness and performance of products over a 50-year lifetime.

Moreover, few recent studies have looked at why radical sustainability innovations often fail in REC industry in spite of their strong ecological and efficiency benefits. For instance, Rennings et al. [5] have examined SBI

challenges in the context of power plant construction. The authors identified high investment costs as a barrier for introducing radical product innovations. In effect, new or improved technologies first have to be presented, manufactured and tested locally before being exported to other areas. Moreover, short-term profitability target in incumbent companies prevents more risky projects, such as radical innovation, to be initiated. Fundamentally, regulation dictates innovation adoption. Relaxed climate policy is a challenge to radical innovations and has led to the era of incremental solutions.

Furthermore, Kajander et al. [4] investigate the current approach in REC industry to produce SBI and why it does not seem to produce new innovation with required speed. Almost hundred innovation projects in the industry were scanned to find out whether they contain the major components of an innovation process – radical innovation target, and strong customer and value network integration into the innovation process. The results implied that sustainability innovations process in the built environment lacks some of the key components of an innovation process as none of the scanned projects included all three components. Moreover, the sustainability innovation processes in REC industry were actually found to resemble traditional R&D processes instead of innovation processes.

### **3 Empirical data and research design**

The empirical data was collected from two-round interview and analysis process. In round-one, we collected data through theme interviews from venture financing organizations that invest in SBI in built environment. In round-two, we interviewed five representatives – 2 CEOs, 2 chairman of boards and a technology director – from REC industry companies active in SBI. The target of the first interviews was to find out what are the key challenges of SBIs from venture financing organization's point of view and how they differ from general innovation challenges. The challenges identified from earlier literature were used as grounding structure of theme interviews. The three interviewed VC experts come from venture finance organizations based in Finland that have altogether over 480 Meur of funds allocated in investments in SBIs in built environment, especially in renewable energies and energy saving technology companies in Finland but also other European countries.

The round-two interviews were conducted by interviewing REC industry companies active in SBI. The target of these interviews was to find out what the key challenges of SBI are from the innovator's point of view and how they differ from general innovation challenges.

Company A supplies project management and building development services and is active in sustainability innovation e.g. through city planning consulting, public transportation construction projects and senior-citizen built environment concept development. In effect, company A is one of the leading sustainability engineering companies in Nordic countries with a turnover of 70 MEUR. Second, company B develops and manufactures efficient, time-saving steel structure solutions for commercial, office and industrial construction, single-family homes, port and transport infrastructure construction and for wind turbines. Company B has global operations and a turnover of 610 MEUR. Third, company C is a globally leading company in the area of indoor environment products, systems and services with operations in 23 countries and a turnover of 150 MEUR. Fourth, Company D has developed radically innovative modular products for new building and repair projects. Company D is a small VC financed growth company with a turnover of 1 MEUR and main operations in Finland. Finally, company E provides REC industry LCM design methods, software products, and related services. Company E operates in Finland and has a turnover of 4 MEUR. Companies A and B are daughter companies of publicly-listed companies in Finland and Sweden, and companies C, D and E are privately-held. All the offices of the interviewed professionals were located in Helsinki Metropolitan area. Each of the interviews lasted approximately two hours.

## **4 Results**

### ***4.1 Round-one interviews: venture financing organizations investing SBI***

All of the respondents stated *complex REC industry value network* as the key challenge to SBI. Taking new SBIs, especially radical, to the market is difficult due to REC industry value network fragmentation. Multiple stakeholder commitment and acceptance are required to go further in the innovation process. It was pointed out that this is a problem for both technological and service-oriented SBI. *Team building* was also brought up by every respondent as a particular

problem of SBI especially in terms of lack of multidisciplinary entrepreneurial teams capable to manage complex value networks and innovation. Moreover, the interviewed experts underlined that SBI in REC industry typically have a *long-term research and development (R&D) background*, which is a challenge for SBI. All respondents expressed that start-ups in built environment are still often product-based and the product cycle is longer than service-oriented innovations such as “dotcoms”. Finally, *pending regulatory decisions* regarding energy efficiency standards was generally seen as a barrier to SBI in REC industry. In addition, some respondents mentioned SBI company *local market orientation* and consumer environmental awareness building as constraints on SBI in built environment.

These interviews suggested that the key challenges to SBI in built environment from venture investor’s perspective are complex value networks, team building, long-term R&D and regulatory decisions required for SBIs.

#### ***4.2 Round-two interviews: active SBI companies in REC industry***

In round-two interviews, the respondents described several challenges inhibiting their SBI activities, which are summarized in Table 1. Most of the challenges identified in round-one interviews were present at the interviewed REC industry companies active in SBI. However, the companies also brought up challenges which were not discussed in earlier literature or round-one interviews.

*Complex value network in REC industry* was mentioned as a challenge to SBI in every company interviewed. SBI activity within REC industry was regarded as a challenging long-term process that requires formidable investments and managerial tools to build and manage networks in a fragmented environment, especially in the case of radical innovations.

**Table 1. Summary of round-two interviews**

Company	A	B	C	D	E
Complex value network	X	X	X	X	X
Team building	X	X	X	X	X
R&D and commercialization management	X	X	X	X	X
Project business orientation in REC industry	X	X	X	-	-

Internationalization of SBIs	-	-	X	X	-
Fundraising	X	-	-	X	X
Regulation and standards	X	-	X	-	-

All interviewed company representatives argued that *SBI team and competence building* is a critical challenge especially concerning attracting the professionals who are development-driven and building teams with multidisciplinary competencies. In addition, several challenges related to *processes and tools of R&D management and commercialization of research results* were present at all interviewed companies. Furthermore, some of the respondents pointed out SBI challenges related to *project based operations in REC industry, internationalization of SBI, fundraising for SBI, and lack of a common understanding on sustainability, innovation and environmental standards.*

### 4.3 SBI challenges in REC industry

We next reviewed the findings from our exploratory empirical study. The key results from round-one and round-two interviews are summarized in Table 2. The challenges of both the venture financing organization active in SBI as well as the companies active in SBI are presented. The challenges identified for SBI in REC industry were categorized under the seven themes of complex REC industry value network, team building, R&D and commercialization management, project business orientation in REC industry, internationalization, fundraising for SBI, and regulation and standards. We will highlight the major differences between the two groups of interviewees.

**Table 2. Summary of empirical observations from interviews**

SBI challenge in REC industry	SBI VC investor challenge	SBI company challenge
<b>Complex value network management</b>	-Complicated and costly decision-making processes	-How to manage systemic change in a fragmented environment? In other words, how to find the right partners and projects for SBI and convince multiple stakeholders of the SBI benefits at the same time?
<b>Team building</b>	- Lack of multidisciplinary and entrepreneurial teams - Lack of innovation	-How to build a team with multidisciplinary competencies and entrepreneurial mindset?



	<b>management competencies</b>	
<b>R&amp;D and commercialization</b>	<b>-Long-term R&amp;D often required for SBI results in long-time to market and big sunk costs</b>	<b>-Lack of processes and tools of R&amp;D management and commercialization of research results especially: how to identify and diffuse SBI and how to manage and organize R&amp;D with universities?</b>
<b>Project business orientation in REC industry</b>	-	<b>-How to create an innovation culture in a project organization?</b> <b>-How to convince risk-averse project participants on SBI?</b>
<b>Internationalization of SBI</b>	<b>-SBI company local market orientation</b>	<b>-How to avoid high costs involved in taking SBIs to new geographic areas?</b> <b>-How to create a company innovation culture for transferring SBIs and related knowledge between teams working with SBIs in different locations?</b>
<b>Fundraising for SBI</b>	-	<b>-How to find the right sustainability-oriented financing sources for high risk SBI-projects?</b>
<b>Regulation and standards</b>	<b>Slow-paced political decision-making for energy efficiency standards</b>	<b>-Lack of a common understanding on sustainability, innovation and environmental standards</b>

Roughly speaking, both groups of interviewees found mostly similar challenges, especially in terms of value networks and team building. However, project business orientation in REC industry and challenges related to fundraising for SBI were present only in SBI companies. In addition, differently from the VC investors of, the companies active in SBI did not perceive pending regulatory decision as such a severe challenge to SBI as investors. Instead the companies highlighted lack of common understanding of sustainability and use of standards as a regulatory challenge. Moreover, while VC investors consider long-time to market and sunk costs related SBI as primary issues in the area of R&D management, the SBI companies feel that it is first and foremost a question of better tools and processes for innovation management.

At SBI company level, the companies interviewed were quite unanimous on the challenges of SBI particularly concerning value networks, team building and need for innovation management tools. However, some differences can be identified

based on company size. For example, large companies pinpointed the challenges related to internationalization and research collaboration with universities. In contrast, small growth companies identified fundraising for SBI as a challenge because it is difficult to find the right kind of VCs that can contribute to sustainability and company development.

## **5 Discussion and conclusions**

The study was set to investigate what the challenges of sustainability business innovations in built environment are and how they differ from the challenges of general innovation. First, a thematic framework for SBI in REC industry was utilized to identify relevant themes, and then several professionals from public and private venture financing organizations and REC industry were interviewed to increase the understanding of challenges specific to sustainability innovation in built environment.

The main findings of this paper suggest that SBIs in REC have several industry specific major challenges. The key challenges mentioned by all of the interviewees appear to be complex REC industry value network, team building and R&D-intensity and commercialization management. In addition, our findings suggest that SBIs in REC industry are constrained by project business orientation in REC industry, fundraising and internationalization issues, and lack of regulation and standards.

It would seem that the challenges in sustainability innovation in built environment differ from general innovation as well as general innovation theories – especially in terms of the importance of complex value networks, project business orientation in REC industry and regulation intensity. Some of the characteristics of SBI challenges identified here resemble the challenges discussed in general construction innovation literature. In addition, our findings add to earlier SBI literature in terms of characterizing some of the challenges related to value networks, team, R&D and commercialisation of SBI in REC industry.

Based on the empirical observations in this paper, it would seem that the key challenges for SBI in REC can be addressed. Fundamentally, new tools for SBI screening, evaluation and management are needed to enable companies and VC investors to succeed in SBIs of REC industry. Moreover, REC industry has to be able to develop customer-oriented and fast innovation processes that holistically

integrate the value networks. Furthermore, the education in REC field should in future include innovation management and financing competencies in their curriculum.

When generalizing based on the results, this study has some important limitations. Since the data collected through interviews for the study is limited in number and geographically, the implications made should consider as suggestive only. Moreover, it should be pointed out that all the interviewed experts were at managerial level positions in their organizations. The way executives perceive SBI is may be biased towards top-down perspective and experience.

This paper sets forth several leads for future research. It would be highly interesting to study further the role of VC in creating SBIs in built environment. Moreover, more research attention should be given to investigate the relationship between sustainability innovation process and LCM -approach.

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