

# Innovation strategy for the Swedish built environment industry

A basis for continuing efforts for innovation  
within the built environment industry

**BYGG**innovationen

# An innovation strategy for the built environment industry

THIS INNOVATION STRATEGY has been decided by the Bygginnovationen programme board in November 2012. It is a basis for discussion and detailing of action plans for continued efforts for innovation by the stakeholders within the built environment industry. This strategy is based on numerous interviews and analyses of what characterizes innovative construction. It corresponds to the challenges which have been identified for the firms in the built environment industry and also includes

- A customer driven innovation climate
- Interaction for innovation
- Encouragement of collaborative innovation

**Innovations in the built environment industry** are important. The built infrastructure is necessary for a society that functions well and for the competitiveness of the nation. This is intimately connected to challenges for the firms in the built environment industry. No other industry is related to so many of the acknowledged global societal challenges. The societal ability to face the challenges of sustainable growth, climate change, urbanization, ageing infrastructure and population is wholly dependent on efficient and innovative processes within planning, construction and management of the built environment.

**The firms within the built environment industry** actually belong to a variety of industries. It is typical that one and the same construction project forms an arena where firms from manufacturing, construction, consultancy, property and several other service industries meet. The value chains of the different firms are interwoven, and this is of great importance for innovation. This also means that a common innovation strategy for the built environment industry is needed.

**It is essential for the innovative ability** among the firms that they can recruit new graduates with a high level of fresh capabilities, just as that there are possibilities for competence development and access to experts within a range of knowledge fields.

**To attract young people** to choose an education within the built environment area, firms and other stakeholders must display an attitude that is marked by continuous learning and an innovative environment.

**An expectation of future yield** is a natural background to firms' investments in innovative thinking. Here, regulations and how these are applied in public procurement, just as traditional business models applied in dealings between firms, have turned out to be obstacles to a favourable development.

**New and established forms** of cooperation and support that contribute to innovation driven processes are decisive for the development of a sustainable innovative context for innovation in the built environment industry. SBUF, the Development Fund of the Swedish Construction Industry, is an often mentioned example of an already established important support for research, development and open innovation with cooperation between firms and between firms and universities.

**An example of a new form of cooperation** which has been welcomed by the sector is the Bygginnovationen innovation programme. A fundamental condition for a strong innovative environment is however that there is also a lively research environment which can participate in large common research programmes and which also allows curiosity driven research. Another fundamental condition is that schemes for cooperation and support are stable over time.

**The Swedish Universities of the Built Environment** (Sveriges Bygguniversitet) is another new form of cooperation which contributes to strengthening the Swedish innovation context for the built environment industry. This is a collaborative association comprising those research and educational units within the four universities of Chalmers, KTH, LTH and LTU that are linked to post-graduate education in civil engineering. This association offers researchers the possibility to speak with a common voice, which facilitates the dialogue with other collaboration partners, for example in relation to large national and European research programmes. Similarly, Arkitekturakademien is an important initiative which in time may acquire a role in the context of innovation.

**The Government's Research and Innovation Bill** (October 2012) proposes increased funding for Formas within the area of sustainable building and urban development. VINNOVA is proposed to receive funding for Strategic Innovation Programmes, and preparatory work has begun for strategic innovation agendas, of which several are within the built environment area. Other recent bills concern research and innovation within energy efficiency and transportation infrastructure.

INNOVATION is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations (OECD Oslo Manual).

# Programme for an innovative built environment industry

**The programme starts from challenges to firms, needs for interaction and of creating a customer driven climate for innovation as well as generally stimulating innovations in the built environment industry.**

## The innovation climate is improved

- By central, regional and local government developing their capabilities to create routinely good conditions for innovations through their procurement practices. This requires competence development ensuring that public clients contribute to an innovative development trend.
- By Sweden acting forcefully within the EU to continue work of simplifying and adapting the public procurement directive, just as for Euro-codes and other international standards to be revised for the purpose of encouraging innovations in construction.
- By reviewing the arrangements for, the direction of and the funding of Swedish participation in international standardization.
- By intensifying the interaction between industry, the universities and those research institutes that are related to the built environment.
- By industry in interaction with public innovation systems establishing test beds for development and demonstration of new business models which reward solutions that are customer oriented, sustainable and reduce risks perceived by small and medium sized enterprises.
- By developing and applying standard forms of contract that clarify the allocation of intellectual property rights.

## Conditions for the development of a strong and sustainable environment for innovation are improved

- If other firms than construction contractors create simple systems for coordinating their in-kind contributions for innovation projects, matching funds from the government or from the contractors.
- If governmental funding increases support to programme interaction between several firms, universities and institutes in larger multi-year research and innovation programmes.
- If governmental funding increases support to curiosity driven research as a hotbed for radical innovative thinking within the built environment industry.
- If national innovation programmes are given the possibility to function and be further developed over a longer period of time.
- If Sweden acts within the EU for developing the European research programmes in a direction which supports innovation to a greater extent, particularly within smaller firms. Administratively laborious practices for application and accounting should be simplified and procedures made more efficient, not least for payments.
- If models for knowledge exchange and interaction with other sectors are developed.

## Conditions for the innovative ability of firms are improved

- By considering the possibilities for firms to recruit well educated graduates with relevant capabilities for innovation when making policy decisions for the orientation and forms of governmental research support.
- By creating incentives for innovation relevant educational efforts within the universities.
- By developing arrangements for concentrated efforts from universities and institutes for continued education in firms.
- By developing and establishing a model for more efficient exchange of staff in both directions between firms and universities for the purpose of innovation.

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# Challenges for the firms

**The firms meet many challenges** when it comes to expanding their activities based on innovations.

**It is urgent to evolve** from project thinking to platform thinking with an emphasis on methods and processes. Process changes are based on introducing new IT systems, primarily Building Information Modelling, BIM, which transforms both ways of working and the distribution of roles. It is related to partnering and other new forms of collaboration.

**Sustainability is important**, since technology innovations may take 5-10 years from research to commercial use. Therefore it is also important to concentrate on particular lines of development without spreading efforts. A further challenge is that the firms are seldom able to—or will—take an integrated responsibility for the end product. This is influenced by the industry standard forms of contract and the tendency to avoid product responsibility. It is not only for consultant firms that there is an essential challenge to introduce new ideas, turn them into commercial concepts and sell them, thus to develop their abilities to show customers what their problems are and various solutions.

**Smaller firm may need** templates for organizing and conducting their innovative activities. This applies in particular to new, innovative and specialized subcontractors which need support and collaboration partners.

**Firms need sufficient competence resources** internally and the ability to attract the right people. Recruitment of young innovative staff with a high level of competence requires that the firms belonging to the built environment industry are attractive. This also requires that the firms can meet the challenge of adhering to good ethics in their activities.

**Firms also must establish** themselves as accepted in a market before they can offer innovations to customers. The passage from volume delivery to value delivery, emanating from user requirements, can be a difficult transition for producers. There might also be a need for dealing with customer requirements of up to 100-year durability of new products and methods. The time perspective is furthermore present when it may take eight years from inception to completion of a new housing project. This also means also that the firm must be able to handle demand variations over the business cycle. Moreover, markets are local. This is not only an issue of different requirements on housing projects in different municipalities. Implementing an innovation is also influenced by differences in the access to local labour and local suppliers.

**Earlier government policies** for supporting research and development within construction have often been orientated towards the challenge of reducing building costs for new housing. It is still urgent to focus on efficiency and measures that may lower housing costs, but this is not sufficient. Today it is evident that there is a need for innovations which contribute to robust technologies markedly reducing the long term risks of moisture and mold problems in newly built or refurbished dwellings. There is a corresponding challenge of increasing the life span and reducing maintenance needs for the nation's crucial infrastructure investments.

**Contributions to a sustainable society** also come from the fact that efficient construction with a high level of architectural qualities is important for the supply of space for both industry and the public sector. Attractive urban environments have many positive effects in society, although these effects are not priced in a market and will be included in commercial calculations. The built environment industry has a strong social dimension. Ultimately it is about upholding fundamental societal functions in Sweden and improving the potential for reaching a high quality of life.

**Important obstacles** to the international competitiveness of what the firms produce (including services) are according to the interviewees:

1. Weak client competence in Sweden
2. Differences in standards
3. Lack of a highly educated workforce
4. Weak university research in the field

These four obstacles point to obvious needs for action.

**National building regulations** are rapidly being replaced by international standards which emerge from EU collaboration. These international standards contribute to creating wider markets and offer increased export possibilities for innovative firms. However, effects for Swedish competence are influenced by how much Sweden engages in the development. In order that international standardization is developed favourably for the competitiveness of Swedish firms in foreign markets, Swedish actors have to be more active in the international collaboration. There is also a need for devoting funds to the provision of knowledge for argumentation concerning the design and contents of standards. The principles for funding participation in standardization activities should be reconsidered.

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# A customer driven innovation climate

**Large clients have possibilities** to influence development in the right direction by formulating more advanced requirements, concentrating on their own client role and "being less good at details". Current work within the Swedish Transport Administration for increasing the proportion of Design-and-Construct contracts and more purposefully and distinctly defining their performance requirements can be a good example for others.

**The pricing of services** delivered by consultant firms should be moved towards flat fees, preferably based on outcomes achieved for clients instead of hourly rates, considering the innovation climate. The same systems thinking is found when a firm begins basing its business models to a greater extent on a total price for a bundle of goods and services.

**Customer driven business models** are a starting point for strengthening the implementation of research results. This means that customer competence is critical, especially among the skilled and experienced actors. Many clients are central, regional and local government units. The ability to formulate intelligent requirements and the procedures for public procurement are then two key questions. Sweden should act forcefully within the EU for continuing work with simplifying and adapting the procurement directive to current needs.

**Development of new business models** should be done by industry in interaction with public clients. This may concern finding new ways of charging fees for consultancy services, bundling of goods and services and systems deliveries. Common to these efforts should be to seek incentives which reward actors who propose long term sustainable solutions. At the same time, payment principles are needed that reduce perceived risks for small and medium sized enterprises. Also standard forms of contracts that clarify the allocation of intellectual property rights should be developed and applied.

**Smaller and innovative firms'** new solutions may enter the market through projects run by large contractors. Large and complicated projects thus constitute a counterpart to the test and demonstration facilities found in the manufacturing industry. This type of interaction between firms of different sizes is already in existence, but can be developed further. The user dialogue in project interaction is important for supporting a broader market introduction of products.

**Patents are a secondary issue** for most consultants and contractors. Many of those interviewed suggest that this issue is of little importance within the built environment industry. However, there are firms, in particular in the product development area, where patent protection is necessary to ensure competitive gains from their own development activities.

**Assuming greater responsibility** is in many cases a key to increased commitment to development activities. This is premised on a clear linkage between liability and authority—meaning that a firm offers longer warranties for solutions that they themselves have chosen or at least have been able to influence the choice of, but not for solutions that someone else has prescribed in detail.

**Public procurement has a decisive** importance for the innovative ability of the Swedish built environment industry. Public clients correspond to about half the turnover of the firms, although the proportion varies for different types of firms. In order to have a procurement climate that stimulates innovation, the interviewees have ranked the following factors according to importance:

1. Higher competence for assessing alternative tenders (with an alternative technology)
2. Increased use of performance requirements in technical specifications
3. Special innovation procurement arrangements
4. Large test bed projects
5. Lower price weight when awarding contracts

**Innovation friendly procurement** is when the procuring organization is open to, and takes advantage of, innovative ideas from suppliers. It is an important driver: daring to procure performance, daring to formulate challenging requirements. It promotes innovation and it is an important condition for market actors having an interest in the long term development of even better solutions.

**Innovation procurement** concerns existing, new or improved products, where the strategic choice to encourage an innovation is made by the procuring organization. Also this is of great interest for the firms of the built environment industry.

**Public clients must** therefore be able to use their buyer power so that they create a good climate for innovations. Although single and focused cases of innovation procurement can be valuable, it is essential that routine procurement contributes to the innovation climate. Public procurement that counteracts the development of legally protected technologies is considered by a few interviewees to be a clear obstacle to innovation.

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# Interaction for innovation

**Firms in the built environment industry** have since long ago relied on open innovation. Open interaction between firms is often aimed at stabilizing accepted practice or developing it as an industry standard. This applies in particular to BIM as a support for virtual design and construction, where many parties are involved and need to change their practices simultaneously. It is typical that open innovation is more relevant for process innovations than for product innovations.

**Open interaction is also needed** for creating common frameworks for energy, climate and environmental classification schemes when the regulations issued by government authorities lack precision. Data bases for experience feedback over a longer period of time is another example, and linked to this there is a need for rapid and joint handling of problems caused by new types of defects in construction. Open innovation can be a preliminary stage as a basis for protected development in individual firms, but interaction may also arise in a situation where a firm already holds a patent. Firms who participate actively in open interaction often get an advantage over their more passive competitors.

**Project and idea competitions** are a variety of open innovation in the built environment industry. Firms may invite a broad group of innovators to find the best solution to a given problem. Also here there is a long tradition of architectural competitions within the built environment industry. However, to provide the right stimulus, the chances of winning should be reasonably proportionate to participant efforts, which is not always the case today.

**Fifteen ways of interaction** between firms and universities were identified in a questionnaire part of the interviews. No less than eleven of these ways were considered important for innovations:

1. Informal contacts
2. Common research projects
3. Staff mobility between university and firm
4. Recruitment of recent graduates
5. Thesis work in the firm
6. Student internships in the firm
7. Part-time positions university/firm
8. Industrial PhD candidates
9. Participation in conferences
10. Continued education courses for firms
11. Consultancy

**What is the opinion of the university** researchers themselves? The collaborative organization of the Swedish Universities of the Built Environment held a national meeting for research group managers in August 2012. A corresponding cooperation questionnaire received responses from 29 researchers. Essentially, their prioritization of the fifteen ways of interaction agreed with the opinions of those interviewed in the firms.

**The Development Fund of the Swedish Construction Industry**, SBUF, plays and has since its start in 1983 played an important role for construction and building services contractors. Since 1993, SBUF has also contributed to the funding of many research projects in universities, primarily orientated towards projects that lead to research degrees in interaction with member firms. SBUF is financed according to labour market agreements. SBUF can serve as a model encouraging consultants, clients, property owners, materials producers and others to be more active in research, development and innovation by creating similar instruments.

**It is important that firms** distinguish between what is common research and development that can enhance the whole industry (by e.g. engaging in standardization which leads to greater efficiency) and what is proprietary and implies development activities that may lead directly to innovations in the market. The OpenBIM and IQ Samhällsbyggnad (Swedish Centre for Innovation and Quality in the Built Environment) associations should also be mentioned here as platforms for broader cooperation. Moreover, the role of the research institutes should be strengthened in this context.

**For smaller consultant firms**, the situation is different. The interviews suggest that ideas and work practices that originate in small consultant firms often gain broader commercial diffusion by being acquired by a large consultant firm who then integrates the activity with its own. It is a special challenge to engage smaller consultancies in a process of cooperation.

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# Encouragement of collaborative innovation

**Initiatives that stimulate collaboration** between large and small firms, as well as between firms and universities, are desirable. Bygginnovationen started with its first call for grant applications late in 2011 and has brokered contributions in less than a year to about thirty projects that may result in innovations. The model has functioned well and should be allowed to continue. From the industry viewpoint, it is important to have a stable arrangement with a long expected period of future activity. In order to attain measurable ultimate outcomes, there should be probably at least ten years of activity, with evaluations as one of the cornerstones for successively renewed modes of operation.

**Bygginnovationen's procedures** are innovations in themselves which have been well received by the Swedish built environment industry. Three types of grants are offered: innovation vouchers, planning grants and development grants. The element of advisory services from the business advisory committee to applicant firms is important and is experienced as valuable. Small and medium size enterprises have a prominent position among projects supported by Bygginnovationen. No less than 32 of 34 projects offered support during the first year of activities came from applications submitted by small and medium size enterprises. That applications can be submitted as late as 15 workdays before programme board meetings explains why applicants consider the process to be rapid, efficient and non-bureaucratic.

**One of the strengths of Bygginnovationen** is thus the business advisory committee which is formed by a group of 40-odd specialists with considerable practical experience of developing products, technologies and processes in the industry. Each application is assessed by at least three chosen members of this committee before the programme board recommends a decision to VINNOVA. In many cases, the assessment includes an element of advice which is of great value to the applicant, even if the application happens to be rejected by Bygginnovationen. Another strength is that all participants in the processing of applications are bound by secrecy agreements towards applicants.

**University research in Sweden** is one of several essential conditions for innovations in firms. This may concern research which creates a more profound theoretical understanding of how technical solutions function, of the institutional features of markets or organizational capabilities of exploiting innovations. Complementary to development efforts in firms, there may also be a need for independent laboratory based research in early stages to identify risks associated with innovative products which may have undesirable side effects in future uses, particularly when producer liability is limited or complicated.

**It is also essential that** there is more unfettered university research, not based on industry co-funding. Here it is

a matter of research standing for radical and cross-border novel thinking, often far from practical applications and thus with results which cannot be brought directly into the marketplace. It may also be a matter of research aiming at developing the contents of international standards that belong to the framework of the built environment industry. In general, there is a need for special funding for research where producing results may take considerable time. This is the case for more than one of the major issues of the built environment. Free-standing and independent research is also needed in the case of procurement studies, not least for the purpose of creating a basis for better formulation of requirements, measurement and monitoring.

**Today in many competing countries** there are well established innovation programmes for the built environment industry. These programmes share principles of interaction between firms, research environments and in most cases also public clients.

**In Denmark, the conditions** are different for linking research to innovations in this sector. Huge private funds, primarily the Realdania association, devote considerable resources to creating and operating research centres in interaction between universities and the industry. As to government support, the innovation consortium scheme should be mentioned: at least two firms, one research institution and an independent advisory body. This scheme has implied annual calls with funding for 2-4 years, although firms receive no grants and have to match whatever funding the research institutions receive under the scheme.

**Through Tekes, the Finnish government** has created a number of (hitherto six) strategic centres for science, technology and innovation. The research strategy for RYM Oy, the centre for the built environment, is based on collaboration with participants from industry and research. Strategy themes are energy efficiency, processes and operational models, competitive urban infrastructure and user-friendly spaces.

**Brancheninitiative Bauwirtschaft** was inaugurated in 2006 in Austria. Among the goals of this government initiative are found a sustainable increase of R&D in the construction sector, including that new small and medium size enterprises are to be linked to R&D, better interaction between science and industry as well as knowledge transfer from R&D projects to smaller firms.

**A Built Environment Industry Innovation Council** has been appointed by the Australian government. The strategic plan of the council for 2009-2014 contains several action areas, among them innovative procurement policy and processes, support of demonstration projects as well as development and application of innovative tools and technologies.

# BYGGinnovationen

**Bygginnovationen** ([www.bygginnovationen.se](http://www.bygginnovationen.se)) is a national innovation programme which runs between 2011 and 2014. It is based on a cooperation agreement between VINNOVA, the Swedish Governmental Agency for Innovation Systems, and 19 firms active within the Swedish built environment industry.

**The overall purpose of the programme** is to develop a strong and sustainable environment for innovation for the Swedish built environment sector by bridging the gap to the university sector and thereby promote the commercialization of knowledge, solutions and research resultat as well as improving interaction between the built environment industry, research institutes and the collaborative association of the Swedish Universities of the Built Environment. Special prioritized areas are sustainable growth, information and communication technologies as well as efficient processes.

**The programme board of Bygginnovationen** has asked (January 2012) Märten Lindström, Ove Lagerqvist and Jan Bröchner to produce a basis for a long term innovation strategy for the Swedish built environment industry. This assignment has resulted in the innovation strategy presented here and which has been decided by the Bygginnovationen programme board in November 2012.

**The innovation strategy is based** primarily on interviews and questionnaires with representatives of the firms within Bygginnovationen and a selection of organizations active within the built environment industry, as well as representatives of public and private sources of research funding. A workshop in June 2012 with the board of Bygginnovationen and 17 participants from its Business Advisory Committee has also provided inputs. The interviews were held during the March–November 2012 period.

## Interviewed for the strategy

Tomas Alsmarker, Tyréns AB

Ronny Andersson, Cementa AB

Tony Andersson, NVS Installation AB

Christel Armstrong Darvik, Stena Fastigheter AB

Ruben Aronsson, Svenska Byggbranschens Utvecklingsfond (SBUF)

Sebastian Axelsson, VINNOVA

Anna-Lena Berg, Cramo Sverige AB

Magnus Bergendal, Peab AB

Fredrik Bergström, WSP Sverige AB

Sture Blomgren, formerly with Formas

Jan Byfors, NCC Construction Sverige AB

Johan Carlstedt, IVA

Mats Deleryd, Volvo Construction Equipment AB

Tommy Ellison, BESAB

Ulla-Britt Fräjdin-Hellqvist, chair, Stiftelsen för Strategisk Forskning

Jonas Gräslund, Skanska Kommersiell Utveckling Norden AB

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Erik Lindbäck, Lindbäck's Bygg AB

Ivo Martinac, KTH

Ola Månsson, Sveriges Byggindustrier

Fredrik Nilsson, White arkitekter AB

Erik Nordström, Vattenfall Research and Development AB

Olle Samuelson, IQ Samhällsbyggnad

Anna Sander, IQ Samhällsbyggnad

Torbjörn Sohlberg, Projektverkstan AB

Kyösti Tuutti, Skanska AB

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