

Smart Housing Småland

Annual report

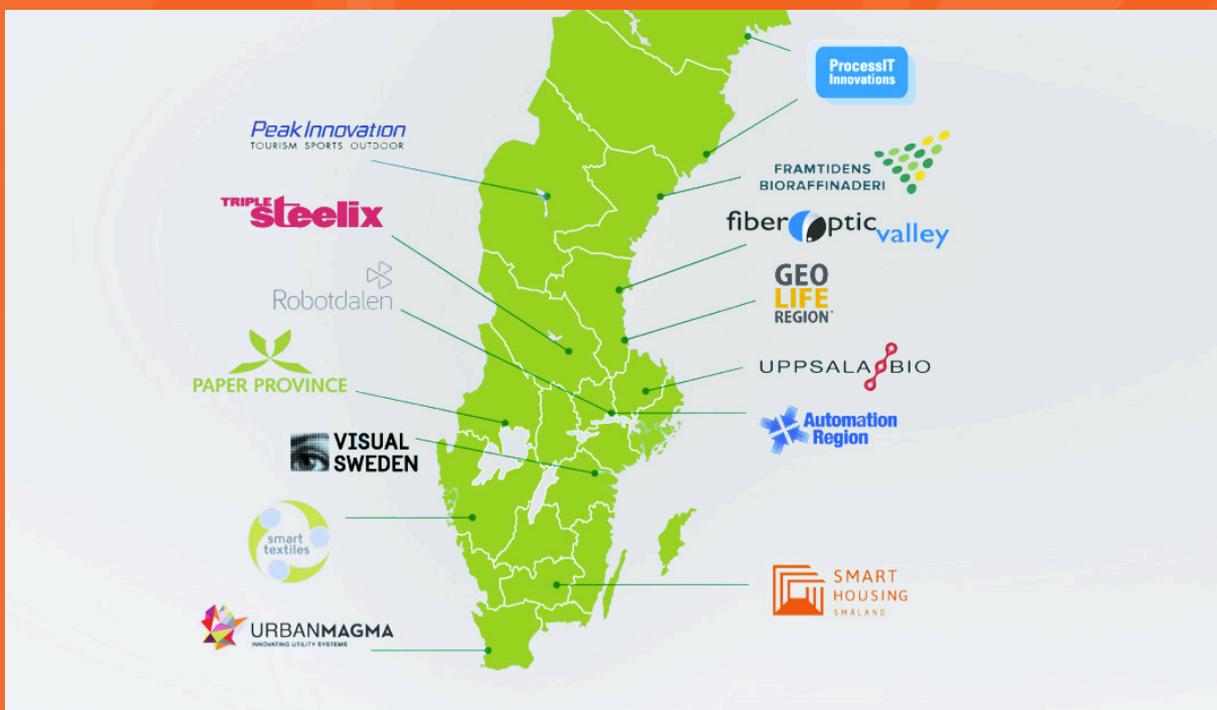
2016



SMART
HOUSING
SMÅLAND

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All of Sweden's Vinnväxt environments.
Illustration: Vinnova.

About the innovation environment

[Smart Housing Småland](#) (SHS) is an innovation environment that started in 2013. The Vinnväxt environment is a ten year investment financed by Vinnova and all of the counties/regions in Småland. The environment works in a triple helix spirit, bringing together the three regions/counties, the two universities Växjö and Jönköping, the research institutes Glafo and SP, the Träcentrum centre of excellence (the Wood Centre Foundation) and companies in the wood construction and flat glass industries. In addition to these there are construction- and glass-related suppliers, subcontractors and stakeholders. Investment is led by SP and is national with a regional hub. Its beating heart is wood and glass and its leading light is building and housing innovation.

Every three years an international evaluation of all Vinnväxt environments is undertaken and in 2016 SHS was evaluated. In addition to praising the developments that had taken place it was highlighted that Smart Housing should focus more on large projects and reach out internationally.

Three larger projects have been the focus in 2016 and will continue to be so over the next few years. These are the structural

fund project BOOST, the construction project High6 and the social and innovation project Smart Urban Living; read more about these later in the annual report.

In future years the focus will be on the spheres of digital transformation, building and housing. In an environment and society in constant flux SHS is working with products and services with a long lifetime. Circularity and digital transformation have the potential to change the market completely. Smart Housing Småland is continuing its extremely exciting and interesting journey. Jump on board and come along.



VINNOVA arranged an international expert evaluation of Smart Housing's three first years as an innovation environment on 18–19 May. The short conclusion of the evaluation was: – Well done! – Lots done so far... – Onwards and upwards! Photo: Elisabeth Flygt.

Statement by the chair of the steering committee

Smart Housing has started well and put down roots in the region, Småland and Sweden. We contribute to collaboration on concrete development projects and ensure that the triple helix works well in practice.

Many companies are now open to partnerships aimed at strengthening industrial house building in wood and glass; this provides commercial benefits. In this environment one meets customers and potential employees (in the form of students). One's own company is enhanced by participating in various types of projects and activities which provide long-term benefits.

Increasingly Swedish industrial house building in wood and glass appears to be the answer to societal challenges such as industrialisation 4.0, the digital transformation and automation of the house building sector, sustainable construction using renewable raw materials, building houses with a high standard of architecture and good energy performance that normal people can afford to live in. In Smart Housing's innovation environment we have a far-reaching responsibility to contribute to solving these challenges together.

In conclusion I would like to mention Smart Housing's day of inspiration, at Träcentrum on 15 December. A really great day! As I understand it we were also present at an historic moment when Sweden's first 3D printed house was unveiled. Tengboms "10 Smart square metres" had been 3D printed by BLB Industries and parts of the building were put on display. I think that these photographs will be in the history books in 50 years' time.

Ola Adolfsson,
Chair of the steering committee of Smart Housing Småland,
CEO of Flexator



Ola Adolfsson, in a white shirt in the foreground, is taking the industrial house building course at Linnaeus University. Here with Erik Söderholm at the teacher's desk discussing "the customer in focus", "respect for the individual" and "continuous improvement".

Statement by the process management team

Since its start in 2013 Smart Housing has striven for social, ecological and economic sustainability in partnership with the triple helix actors in the region. At the same time innovation is the beacon for the environment's beating heart - wood and glass.

These are some of the tools used to develop the innovation environment.

- **Preliminary studies** that "get the ball rolling" and generate new activities and projects.
- **Testbeds/prototypes** that exhibit and demonstrate new solutions.
- **Seed finance** that first and foremost stimulates research applications.
- **Degree projects** aimed at bringing companies and academia closer together.
- **Networks, meeting places and topical groups** that become a forum for learning and development.
- **Open innovation** that makes innovation rapidly available and applicable.
- **Communication** for the greatest possible impact.

The areas of focus for the next three years will be industrial **house building** in wood and glass and the potential for these materials. **Housing** with the focal point being user issues and sustainability factors. Increased understanding of the needs of users. This, in association with good aesthetic design and optimised configuration adapted for industrial production, will allow desirable, cost-effective and socially sustainable buildings. The last area is **digital transformation** a tool for many different parts of those processes that engender smart living.



Smart Housing's process management team. Kirsi Jarnerö, deputy process manager, SP Sustainable Built Environment; Mikael Ludvigsson, process manager, Glafo – the Glass Research Institute, and Johan Palm, Träcentrum. Photo: Joel Dittmer.

Key figures 2016

172 participating companies/organisations

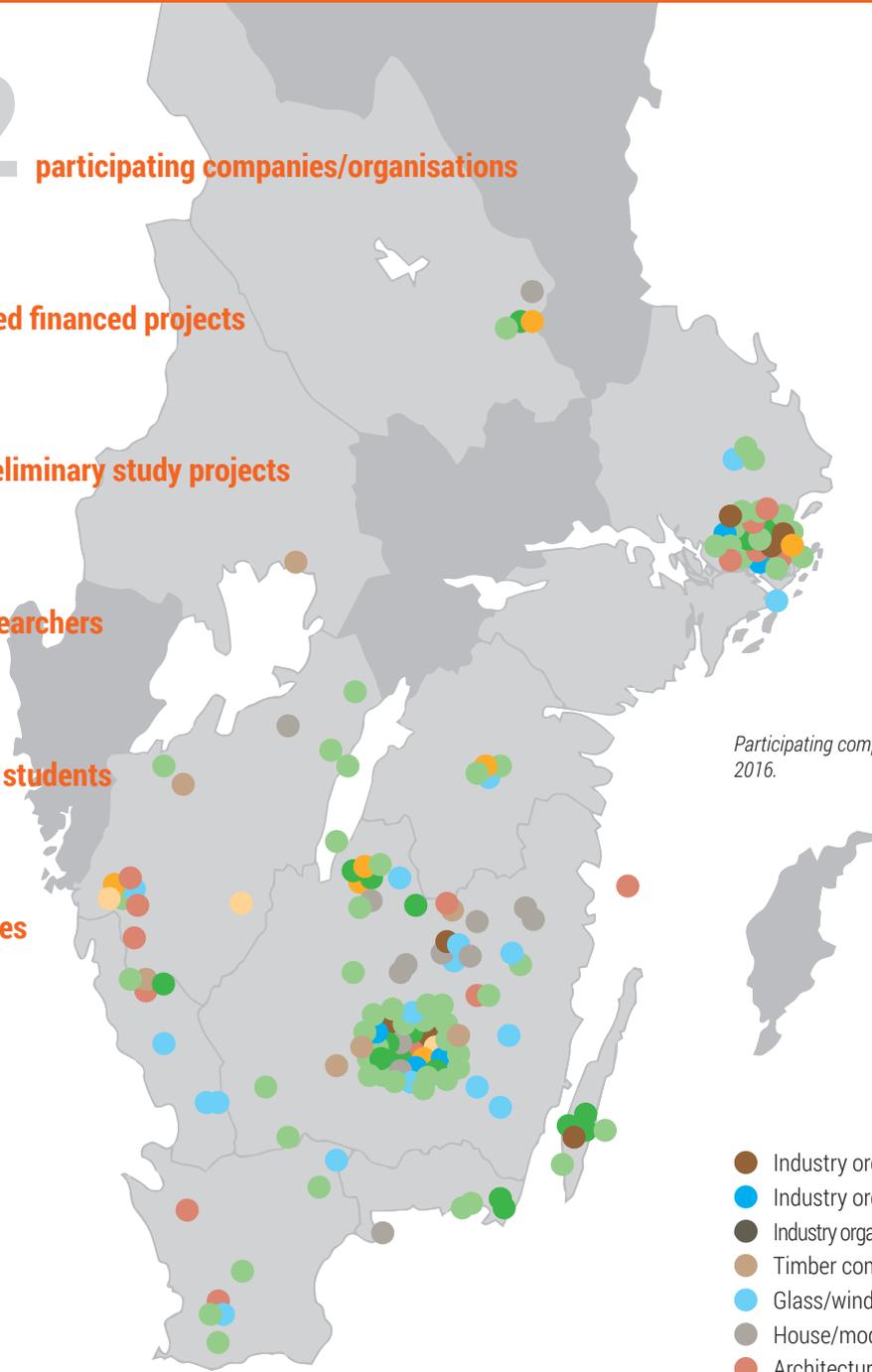
16 seed financed projects

18 preliminary study projects

97 researchers

6 doctoral students

8 prototypes



Participating companies and organisations 2016.

Off the map

- Industry organisation - wood
- Industry organisation - glass
- Industry organisation - housing and construction
- Timber company/sawmill
- Glass/window company
- House/modular building company
- Architectural practice
- Academia
- Research institute
- Public sector actor
- Other issues

Reference group

Smart Housing has further strengthened its cooperation with academia and the industrial sector by setting up a reference group. The participants introduce themselves below.

Anders Isaksson, COO and Deputy Managing Director of [Hancap](#), Chair of the reference group. Smart Housing plays a very important role in Småland and Sweden by binding together trade and industry with universities and research institutes. I am honoured to be helping raise the pace of innovation in Småland through Smart Housing. One area the reference group is empowering is business intelligence. For example over the course of the year SHS has supported an international research study mapping multi-storey wooden buildings constructed in France, Canada and the Nordic region.

Magnus Granström, Head of Research at [The School of Engineering at Jönköping University](#). He has an academic and industrial background, including from the University of Cambridge and AB Volvo. Smart Housing is important for Jönköping University from many perspectives, but above all as a platform for collaboration where, together with our partners in industry and other actors, we can shape projects as well as educational specialisations and degree projects. I contribute to this environment with my academic network and my many years' experience of collaboration.

David Johnsson, from Halland used to be a lawyer. He is now Managing Director for [TME](#) [*The Swedish Federation of Wood and Furniture Industry*] an industry and employers' organisation for the timber processing and furniture industry. Among other things we organise Sweden's industrial house builders. For us it is important to contribute to the development of industrial house building in every respect. SHS is a unique opportunity for us, as representatives for our members, to contribute to the innovative house building of the future.



*Anders Isaksson, photo: Elisabeth Flygt
Magnus Granström, photo: Anders Arvidsson
David Johnsson*

Reference group

Susanne Rudenstam, head of [Sveriges Träbyggnadskansli](#) [*The Swedish Wood Building Council*]. There is great interest in wood construction and wood construction systems at the moment, and we have a wood construction industry that is gaining ground vigorously. An industry that is growing, learning, innovative and challenging. The development of the modern wood construction industry is based on strong innovation and the ability to find new solutions. I believe that the benefits and contribution of Smart Housing will be significant for future development. Smart Housing is a unique structure and I am overjoyed in having the opportunity to follow and participate in its work through my involvement with the reference group.

Ann-Charlotte Larsson, Vice Rector of Technology at [Linnaeus University](#). One area on which we focus is how collaboration on education and research can strengthen innovation and regional development, adding value to several organisations. This is the motive force and engine that an innovation environment needs. Here academia can help companies with new ideas and the development of personnel, while they help academia with the development of courses and new areas of research. At Linnaeus

University we contribute to Smart Housing Småland with our expertise in wood, construction, design, energy, management and development, together with students, teachers and researchers.

Anders Meurling, consultant, [Svensk Planglasförening](#). Is a member of the reference group on behalf of Svensk Planglasförening [*The Swedish Flat Glass Association*]. The Planglasförening sees SHS as a forum to stimulate the association's member companies to work harder on innovation in their areas of activity, both through their own projects and by taking advantage of other people's projects. The contribution of the Planglasförening and myself is to communicate the interests/ views of the flat glass industry in forming the innovation environment and conveying information from our work in the SHS to our member companies.



*Susanne Rudenstam, photo: Anders Roth.
Ann-Charlotte Larsson
Anders Meurling*

Participant companies and organisations

Together we are creating sustainable growth, better housing and new business opportunities. The triple helix model works as a catalyst for new ideas and business opportunities.

Absolicon Solar Collector A-hus AIX Arkitekter Almi Anebyhusgruppen AB Aquavilla Produktion Arkitektbolaget Kronoberg AB Avfald/Värme Danmark Ballingslöv AB Berg CF Möller Bjerking Ingenjorsbyrå BLB Industries BoKlok AB Brandskyddslaget Briab Byggnadstekniska byrå CBBT Centrum för Byggnad och Boende med Trä Chalmers tekniska universitet Chromogenics Coompanion Derome Drivhuset DTU Danmark Edvall Arkitekter AB Eksjöhus AB Elitfönster EMC Energi och Miljöcentrum Energikontor Sydost Ergosafe Falu kommun Flexator Forserum Safety Glass Gar-bo GBF – Glasbranschföreningen GBJ Bygg GFAB Glasforskningsföreningen Glafo GKN Aerospace Sweden AB Glafo – glasforskningsinstitutet Glasbranschföreningen Glascentrum i Växjö Glasvision Goda Hus GS-facket Götenehus AB Henrik Teleman Konst och Produktion Hjaltevadshus HSB Huskomponenter Lingham Husqvarna AB Högskolan i Dalarna Impact Coatings Information Engineering Center Ingarps trä INN Internationella handelshögskolan Jönköping Inwido Sverige AB Isofloc Scandinavia Joniglas Kalmar kommun Klaes Jansson KLH Sverige Kongsberg Automotive AB Kosta Glasproduktion Kronfönster KTH EDUCATION AB Kulturparken Småland Kungl. Ingenjörsvetenskapsakademien Liljewall arkitekter Lindbäcks Linköpings universitet Linnéuniversitet Luleå Tekniska Universitet Länsförsäkringar Kronoberg Länsstyrelsen Blekinge Länsstyrelsen Jönköping Länsstyrelsen Kalmar Länsstyrelsen Kronoberg Macken Martinsons Byggsystem AB Masonite Beams MDI Midroc Modigminoz AB Moelven Byggmodul AB Moelven Töreboda AB Moelven Wood AB Myresjöhus/BWG Homes OBOS Nibe AB Nova Innovation Solutions NY Nya Norrlist Nyföretagarcentrum Nässjö Kommun Osby Glas Paroc Pilkington Floatglas Polaris AB Polyplank Region Blekinge Regionförbundet i Kalmar län Regionförbundet Jönköpings län Regionförbundet Södra Småland Renewinn Saint Gobain Emmaboda glas Scandinavian green roof institute Screen Interaction AB Segel AS Setra Plusshus AB Sika Sverige Skandinaviska Glassystem Skellefteå Kommun SmålandsVillan Snidex AB Solibro Research AB SP Sveriges Tekniska Forskningsinstitut SSC Skellefteå AB Storebrolyan Susen AB Svea Skog Swedish Match Industries AB Swedish Waterjet lab Svensk Husproduktion Svensk Planglasförening Svenskt Trä Swerea Sveriges Träbyggnadskansli Södra Innovation Södra skogsägarna Tekniska högskolan Jönköping Temporent Tengbom The Bridge Thin Film Electronics Thomas Frick AB Thule Sweden AB Tina Wik Arkitekter Trivselhus AB Trä- och möbelföretagen Träbransch Norr Träcentrum Träregion Småland Trästad Sverige Trätappor Norsjö AB Tyréns AB Uniglas i Vetlanda AB Vasakronan Trähus AB WeBeHome White Arkitekter Vida Videum Science park Villa Vida Villaägarna Vimmerbyhus Vindelåns snickeri AB Virserums konsthall VisionLab Wood-Eye AB WSP VTT Technical Research Centre of Finland Växjöbostäder AB Växjö kommun Växjö Kommunföretag AB VÖFAB Yaskawa Zick Zack Byggelement Åseda Värme och sanitet

Preliminary study projects

Preliminary study projects

Preliminary studies are one of the tools we have used a great deal in Smart Housing to investigate or kick start activities in a specific area.

Preliminary studies - ongoing and completed in 2016

- Laserskärning av planglas [*Laser cutting flat glass*], Glafo
- Det åldersbeständiga boendet [*The age-resistant housing*], Jönköpings University
- Unika fönster: rationell produktion av obegränsad valfrihet [*Unique windows: efficient production with unlimited choice*], Glafo
- Additiv teknik som möjliggörare i industriellt trähusbyggande [*Additive technology as an enabler in industrial wooden house building*], Swerea IVF
- Solar Film (SoFi) – Laminering av organiska solceller [*Solar Film (SoFi) - Lamination of organic solar cells*], Glafo
- Underlag för användning av solceller i höga modulbyggnader [*Basis for the use of solar cells in high rise modular buildings*], Glafo
- Produktion av CLT i södra Sverige [*Production of CLT in southern Sweden*], Vida
- Lösullsisolering istället för mineralullsskivor [*Loose-fill mineral wool insulation instead of mineral wool slabs*], Swerea
- GreenRoofExplore, Visionskompaniet Arkitektur & Projekt AB
- Ny glasgång för Kulturparken Småland [*New passageway for Kulturparken Småland*], Glafo
- Användarorienterade affärsmodeller i trähusbranschen – kartläggning och utveckling [*User-oriented business models in the wooden house building industry - identification and development*], Jönköping International Business School
- FE-modell av en volymmodul – spännings- och stabilitetsanalys [*FE model of a box unit - stress and stability analysis*], Linnaeus University
- Kartläggning av marknadens flexväggar för det anpassningsbara boendet [*Identification of flexible dividing walls for adaptable housing*], Glafo
- Spontangranulering av härdade glas [*The spontaneous failure of toughened glass*], Glafo
- 3D visualisering av boendemiljö [*3D visualisation of the residential environment*], Glafo
- Hållbara geometrier: träfiberförstärkta biokompositer optimerade för 3D-skrivning [*Sustainable geometries: wood fibre reinforced biocomposites optimised for 3D printing*], Glafo
- Integrerat ljud i duschvägg [*Integrated sound in a shower screen*], Glafo
- Kompakt enhet för värme, ventilation och varmvatten i volymmoduler [*Compact unit for heat, ventilation and hot water in volume modules*], SP

SHS reports 2016 (in Swedish)

- Det åldersbeständiga boendet [*The age-resistant housing*]
- Unika fönster: rationell produktion av obegränsad valfrihet [*Unique windows: efficient production with unlimited choice*]
- Additiv teknik som möjliggörare i industriellt trähusbyggande [*Additive technology as an enabler in industrial wooden house building*]
- Solar Film (SoFi) – Laminering av organiska solceller [*Solar Film (SoFi) - Lamination of organic solar cells*]
- ICCG – The 11th International Conference on Coatings on Glass and Plastics
- Underlag för användning av solceller i höga modulbyggnader
- Förutsättningar för produktion av CLT i södra Sverige [*Potential for the production of CLT in southern Sweden*]
- Automatiserad inblåsning av mineralullsskivor [*Automated blowing of loose-fill mineral wool insulation instead of mineral wool slabs*]
- GreenRoofExplore
- Förstudie – ny glasgång för Kulturparken Småland [*Preliminary study – New glass passageway for Kulturparken Småland*]



Project visit to Swerea IVF's 3D printing laboratory. Photo: Elisabeth Flygt.

Preliminary study projects

The age-resistant housing

The preliminary study “Age-resistant housing” gives an overview of research into the residential preferences of the elderly and examples of forms of housing particularly aimed at the elderly within the ordinary housing stock. One result of the project is that Jönköping University has taken the initiative in the creation of a regional network, BoÅl, for all of the different actors engaged in housing issues for the elderly. The vision is to initiate



*The SHS prize has been designed by glass designer/professor Erika Lagerbielke.
Photo: Joel Dittmer.*

a project in which new technology and new housing solutions demonstrate the opportunities that are within reach.

Project manager: Martina Boström, Institute of Gerontology, School of Health and Welfare, Jönköping University, martina.bostrom@ju.se and Kaj Granath, Department of Construction Engineering and Lighting Science, The School of Engineering, Jönköping University, kaj.granath@ju.se



*Kaj Granath and Martina Boström were awarded Smart Housing's newly established innovation and inspiration prize for their work which has provided a good basis for development in the innovation environment.
Photo: Ulrika Wikander.*

Loose-fill mineral wool insulation instead of mineral wool slabs

The SHS preliminary study “Automated blowing of loose-fill mineral wool insulation instead of mineral wool slabs” tested a new efficient technique for the automated blowing of loose-fill mineral wool insulation into prefabricated floor elements containing building services. Using loose-fill mineral wool in combination with a blowing slide was unexplored and the study could show that, while the technique worked, further development of the loose-fill mineral wool material, together with the optimisation of blowing technology was necessary.

Project participants: Flexator, Paroc, Michael Hohenstein, Thomas Frick and Swerea IVF.

Project manager: Kalle Persson, Swerea IVF, kalle.persson@swerea.se



Here the new technique for automated blowing is being demonstrated at Träcentrum in Nässjö. Photo: Kalle Persson.

Preliminary study projects

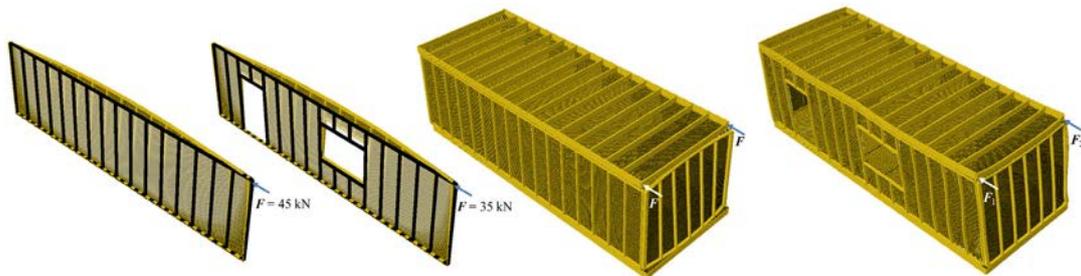
Computer model for studies into the stability and deformation of box units (ongoing)

The preliminary study "FE model of a box unit - stress and stability analysis"* has produced an FE model for studying the deformation and rigidity of a typical box unit for multi-unit dwellings made of wood. The model has been made to be as quick and flexible as possible, and can simulate all nailed, screwed

and bolted joints in the unit. It proved to be possible to create a quick and effective model, which means that the conditions are favourable for simulating and analysing complete multi-unit dwellings with reasonable calculation times.

Project participants: Linnaeus University, OBOS Sverige and the SP Technical Research Institute of Sweden.

Project manager: Sigurdur Ormarsson, Linnaeus University, sigurdur.ormarsson@lnu.se.



*The simulated deformation of two wall units and two box units when they are subject to the load of horizontal forces at the top of the units.
* Finite element modelling is a numerical calculation method used to solve partial differential equations.*

There should be the potential for the production of CLT in southern Sweden (project report)

The preliminary study "Production of CLT in southern Sweden" states that the market for CLT (Cross Laminated Timber) is on the increase, above all in Europe but also in the Nordic countries. The study shows that an investment in CLT production of SEK 100 million in southern Sweden could be profitable. Manufacturing CLT can be a good way for the sawmill industry to add value to low quality sideboards and centre cut material, but requires more expertise.

Project participants: Vida AB, Linnaeus University, GBJ Bygg AB, Projektbyggaren AB and Dynea.

Project manager: Jan Oscarsson, Linnaeus University, jan.oscarsson@lnu.se



Photo: Jan Oscarsson.

Preliminary study projects

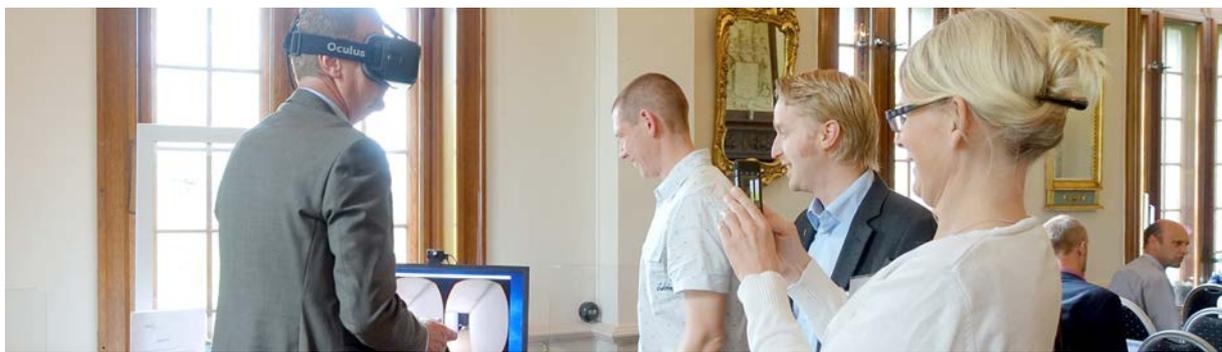
3D visualisation of the residential environment (ongoing)

In the SHS preliminary study “Interactive 3D visualisation of the residential environment” the potential of VR as a tool for the development of residential environments is evaluated. The aim is to be able to provide a virtual experience of the finished building at the project planning stage. This could be used for work on prototypes and development, streamlining various time-con-

suming operations and supporting assembly and construction work in a cost effective manner. Work carried out in 3D and VR can also be used at a later stage for AR (Augmented Reality) in areas of application directly related to physically real operations.

Project participants: Glafo, Linnaeus University, OBOS Sverige and VisionLab

Project manager: Jerry Eriksson, Glafo, jerry.eriksson@glafo.se



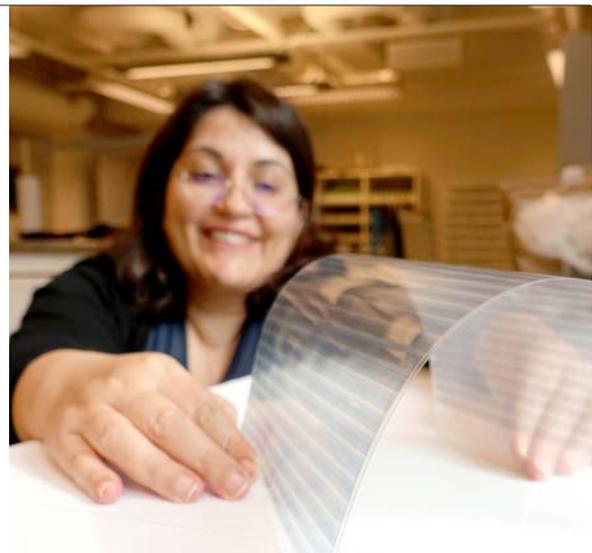
Conference delegates try out the SHS VR prototype at Glafo's glass theme day at Teleborg Castle in Väckjö.
Photo: Parisa Sehati.

Preliminary trials show a 50% increase in output from laminated organic solar cells

The preliminary study “Solar Film (SOFI) – Lamination of organic solar cells” investigated how the efficiency of organic solar cells would be affected by laminating them between panes of glass. A few organic solar cell modules were laminated and their efficiency before and after lamination was tested. The target was a maximum 20% reduction in efficiency but the measurements instead showed that the lamination process increased output by approximately 50%. The next step is to verify, optimise and modify the solar cells and the lamination process. This will result in a more rapid and automated lamination process that leads to economic viability.

Project participants: Glafo, Forserum Safety Glass, Linköping University and the SP Technical Research Institute of Sweden

Project manager: Parisa Sehati, Glafo, parisa.sehati@glafo.se



Parisa Sehati, who researches the development of solar cells at Glafo, exhibits a flexible organic solar cell. Photo: Elisabeth Flygt.

Major projects

Major projects

High6 – Innovation at every level

Smart Housing aims to work on projects that are run in a spirit of open innovation. It is therefore very interesting when an industrially manufactured wood building gets the opportunity to blossom in a partnership between different parties. Innovation opportunities arise where cross technical constellations meet and discuss technical, design and the necessary, sustainable solutions. Together with Tengbom, OBOS Sverige and Smart Housing are conducting the High6 construction project. This going to be a timber framed six floor building with digital solutions and glass. A building project such as this means that a great many innovative and interesting subsidiary projects will be achieved as part of one and the same main project.

These SHS pilot studies relate to High6:

- Kartläggning av marknadens flexväggar för det anpassningsbara boendet [*Identification of flexible dividing walls for adaptable housing*]
- Underlag för användning av solceller i höga modulbyggnader [*Basis for the use of solar cells in high rise modular buildings*]

- FE-modell av en volymmodul – spännings- och stabilitetsanalys [*FE model of a box unit - stress and stability analysis*]
- Utveckling av interaktiv VR-modell av High6-projektet [*Development of interactive VR models for the High6 project*]

Sustainability permeates the entire operation and the building process. The project strives for economic, ecological and even social sustainability in relation to the needs and quality of life of residents.

The needs of residents govern the project and the industrial building production system becomes a tool for flexible and aesthetically appealing solutions.

Project core: OBOS Sverige and Smart Housing together with Tengbom
Project manager: Peter Stenfelt, OBOS Sverige,
peter.stenfelt@obos.se



Architectural sketch of High6 created by Tengbom.



Major projects

Smart urban living

Smart urban living is a pilot (in other words an area in which Sweden can become a global arena for a specific area of technology) that the IVA – the Royal Swedish Academy of Engineering Sciences initiated in 2015. SHS took the opportunity to lead the innovation activities related to smart urban living in order to stimulate construction in Småland and Sweden together with various other actors in the Växjö region.

This is a natural continuation of Växjö municipality's initiatives in the field of sustainable wood construction. Växjö is already well known for its profiling of wood buildings and regularly receives national and international delegations.

The objectives drawn up for the national pilot also apply when the challenge is addressed locally. The carbon footprint is an important parameter and will be a prioritised component in the process, as will involving groups of residents at an early stage of the project and incorporating them into the project's living laboratory and testbed activities. In at least one of the planned houses the aim will be a net production of energy. Digital transformation is increasingly more important in the built environment, and smart solutions are another priority area in which work will be undertaken.

Local partnership: Glafo, Linnaeus University, Region Kronoberg, the ICT cluster around the Information Engineering Center, Energikontor Sydost and Smart Housing Småland. In addition the City Architect and Växjöbostäder AB are important actors.

Project Manager for innovation: Mikael Ludvigsson, Glafo, mikael.ludvigsson@glafo.se



Some thirty people gathered to work on the development of smart urban living. What is particularly exciting for us is the discussion about how to establish free zones for innovative building and living. Photo: Elisabeth Flygt.

Major projects

BOOST (www.smarthousing.nu/BOOST)

BOOST (housing, development and management for strong growth) was initiated by Smart Housing to kick start a number of in-depth housing, development and management initiatives. The project started in the late autumn of 2016. The total budget is SEK 18 million, half of which will come from the EU Structural Funds and half from regional actors. The goal is to establish partnerships between the fields of metadesign, technical prototypes and business model innovation based on housing and construction in glass and wood, for commercialisable innovations.

Three areas of focus

Metadesign which inventories, analyses and presents the housing needs of new arrivals, the elderly and young people in relation to society, companies, organisations and sustainability (led by Linnaeus University).

Technical prototypes which produces prototypes in glass and wood in order to design housing that meets the needs of users (led by Glafo, the Glass Research Institute).

Business model innovation which develops a spectrum of business models for newly built housing suitable for small and medium-sized enterprises that put the user in focus (led by Jönköping University).

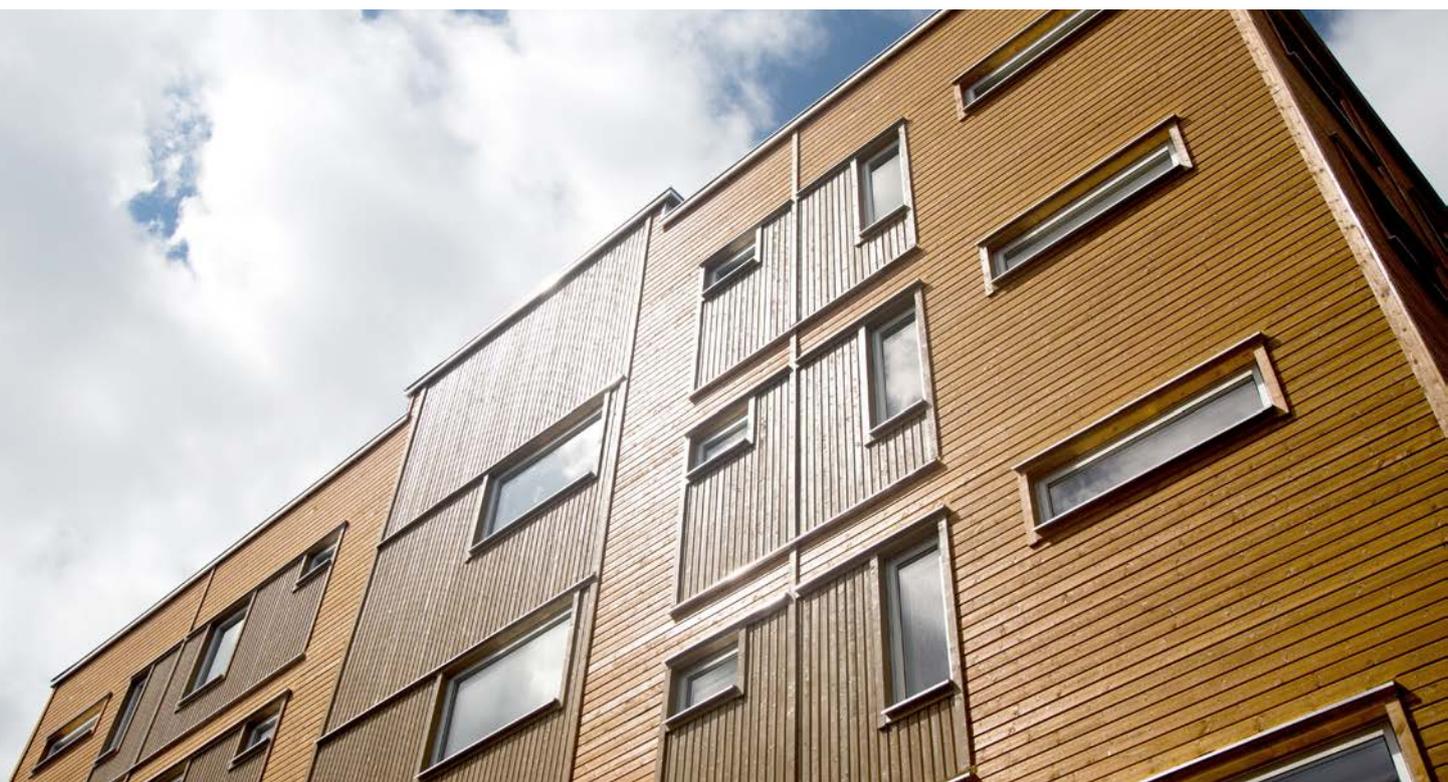
Partnership: SP Technical Research Institute of Sweden (project owner), Träcentrum, Jönköping University and Linnaeus University

Project manager: David Andersson, Träcentrum, david@traacentrum.se

The project will continue until 28 February 2020.



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Learning

Learning means that knowledge and new insights influence one's actions in a particular direction, and in Smart Housing we work internally with the help of ongoing evaluation, and externally using learning as a tool for the development of the innovation environment.

Examples

A field trip with architectural students from the Swedish Royal Institute of Technology was supported by SHS so that they could obtain a broad overview of wood construction. This is one step towards the increased collaboration of architects on the environment.

The ProWOOD research school has generated learning in the innovation environment. SHS financed and participated in a field trip of doctoral students to Austria and Germany to study wood construction. SHS has worked with corporate contacts for the new research school ProWOOD+.

A number of topical groups have been initiated which are involved in continuous learning. The BIM group has advanced furthest in this respect and has held several seminars throughout the year, reporting on the results of surveys and holding a theme day on model based production. In addition there are topical groups focused on supply chains, flat glass and fire.

We welcome proposals for new topical groups; meeting places for people who want to learn more and expand their network of contacts in a particular subject area.



On 30 November Jörgen Olsson, SP, presented his licentiate thesis "Low frequency impact sound in timber buildings – simulations and measurements" at a seminar at Linnaeus University in Växjö. This is also part of his work as a doctoral student at the ProWOOD research school that Smart Housing supports. Photo: Elisabeth Flygt.

Seed finance and research

Smart Housing stimulates research among other things through advice, contacts, the dissemination of information and participation in reference groups and can also provide a small amount of seed finance to encourage and advance research and innovation in partnership between academia, institutions, business and society. We support projects that comply with SHS's vision of creating smart housing and a sustainable built environment based on glass and wood.

We are sometimes also involved in the design of activities at universities such as professorships, places for doctoral students, training and courses. Examples of this include professorships in lighting science, building physics and building conservation, and courses in lighting science at Jönköping University and sustainable structural engineering at Linnaeus University.

Examples of seed financed projects

The first EU project provided with seed finance, [LIMES](#) (Light innovative materials for efficient solar cell modules), is now in its final phase and has resulted in a fruitful international cooperation between partners from the United Kingdom and Spain. There are concrete plans to continue with a new project with a Technology Readiness Level (TRL) raised to 6-7. This work has



The energy renovation of detached houses is of great interest as 80% of the stock is over 30 years old. In "[One-stop-shop business model for energy renovation of detached houses](#)" the aim is to find a working and business model in which one actor can coordinate the many actors that must be involved in energy renovation. **Project manager:** Krushna Mahapatra, Linnaeus University.

resulted in nine conference papers and a scientific article in progress. **Project Manager:** Stefan Karlsson, Glafo

Other seed financed projects 2016

- Glas och grafen [*Glass and graphene*], Glafo
- BioInnovation Construction and design, SP Sustainable Built Environment
- Sustainable Structural Engineering, Linnaeus University
- Public procurement for sustainability and strategical objectives, Jönköping University
- Solar Film: Laminering av organiska solceller [*Lamination of organic solar cells*], Glafo
- SIMS – Strategic Integration of Management Systems, Jönköping University
- SCI-FI – Scientific Collaboration Initiative for Functional Invisibility, Glafo
- Agile product development platform, Jönköping University
- Whispering game, Jönköping University
- Konst och kraft på fasaden [*Art and power on the façade*], Glafo
- TOR – Tysta Offentliga Rum [*Quiet public spaces*], Glafo
- Trä och Glas [*Wood and glass*], Linnaeus University
- Lokal fiberorientering i granvirke [*Local fibre orientation in whitewood*], Linnaeus University



"An organised strategy for agile renewal with a focus on small to medium enterprises" establishes an agile approach based on the Japanese Hoshin Kanri method for innovative growth, adapted for strategic work in established small to medium enterprises. **Project manager:** Anders Melander, Jönköping International Business School. Photo: Dörr & Portbolaget AB.

Prototypes

We believe in the power to influence through prototypes. They create credibility, inspire and are perhaps the most important and clearest example that something is feasible – “seeing is believing”.

This can be something that whets the imagination, showing what is possible with contemporary technology from the world's leading research institutes. It can also be a visionary thought, attracting the curiosity and creativity of the viewer, or resulting in a better living environment.

SHS works with everything from visionary and near-market prototypes to extremely large prototypes such as the housing module presented in Almedalen in 2014. This is still alive and kicking following supplementary insulation and the installation of sustainable sources of energy in 2016, and will be an important testbed and living lab in 2017.

Prototypes and a test bed

- Touch wood
- Virtual 3D model 1.0
- Virtual 3D model 2.0
- 10 smart square metres
- Flexible dividing walls
- Vision of future housing
- Light in walls
- Housing module (testbed)

Here are some of this year's prototypes

Large-scale 3D printing

Below are examples of how large-scale 3D printing can be applicable in the construction industry. Together with BLB Industries and the Tengbom architectural practice Smart Housing Småland's prototype operation has produced a printed corner of the Tengbom concept “10 Smart Square Metres”. The prototype is printed from a wood fibre-based material using a 3D printer from BLB Industries, especially developed for rapid, large scale print operations. .



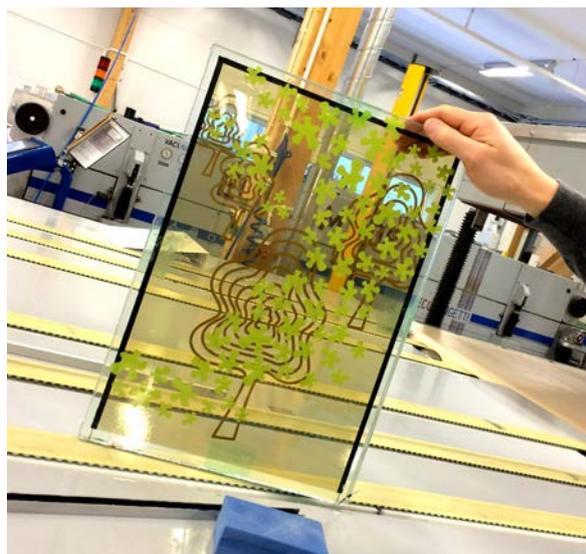
World premier at Smart Housing's inspiration day for the full-scale printout of part of “10 smart square metres”. Photo: Joel Dittmer.

Prototypes

Screen printed electrochromic glass

The SHS study "Ny glasgång för Kulturparken Småland" [*New passageway for Kulturparken Småland*] investigated if it is possible to use transparent intelligence artistically. In conjunction with the study a number of prototypes were produced in a collaboration between the glass designer Erika Lagerbielke, Chromogenics, Forserum Safety Glass and Glafo.

Electrochromic glass can change from light to dark using a relatively low voltage. A pattern has been laminated into the glass together with the electrochromic film and another pattern between two other sheets of glass so as to create distance and depth between the trees and leaves.



From the Forserum Safety Glass factory. Photo: Lina Grund Bäck.

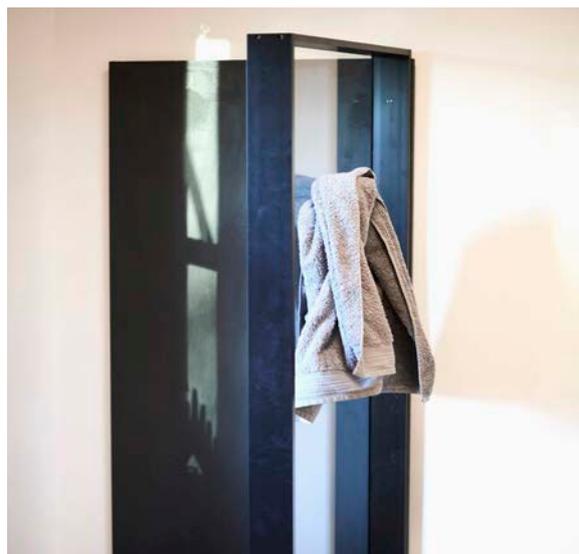
Integrated sound in a shower screen

At last you can have music to accompany your singing in the shower!

The shower screen, that consists of laminated glass, acts as a loudspeaker together with a transducer. This is controlled by a mobile phone using Bluetooth.

The actual electronics are on the outside of the screen and are concealed by a towel rail. A rechargeable battery powers the unit. You can change the volume and song from the inside of the shower screen using touch sensitive buttons.

The prototype is a collaboration between Glafo, SP Danmark, GFAB and INR. It is the first prototype from the "smart bathroom" concept.



From the exhibition at the SHS inspiration day – pity that the picture does not come with built-in audio – it sounded good! Photo: Joel Dittmer.

Internationalisation

Internationalisation is one area that Smart Housing is developing by establishing innovation-focused partnerships for the export of Swedish building and housing concepts.

Several delegations from China have visited over the course of the year and, because they showed great interest in Swedish wood construction, SHS arranged a visit to China with the objective of forming an opinion with regard to the prerequisites for wood construction and the opportunities for exports and partnerships.

A field trip to Austria, Germany and the Holzbau Forum provides interesting information about house production in Austria and Germany as well as valuable contacts at the University of Natural Resources and Life Science, Boku, in Austria.

As a result of the preliminary study on loose-fill mineral wool insulation, AB Thomas Frick and Paroc have invited the participants to visit operating facilities in Germany.

Further examples

- Took part in the International Conference on Coatings on Glass and Plastics.
- Gave a lecture at [engineered transparency](#).
- Taking part in COST, Cooperation in Science and Technology – a European network programme for research, in the [TU0905](#) “Structural Glass” group.



From the SHS China visit during which opportunities for partnering and export were examined. Chinese wood construction was also studied, photo: Kirsi Jarnerö.

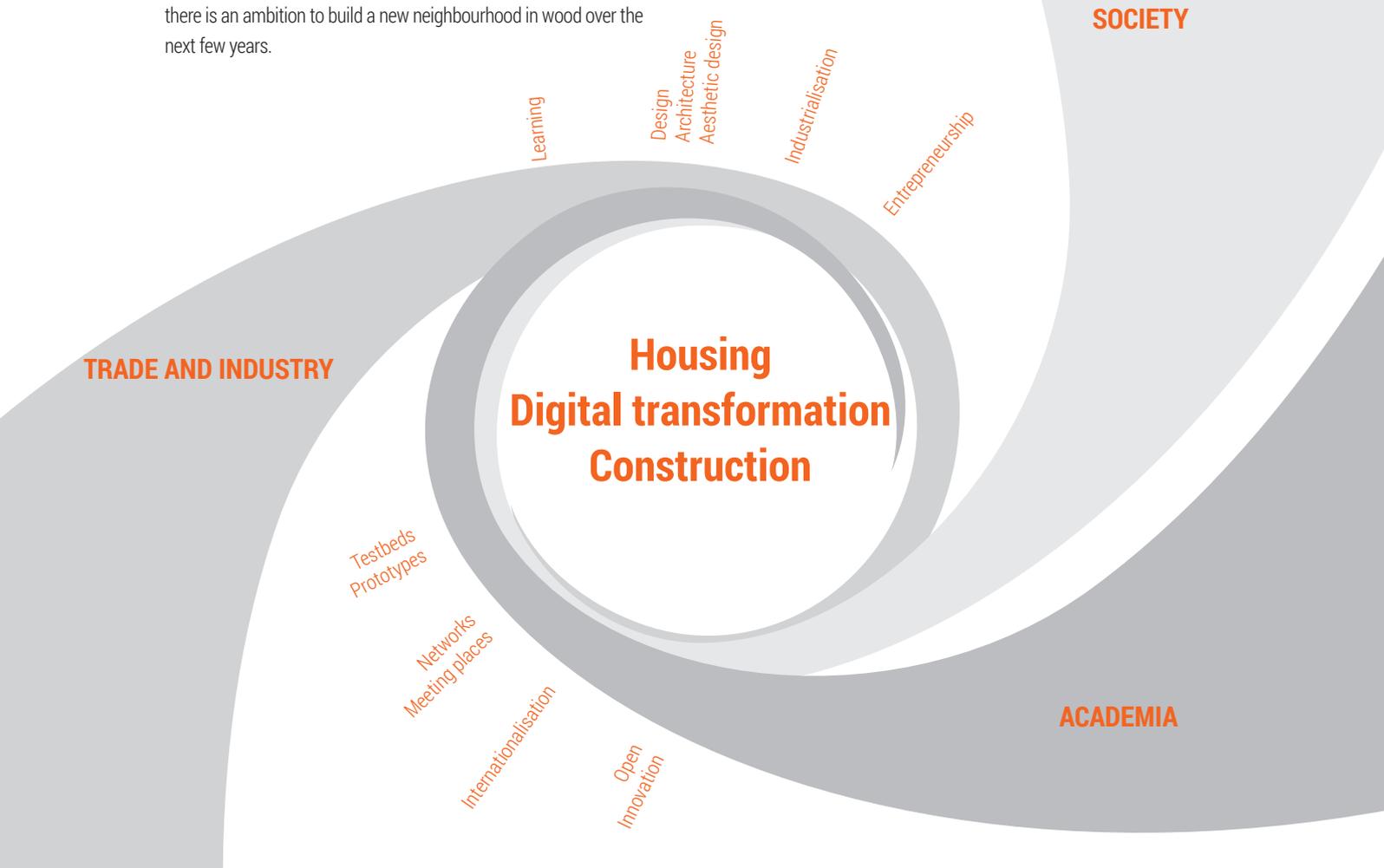
Society

SHS's initiatives are targeted at the triple helix actors in the spheres of interest of the innovation environment. Here we are endeavouring to gather and coordinate the social forces that are part of the issues close to our heart. Smart Housing arranges regular meetings with the regions, counties and representatives of business and academia to exchange information and identify potential areas of collaboration and development. For future years, digital transformation, construction and housing have been identified as three clear spheres of interest, in which wood and glass deliver major opportunities for innovative and sustainable development for industrial construction and the housing of tomorrow.

The major projects now underway are located throughout the Småland region. The High6 project in Kalmar will be completed in 2018. In the BOOST project academia and business are working together. Växjö municipality is heavily engaged in Smart Urban Living. Towards the end of 2016 opportunities also arose in Nässjö municipality where there is an ambition to build a new neighbourhood in wood over the next few years.

The universities in Småland (Jönköping University and Linnaeus University) are involved in large sections of the work of SHS. This strengthens the environment and generates new knowledge. The Kalmar region's location in the Baltic region opens a hitherto unexploited opportunity for the environment to work at an international level.

Innovative growth in the regions' businesses is a primary success factor for the innovation environment. Social, economic and ecological sustainability are important elements in everything that SHS does. In particular ecological sustainability is a core area and within this the development of the circular economy is very interesting.



Society

Supporting other people's development

Smart Housing is increasingly invited to collaborate in other parties' networks, projects and events:

- Is part of Region Kronoberg's network for the innovation support system.
- Member of Trädstad Sverige which wants to inspire the development of wood construction and to spread knowledge about how this can be done.
- Part of Höglandets Trähusnätverk a network of managers in the wood house industry and the municipal commissioner for Höglandet.
- Part of the Swedish Federation of Wood and Furniture Industry, TMF, technology group which collects technology and developmental expertise from wood housing companies.
- Co-organiser and sponsor of the Växjösamtalet [*Växjö Dialogue*].
- Has sponsored Smålands Trädagar 26–27 June in Virserum.
- Has a place on the steering committees and reference groups in the projects; BigData, One-stop-shop business model for energy renovation of detached houses, Stadsutvecklingsprojektet Torparängen [*Torparängen Urban Development Project*].
- Has regular features in the industry newspaper Glas.
- Participates in 500K, a project run by KOD Arkitekter that wants to create 500,000 homes in our gardens.
- Contributor to Glafo's Temadag glas [*Glass theme day*].



Per Hedberg, Desk Officer at the Swedish Ministry of Enterprise and Innovation told the Växjö Dialogue that the government had several initiatives to expand wood construction as this was viewed as an important tool in the transformation to a more sustainable society. Photo: Elisabeth Flygt



Organisation

Steering group

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Helena Nilsson
Olof Björkmarker
Lars Sandberg
Johan Blixt
Anders Carlsson
Peter Stenfelt
Linda Camara
Marianne Grauers
Stephen Hwang
Lars Niklasson
Karin Lindskog

CEO
Regional Director
Member of the Regional Council
Head of Department
Business Development
Technical Manager
Business Area Manager
Office Manager
Division Head
Vice Chancellor
Pro Vice Chancellor

Flexator
Regional Federation in Kalmar County
Region Kronoberg
Jönköping County Administrative Board
Vida AB
A-hus AB/Derome
Myresjöhus AB/OBOS Sverige AB
Tengbom
SP Built Environment Division*
Linnaeus University
Jönköping University
The Swedish Federation of Glazing Contractors

Reference group

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Magnus Granström
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Ann-Charlotte Larsson
Anders Meurling
Susanne Rudenstam

Hancap
Jönköping University
Swedish Federation of Wood and Furniture Industry
Linnaeus University
The Swedish Flat Glass Association
Swedish Wood Building Council

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SP Sustainable Built Environment*
Träcentrum Nässjö

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Deputy Process Manager

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Ongoing Evaluation Researcher
Ongoing Evaluation Researcher
Ongoing Evaluation Researcher

*In 2017 SP, Glafo, Swedish ICT och Innventia came together in RISE to create a joint institutional sector and become a stronger innovation partner for business and society.

How to benefit from SHS

There are many ways to take part and develop in the Smart Housing Småland innovation environment. Please feel free to contact us if you are interested! One of many ways of taking part is to take the initiative for a Smart Housing Småland project or participate in such a project as a business development project or pilot study.

As a minimum the following parties should be included:

- a company and an academic institute in Småland or
- more than one academic institute in Småland

A higher priority is assigned to project proposals which develop the innovation environment through:

- open projects (in other words projects that do not require secrecy)
- the involvement of several companies
- a high proportion of the work carried out by your own company

Companies are expected to participate in projects with their own work.

You can also participate in various topical groups and networks and in an exchange of experience in our seminars and workshops.

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