

EXPERIENCE MEETS NEW IDEAS AND CHALLENGES - A STRATEGY-MODEL FOR CONSIDERATE BUILDING IN RURAL AREAS

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ABSTRACT

Background and aim. A challenge when building in rural areas is to minimize the negative effects on climate, environment and to avoid conflicts between local and national interests. In the Interreg project SOURCE (Sustainable and nature pOsitive development of housing for ReCreational usE) the aim is to learn more about building recreational homes with a minimal negative impact. The research project supports business growth by collaborating and transfer knowledge between university and schools, local companies and organizations. The aim is to develop a circular building process based on local conditions in rural areas, by mutual learning.

Methods and Data. A model with “five strategies for considerate recreational-houses” will be further explored and developed: **1. Share**, existing buildings. **2. Convert**, use and update existing buildings **3. Condense**, add new buildings. **4. Simplify**, identify local materials that can be used **5. Active maintenance**, an agile process.

Findings. Knowledge from local conditions can be of importance when planning a house without connection to municipal supply systems. Persons that are familiar to local traditions, materials, resources and conditions can have “tacit knowledge” to be transferred in well planned meetings with students.

Practical/Societal Implications. Challenges for building in rural areas will be identified and solved: Transports to the construction site. The design of the foundation. Heating, electricity, water-supply and waste planned for an off-grid solution. Respect for regulations and national interests. Local cultural and social values. The whole process must therefore be accurate planned in dialogue, taking care of different perspectives, and experiences.

KEYWORDS: Considerate building, local knowledge, mutual learning, off-grid solutions

1 INTRODUCTION

The construction and property sector has a fundamental problem, namely being fragmented. The gaps between the involved actors in a traditional building process, are caused by different factors. A separation between design and construction and lack of trust are examples on what causes fragmentation. This phenomenon causes difficulties to keep the wholeness and to foresee the consequences of all choices that must be made in a planning and building process. The negative impact of the building process on the environment and climate is also a challenge to deal with. In Sweden between 6 and 40 % of the total of factors disturbing the environment can be related to the building and property sector (Boverket 2025). This makes it even more important to use all available knowledge and to co-operate to achieve the best solutions.

In the countryside, especially in areas with high natural values, it is of great importance to minimize the negative effects when building houses, roads and other infrastructure. This is important to maintain the unused and original conditions. In more exploited areas there are also possibilities to re-construct natural habitats and areas. There are several good examples from Norway to study and learn from.

As a perspective on circularity this paper will present a wide spectrum of factors and models that can support the aim to reach a better circularity.

The SOURCE project will continue for some time, so this paper can be called a status report that reflects the current research material. Models and ideas will be developed and tested further on.

1.1 CHALLENGES

The National Board of Housing, Building and Planning's environmental indicators are based on data from the Statistics Authority, Statistics Sweden. Overall, the sector accounts for 6 to 40 percent of negative environmental impact in Sweden in the areas that are followed up with the Housing Authority's environmental indicators. It should also be added that the sector contributes to additional emissions in other countries through the import and transport of construction products.

Environmental indicators shows an updated picture of the environmental impact from the construction and property sector:

- greenhouse gases 22%
- nitrogen dioxides 19%
- particles 20%
- energy use 34%
- hazardous chemical products 9%
- environmentally hazardous chemical products 4%
- waste 39%

Another challenge is the well-known problem with a fragmented sector where knowledge spread to different actors and with a process that is longitudinal. This is like a relay race that creates several gaps between actors and usable knowledge. These gaps can be bridged and supported by circular models. The challenge is to create a more circular way of using existing knowledge from all members in the project team. Knowledge-circularity can develop and contains routines for how to loop the feedback and can therefore support a better and more sustainable process. The complexity with different stakeholders needs a tight collaboration with a joint ambition. The learning process to work more sustainable, starts early in an education, and can be supported through connection to external contacts, that combines theory and practise. The models presented in this paper can support knowledge management and better communication and hopefully minimize fragmentation. During further research and collaboration with students and companies the models will be implemented and developed. The authors long and aggregated experience from both theory and practise from different parts of the construction sector, are forming the basis of models presented in this paper.

Research, pedagogical development in education and collaboration with external actors, are three important tasks for employees at universities. The aim is to show how these different tasks can be used and executed in close collaboration with other actors, for everyone's benefit.

1.2 PROBLEM AREA

Fragmentation causes gaps between the actors and their knowledge and their usable experiences. The challenge is to manage a process with better collaboration where this can be better used in a building process.

The gaps in construction sector can be described as an effect of a separation of design and construction (Nawi et al, 2014). Fragmentation caused by a lack of feedback loops or co-ordination between the design and construction process can also widen the gap. Another cause is lack of communication in the supply chain due to actors' different languages and communication culture. A process without focusing on the clients and their involvement through both design and construction process, hinders knowledge integration. One-off projects with unique conditions and temporary relationships, cause an adversarial culture with a lack of trust and mismatches between actors in the project team.

Traditional fragmented processes can be changed with a common ambition to work towards sustainable goals.

In case studies on big scale projects, good examples are presented (Svetoft, 2009) The key factors are: time to build trust and collaboration between the actors involved. Using everyone's' knowledge early in and through the whole process, as well as working together with focus on the end-users' requirements, give clearly good results. Both practical and theoretical knowledge must be transferred in a mutual learning process by the actors involved, when you want to achieve a beneficial effect in an environmentally and climate-friendly construction process. Experiences from local conditions, cultures and traditions require mutual learning and respect. Actors with different roles in a building project, can get inspiration from local companies and from students and pupils involved.

1.3 AIM AND RESEARCH QUESTIONS

Circularity in the building and property sector have different angles to study furthermore. In rural areas there are challenges both to identify and then to handle. The aim is to minimize the negative impact caused by building projects in rural areas, that have sensitive environmental conditions and high values. SOURCE's main goal is to guide small and medium-sized businesses (SMB) in mountain municipalities in Trøndelag and Jämtland-Härjedalen into a more nature-positive recreational housing development. Theory will be put into practice through workshops in pilot studies and a toolbox.

The questions are:

How can we build in rural areas with minimal negative effects on the environment and climate?

How can we support knowledge transfer and combine practice and theory?

2 PERSPECTIVES ON CIRCULARITY

This paper will discuss the wideness of Circularity and reflect on the research project SOURCE that can give new perspectives when dealing with the challenge to build recreational houses in rural areas with minimal negative effects. Building material is one aspect as well as circularity in economy and business models. When adding the perspective on how to manage and take decisions in circularity, both practical and theoretical knowledge must

be transmitted and used. Especially when local conditions, culture and traditions are to be considered.

The overarching research question for this study is what constitutes examples of sustainable and circular construction. To answer this, it is necessary to specify the concepts and what they stand for. Sustainable construction goes back to the Rio Declaration in 1992 and Agenda 21 with the mission to the countries of the world to combine technology, economy and ecological sustainability into a new lifestyle based on solidarity, which means ecological, economic and social sustainability. This was followed up at the UN conference in 1996 in Istanbul with an action program for sustainable construction and housing, which means economy with physical resources and consideration of biological, economic, organizational, social, historical, cultural and aesthetic resources (Atlestad et al, 2015).

The concepts of sustainable construction and sustainable community construction also include many other aspects, for example energy, land planning and land use, consideration of existing environments, to design with nature and not against it, to design so that places are safe and accessible to people of all ages and with different functional variations. It also includes respecting the natural cycle of water by avoiding, for example, hardening surfaces, draining natural wetlands or emptying groundwater reserves, which can cause floods, landslides and sinkholes.

The principle of circularity built on the four laws of ecology was already launched in 1971 by the biologist and ecologist Barry Commoner in the book "The Closing Circle". Commoner argues that the entire business community globally must be subject to a program of ecological reconstruction. Gösta Ehrensvärd, professor of biochemistry, presented similar thoughts in the book "Före – Efter" ("Before – After") by (Ehrensvärd, 1971), where the author predicts that if industrial society is not quickly converted to cycle-adapted production, it will lead to global ecological collapse as early as around 2050. In the Club of Rome's report "Limits to Growth" (Meadows et al, 1972) the researchers present a similar scenario. Ellen MacArthur foundation has suggested definitions and three design principles of Circular Economy:

"Circular economy: A systems solution framework that tackles global challenges like climate change, biodiversity loss, waste, and pollution. It is based on three principles, driven by design: eliminate waste and pollution, circulate products and materials (at their highest value), and regenerate nature."

or in short:

"Circular economy – an economy designed to keep materials in use, eliminate waste and regenerate natural systems." (www.ellenmacarthurfoundation.org)

2.1 ENVIRONMENTAL GOALS AND CLIMATE REGULATIONS

Business models and environmentally friendly work must be combined. By using the circularity as a vision, the long-term thinking is supported instead of short-term strategies and longitudinal processes. Both sixteen national and seventeen global goals for a better environment and climate helps to change the way of taking decisions and collaborate with new strategies.

It is crucial that good ambitions are supported by regulations and law. In Swedish law, steps are taken by the government to support the building and property sector towards a more environmentally friendly way of working. The law to declare the energy use was introduced in 2006: *"The purpose of the law is to promote efficient energy use and a good indoor environment in buildings."* (Regeringen, SFS 2006:985)

The law about climate declaration is a new way to regulate the whole building process and encourages dialogue between actors involved to find new and better solutions for the climate. Boverket declares the aim with the law: *"By calculating the climate impact, the builder's knowledge increases, which in turn makes it easier to take measures in the construction process that reduce the climate impact."* (Regeringen, SFS2021:787)

2.2 KNOWLEDGE AND EXPERIENCE MANAGEMENT

2.2.1 Organizational and mutual learning

Construction processes are generally complex, with many actors involved at various stages. The information about what is to be built must be transferred from one actor to another is often done in a linear process during a limited period. Sustainability adds even more complexity to a project, not least because the meaning of the word sustainability varies between different actors. New building techniques or materials may be needed, as well as specialized expertise from other areas. (Jonasson et.al, 2020)

Practice from companies and theoretical knowledge from academy meets through pupils and students and create development. Local culture and conditions are important as well as influences from other places with similar conditions. Single-loop learning mean that you can learn from mistakes to do better next time: share, learn and do better and double-loop learning (Argyris & Schön, 1978). It occurs when error is detected and corrected in ways that involve the modification of an organization's underlying norms, policies and objectives. Reflection is important to achieve this change. Similarities can be found in theories in design and in organizational learning (Senge, 1990). The study of group learning and building a shared vision is essential. To have joint goals and keep up a creative atmosphere also includes a good leadership in the process. To use knowledge from different actors and learn together can be used from the very start in a planning and building process. Consultants, builders, craftsmen, clients and

public actors, companies can meet students and pupils and be able to learn more together.

At the sustainable building engineering program at Mid Sweden University there is a more than thirty years' experience to work integrated with research, education and development of construction projects together with the building companies.

An interesting example is the project Storsjö Strand, a new township in Östersund, using a strong interactivity and a triple helix process with the municipality, developers, and the university. The role of the university was, by an action research approach, to create involvement in the process and to document and evaluate it. (Jonasson et.al, 2014)

2.2.2 A pedagogical management model by Penta-Helix

Rapid changes, innovations and social development require collaboration and co-operation. Collaboration and mutual learning create joint benefit and local implementation power. The model Penta-Helix (figure 1) can support each actor to see its role in mutual learning. This model was developed in a project when a non-profit organization. The home village association at Bjäre is planning a building in the living history museum in Båstad. Local companies, networks and public actors form a reference group that can give feed-back and have a role as external supervisors and contacts.

The project involves students and pupils who are invited to create a meeting place, a "Food culture house", to meet and learn about local food, based on a historical and cultural perspective. The collaboration with all five actors has given very positive results and ideas in a process that will continue further on.

Fundings from the county's "Fund for environment" supports the costs for the small but important things like coffee, lunch, travel costs and communication. Students and pupils' results have been presented and discussed at workshops and meetings with representatives from all five parts in the model Penta-Helix.

Pupils from practical courses and programmes takes care of several of the chores that are connected to cultivation. Thesis by students was presented at posters and were available in the main building in the living history museum. Every year new students and pupils can participate and contribute with new ideas.

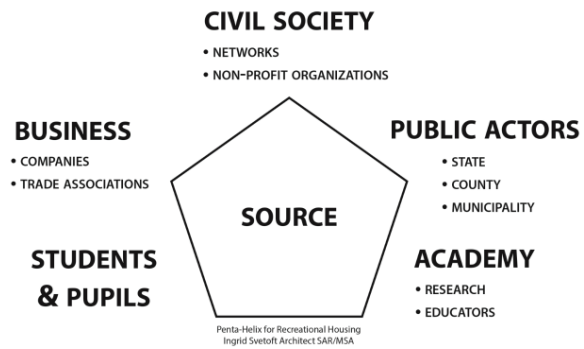


Figure 1: Organizational learning by Penta-Helix model (Authors, 2025)

2.2.3 Civil society

The energy and commitment from civil society, networks and non-profit organizations is always an important resource to involve. The definition of this group is usually of a local form due to local conditions and traditions. There can be formal and informal networks based on a group of citizens, special interests and hobbies for example. Some of the actors can be part of a regional, national or international organization.

2.2.4 Public actors

Public actors as municipal officials and politicians can prepare and take decisions that are important implementation force to a project. Representatives from state, county and municipality can all reflect on their decisions on planning. By sharing their knowledge about regulations and law a better understanding can be achieved among all actors involved.

2.2.5 Academy

Within academy there are knowledge, research and findings with both national and international perspective. In the mission for a university there are three main things to work with: research, pedagogy and collaboration. Teachers, researchers and lecturers are the link to students and pupils in courses and when supervising thesis.

2.2.6 Students & Pupils

Students and pupils from different schools can give a fresh perspective on important societal and environmental issues. Their studies, thesis and examinations can be combined with real cases and give a win-win situation. This group often gives a dynamo-effect to a project. We can also talk about reversed mentorship when companies for example receives new ideas from students. Or questions that make the companies reflect on their own business.

2.2.7 Business

Local companies and trade associations can get new perspectives and share their practical experience to the other actors involved. Their role can also be to transfer local culture, conditions and tradition.

2.3 INTEGRATED PLANNING

Integrated Planning (IP) is a construction site management tool. IP integrates the different planning skills used by site managers, construction workers and craftspeople's into an interactive group which manages a production planning process from the earliest stages to the end of a building project (Mikaelsson, 2017).

The studies which provided the basis for this tool, were performed over three decades, tested, longitudinally evaluated and refined the IP model for use in modern sustainable building sites.

The refined model (figure 2), Integrated Planning for Sustainable Building Production (SBP), includes the factors: leadership, health and safety, quality management and environmental management (Mikaelsson, 2017).



Figure 2: SBP, model for Integrated Planning for Sustainable Building Production (Mikaelsson, 2017)

2.4 GOING FORWARD BY LOOKING BACK-RECREATIONAL HOUSING IN A HISTORICAL PERSPECTIVE

There are many good examples to learn from that has a durable progression over time. We often have an ambition to create new ideas and plans but forget to look at previous achievements.

It is hardly possible, nor desirable, to formulate any unambiguous definition of the concept of sustainable and circular construction. The concepts slide into each other together with other concepts such as eco-building, green building and environmentally friendly construction. What can be perceived as conceptual confusion can, on the other hand, be an expression of something positive, such as that dear child has many names.

Similar reasoning can be applied to the definition of recreational houses. After all, the concept is quite new and stems from the time when the concept of "leisure time" arose as opposed to working time. It was only during early industrialism with wage labour that a clear distinction was made between working time and leisure time. The early labour movement fought for eight hours of work with eight hours of rest and eight hours of leisure. A broad definition of a recreational house can thus be the house

where you live in your spare time. The architect Anders Nyqvist, who designed Sweden's first sustainable recreational house village, Rumpans Ekoby, started from this definition in the book "Rumpans Ekoby - From vision to realization:

"The architect's view of the concept of holiday home can be summed up in the following sentence: A recreational house is a house where you live in your spare time." (Nyqvist, 2019)

The houses in the Rumpans village were designed in accordance with this so that they could be used all year round. The architect himself moved with his family after a few years and settled permanently in Rumpans's eco-village.

The best summary of the vision for Rumpans Ekoby and the vision of sustainable construction can probably be found in Anders Nyquist's introduction to the book:

"Rumpans's eco-village is a housing vision that has been able to be implemented without compromise. When the ideas were launched, the words ecovillage, long-term sustainable construction, life cycle analysis or cycle-adapted construction were not in the vocabulary. What we strive for in today's construction was already 50 years ago in the description of Rumpans's eco-village but expressed in other words.

The idea of the village has been easy to understand, and the loyalty of the settlers has been great. The village is a social experiment based on community. Everyone involved has been able to contribute with their knowledge. The village is completed by 25 families who had limited knowledge of how to build a cycle-adapted village in balance with nature. Learning from each other and helping each other have been our guiding stars. The purpose of this book is to document our journey from an overgrown agricultural landscape to a living village". (Nyqvist, 2017)

3 THE SOURCE PROJECT

In the Interreg project SOURCE (Sustainable and nature pOsitive development of housing for ReCreational usE) the aim is to learn more about building recreational homes with a minimal negative impact.

The SOURCE project consists of 7 Work Packages with research questions ranging from restoring damaged nature to developing regenerative tourism.

Theory will be put into practice through workshops in pilot studies and results in a Toolbox.

3.1 PROJECT DESCRIPTION

The development of simple cycle-adapted concepts for sustainable recreational houses is needed. A model for this will be developed via the Industry Council for Sustainable Community Building at Mid Sweden University. It means, in short, that teachers and researchers in dialogue with companies will develop construction solutions that can be built in collaboration

with the education for construction workers at the regional high school educations.

The goal is that establishment and operation of the houses will contribute to less utilization of resources and that the resources are kept longer in the cycle. That means developing prototypes and concepts that generate and produce, both for people, climate and biodiversity, rather than consuming. It could be, for example, outlining new ways to use solutions, to present a typical house or construction methods that can replace conventional methods and thus reduce the impact of future construction projects. Old methods and materials can also be more sustainable and circular as they are cleaner and easier to reuse.

3.2 METHOD

The work package WP4 aims to apply a research approach called 'Change Agent' (Kørnøv et al., 2010, Kørnøv et al., 2011). Change agent in this context means that the Researchers' do not only show good examples of sustainable houses, but instead jointly develop a prototype together with the industry and academia. That means that the researchers act as change agents. The researchers are not just observers but contribute to the development of a field.

A model for circular concepts for sustainable houses will be developed via the Industry Council for Sustainable Community Building at Mid Sweden University. Teachers and researchers in dialogue with companies will develop construction solutions that can be built into small modules in collaboration with the education for construction workers at the regional upper secondary education.

The models developed from earlier research and studies presented in this paper, will be implemented and tested in projects with a natural continuation. New sustainable projects and collaborations and restart of former projects gives conditions for collaboration in a Penta-Helix formation. Existing contacts with students' external actors in ongoing education will provide opportunities to use the succession model for student collaboration. And the model for integrated planning can support actual planning and construction processes for sustainability.

3.3 A MODEL FOR CONSIDERATE RECREATIONAL HOUSES

Work Package WP4 Circular Economy, revolves around two research questions:

WP4.1 How can recreational housing development help keep resources in the cycle longer?

WP4.2 What measures can reduce the total footprint of recreational housing?

Our aim are answers that contributes to a more circular economy. It's about where we build, how we build: how big, with what materials and technical solutions, how people travel to the site, what they do there, and how often the houses and resources are used.

Two conditions are specific to holiday homes:

- They are often empty for a large part of the year.
- It is a growing problem if you build on untouched natural land.

In many rural areas there are already existing buildings that can be used significantly more than today. Increased use of these buildings helps to preserve the value of investments made and can provide increased income, reduced costs, new local service offerings, new jobs and, in the long term, even occupancy.

Instead of focusing on just building new houses, we propose a process that identifies and evaluates local conditions in the first step; to continue to build upon, and do more with, resources that already exists.

A model (figure 3) with "five strategies for considerate recreational housing" will be further explored and developed in the SOURCE project. These five strategies are share more, convert, condense (densify), simplify and maintain. We have chosen to give maintain, or active management, a special position as a unifying strategy (the glass), while the other four (ingredients) depend on the conditions at the site.

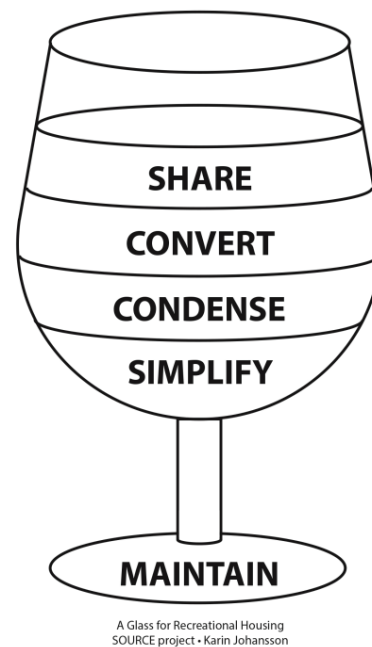


Figure 3: A Glass for Considerate Recreational Housing (Authors, 2025)

3.3.1 Share more

Both buildings and equipment like boats, fishing rods and bikes can be shared. There are however several thresholds for increased sharing. One is practical, regarding keys, cleaning and supervision, and another is emotional, it is one's second home and there may be objects that are personal, fragile or have great sentimental value. And of

course, the desire to be alone in a place, a longing for solitude.

Increased sharing can be achieved in several ways: Swap a home through home exchange services. Rent out homes that you already have. Your permanent home can be someone else's holiday home. Furnish and remodel to make room for more people, together or separately. Buy a co-op instead of your own holiday home. Create a room or cupboard with things to share. Develop local services that facilitate sharing.

3.3.2 Convert

Update and use existing buildings that currently have a low utilization rate. Reuse entire houses instead of just parts.

Convert buildings that are not used or have a low level of use, in rural areas and small towns, and get a historical and practical context around which you can continue to build concepts. Create lifestyle homes and themed tourism.

These buildings can be agricultural buildings, barns, summer houses, cottages, public buildings like schools or community center's, closed shops or empty office or industrial premises.

3.3.3 Condence

Create more beds in existing houses. Connect more houses to existing infrastructure. Extend and develop new seasons on already developed land, especially around infrastructure that has already involved major interventions, such as ski resorts, golf courses, trail systems and houses with a high year-round standard.

3.3.4 Simplify

Identify methods and local materials that can be used and re-used. Start from the site. Build small-scale and square-smart with simple technical solutions and locally produced materials. Make it reversible and easy to move. An allotment within cycling or public transport distance is still a good solution.

3.3.5 Maintain- active maintenance and management

Active management is an agile process. It means continuously maintaining and adapting buildings based on changing conditions and needs. A prerequisite is choosing good materials that can be maintained. Fix problems as soon as symptoms appear, before major damage has developed. Avoid replacing functioning parts. Use things in their place. Define needs and see what can be done with what already exists. Supplement with materials and techniques that are adapted to the building's construction system.

In summary:

- Use what already exists
- Limit new production, overconsumption and dormant resources.

3.3.6 Business potentials

Increase revenue opportunities:

- ROT, renovation, remodelling and extension offers with sustainable materials and methods

- Local services that facilitate sharing, for example reception, property management, cleaning, storage, service packages: adapt the house to the person coming. Destination development - new and longer seasons with themes, activities, courses, packages, food

- Cooperative housing. Further research should be done to investigate the conditions, practical and economic advantages and disadvantages, and possible consequences for local communities of converting holiday homes to cooperative housing with multiple co-owners.

3.4 SUCCESSION MODEL FOR STUDENT/PUPIL COLLABORATION

The Penta-Helix model can be used in combination with a Succession model to support knowledge development. Supported by companies, researchers, trade associations, schools and public actors.

When actors with different experiences exchange their ideas, new perspectives can be unfolded. That is one of the positive effects when theory and practice meets in research projects. In the SOURCE project possibilities to include students in their university studies has been developed and gives the framework for a model (figure 4). In contacts with Jämtlands gymnasium and the program for building the idea is to create a long-term co-operation. The Succession model includes four steps:

1. Course project
2. Thesis.
3. Internship and workplace introduction to profession.
4. Profession



Figure 4: Succession model for student/pupil collaboration (Authors 2025)

3.4.1 Course project

In universities and schools there are many possibilities to use cases and projects that are performed by private and public actors. In course projects networks and persons can be connected that bridges between academy, civil society and municipalities and local companies. These projects are crucial to plan in detail to match the schedule for all parts. The time invested by the external actors can be paid back from the students/pupils by a short presentation or documentation of their results.

3.4.2 Thesis

Different kind of thesis can balance between a formal template and a case study with external contacts. For the supervisor it is of great importance to remind the student/pupil to have critical perspective on the topic and question to study as well as work independently. The

external contact can get a new perspective on their own organization and work. For the supervisor there is often a positive effect when the student/pupil is highly motivated in their writing process. Being part of a research project or a real project gives new knowledge and several contacts that can be useful in the future.

3.4.3 Internship

When contacts are established when collaborating in course projects or thesis a relation for further collaboration can be achieved. When working as an external supervisor there are possibilities to present the company or public organization for a forthcoming employee. The student/pupil can also learn more about a prospective employer. In this model an internship gives both parties a possibility to see if there are interest to continue in a work relationship.

3.4.4 Profession

If the collaboration in project, thesis and internship is of mutual interest, a long-term employment relationship can be formed. Companies can more easily work with the employment process if contacts and collaboration have been performed. It takes a lot of time and effort to handle an add and then go through all applications. Companies do not only employ their staff but also keep their employees. Trust and loyalty towards all parts of the work relationship can be grounded during education.

4 CONCLUSIONS

Challenges for building in rural areas will be identified and solved: Transports to the construction site. The design of the foundation. Heating, electricity, water-supply and waste planned for an off-grid solution. Respect for regulations and national interests. Local cultural and social values. The whole process must therefore be accurate planned in dialogue, taking care of different perspectives, and experiences and follow regulations. The actors, methods and models presented in this paper can support a planning and building process to minimize the negative climate impact.

Circularity is a fundamental principle for all sustainable construction, thus also for the construction of recreational houses. IVL The Swedish Environmental Institute wrote in 2018: "In practice, circular construction is often about minimizing waste in various ways or increasing material recycling." (www.ivl.se)

To be able to circulate, the building materials must meet certain requirements, for example, be non-toxic, and able to be dismantled, reused or recycled, and not create waste. Many building materials are composites (consisting of several materials) that are impossible to take apart and contain toxic additives. Other materials are non-toxic (eg brick) and can be used but we do not have systems to handle them. Industrially produced building materials and details can be delivered with large quantities of packaging. Sometimes it is therefore also meant that the materials should be local, fossil-free, low-processed, natural materials that are not taken from the earth's crust,

for example unburnt minerals and straw instead of wood. This can sometimes be problematic in relation to legislation where building materials must have declarations and meet standards. In a broader sense, the term "circular" can also refer to how the residents of the house close local loops through how they have arranged water supply, water purification, latrine and kitchen waste management, for example through rainwater collection, sand filters, bio-purification plants, root zone (productive purification), composting or biogas production.

The models, methods and good examples presented in this paper can all support possibilities to co-operate and combine practical experience and theoretical knowledge. In the SOURCE project these models will be presented, tested and hopefully implemented with the ambition to minimize negative climate effects. For local companies' collaboration with other actors and students/pupils, can give positive effects for growth. When learning together and discussing challenges new ideas and new knowledge occurs. The network and collaboration in project and thesis also provide contact with future employees. To face climate and societal challenges together, collaboration and circularity in a broad perspective can give positive effects. For individuals, companies as well as to society.

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