

- VÄNERSBORG -

# RETURUM

- A Knowledge and Activity Centre Focused on Cyclical Resource Management -

EST.

2016



*Master's Thesis Project, Spring Semester 2016  
Design for Sustainable Development  
Chalmers Architecture  
Hampus Larsson*



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## RETURUM

A Knowledge and Activity Centre Focused on Cyclical Resource Management

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This is a Master's thesis written during spring 2016 within the Masters Programme: Design for Sustainable Development, Department of Architecture, Chalmers University of Technology, SE-412 96 Göteborg,

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*Imagine a place where people can come and realize projects that they have thought about for a long time but did not have the time, tools, space or knowledge. A place where products and waste can get an extended or second life through activities regarding reparation, recycling, redesign, upcycling and reuse. Connected to these activities are exhibition spaces, food, urban farming, arts and crafts and other cultural activities. People with different backgrounds can come together here to learn, cooperate and create new ideas. A hub where a sense of community, sharing and collaboration contributes to a more robust local society and closes the loops of resources. This place is called Returum!*

# ABSTRACT

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*People in our society are consuming more resources which creates an increasing pressure on the Earth's ecosystems. The planet's capacity will eventually not be able to sustain our demands, and we will have to rethink our perception of waste and products.*

*This thesis investigates how to create a concept of a physical meeting place which strives to create a new approach to waste and products in Vänersborg, Returum. Through connecting agents, education and activities that focus on upcycling, redesign, repair, recycling and reuse, Returum aims to support a transition into a more circular and sustainable Vänersborg. This work intends to inspire Vänersborg municipality and to show that they can play a key role in the transition to sustainable development and reduce the environmental footprint.*

*Throughout this thesis studies have been done to understand how Vänersborg municipality works regarding sustainable resource management today. Potential agents and their activities have also been identified as they together can pollinate each other in Returum and reach further up the waste hierarchy. The investigation is based on literature studies, site visits, dialogues and meetings.*

*The result is the concept of Returum which consists of a Design Framework, Program & Design Strategy, Location Strategy and Organizational Strategy. The concept has been implemented into the Timjan house in Vänesborg to showcase how Returum could look and work. The design focuses on pedagogical and cyclical building solutions with the ambition to increase the knowledge and awareness of sustainable resource management.*

*Returum is a new type of public meeting place which contributes to a more robust local community and closing the loops of resources.*

## RETURUM CONCEPT



Key words:

- Sustainable Development
  - Cyclical Thinking
- Resource Management
- Reuse • Repair • Recover
  - Upcycling • Recycling
- Knowledge Creation • Sharing
- Network • Sustainable Design



# SAMMANFATTNING

Människor i vårt samhälle konsumerar produkter i en allt högre takt vilket bidrar till att vår jord utarmas på resurser. På sikt kommer vår planet inte kunna upprätthålla den livsstil vi skapat och vi behöver förändra vår syn på avfall och produkter.

Detta arbete undersöker hur ett koncept för en fysisk mötesplats kan skapas med syfte att generera en ny syn på avfall och produkter, Returum. Genom sammankoppling av aktörer, utbildning och aktiviteter som fokuserar på reparation, redesign, upcycling, återvinning och återbruk syftar Returum till att stötta omställningen till ett mer cirkulärt och hållbart Vänersborg.

Arbetets syfte är också att inspirera Vänersborgs kommun och påvisa att de kan spela en viktig roll i omställningen till ett mer hållbart samhälle och att reducera det ekologiska fotavtrycket. Ambitionen är att skapa en ökad medvetenhet kring hållbar resurshantering och hur det påverkar levnadsstil och miljö. Arbetet har sin utgångspunkt i teorier om cirkulärt tänkande (kretsloppstänkande) och Vänersborgs nya Översiktsplan som beskriver ett framtida hållbart Vänersborg där det är enkelt att leva miljövänligt.

Undersökningar har genomförts för att få en insikt i hur avfallshanteringen i Vänersborg fungerar idag samt för att jämföra resultatet med cirkulära teorier om avfallshantering. Arbetet har även undersökt vilka potentiella aktörer som kan kopplas samman för att pollinera varandra och tillsammans nå högre upp i avfallshierarkin. Litteraturstudier, samtal och möten på plats ligger till grund för arbetet.

Resultatet är ett koncept för Returum som består av ett Designramverk, Program & Gestaltungsstrategi, Placeringsstrategi och Organisationsstrategi. Returum-konceptet har blivit implementerat i Timjanhuset i Vänersborg för att illustrera hur det skulle kunna se ut och fungera i verkligheten. Gestaltningen av Returum fokuserar på kretsloppstänkande och att finna pedagogiska lösningar som kan generera en ny syn på avfall och produkter.

Returum är en ny typ av offentlig mötesplats som kan bidra till ett mer robust lokalsamhälle och som sluter kretsloppen av resurser.

## RETURUM-KONCEPTET



### Nyckelord:

- Hållbar Utveckling
- Cirkulärt Tänkande
- Kretsloppstänkande
- Resurshantering • Återbruk
- Reparation • Renovering
- Upcycling • Återvinning
- Kunskapsskapande • Delande
- Närverk • Hållbar Design

## THE AUTHOR

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Hampus Larsson was born and raised in Vänersborg, Västra Götaland, Sweden. He has a Bachelor's degree in architecture from Chalmers and started his Master's in 2014.

*I did my Bachelor in architecture at Chalmers, and I did an internship for an architectural firm called Tengbom, in Karlstad before I started my Master's degree.*

*I completed my Master's program in Design for Sustainable Development at Chalmers, but I also did an exchange semester in Newcastle, Australia in 2015. During my Master's, I became interested in circular system thinking. My projects were often based on social economy, education, waste management (recycle, reuse, repair, redesign) and community building.*



(Author's picture)

## THANK YOU!

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*This project would not have been possible without knowledge from Emilio da Cruz Brandão, Lena Falkheden, Maja Lindstedt, Pål Castell and Jonas Hagberg.*

*Thanks to everyone who lent me their time through meeting me, answering emails and telephone calls.*

*Thanks to teachers/ supervisors for supervision and important input from Chalmers University of Architecture.*

*Thanks to study colleagues who supported me with important input during my thesis.*

*A special thanks to my nearest friends and family who always supported me when I needed it. I dedicate this work to you all.*

Hampus Larsson  
2016-06-08

*Hampus Larsson*



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# READING INSTRUCTIONS

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Some sections consist of short introductions in order to facilitate the reader and are shown like this.

## THIS MASTER'S THESIS...

...is preferably read from cover to cover, but for those who want to read something specific, this is facilitated by the graphical figure (below). It helps the readers to orientate themselves in the text. The figure uses different colours to define chapters.

Every chapter is summed up in a section called conclusions and reflections at the end of every chapter. These display the information that was brought from each chapter and explain what the next step will be.

Keywords will be marked with **bold characters** in the text. This facilitates the reader to find important information.

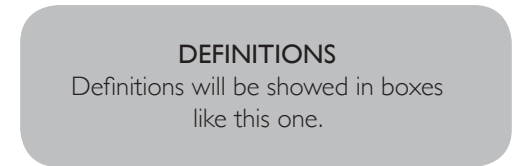
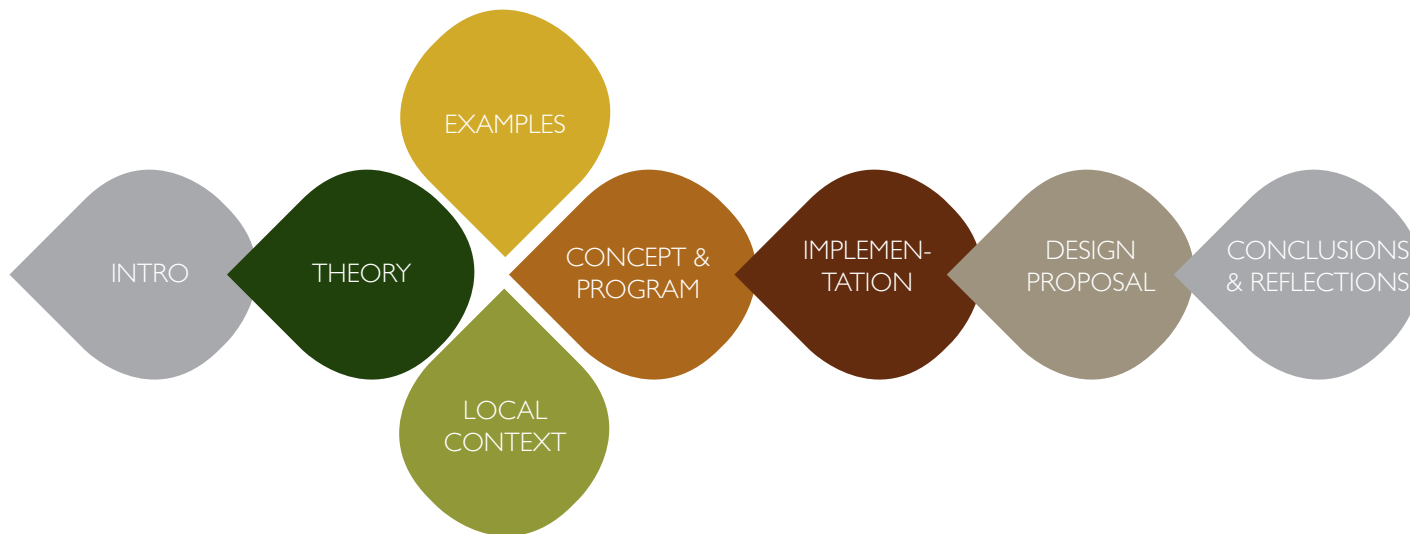
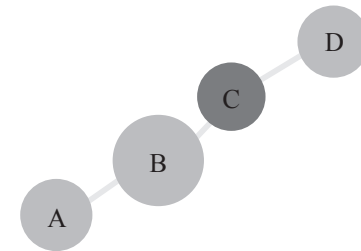


Figure XX: Example of figure





# TERMS

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## SUSTAINABLE DEVELOPMENT

The concept of Sustainable Development is very broad, and there have been many attempts at trying to define it. The most well known is probably Bruntland Commission's definition from 1987 which defines the concept as:

*“Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

*(Bruntland Commission, 1987).*

## CYCLICAL THINKING

Everything operates in closed systems, as in nature. In cyclical systems there is no waste as consumed resources are valuable for someone else.

## LINEAR THINKING

This system is based on take-make-dispose approach and generates high proportions of waste. It sets ecological and social aspects aside for economical growth and profit.

## PRODUCT & WASTE MANAGEMENT

Aspects regarding waste generation & separation, collection, transfer & transport, treatment & disposal and prevention actions.

## RETHINK

Be mindful of your consumption, your relationship with things and your relationship with the earth.

## REFUSE

Do not consume more than you need.

## REDUCE

Reduce consumption of energy and materials.

## REUSE

Share with others and find new uses for objects.

## REPAIR

Fix or upgrade rather than throwing away.

## RE-GIFT

Share and be part of gift economy.

## RECOVER

Energy and material recovery (including upcycling).

## RECYCLE

Close the loop and remake.

## AGENT

Organization, group of people or individuals.

# INTRODUCTION

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*This part describes the project's background and approach to create the right understanding and expectations for the reader.*

- Background
- Purpose & Aim
- Methods & Process
- Focus Areas



# BACKGROUND

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The population on Earth is increasing and people are consuming resources at a pace that has never been experienced before. As a result Earth's ecosystems are under huge pressure, and it will eventually not be able to sustain human demands for future generations (WWF, 2014).

In order to save resources we have to question the way we use, treat and value products and waste and have a long-term perspective. In contrast to linear thinking (take-make-dispose approach) one has to find new solutions that work in symbiosis and mimic natural solutions, cyclical (circular) thinking. Theories such as Cradle-to-Cradle and Blue Economy have received increased attention as they see waste as a valuable resource for creating new products. The increased interest for circular thinking has resulted in new economies; circular economy and sharing economy. People and businesses have started to see the value in sharing and co-owning as it saves resources and generates additional social values.

The issue of waste has also received increased attention and has reached the top agenda of the European Union. The Environmental Objectives of EU state that member countries should work actively to prevent waste and should strive to reach more circular resource management. Sweden is no exception, and the amount of waste being produced there is also increasing. According to legislation, municipalities are in charge of decreasing and encouraging people to reduce waste. Today, the waste management department of Vänersborg is mainly working with recycling and energy recovery (Vänersborgs kommun, 2012).

In order to reach more sustainable resource management, municipalities have to work actively with waste issues and provide inhabitants the proper infrastructure to change their actions and mind-sets. In addition to the potential of saving resources, cyclical thinking in resource management can bring positive side effects for social and economic aspects.

Vänersborg municipality wants to work actively with sustainability issues. In their comprehensive plan, one can read that they strive to make it easy for inhabitants to live environmentally friendly and encourage re-use activities (Vänersborgs kommun, 2016).

# PURPOSE & AIM

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The aim is to create a concept of a physical meeting place in Vänersborg, which strives to decrease the amount of waste and create a new approach to resources through activities regarding redesign, upcycling, repair, recycling and reuse. The purpose is to reduce the environmental footprint and proposes that Vänersborg municipality can play an active role in the transition to sustainable development.

This work will investigate potential agents and activities which can be connected to a meeting place (hub) in order to reach more sustainable resource management in Vänersborg. Additionally, this work intends to investigate cyclical building design solutions and how it can be shown through architecture.

This work focuses on cyclical theories and the new Comprehensive Plan of Vänersborg, which promotes a city where it is easy to live an environmentally friendly lifestyle.

## FOCAL QUESTIONS

- *How is Vänersborg municipality working with cyclical thinking today regarding resource management?*
- *What agent groups and activities in Vänersborg can pollinate each other in Returum and create synergy effects?*
- *How would a concept of Returum work and look like in the local context of Vänersborg, through a building design?*

# FOR WHO?

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This thesis primarily aims to inspire Vänersborg municipality in their work of providing inhabitants with information and the right infrastructure in order to create a more sustainable future. Since Swedish municipalities commonly have the same structure there will be a possibility to implement the Returum concept in other municipalities as well.

This thesis has an environmental and social perspective and intends to showcase how Returum could look and work in the local context of Vänersborg in order to create discussion.

Returum should be seen as one initiative among many that are needed in order to reach a full-scale transition.

# METHODS

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## LITERATURE RESEARCH

The research has been about cyclical thinking which has contributed to create a theoretical foundation.



## SKETCHING & VISUALIZATION

Handmade sketches have been used in early phases to understand complex systems and to explore the design. The sketches have been translated into diagrams, digital drawings and perspectives.



## OBSERVATIONS

Observations have been undertaken through study visits both inside and outside the municipality of Vänersborg.



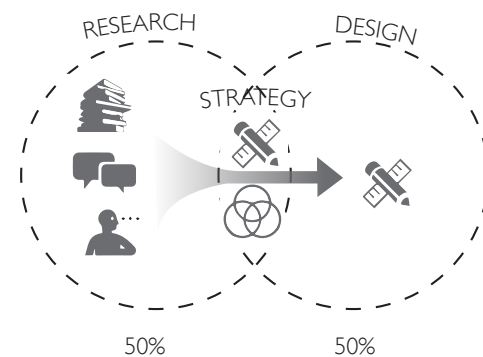
## DIAGRAMMING

The information gained from research has been concluded into diagrams in order to bring clearness into complex issues.



## DIALOGUES & MEETINGS

Meetings and informal dialogues brought clearness into how agents and their activities work and are structured. The conversations were aiming to generate qualitative data and took place where the agents operate in order to make them feel confident. It also offered an opportunity to get a deeper insight into how their activities work (see reference list for more details).

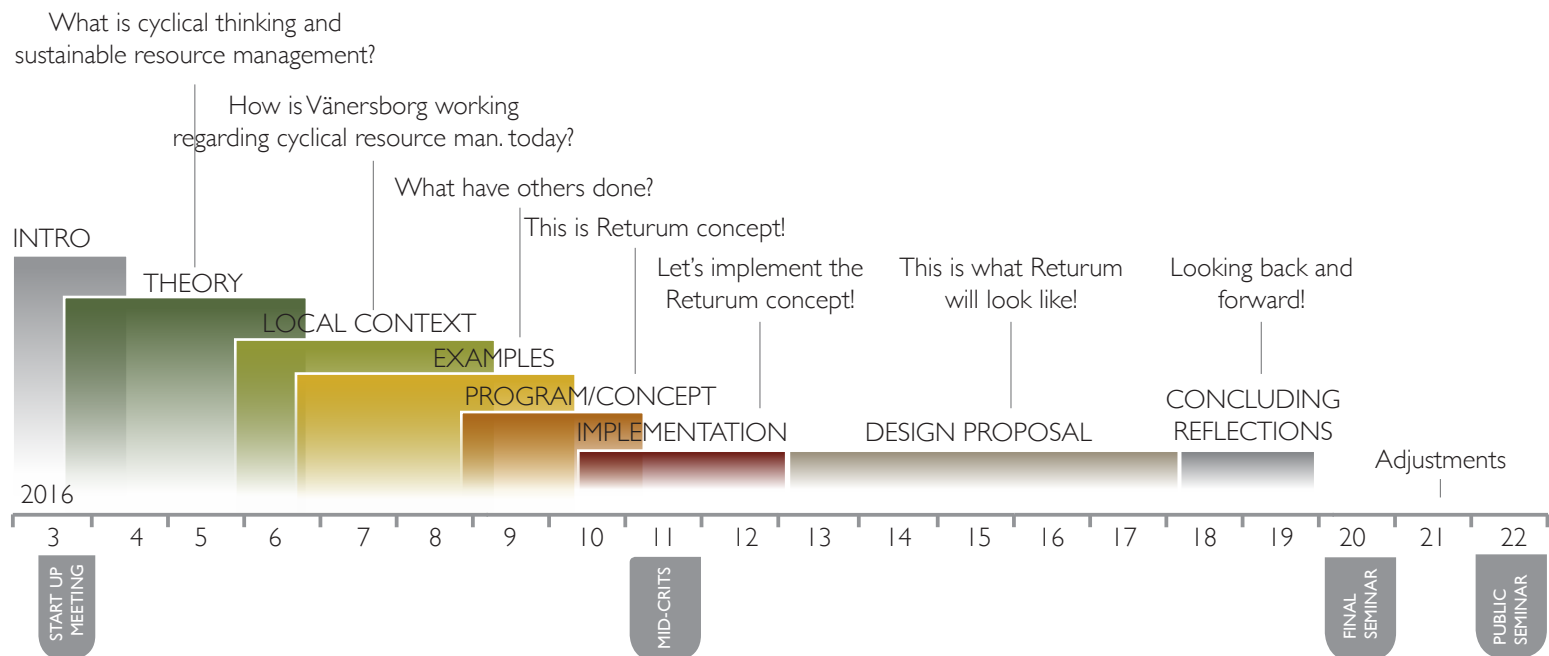


# PROCESS

This is *research for a design project*, and the methods are influenced by previous experiences from master studios. This includes design and processing as well as analysis and inventory methods.

The first half of the semester was dedicated to theory building and development of the Returum concept. This phase was characterized by meetings, dialogues and site visits in order to analyse the local situation. Many study visits to reference projects were done in order to get perspective on the gained information.

The second half of the semester was spent focusing on design and diagramming the gained information. The concept of Returum was now implemented into the local context of Vänern in order to investigate how it would look and work. In order to implement the Returum concept into an existing building an analysis of the building was done. The result is a redesign of the Timjan house in Vänern which could become the first Returum.





# FOCUS AREAS

## DELIMITATIONS

The diagram to the right shows the focus areas of this thesis (dark grey equals more focus). Further explanations:

**Geographical delimitation:** The project will be based in Vänersborg municipality since it is easier to get in contact and connect agents in a small municipality.

**Agent delimitation:** The project has a strong focus on interdepartmental collaboration within the municipality of Vänersborg. It will also include external actors in order to not have too narrow scope.

This master thesis does not deal with governmental and legislation issues regarding circular economy.

## SUSTAINABLE RESOURCE MANAGEMENT

### CYCLICAL THEORIES

Blue Economy

Industrial Ecology

Permaculture

Cradle-to-Cradle

Regenerative Design

Biomimicry

The Natural Step

Agenda 21

### CYCLIC STRATEGIES

Resource Loops

Product Life Extension

Sharing Platforms

Circular Design

Product as a Service

Circular Marketing

### SERVICE PERSPECTIVE

Collection

Transfer & Transport

Generation & Separation

Treatment & Disposal

Prevention

## GEOGRAPHICAL

Global EU National Regional **Municipal** City District Neighborhood Household

## BUILDING



Energy & Climate

Materials & Detail

Spatiality

Accessibility

Flexibility

Functions & Activities

Flows

Legislation

Construction & Tech.

Pedagogical Design

System Integrated Design

Heritage

Economy

Aesthetics/ Design

Management

## URBAN



History

Future Plans

Geo-Technical

Urban Spatiality

Accessibility

Town-Scape (typology)

Flows

Ecosystem services

Character & Heritage

Legislation

Socio Economic Aspects (demography, integration etc.)

Functions & Activities

Economy

Densification

## ORGANIZATION



Agents

Functions & Activities

Network & Structure

Economy

Legislation

Target Group

Management

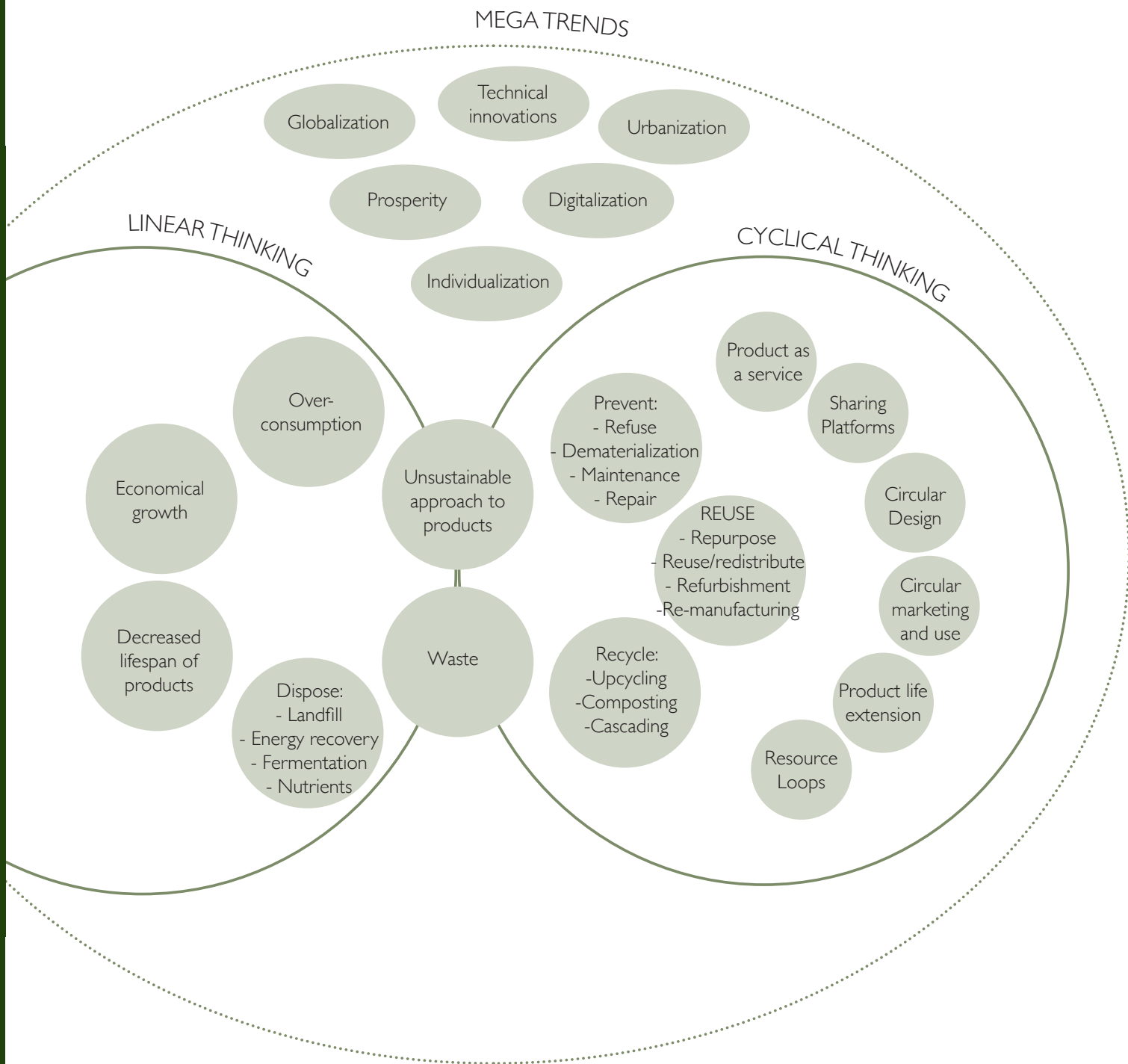
Partnership

# THEORY

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*Placing the project in a global and local context.  
Ongoing trends motivate and enable the direction of  
the project.*

- Linear Thinking
- Mega Trends
- Cyclic Thinking
- Collaborative Economy
- Visions & Guidance
- Enabling a Transition
- Possible Enabler



Theory-model

# LINEAR THINKING

---

*If the rest of the world lived like people in Sweden one would need the regenerative capacity of 3,7 Earths in order to sustain our demands on nature (WWF, 2016).*

## OVERCONSUMPTION

The population of Earth is growing and increased economical wealth means that **people consume more resources** in a pace that has never been experienced before. Overconsumption has become a major problem in many OECD-countries, including Sweden, as it puts Earth's ecosystems under huge pressure and contributes to an increased ecological footprint. The planet's capacity will eventually not be able to provide the amount of natural resources that are needed in order to sustain people's lifestyles (including people in Sweden). The negative consequences of this trend can be seen in diminishing or disappearing ecosystems, change of land use, extinction of species, increased greenhouse gas emissions and **more waste** (WWF, 2014).

### OECD-COUNTRIES

OECD (Organisation for Economic Co-operation and Development) is an international economic organisation which aims to stimulate economic progress and world trade. All member countries are committed to democracy and the market economy. The organisation includes many of the world's most developed countries, including Sweden (OECD, 2016).

## TAKE-MAKE-WASTE MODEL

The *Take-make-waste model* or *Linear model* describes today's market economy, which focuses on **economical growth** and **profit** rather than social or environmental aspects. Products are produced, consumed or used without any regard to how the manufacturing process works, how raw materials are extracted or if the materials in the product can be reused or are degradable by nature. Today, many products are designed and constructed with a **short lifespan** in order to sustain the demand. As products get old, out of fashion or break consumers tend to purchase new products instead of repairing them (Planned obsolescence, 2009). Today's global market makes the issue complex as products are manufactured, used and disassembled in different countries. Increased demand of imported and exported goods could be a **threat** to our society as it becomes more sensitive to global economic and political issues (SLU, 2014).

## START OF A CHANGE

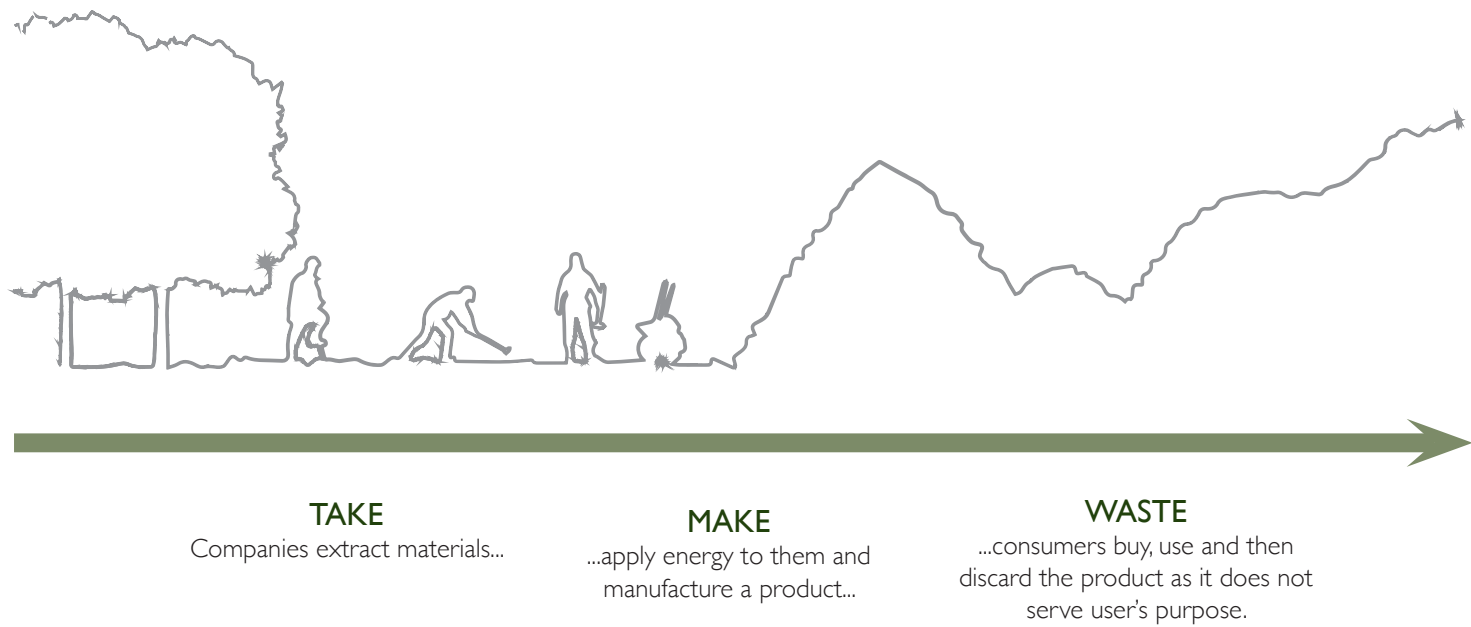
The take-make-waste economic system will not last forever as Earth's resource reserves will eventually become exhausted. A new approach is needed which changes people's approach to products and waste and contributes to more resilient societies.

Inspiration can be found in nature by studying its systems which operate in cycles. In nature there is no waste as substances flow in ecosystems and contribute to build-up and breakdown. The way nature works has become inspiration for various philosophies and strategies that emphasize the importance of cyclic thinking in order to achieve sustainable development. It is not only the ecological perspective that takes advantage of cyclical thinking, but also economic and social ones. (Cuginotti, A., Miller, K. M., and van der Pluijm, F., 2008).

### ECOLOGICAL FOOTPRINT

A way to indicate the state of the planet and humans impact upon it by measuring and comparing the area required to supply the ecological goods and services humans use to the land actually available to provide these goods and services (WWF, 2014).

Fig 1: Take-make-waste model (Cradle-to-Grave)  
(Based on Frick & Hedenmark 2016, page 28)





# MEGA TRENDS

---

*The linear approach is influenced and accelerated by mega trends, which are great driving forces in societal development that will affect all areas (state, market and civil society) in future (Larsen, 2006).*

## GLOBALIZATION

Flows of people, goods, capital, information, technologies, services and culture are increasing which contributes to global interconnectedness.

Globalization makes people more alike as production and consumption values become more similar worldwide. The market is global and borders are blurred out. Improved transportation systems have improved mobility of goods and people (Larsen, 2006).

## PROSPERITY

As people get more economic resources they consume more physical resources. Humans have adapted the take-make-waste model which has resulted in unsustainable lifestyles. People buy, use and throw things away as they get old, out of fashion or break (ibid.).

## INDIVIDUALIZATION

There has been a turn from collectivist society norms (tradition and obligation) into focusing on individual skills and interests. Uniqueness and individualism in products is getting more important for consumers (ibid.).

## URBANIZATION

More than half of the Earth's population live in urban environments. Cities grow at record speed which generates increased demands of products and services (FN, 2014).

## TECHNICAL INNOVATION & DIGITALIZATION

Since the industrialization in the late 19th century increased efficiencies have allowed products to be produced faster and in a higher quantity than ever before. Mass production at a low cost contributes to increasing consumption and waste rates.

Digitalization and social media have simplified it for companies to be able to reach consumers globally and enables people to consume products and services through digital media world wide (UNEP News center, 2011).

## TREND

A trend is a change in context which can impact the local and global context. Trends can last for a long or short time. Trends are visible and have a direction/movement, thus increasing or decreasing (Larsen, 2006).

# CYCLIC THINKING

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*In response to society's linear consumption behavior, strategies have emerged with the common ground that the use of resources must be reduced, become more efficient and have better impact on the environment. Inspiration is found in how nature deals with material flows and waste in circular systems. Some strategies take a step further in the understanding that waste can be a resource for something new or even better (upcycling).*

## ALTERNATIVE VALUE SYSTEMS

The traditional way of looking at waste is that it is a leftover after consumption with no value to the consumer. Waste is referred to as materials, products and to a condition which a product and material can have. This approach has become challenged by theories which claim that waste is subjective as it can be a valuable resource for someone else (producer). Thus **waste is a value** which is **added to a material or product** by agents in its lifecycle.

If waste is an attribute of value that humans give materials and products, one should rather **question the value system** itself rather than seeing waste as the issue. The value of a resource is often determined by cosmetic or condition standards of the product. If the object does not fulfil the requirements it most likely will be considered as waste (Dartel, & Nigten, 2015).

The problems related to waste and unsustainable resource management are connected to market economy as it sets a price on things. Most ecological and social values cannot be given a price tag and economic profit must be set aside to give space for moral and ecological issues (Sandel, 2012).

## EARLY CIRCULAR MODEL

Architect Walter Stahel together with Genevieve Ready published in 1976 a report *To replace energy with labour* where they investigated new ways of using materials and energy as a result of the energy crisis in 1970s. They stressed the importance of having workshops all over Europe where products could be reused, repaired, reconditioned and recycled in order to **increase the life span of products** and decrease energy and material consumption. Stahel's theory is referred to as *The self-replenishing system* and later led to what is now known as the circular economy. Stahel claims that industries have to adapt the **reuse** and **service-life** extension of goods as a strategy for **waste prevention**, create regional job and use resources efficiency. According to Stahel, this will contribute to disconnect wealth from resource consumption and dematerialize the industrial economy. Stahel also defines *Cradle-to-grave* which refers to the linear economy (Take-make-waste model) (Frick & Hedenmark, 2016).

## REGENERATIVE DESIGN

American landscape architect and professor John T. Lyle was inspired by Stahel and studied how materials and substances flow in nature. Lyle found inspiration in how nature restored or renewed its own energy resources and materials whereby the result could **become more valuable** than it was at the beginning. It maintains or **increases the qualities** of the resources and expands its usage. Lyle calls this approach *Regenerative design*. An economic system that apply Regenerative design gain human demands and resilience of ecosystems. Regenerative design is associated with all systems that process themselves, renew or regenerate the sources of energy and materials that they consume (Frick & Hedenmark, 2016).

*“...the extension of the use-life of goods is, first, a sensible point at which to start a gradual transition towards a sustainable society in which progress is made consistent with the world's finite resource base...” Walter Stahel (ibid.)*

## CRADLE TO CRADLE (C2C)

Chemist Michael Braungart and architect William McDonough were inspired by Stahel's work and introduced the model *Cradle-to-cradle* to describe pure circular flows without pollution or waste. In an article they presented an alternative to today's industrial production which focuses on **doing good instead of doing less bad**. C2C is focusing on mimicking ecosystems and its logic in nature. Central to the model is that waste is a valuable resource and all things must be decomposed in the **biological cycle** (by nature) or in the **technological cycle**. In the biological cycle materials become nutrition for plants, animals and humans. In the technological cycle waste is converted into new materials and products. An important part in their work is **upcycling** (to upgrade) materials to a higher quality. Cradle-to-cradle defines three core principles:

- 1. Waste=food**, everything is a nutrient for something else.
- 2: Use the sun**, use fully renewable energy resources.
- 3: Enjoy diversity**, species, culture and innovation. Diversity leads to sustainable systems.

Regenerative design together with Cradle-to-cradle's philosophy of two closed cyclical systems create the base for a circular economy (Frick & Hedenmark, 2016).

## UPCYCLING, ART & DESIGN

Art and design can be used as a catalyst in the upcycling process. It contributes to an alternative value system and gives waste a **higher value** as well as contributing to well being. By exploring materials and products a new knowledge and awareness of the materials could be created and contribute to a new way of looking at waste and products (Dartel, & Nigten, 2015).

Upcycling activities are strongly linked to art and crafts activities and can add emotional and social dimensions to the process.

*"...art and design can explore the relation between value systems and the production of waste through objects, installations, performances and interventions. By doing so, these artists and designers may instigate openings, however small, to the large-scale systemic and social changes required to make the transition to a model in which the production of waste is greatly reduced, or even eradicated."*  
(Dartel, & Nigten, 2015)

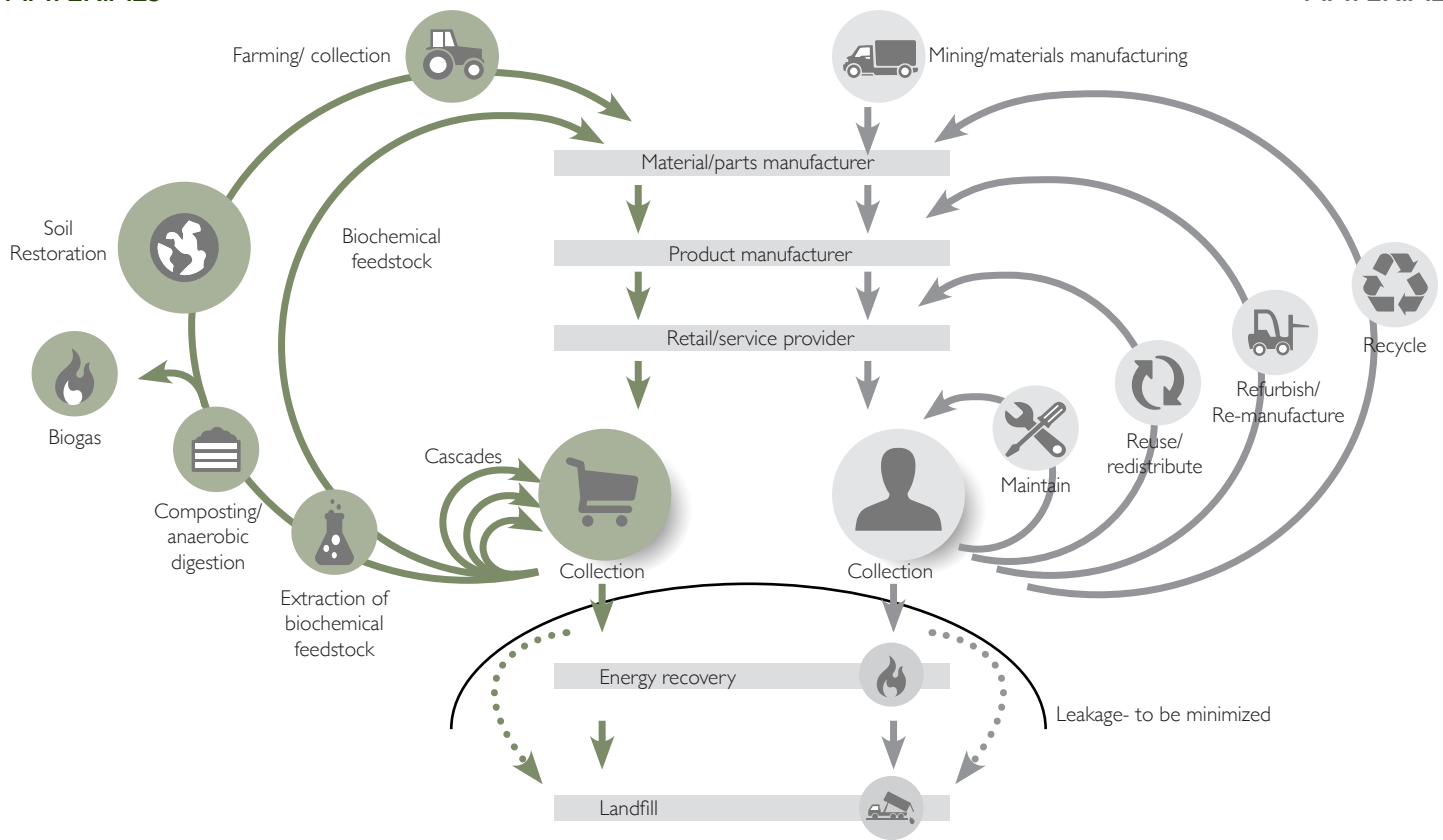
Fig 2: Continuous improvement strategy  
(Based on Frick & Hedenmark 2016, page 77)



Fig 3: Cradle-to-Cradle strategy  
 (Based on Ellen MacArthur Foundation 2012, page 29)

**BIOLOGICAL MATERIALS**

**TECHNICAL MATERIALS**



## BLUE ECONOMY

*Blue economy* is a philosophy which was founded by Gunter Pauli. The philosophy strives to use resources more efficiently and is critical to today's "mass-production at a low price" approach, which according to Pauli is an inefficient way of using resources. Pauli argues that companies should **collaborate** and see each other as resources (as in nature where different life forms live in symbiosis). This will generate economical as well as social profits as the model creates new job opportunities and saves resources (maintenance, repair and recycling is cheaper and provides new job opportunities). Central to Blue economy is finding profitable solutions that are **innovative, optimized** and that work in **symbiosis** with other systems (as in natural systems where everything is interconnected and evolving). Innovative solutions are non-linear, take place in every moment and are in constant change. Inspired by nature, it looks for optimized rather than maximized solutions that can generate **multiple benefits** (offering more with less). The aim is to respond to basic needs by using what already exists (Frick & Hedenmark, 2016).

## COMET CIRCLE MODEL

The model considers product management in a **lifecycle perspective**. The model describes the technological circle more in depth and focuses on updating the manufacturing process in order to support **life-long usage of a product**. By designing products in a way that they can be reused and recycled, resources could be saved. The first circuit is about keeping the product for as long as possible (repair and maintenance). If the product does not fulfil the consumer's requirements it will be reused. The shorter the loop is the more sustainable is the usage of the product as it decreases production of waste (Frick & Hedenmark, 2016).

A new economy has been developed based on recycling materials and products. Some materials are more profitable to recycle than extract from new raw materials. Urban-mining is a movement which emphasizes this approach, claiming that valuable resources are hidden in our societies, in products, packages and components (Frick & Hedenmark, 2016).

## PERMACULTURE

Permaculture is a philosophy which focuses on **symbiosis** between nature and humans. It is about organizing nature and what is already existing in order to generate more energy than it consumes. The name Permaculture comes from the words permanent agriculture and was developed by Bill Mollison and David Holmgren in Australia 1978 (Frick & Hedenmark, 2016).

In permaculture the user is **included and in charge of the process** rather than managing it separately. Users live, act and work close to the loops as it gives a deeper understanding and closer relationship to the produce.





# COLLABORATIVE ECONOMY

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*In most industrialized countries there is a norm of buying and owning even though the products are not frequently used. Collaborative consumption is responding to this through theories about co-owning and sharing resources.*

## COLLABORATIVE CONSUMPTION

This approach is a counter-reaction to the unsustainable lifestyles humans have created. Private owning should be replaced with **co-owning and sharing**. It is a change from private ownership of products (traditional consumption based economy) into shared resources through **lending and borrowing products and services**. People tend to want to make a hole in the wall but do not want to buy or own the drill themselves. This trend could be seen as the start of a changing society where collaborative consumption is given more acceptance (Botsman and Rogers, 2010).

Collaborative consumption contributes to sustainable resource management in two ways. It is the **optimized** way of using products since it contributes to minimizing consumption and enables more users to access the same product. It also **adds new social values** which are contradicting with today's economic system. Instead of valuing people from what they own, one would start to see the soft values such as knowledge, trust and willingness in contributing (Frick & Hedenmark, 2016).

## EUROPEAN COMMISSION DEFINITION

In 2013 the interest of collaborative consumption reached the higher instances as the European Commission's consultative body EESC (European and Social Committee) arranged a meeting to spread and exchange knowledge about collaborative economy in Europe. The outcome became a manifesto and the start of the network *European Sharing Economy Coalition*, which aims to influence the European politics to promote collaborative economy.

The manifesto presents three core principles of collaborative economy: **Product Service System** (more people have access to the same product), **Redistribution Markets** (redistribute used products and extend life span of objects) and **Collaborative Lifestyles** (people share and exchange resources and knowledge) (Frick & Hedenmark, 2016).



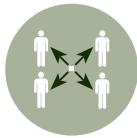
*Product Service System:* This system is based on people pay a monthly or annual fee in order to use a product. Internet is accelerating this as it become sharing platforms for communities. Carpools have been used for a long time but recently new businesses see possibilities in collaborative consumption (ibid.).



*Redistribution Market:* Permanent and temporary places where products can be redistributed (ibid.).



*Collaborative lifestyles:* This concept is about sharing and exchanging one's time, room and knowledge (ibid.).



## PRODUCT SERVICE SYSTEM

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- The Tool Library concept has spread fast the last during decades. Tool Pool in Malmö, Sweden, is an example where people can lend tools and in return give the company publicity through social media.



- Swedish public libraries have started to see opportunities in lending other products than just books. For example at Stockholm Cultural House people can use sewing machines and in Helsingborg the public library lends tools.



## REDISTRIBUTION MARKET

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- Klädbytdagen (Cloth exchange day) is arranged by the Environmental Protection Agency in various places in Scandinavia.



- Retuna is a galleria which only sells reused products. Goods are left at a depot (local recycling station) close to the mall and are then redistributed in stores. Products can also be given a new life as they get repaired, refurbished or upcycled in stores.



## COLLABORATIVE LIFESTYLES

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- AirBnB is a website where people can hire private accommodations without any intermediary. Another examples is hinna.se which is a Swedish virtual platform where people can upload what they need help with, how much you want to pay or get paid to do the job.



- The concept of lending people is getting bigger and Karlstad municipality has launched a digital platform called VarmtVälkommen.se (Warm Welcome). It is an integration project run by the municipality in order to encourage people to get in touch and decide a place where they can meet.

# VISIONS & GUIDANCE

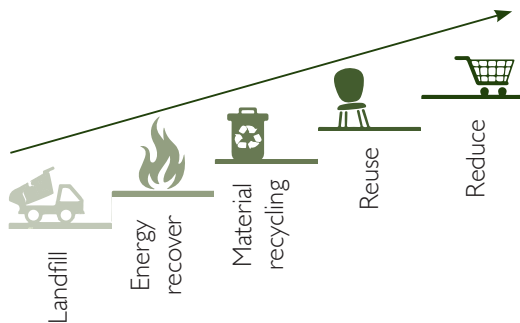
*In order to reduce waste there have been attempts by governments, scientists and businesses to understand the current situation and set ambitious goals regarding waste and product management.*

## EU WASTE HIERARCHY

The Waste Stair (*Waste Hierarchy*) is a model created on an initiative by EU. The purpose is to describe how waste should be treated and processed to achieve EU environmental objectives. The further up in the staircase one works, the more sustainable the resource management is (Vänernsborgs kommun, 2012).

EU commission decided in 2014 to reduce the amounts of waste in the long run by introducing the concept of circular economy, which is based on the concept that there is no waste. **Materials are circulating in closed loops** with no degradation of material or product quality (European commission, 2014).

Fig 5: Waste Hierarchy  
(Based on Vänernsborgs kommun, 2012)



## FROM 3R TO 8R

The 3R model (Reduce, Re-use, Recycle) is an established model which aims to describe how to treat waste in a sustainable way. Recently, this method has been criticized for being too narrow and in the report *Short Circuit: The Lifecycle of our Gadgets and the True Cost to Earth* the 8R model is presented. The model describes how one should think to reach further up the waste hierarchy (The Gaia Foundation, 2013).

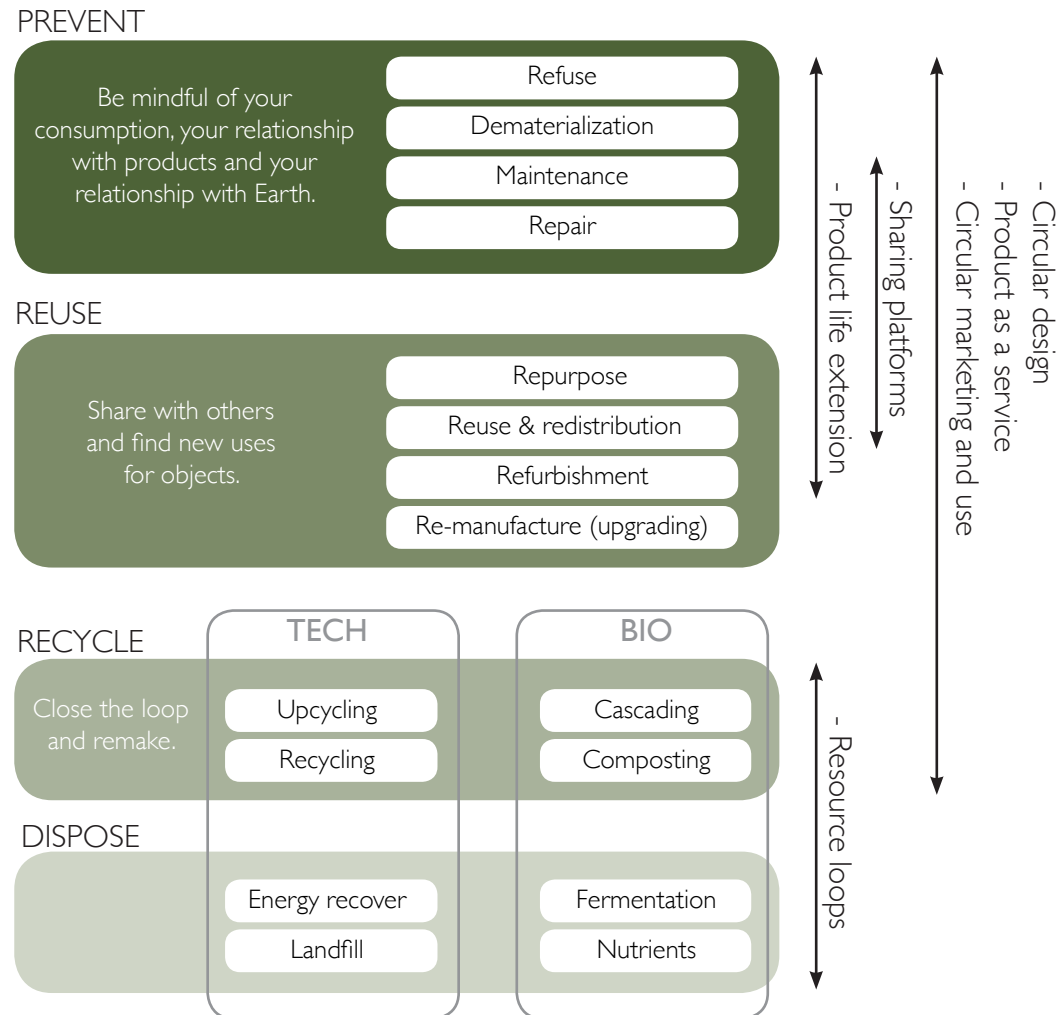
Fig 6: 8R model  
(Based on The Gaia Foundation 2013, page 73).



## CIRCULAR LADDER

The Circular Ladder model is a development of EU's waste hierarchy model and describes activities which **increase the "degree of circularity"**. Six strategies are presented (on the right side of the ladder) which can stimulate the activities and start the transition into a more circular approach to waste and products. A cyclical resource management combines different parts of the ladder and constantly strives to reach the top rungs (De Groene Zaak, 2015).

Fig 7: Circular Ladder  
 (Based on De Groene Zaak 2016, page 8)



# ENABLING A TRANSITION

## KNOWLEDGE CREATION

In order to reach the top rungs in the waste hierarchy (reduce, rethink, refuse) knowledge creation is required. It is about changing people's mind-sets; approach and perception of waste and products.

**Knowledge conversion** is made when tacit knowledge changes into explicit knowledge and vice versa. In order to make knowledge change (from tacit to explicit) one has to provide it with the right infrastructure or conditions.

It is about offering activities which emphasize **dialogue** (aims to inspire, get new perspectives and find solutions to problems) and **practice** (sharing tacit knowledge through shared experiences and find solutions through practical experience) in a physical environment that supports the activities (Robinson et al, 2005).



### TACIT KNOWLEDGE

Tacit knowledge is hard to formalize or communicate as it refers to personal and context-specified knowledge (i.e. practical, routine, and procedural) (Robinson et al, 2005).

### EXPLICIT KNOWLEDGE

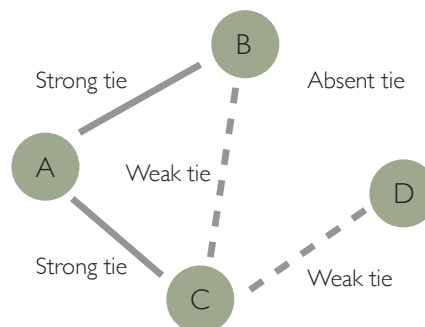
Explicit knowledge is transferable regardless specific context (i.e. rationalizing, theoretical and analytical) (ibid.).

## SOCIAL NETWORK THEORY

Resources can be saved and knowledge can be gained if agents start to see each others as resources. In a collaborative world, **networking** will become important and it will be about seeing objects as parts of systems rather than as isolated individuals.

A social network consists of agents who act in a system with **strong, weak or absent ties** between them (based on spent time, emotional intensity and intimacy in a relationship). The ties contain information (i.e. friendship or shared interests), which contribute to a common sense of trust between the agents. In the text *The strength of weak ties*, Mark Granovetter defines a theory called the *Impossible triangle*, which claims that if there is a strong tie between A-B, and A-C, there must be a tie between B and C, albeit weak. Granovetter states that it is the **weak ties** that contribute to **build up social networks** and **spreading of information** (Granovetter, 1973).

Fig 8 : Impossible triangle  
(Based on Granovetter, 1973)



Agents operate in **clusters** with strong links between them (agents who share similar information i.e. friends, family or colleagues). The weak ties can contribute to create bridges between agents, thus contributing with valuable input for existing clusters. Clusters **concentrate resources, skills and abilities** which increases the opportunities for cooperation and meetings between agents. Thus the weak ties become important as enablers to connect agents and clusters (Granovetter, 1973).

Efficient networks, clusters and agents are connected through **hubs** in order to reduce the distances between the different parts of the network. This method is called **small-world-network** and is applicable to urban planning, transportation systems, companies and other fields. The system could also be vulnerable if the hubs stop working (i.e. public transportation) (Berg, E. et. al., 2014).

Fig 9: Small-world-network  
(Based on Berg, E. et. al., 2014)

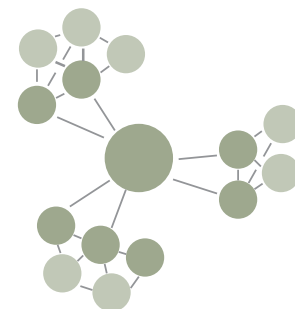
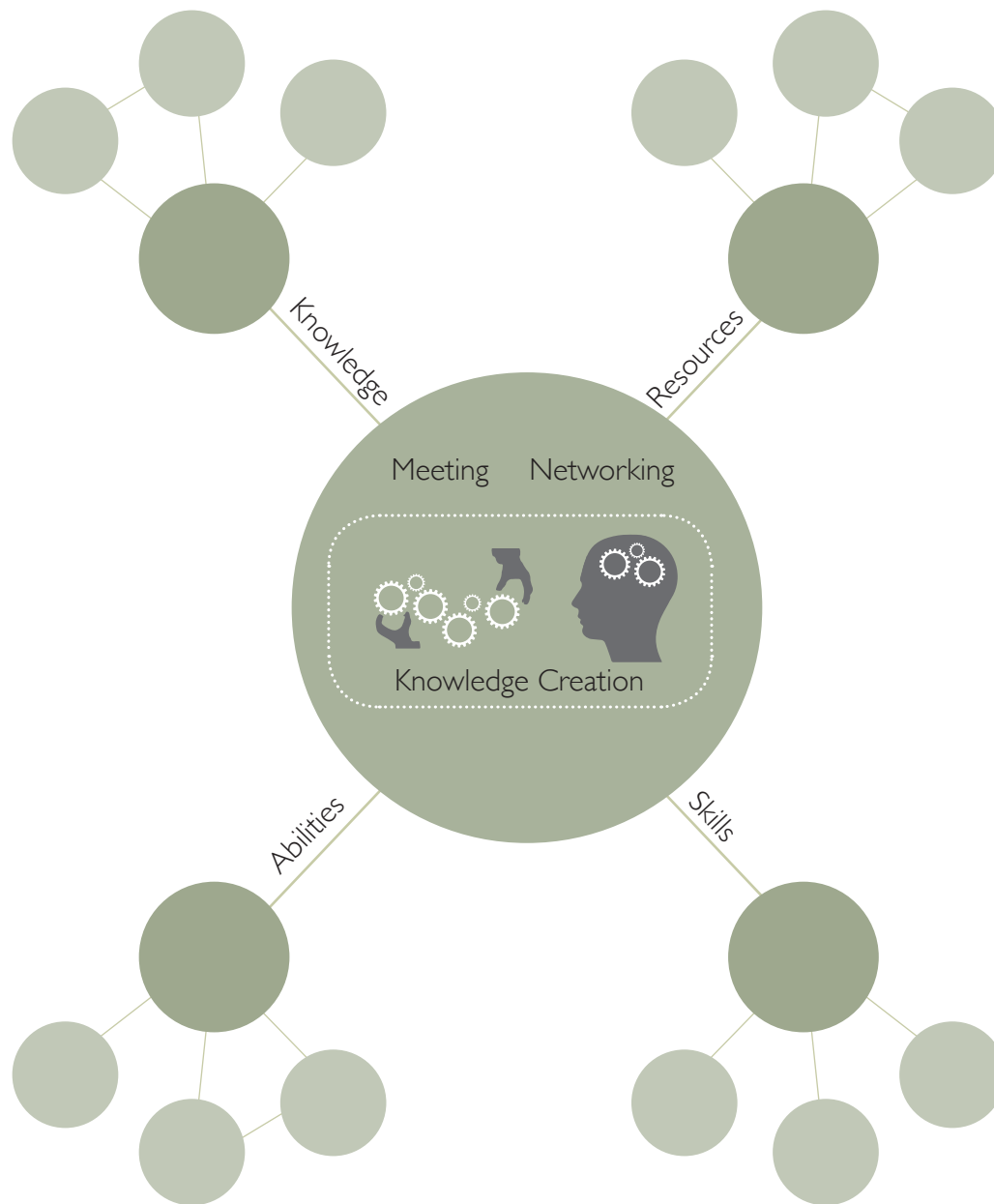




Fig 10 : Diagram summarizing of the network theory section.



# POSSIBLE ENABLER

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*In order to reach sustainable resource management one needs to stimulate knowledge creation regarding cyclical thinking. Municipalities, who are part-responsible for waste management, also have a responsibility to prevent waste. Municipalities have the opportunity to support, strengthen and develop local businesses as well as small-scale activities (start-ups) to become pioneers in circular economy and cyclical thinking.*

## WHO IS THE ENABLER?

So far, the business sector and the academia have lead the development of circular resource management. The transition cannot be made by one sector thus it needs **cross collaboration actions**. The public sector can work as an important enabler of cyclical thinking through changing legislation, pioneer projects and providing the right infrastructure in order to make the circular economy standard practice.

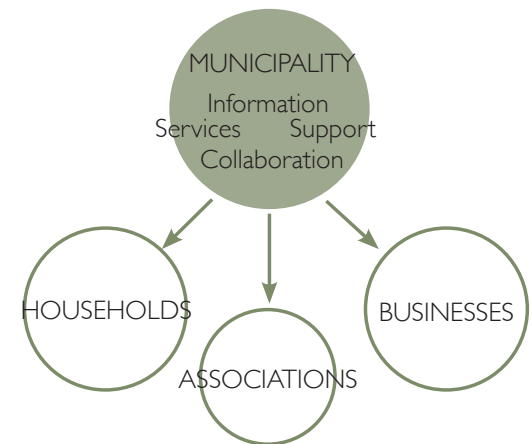
- **Pioneering actions**; enabling space for actors where they can experiment with redesign and value chains which stimulates innovations within circular economy. The physical space is important for further practical exploration.

- **Mainstream actions**; making the circular economy standard practice.

Governments thus have to adapt legislation and provide societies with the right infrastructure to accelerate a change (De Groene Zaak, 2015).

## MUNICIPALITIES ROLE

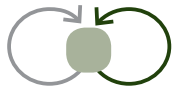
Municipalities are described as community developers, which means that they lead strategic development issues concerning society. They have an important role in relation to businesses, associations and residents as they work to provide the agents with welfare and services (schools, sanitation and waste management etc.). They also work to facilitate and enable others to become co-creators in the development of society. This includes stimulating new collaborations in various ways i.e. by encouraging initiatives and creating places where different actors can meet. Municipalities should also do their best in facilitating for agents who want to contribute to development, for example, start a business or an association (Vänersborgs kommun, 2016).



# CONCLUSIONS

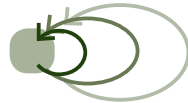
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*After studying various theories about cyclical thinking and sustainable resource management five concepts have grown stronger as they summarize the theories. Cyclical thinking in resource management should emphasize:*



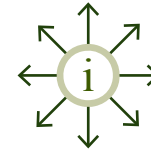
## TECHNOLOGICAL & BIOLOGICAL WASTE

The waste management should strive for a circular system and include upcycling. Biological and technological waste should be treated in two separated systems.



## ENCOURAGE SHORT CIRCUITS

Collaborative consumption and reuse have a crucial role in the change to more sustainable resource management as it reduces the amount of waste and encourages product life extension. Additionally it can contribute to alternative value systems and bring positive side effects.



## INFORMATION, EDUCATION & SUPPORT

To reduce waste and encourage more sustainable and circular lifestyles one has to provide society with the right infrastructure. Residents need knowledge and encouragement to change their habits and arenas for this purpose will have an important role in the future. People need to see that everyone is valuable and can do something in order to create a more sustainable society.



## MULTIPLE BENEFITS & NETWORKS

Encourage new partnerships and entrepreneurship with focus on circular economy in order to strengthen local communities. Strive to create win-win situations where activities are multifunctional and support each other. Everything has several benefits including social and economic aspects. By emphasizing circular thinking with a strong focus on collaboration and sharing, synergy effects will occur and contribute to a more robust community.



## ARTS, REDESIGN & UPCYCLING

Through promoting upcycling one can give products a new and better value. It should strive towards the approach waste=food in order to create a positive approach to waste and innovative ideas. Activities regarding upcycling, arts and crafts can generate positive social as well as economic aspects.

# REFLECTIONS

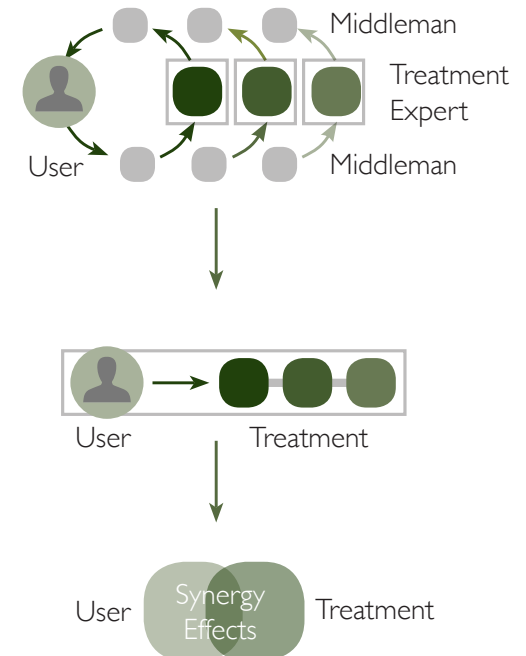
*In order to reach further up the Circular ladder one has to adapt circular models and change the mind-sets of people by letting them confront their waste and explore alternatives to throwing products away. In the long run it could lead to a new economic system that does not only connect growth and profit through consumption of resources.*

## ENHANCE THE OVERLAP

After studying the Cradle-to-cradle and Comet circle model, the waste management system could be considered as being operated by experts whom are separated from the user. These intermediary agents create a distance (gap) to the user and give the consumer a message that they can consume at the same pace as before.

In order to reach further one has to challenge the mind-sets of people and let them confront their waste by exploring alternatives to throwing products away. Hence users must be provided with infrastructure which emphasises the concepts of circular thinking. If users could be the experts and be part of or undertake the waste management process (as in Permaculture) one could save more resources compared to before.

Beside the economical and environmental advantages of saving resources there is a strong social and knowledge dimension to bring the management system closer to (and include) the user. When the user overlaps the management processes it can add new social values through meeting and learning from each other. If people can see how materials and products can be turned into something valuable it is more likely to change their perception of waste and products. As mentioned before, upcycling, art and redesign could trigger and accelerate this transition. Additionally it could contribute to more robust communities.



## **NEXT STEP**

Insights from this chapter have been condensed into a number of aspects which are important to strive for in order to reach more sustainable resource management.

From the theory it became clear that municipalities could work as an important enabler in the change to more sustainable resource management. This will be explored in the next chapter as it uses the theory to investigate a potential network of agents and waste prevention actions in the local context.

# LOCAL CONTEXT

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*This section intends to provide an understanding of the current waste and product management system in Vänersborg municipality and identify on what level cyclical thinking is implemented. In order to understand the local context one also has to study how the waste management system works on a national level. The Circular ladder will be used as a tool to evaluate on what level the municipality works with cyclical thinking in resource management. Additionally, this part intends to identify potential agents for cooperation.*

## Swedish Context

- Current Situation
- Guiding Documents
- Responsibility

## Local Context

- Current Situation
- Guiding Documents
- Responsibility
- Evaluation
- Other Agents



## WHY?

This investigation will be necessary in order to understand the current waste and product management system in Vänersborg and to identify gaps and directions for this project. The municipality of Vänersborg is chosen as a benchmark due to various reasons:

- The municipality has started to work actively with the waste management issue by deciding to build a new eco-recycling park.
- The municipality is working on a new *Waste management plan* which this work can give input to.
- The new *Comprehensive plan* stresses the importance of working actively with sustainability issues.
- Vänersborg is a small town which hypothetically makes it easier to connect stakeholders and create networks.
- Use previous knowledge from the studio *Planning and design for sustainable development in a local context* (held in Vänersborg 2014).



## HOW?

To evaluate on what level the municipality works with waste and product management, the Circular ladder model will be used as an evaluation tool. The hierarchical model is used by the municipality today thus it will be easy for them to relate to. Other aspects associated with waste and product management (collection, transfer & transport, treatment & disposal, prevention actions, aesthetic aspects, accessibility and littering on site) are also considered in this analysis. These aspects will be reflected upon and summarized in a SWOT-analysis in the end of each section.

Prevent	Refuse	Outlined = not working with this issue.
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	Filled box = working with this issue.
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Tech Upcycling	Bio Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients

This investigation also intends to identify other agents who actively work with these issues (focussing mainly on municipal departments).

Information will be collected through site visits and by looking into guiding documents (Waste plan). The geographical delimitation is the city of Vänersborg with main focus on the city centre area.



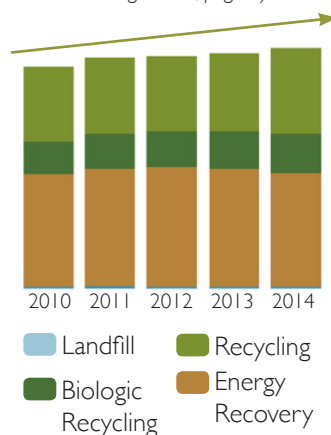
# SWEDISH CONTEXT

Sweden's economy has in the past been based on production but as manufacturing became more profitable overseas (considering staff, oil prices and transportation) industries have moved. Despite the degradation, Swedes consumption rates have expanded resulting in a high proportion of imported goods and waste (SCB, 2007).

## CURRENT SITUATION

The amount of **waste is increasing** in Sweden (see fig. 11). Sweden has progressed greatly when it comes to waste treatment (high proportion of material recycling and energy recovery) but the biggest challenge is still to reduce the amount produced and minimize formation of waste. Municipalities in Sweden are primarily working in the **low or middle parts of the waste hierarchy** but initiatives to create eco-recycling parks are becoming more popular as a way to combat this trend. Municipalities and their companies are described as the transition engines to more sustainable resource management (Avfall Sverige, 2015).

Fig 11: Increasing amounts of waste in Sweden (Based on Avfall Sverige 2015, page 4).



## GUIDING DOCUMENTS

Every municipality in Sweden is required to have a **Sanitation policy** which consists of a Waste plan and regulations of the waste management. The **Waste plan** includes details of how the municipality intends to reduce the amount of waste and goals to raise awareness among inhabitants and businesses (Avfall Sverige 2015).

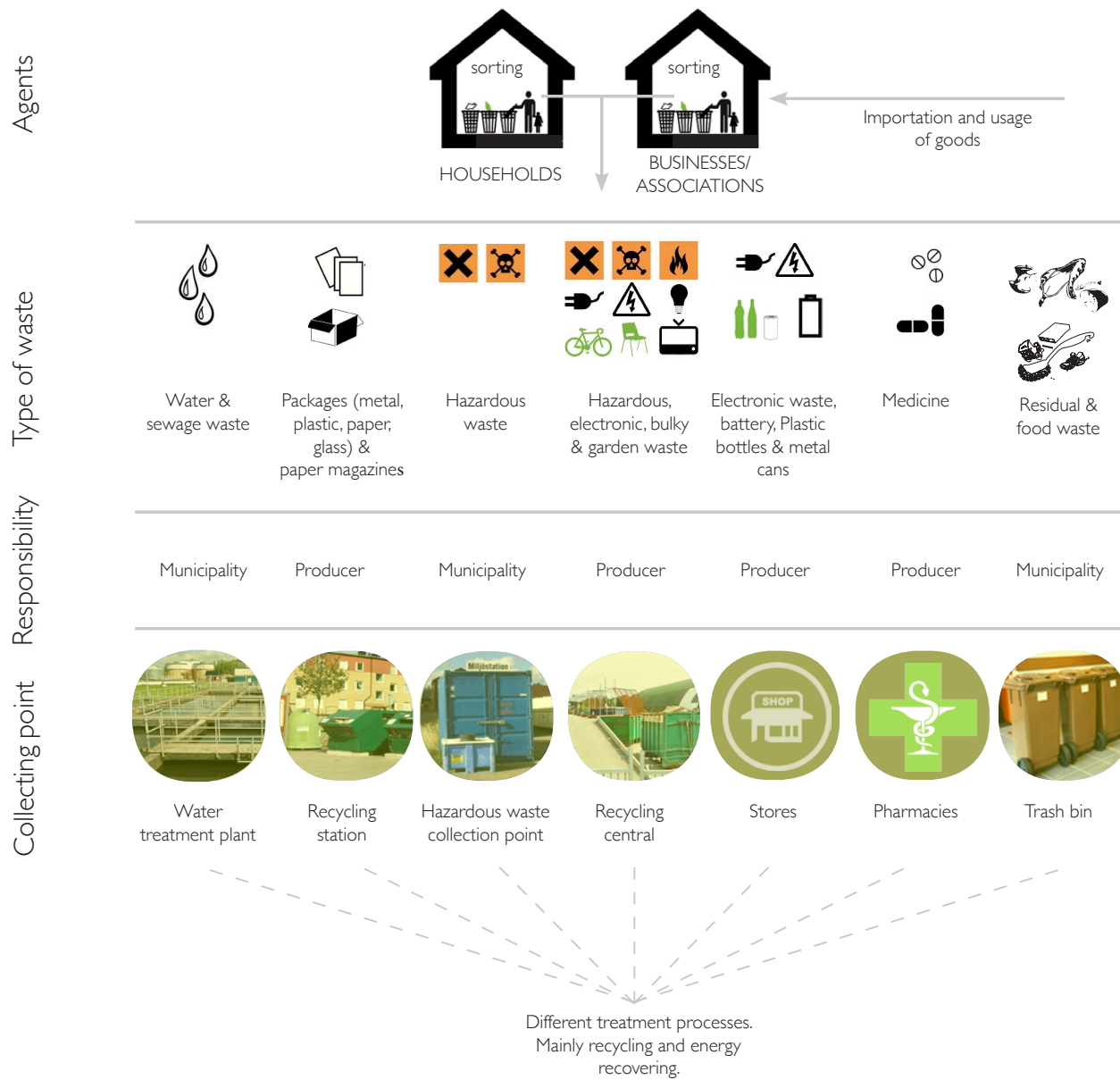
Avfall Sverige (Swedish Waste Management and Recycling association) is an organisation which aims to supervise the industry regarding waste issues from treatment processes to political decision-making. In Avfall Sverige's guiding documents one can read that municipalities shall promote prevention of waste but also reuse and recovery operations. The waste management should also strive towards achieving the maximum environmental and social benefit and it is a responsibility in which everyone should participate including municipalities, producers, households, and businesses (Avfall Sverige, 2015).

## RESPONSIBILITY

The responsibility for waste collection is divided among several actors. The municipality is responsible for **household waste** (residual waste, food waste, hazardous waste, bulky waste and water/sewage waste). Producers are responsible for fractions of household waste such as packaging (metal, plastic, glass, paper), newspapers, batteries, electronic products and prescription medication (pharmacy). Households and other waste holders have the responsibility to sort their waste and leave it at designated collecting points (Avfall Sverige 2015).

Municipalities are responsible for waste to be treated in an environmentally healthy manner. They are also responsible for preparations of reuse. The system of transporting and collecting is illustrated in the diagram on the next page.

Fig 12: Swedish municipal waste management & responsibility  
 (Based on Boverket 2011, page 8)



# LOCAL CONTEXT

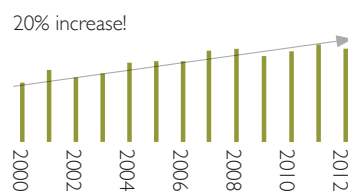
Vänern is situated in a south-west part of Sweden by the southern tip of lake Vänern. Vänern was founded in 1644 and the municipality today has over 37 000 inhabitants whereby 25 000 live in the city.

## CURRENT SITUATION

The municipality of Vänern is no exception as the amount of **waste there is also increasing**. The biggest proportion of the collected waste in the municipality is bulky waste, residual waste, food waste, paper, cardboard, compost (from gardens) and wood waste. Studying statistics one can conclude that there is no tendency for a decreasing amount of waste (Vänerns kommun, 2012).

Many of the products that people disposes could **potentially be reused** but due to the lack of collaboration in the municipality, the resources end up in energy recovering processes.

Fig 13: Increasing collection of bulky waste  
(Based on Vänerns kommun, 2012)



## GUIDING DOCUMENTS

The **Waste plan and Policy documents** describe that the waste management should strive to...

...**prevent** and **reduce** the amounts of waste by **encouraging recycling** and **reuse** of products.

... establish and encourage **activities that promote reuse** and redistribution of clothes, furniture and other reusable products.

... make **residents more aware** of resource management through **information** campaigns and actions.

...enable **easy, accessible, safe and aesthetically pleasing** collection systems.

...build an eco-recycling park at Tengrenstorp.

The new **Comprehensive plan** of Vänern presents seven core principles which are priorities and directions for future development in Vänern. Some of them can be connected to waste management.

- *Core Principle 6*; It should be easy to live an environmentally friendly lifestyle .

...encourage qualitative **meeting places** that are not based on environmentally harmful consumption.

...emphasise **urban farming**.

... increase the opportunities for **reuse** and **recycling**.

- *Core Principle 2*; An attractive and welcoming city rich with activities.

...offer free **meeting places** and **activities** that are **open to everyone**.

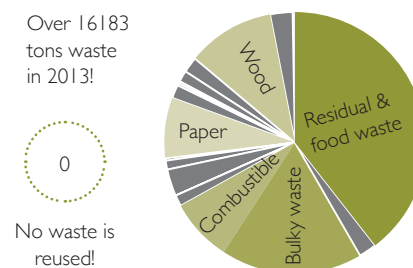
...contribute to a **vibrant urban life**.

- *Core Principle 4*; The development is driven by cooperation.

...make it easy for companies to **start up** and establish themselves in Vänern.

...encourage **collaboration** and **cross border/disciplinary cooperation**.

Fig 14: Waste types and reuse  
(Based on Vänerns kommun, 2012)

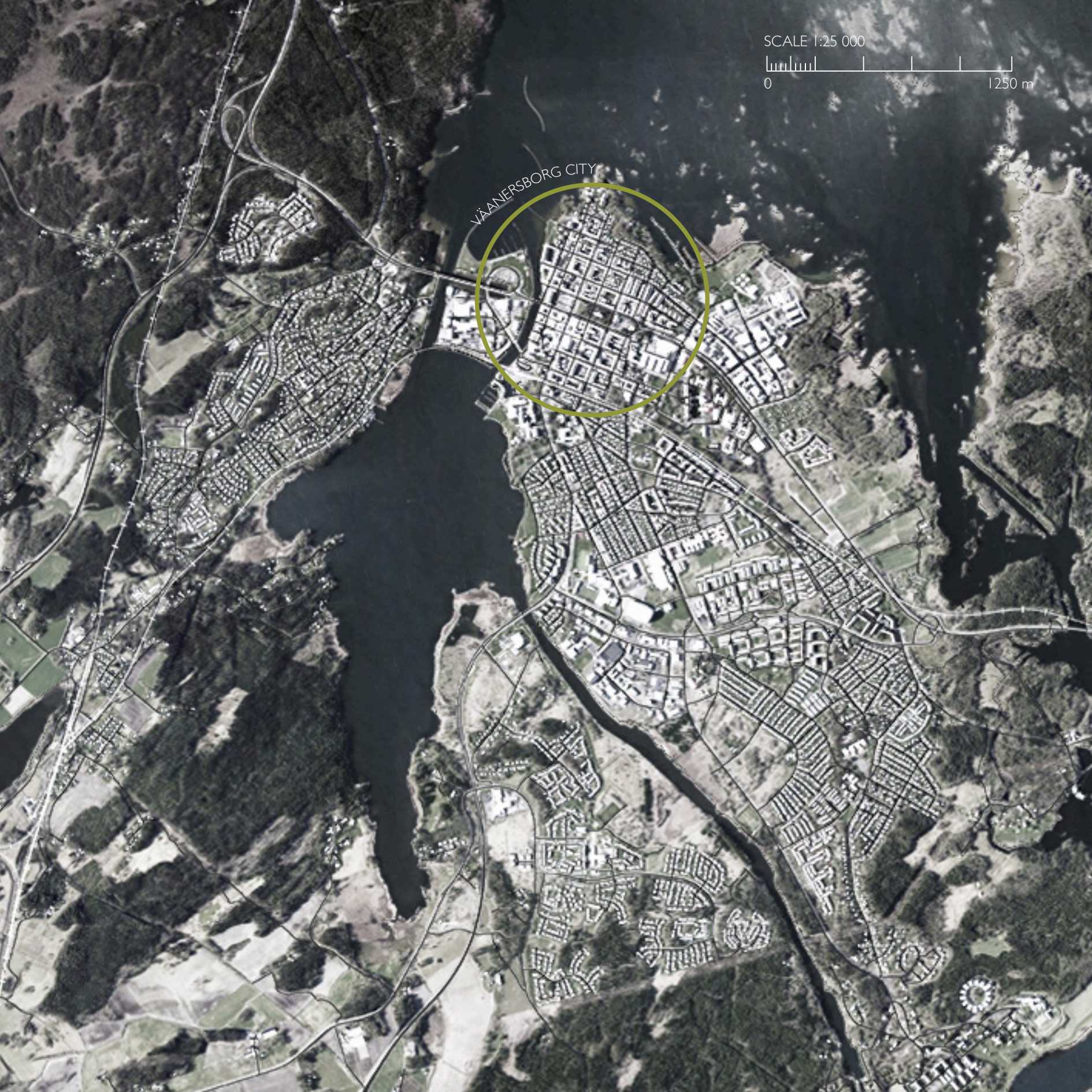




SCALE 1:25 000



VÄÄNERSBORG CITY





## RESPONSIBILITY

From previous sections it has become clear that the municipality in Vänersborg is responsible for various aspects regarding resource management:

- **Generation & separation**
- **Collection**
- **Transfer & transport**
- **Treatment & disposal**
- **Prevention actions**

Other important aspects stated in the Waste plan are:

- Aesthetic aspects
- Accessibility
- Littering

The local waste management in Vänersborg is operated as the national system. Waste is divided into different categories depending on composition, size and treatment procedure (Vänersborgs kommun, 2012).

### FTI

A nationwide recycling system for packaging. FTI's role is to provide all companies with access to the nationwide recycling system, which is designed to simply and efficiently meet producer obligations (FTI AB, 2016).

## COLLECTION

Garbage Bins



## SEPARATION



## TRANSFER, TREATMENT & DISPOSAL

Households and businesses put their food and residual waste in bins. The food waste is sold to Borås for biogas production while the residual waste is sold to Halmstad for energy recovery.

Recycling Central



Bulky waste



Households and businesses leave their bulky waste at the recycling central (soon eco-recycling park). The waste is sold for use in energy recovery, combustion and recycling processes.

Hazardous Waste Collection



Hazardous waste



Households and businesses leave hazardous waste in containers which work as collecting points. The waste is sold for use in recycling processes.

Recycling Station



Disposal waste



The municipality provides recycling stations for producer responsibility waste. The municipality does the work for FTI who own and recycle the materials.

Water Treatment Plant



Waste water



Water and sewage waste is transported to the water treatment plant for biogas production.

An eco-recycling park will replace the recycling central. It will offer consumers the same service as at the current recycling central and the municipality has the ambition to offer a shed for reusable construction materials and products (ibid.).





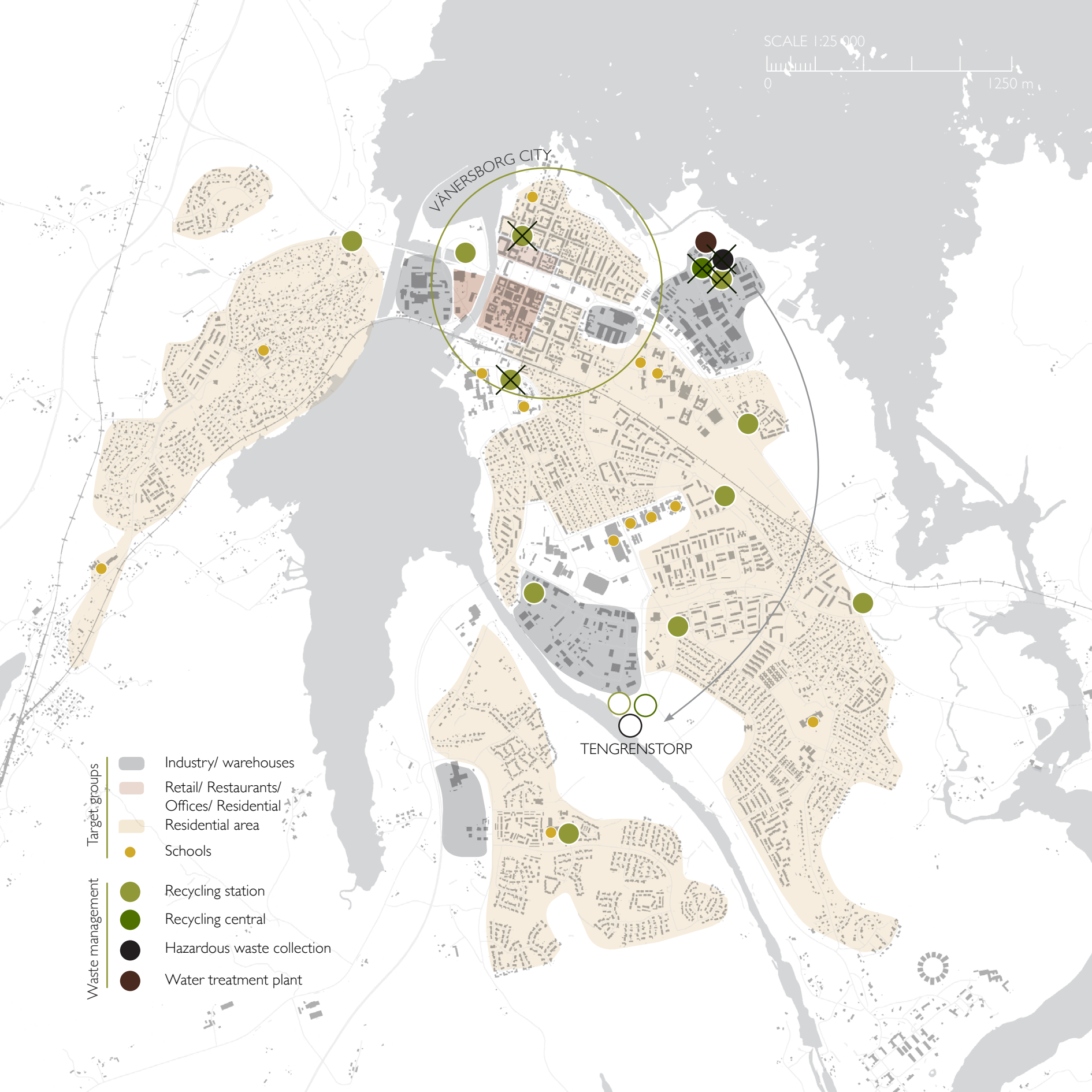
SCALE 1:25 000



- Target-groups
- Industry/ warehouses
  - Retail/ Restaurants/ Offices/ Residential
  - Residential area
  - Schools
- Waste management
- Recycling station
  - Recycling central
  - Hazardous waste collection
  - Water treatment plant

VÄNERSBORG CITY

TENGRENSTORP



## PREVENTION & INFORMATION

The Waste management plan and Policy document of Vänersborg brings forward some target groups that it views as important to reach out to regarding resource management.

### Local Businesses:



The municipality acts as a supervisory authority and supervises businesses regarding waste management issues. Municipalities cannot control businesses to act in a certain way but by spreading information about the waste management the municipality wishes to affect the attitude towards waste. Waste from local businesses is under producer responsibility. Depending on type, local businesses can dispose their waste at the municipal collecting points (Vänersborgs kommun, 2012).

### Schools:



A *Waste information officer* carries out information about waste management to schools in the municipality. Investments in early understanding of waste management can create a new approach to waste in the long run (ibid.).

### Households:



As earlier explained, the municipality is in charge of collection, transportation and treatment of household waste in an environmentally sound manner. The municipality is also in charge of informing households about waste management and encourages inhabitants to reduce and reuse their waste and products. In order to inform the inhabitants, previous actions have been undertaken by uploading information on the municipal website, distributing an annual free calendar and launching a website which helps people to categorize and sort their waste in a correct manner (ibid.).

## SWOT ANALYSIS

The SWOT analysis is focusing on aspects such as generation & separation, collection, transfer & transport, treatment and disposal, prevention actions, aesthetic aspects, accessibility and littering on site. The investigation has been done through study visits and literature studies based on the Waste plan.

The main focus has been on recycling stations and recycling central.

### SWOT-ANALYSIS

The SWOT-analysis identifies the strengths (S), weaknesses (W), opportunities (O) and threats (T) of a site to consider when planning for development.

## SWOT analysis regarding resource management in Vänersborg

- Well developed waste management system which the target groups find familiar.
- Cyclical thinking is starting to spread through the organization due to the new eco-recycling park at Tengrenstorp.
- Low proportions of waste ends up in landfills.
- Social interaction occur as people meet at the collecting points (recycling central and recycling station).

- The waste treatment is working in the lower rungs of the Circular ladder.
- The collection points are located far away from the users and the accessibility is mainly adapted to cars.
- Collection points are not athletically pleasing (dirty, grey and harsh atmosphere).
- No cooperation on reuse which results in that functional products are thrown away.
- Waste prevention actions not enough to change peoples perception of waste/products.
- Collection points are not connected to the surroundings (isolated islands in urban context).
- Lacking information about how the users contribute to the linear approach.

- Opportunities to connect waste management to other agents and activities.
- See waste as value for other activities and processes.
- Complement the waste management with a knowledge centre for rising awareness of cyclical thinking.
- Vänersborg municipality can take the lead in sustainable resource management and cyclical thinking through pioneer projects.
- Provide the inhabitants the infrastructure that is needed in order to repair, maintain and upcycle their products.
- Complement the eco-recycling park.

- Fewer and longer distances to collection points in future can make people less willing to sort their waste.
- Longer distances generates more transports (cars).
- Increased amount of waste in the municipality.

# CONCLUSIONS

The waste management department of Vänersborg works mainly on the lower rungs of the Circular ladder. The guiding documents strive to reach further up the Circular ladder in order to achieve more sustainable resource management. The new eco-recycling park is an attempt to reach further up the waste hierarchy and see waste as a valuable resource.

Today	Vision
Refuse	Refuse
Dematerialization	Dematerialization
Maintenance	Maintenance
Repair	Repair
Repurpose	Repurpose
Reuse & Redistrib.	Reuse & Redistrib.
Refurbishment	Refurbishment
Remanufacturing	Remanufacturing
Upcycling/cascading	Upcycling/cascading
Recycling/compost.	Recycling/compost.
Energy rec/ferment.	Energy rec/ferment.
Landfill/nutrients	Landfill/nutrients

There is still a challenge to prevent waste which means that one should consider the actions before products become waste and end up at the recycling central. The eco-recycling park is a good initiative but the narrow focus on product types (building materials) has to be broadened and also include more product types. Generally, the accessibility has to be improved so that not only cars have access to collection points.

There is a gap between the vision and how the management is operated today. In order to bridge this gap, further initiatives have to be made which encourage:



## KNOWLEDGE CREATION

Provide inhabitants and agents infrastructure in order to gain knowledge about waste prevention (support, education, activities regarding waste prevention and sustainable resource management).



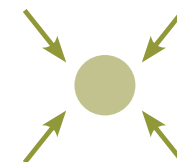
## OFFER ALTERNATIVES

The target groups have to be offered alternatives to throwing things away. By emphasizing circular design, resource loops, products as a service, sharing platforms and product life extension (reuse, recover, upcycling, recycle) a new approach to waste and products can occur. New collaborations and networks have to be created in order to accomplish this.



## SHOW THE POTENTIALS IN WASTE

Let the target groups explore the possibilities of waste in order to make them realize that it can be something valuable. The arena must be designed in a pedagogical way in order to raise awareness and question the value of waste.



## IMPROVE ACCESSIBILITY

Today the waste management is pushed to the peripheries of the city. The issue of waste and resource management has to be central in urban development in order to enable a transition and confront people's perception of waste and products. It has to be easy, aesthetically pleasing and accessible by various transportation options.

### MUNICIPALITIES RESPONSIBILITY

According to the studied literature municipalities play a crucial role in the work of reducing waste. They have a responsibility to step up in the waste hierarchy by promoting reuse and recovery of products. Municipalities have another important function, as they should inform target groups about the waste management system. The Policy documents stress the importance of collaboration in order to reduce and prevent waste.

### NEXT STEP

The following section will investigate other agents in Vänersborg that work actively with issues regarding cyclical resource management. The aim is to find possible collaborators for a new network of agents who can work together to reach further up the waste hierarchy. The main focus will be to find agents with connections to the municipality of Vänersborg. Based on the network theory in the previous chapter, weak ties can connect agents and create strong networks. In this investigation, the weak ties equal the connection to the municipality and the activities which can be related to cyclical resource management. The investigation will be based on study visits and literature research.

# AME- LABOUR MARKET SERVICES

The Labour Market Services AME (Arbetsmarknadsenheten) operates under the Labour Market Department in Vänersborg municipality. AME runs various activities which aim to create employment for people who are outside the labour market. These people are offered public sheltered employments and many of the activities are related to reuse, upcycling, growing, farming and reparation of products. It is open for the public but its main customer is the municipality since the operation should not compete with private businesses.

It is common to connect Labour market services to recycling, upcycling and other arts and crafts activities. This is established in several municipalities for example at Alelyckan in Göteborg. In connection to the recycling station participants collect, sort and sell products in their own second-hand shop. Some places also offer reparation of products. The aim is to offer activities that create meaningful employments for the participants. Social aspects are the main focus and the participants get involved on their individual terms. Labour market services have positive effects on the environment and economy as it saves resources. It also has a strong social aspect as it uses resource management actions for self-development.

## ACTIVITIES

### 1. Knutpunkten Activity Centre

- Second-hand shop
- Bakery and café
- Carpentry
- Bicycle workshop
- Sewing and weaving room
- Bicycle workshop

### 2. Butik Unik

- Retail of upcycled products
- Bike lending

### 3. Lyckans Second-hand Store

### 4. Torpet

- Growing flowers and vegetables.
- Café
- Creative studio (workshops for pottery, watercolour painting and moulding activities).

### Lilla Hjälpen (Small-help service)

- Free housekeeping services for disabled and elderly (i.e. changing light bulbs, changing batteries, taking things down from the attic etc).
- (Vänersborg, 2016)

Prevent	Refuse	
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Upcycling	Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients



SCALE 1:25 000

0 1250 m



4  
Torpet, in Vargön

- Activities work on multiple levels in the Circular ladder.
- Biological and technological resource management.
- Strong social perspective.
- AME wants to expand their activities.
- Used to the concept "learn by each other"

- Poor accessibility
- "Hidden" in the industrial are of Holmängen.

- Connect activities to municipal waste management.
- Open up AME for citizens.
- See AME as a complement and support-function for actors in the same business.

- Agents within the same business as AME might see it as a threat to their own business.
- People's willingness to participate.
- Rapid shifts of participants makes it necessary to have experienced supervisors.



# VOLUNTARY GROUPS: SECOND-HAND

Vänernborg has a strong second-hand culture with many available stores (including virtual and temporary events). The shops are commonly located in industrial areas and work as meeting places where people with different backgrounds socialize through resource management, café and other activities.

## 1. ERIKSHJÄLPEN SECOND-HAND

Erikshjälpen is a charity organization operated by the Pentecostal movement. The second-hand shop is popular as people from all over Vänernborg come here to **meet, donate and buy goods**. The second-hand store also includes a café which is operated by AME.

## 2. RED CROSS SECOND-HAND & MEETING PLACE

Röda Korset Vänernborg (red cross) is an organisation free from religious and political opinions. It operates a second-hand shop and meeting place in central Vänernborg and the profit is used for charity work. Over 250 volunteers work within the organization. To work here you have to agree upon the **core values** which are based on equality, human rights and respect. Röda Korset does not collaborate with other similar organizations today.

Inhabitants contribute by leaving goods here and in return they get a coffee ticket. The second-hand shop also consists of a laundry room, a small workshop for repairing and storage space. The organization still sees potential for expansion. Goods that are not sold are dissembled and sent to recycling. Clothes and fabrics that are not sold are donated to charity organizations abroad.

## TEMPORARY

3. **Superloppis**: One of Sweden's biggest second-hand events and it is arranged in the Arena Vänernborg.

4. **Bakluckeloppis**: Vänernborg Soccer Club arranges Bakluckeloppis (car boot sale) at the square in Vänernborg.

5. **Oktobermarknaden**: The city centre transforms into a big market place and the October fair attracts thousands of people. Second-hand products are sold in some market stalls.

Prevent	Refuse	
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Tech	Bio
	Upcycling	Cascading
Dispo.	Recycling	Compost.
	Energy rec.	Ferment.
	Landfill	Nutrients

SCALE 1:25 000

0 1250 m



- Strong second-hand culture.
- Café connects people.
- Strong social perspective.
- Reuse and meeting place work well together
- Attracts people with various backgrounds.
- Second-hand shops have a sense of "extra living room".

- Poor accessibility
- Some places are "hidden" in industrial areas.
- No cooperation with other agents in the same business.

- Offer rent-able space for associations.
- Support the charity organizations through more collection points.
- Meeting place with focus on resource management.

- Local businesses might see second-hand as a threat to their business.
- Premises must support intense flow of products and people.

### BUSINESS DEVELOPMENT OFFICE, VÄNERSBORG MUNICIPALITY

The Business Development Office (Näringslivskontoret) works with business development in order to **spread knowledge** about starting up companies and to facilitate for future business to establish in the municipality. They also work with **counseling** for existing companies on the market.

The Business development office acts as “the spider in the web” between the various municipal administrations and facilitates to **shape arenas for networks** that foster entrepreneurship in Vänersborg (Vänersborgs kommun, 2016).

### STUDIEFRÄMJANDET STUDY ASSOCIATION, VÄNERSBORG

Studieförbundet is one of the largest study associations in Sweden and organises study circles (small groups studying a specific subject or question of common interest), events, seminars and projects in municipalities. They offer a wide spectrum of **courses** within the fields of nature, environment and also cultural topics.

Studieförbundet is open to everyone and emphasises **life long learning** by giving people the opportunity to practice participation in society and provide tools for self-development. The activities are financially supported via governmental grants and funding from municipalities (Studieförbundet, 2016).

Prevent	Refuse	
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Upcycling	Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients
	Tech	Bio

Prevent	Refuse	
	Dematerialization	
	Maintenance	
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	Refurbishment	
	Remanufacturing	
Recyc.	Upcycling	Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients
	Tech	Bio

## CULTURE & LEISURE DEPARTMENT, VÄNERSBORG MUNICIPALITY

The Culture and Leisure Department can be connected through cyclical resource management as **art and crafts** can be linked to reuse actions such as upcycling, redesign and re-purpose of products. According to the theory in previous chapter artists have a crucial role in order to change people's perception of waste and products. Through **installations and exhibitions** one can show the potential in waste and products and **question habits**. Other municipalities have started to explore the social value of reuse and recycling activities and it has started to become implemented into existing culture houses. Examples are Stockholm Culture house and Garaget in Malmö.

Prevent	Refuse	
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Upcycling	Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients

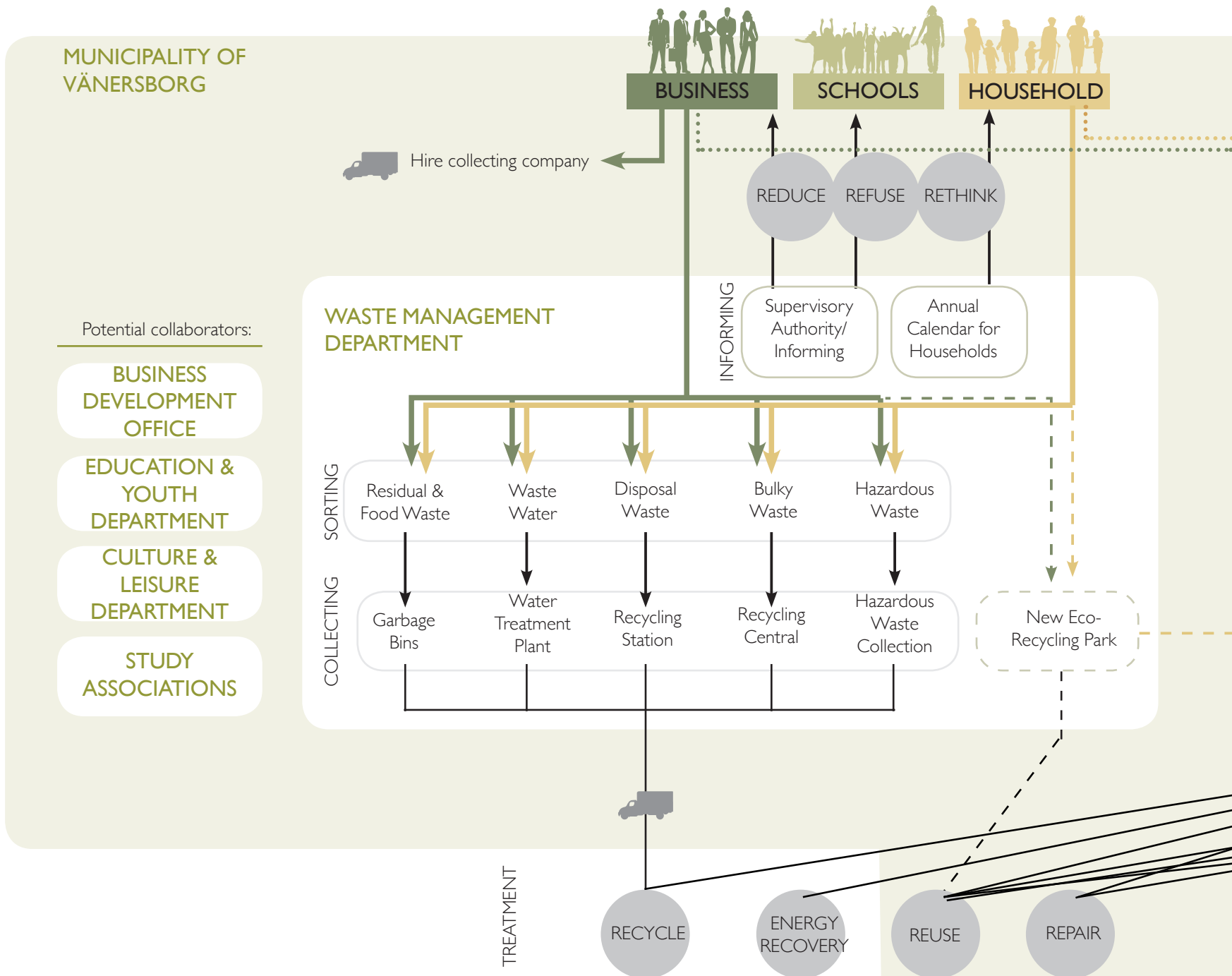
## YOUTH & EDUCATION DEPARTMENT, VÄNERSBORG MUNICIPALITY

In the guiding documents of the school (curriculum, LGR 11) one can read that children should explore and develop **knowledge about materials** in products, how they can be recycled and how it can be connected to sustainable development. Additionally children should have the right to **express themselves in the public room** and contribute to democracy (Skolverket, 2015).

In Gothenburg, arenas have been developed where school classes come and explore waste and products in experimental activities. The arenas educate both children and teachers in cyclical resource management and are part of the education.

Prevent	Refuse	
	Dematerialization	
	Maintenance	
	Repair	
Reuse	Repurpose	
	Reuse & Redistrib.	
	Refurbishment	
	Remanufacturing	
Recyc.	Upcycling	Cascading
	Recycling	Compost.
Dispo.	Energy rec.	Ferment.
	Landfill	Nutrients

# CONCLUSIONS



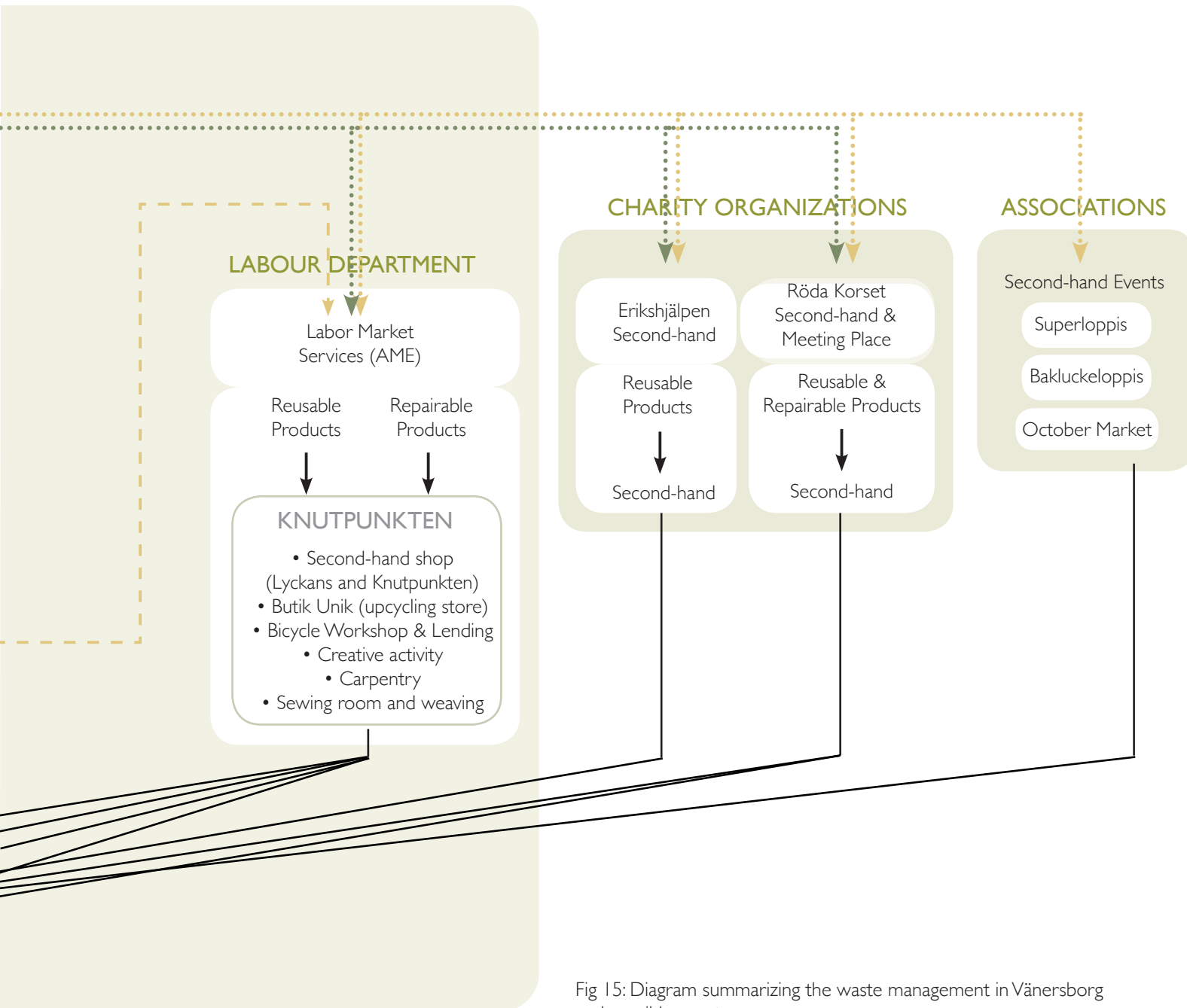
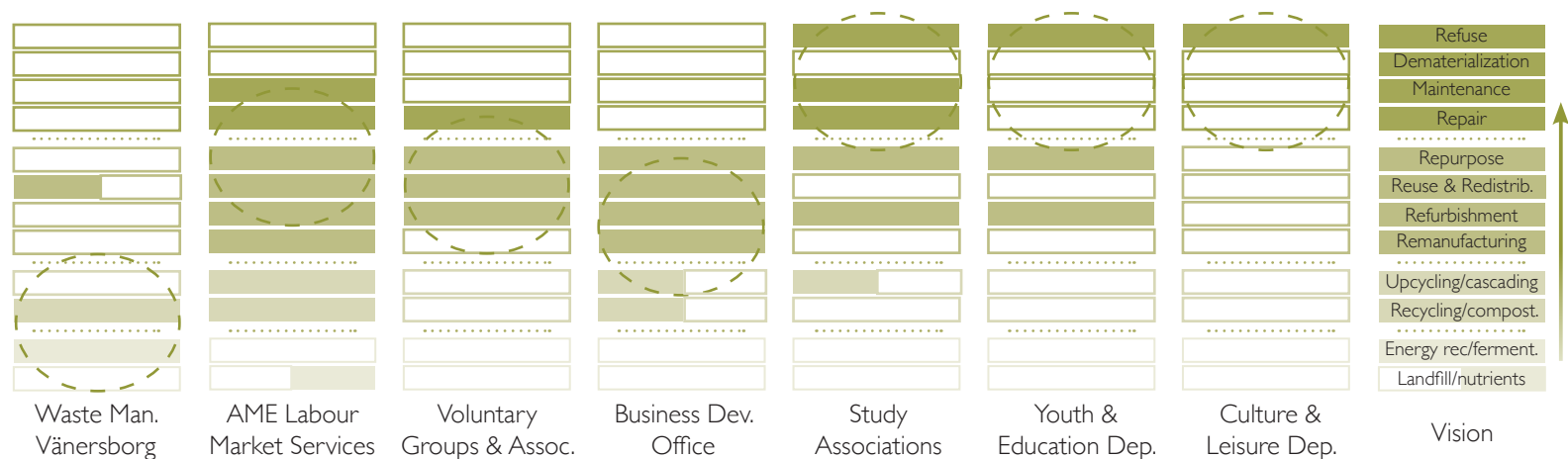


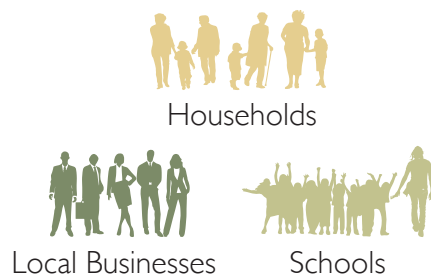
Fig 15: Diagram summarizing the waste management in Vänersborg and possible agents

# CONCLUSIONS



## TARGET GROUPS

The Waste Management Department has identified three agent groups which are important to reach out to when it comes to resource management. Households; because the municipality is in charge of collecting and transporting waste and that the treatment is done in an environmentally friendly way. Local businesses; because they generate a lot of waste and need to be supervised about waste management. Schools; in order to raise awareness about waste management.



## POTENTIAL COLLABORATORS

Other agents have been identified as their activities can be connected to resource management and activities further up the circular waste ladder. By connecting the agents and offering them an arena (hub) where they can pollinate each other, a new type of public meeting place can occur. In addition to this, the agents found in this investigation can easily be connected to the target groups presented to the left.

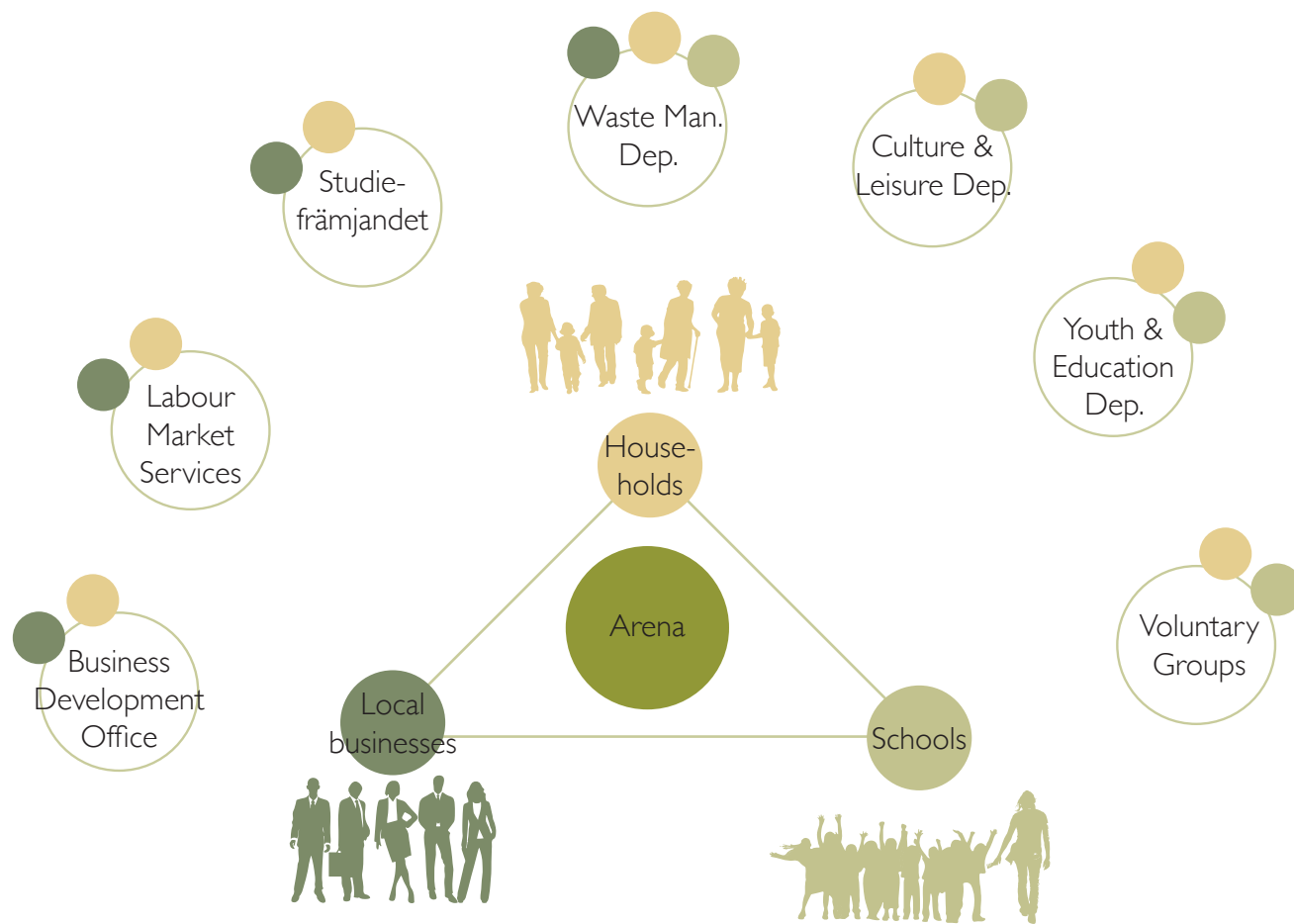


## NEXT STEP

This chapter gave insights into the local waste management in Vänersborg and how it works compared to cyclical theories about sustainable product and waste management. In order to widen the perspective, reference projects have been studied to understand how others work with these aspects. The investigation ran parallel to the analysis of the local context but is presented in two separated chapters.



Fig 16: Diagram summarizing the gained information



# EXAMPLES

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*This section presents inspiring reference projects that actively work with cyclical thinking and sustainable resource management. The chosen projects show solutions on an organizational or building level.*

## Organization Level

- Sinkadusen, Mölndal
- Returen, Göteborg
- Innovatum, Trollhättan
- Garaget, Malmö

## Building Level

- Sustainable building
- Naturhus Concept
- Sikkhall Naturhus, Vänersborg
- Ekopark, Strömstad
- Kvernhuset Ungdomsskole, Fredrikstad
- Bråta Pavillion, Härryda

## WHY?

In order to develop a network of agents and propose an arena for cyclical thinking and resource management one has to look for inspiring reference projects. The projects that have been chosen are actively working with sustainable resource management on an organizational, activity or building level. The insights will be used to define directions for an arena or centre in Vänerborg where agents meet, learn and collaborate regarding sustainable resource management.

## HOW?

This investigation will be based on study visits and literature studies. The geographical context is delimited to the Swedish context and should include municipal collaboration.

The examples are also chosen as they work with the same target groups as defined by the Waste Management Department in Vänersborg; Households, Local businesses and Schools.

The investigation is divided into two parts. The first section investigates activities and organizations while the second one focuses on buildings and how to integrate cyclic thinking into architecture.



Households



Local Businesses



Schools

# SINKADUSEN, MÖLNDAL

## WHAT?

Sinkadusen is an interdisciplinary meeting place where pedagogues and children learn with and from each other through experimenting with waste material, products and techniques. The activities strive to be *inviting*, *innovative* and *aesthetic*.

*“We provide creative activities that intend to generate a meeting between people, materials and environment.”*  
(Mölnads Stad, 2016).

The building hosts four activities: *Makers Mölndal*; a virtual learning environment with tools, ideas and a special focus on programming for children.

*Skatan*; a creative recycling centre which collects residual waste and material leftovers from local businesses.

*Språkoteket*; a room for preschool language development where pedagogues can lend material as well as get supervision within the topic.

*Creative Preschool*; a network for teachers where they get new ideas and inspire each other together with the directors of Sinkadusen (Mölnads Stad, 2016).

## BYWHO?

The main stakeholder is the municipality of Mölndal and the department of education and youth.

## FOR WHO?

Sinkadusen is aimed to be a centre for pedagogues and pupils. Local businesses can leave their residual waste here (plastic, wood, fabrics, tiles, wallpaper, paper etc.).



## CONCLUSIONS

- Network of actors from different sectors.
- Questioning and adding value to waste through upcycling.
- Knowledge creation activities.
- Art, redesign and upcycling activities.



# RETUREN, GOTHENBURG

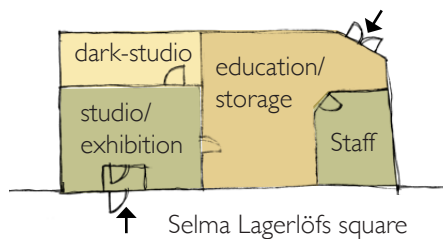
## WHAT?

Returen is a creative recycling centre which collects disposable materials from the local community and local businesses. It is located on the main street at Selma Lagerlöf square in the district of Backa. It is a place for sustainability, creativity, inspiration and sharing between people and works as an arena for developing creative processes and artistic activities.

## FOR WHO?

Returen is a meeting place where kindergartens and schools work, develop and learn together in a context that favours social and ecological sustainability. Returen works in cooperation with local businesses and the local community who donate material and waste products for artistic and educational reasons. It is a win-win situation.

The dark-studio enables visitors to experiment further with the waste and products by using technology and digital tools.



## BY WHO?

Returen is an initiative by the Education Sector in Northern Hisingen Gothenburg and it runs as a project with funding from the Environment Department of the City of Gothenburg.



## CONCLUSIONS

- Importance of central location.
- Activities can spill outside.
- Questioning and adding value to waste through upcycling.
- Knowledge creation activities.
- Network of actors from different sectors.
- Art, redesign and upcycling activities.



# INNOVATUM, TROLLHÄTTAN

## WHAT?

Innovatum is located in Trollhättan and works as a bridge between the scientific, education and business communities. Innovatum also hosts temporary events which attract people at different times of the day and year. One example is the *Xplodera Go Green* which is an event that focuses on changing the consumption society by emphasizing and showcase upcycling, recycling, redesigning and reuse activities (Innovatum, 2016).

## BY WHO?

Innovatum is a cross-disciplinary collaboration between the municipality of Trollhättan, Högskolan Väst (University West), businesses and associations. Together they created Innovatum Foundation which today owns the main part of Innovatum (ibid.).

## FOR WHO?

Innovatum is an arena for innovation with focus on clean-tech. New businesses can test their ideas through start-up projects and get support from incubators. Synergy effects occur as people from different sectors work under the same roof. University West cooperates with Innovatum on research projects (ibid.).

Innovatum Science Centre is a part of Innovatum where people get an understanding of natural science and technique through experimental activities. The activity centre is also a museum where one can learn more about the history of the Innovatum area. Its main target group is schools (children & youth) (ibid.).

Local  
businesses

Schools

House-  
holds

## CONCLUSIONS

- Activity and knowledge centre.
- Cross-disciplinary collaborations.
  - Actors pollinate each other.
- A living area during different times of the day and week.
- Experimental activities in order to understand natural science.
  - Permanent, temporary and overlapping activities.





# GARAGET, MALMÖ

## WHAT?

Garaget is described as Malmö's extra living room and is a place where citizens can borrow books, magazines, visit the ecological café, borrow tools, repair products or participate in events or seminars. The centre focuses on social interaction between people and economic profit is set aside. The activities are strongly influenced by sharing and user participation (Malmö Stad, 2016).

## BY WHO?

The municipality of Malmö is the main stakeholder. In the evenings various associations use Garaget (for workshops, seminars, movie nights etc.) (ibid.).

## FOR WHO?

Garaget is open for all citizens of Malmö and is free of charge. Activities are strongly influenced by the participants as they shape the activities of Garaget through dialogue processes in order to meet their needs (ibid.). The centre is like a living organism, a set framework (building and core functions) with a dynamic content (activities etc.).



## CONCLUSIONS

- Participants can shape the activities.
- Open and inviting for everyone.
- Soft transit zone (to get involved in the activities).
- Sustainable resource management connected to social activities.
- Permanent, temporary and overlapping activities.
- Art, redesign and upcycling activities.



# CONCLUSIONS

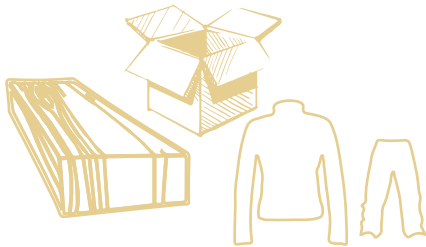
## WASTE & PRODUCT CRITERIA

By studying precedents it has become clear that some materials and products are more suitable for upcycling and redesign.



### Bulky waste products:

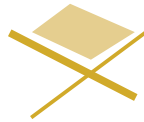
Products that easily can be repaired, redesigned, upcycled or repaired with tools that are easy to manage (i.e. furniture, bicycles etc.).



### Residual Waste

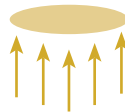
- Fabrics/Clothes
- Paper/Cardboard
- Wood
- Packages (plastic, paper, metal, glass)

Other factors from the investigation that are important to consider in a design:



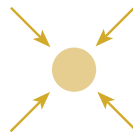
## LOCATED AT INTERSECTIONS

As Return, it is convenient if the arena is located close to where people circulate. This increases the possibility of spontaneous visits and drop by visitors.



## SUPPORT LOCAL ACTORS

It is positive if the arena and its activities support local actors. This will generate a sense of belonging and a place where people could drop by regularly. It also contributes to cross-disciplinary collaboration and meetings.



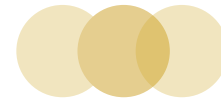
## GOOD ACCESSIBILITY

The accessibility of people and goods is essential. It is convenient if the arena is located close to public transportation nodes and has a well-adapted product flow system.



## OPEN AND INVITING

It is convenient if the arena has clear entrances and works with transparency, regarding activities inside and the relationship between inside and outside. As in Return, activities can spill out into the urban space and support everyday life.



## OVERLAPPING ACTIVITIES

If the arena offers multiple activities which also overlap it is more likely that synergistic effects will occur and contribute to enrich the organization. The activities should be easy to interact with and offer the visitor a stage-wise introduction.



### NEXT STEP

Previous examples show how buildings have been adapted to organizations and activities regarding cyclic thinking and sustainable resource management. The next section will investigate how the building itself can be designed by taking cyclical aspects into consideration.

### WHY?

There is a pedagogical aspect and advantage if the building itself shows the potential in cyclic thinking and resource management.

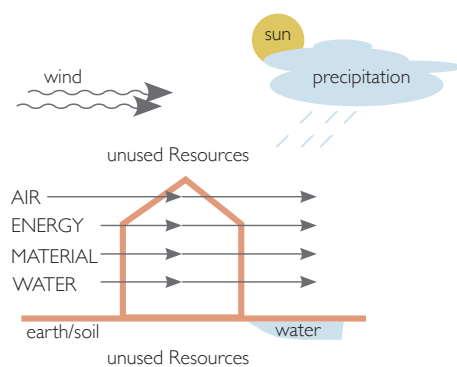
# SUSTAINABLE BUILDING DESIGN

## CYCLICAL DESIGN APPROACH

The theory of cyclical thinking can also include building design. For example Cradle-to-cradle has developed design principles for the built environment which strive to close the resource loops. William McDonough stresses the importance of considering all inputs of products (how materials are extracted, tech-/biodegradability and ability to be reused). It is a life cycle approach which considers aspects such as material use, energy use and water use (Frick & Hedenmark, 2016).

In order to close the loops it is necessary to think holistically, have a long term perspective and see objects as parts of systems rather than being isolated (Brophy, 2011).

Fig. 17: Linear (conventional) building design (Based on Brophy, 2011).



## ROPEL'S CYCLICAL APPROACH MODEL

In Caroline Ropel's master's thesis *Naturligt-vis* from 2014, a model is presented which on a comprehensive level shows how local natural resources (systems) can be used and further developed into an ecological and cyclical building. As Brophy proposes in the models (fig 17 and 18), one should strive to use the sun, wind, water and nature. This model will be used and further developed as it systematically shows important aspects to consider when designing a sustainable building.

Fig. 18: Circular building design (Based on Brophy, 2011).

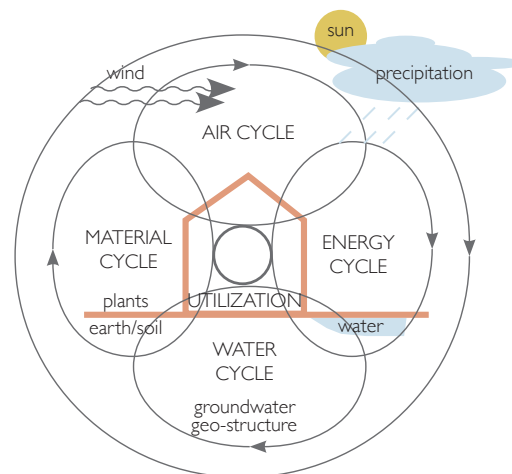


Fig. 19: Ropel's cyclical approach model (Based on Ropel, 2014).

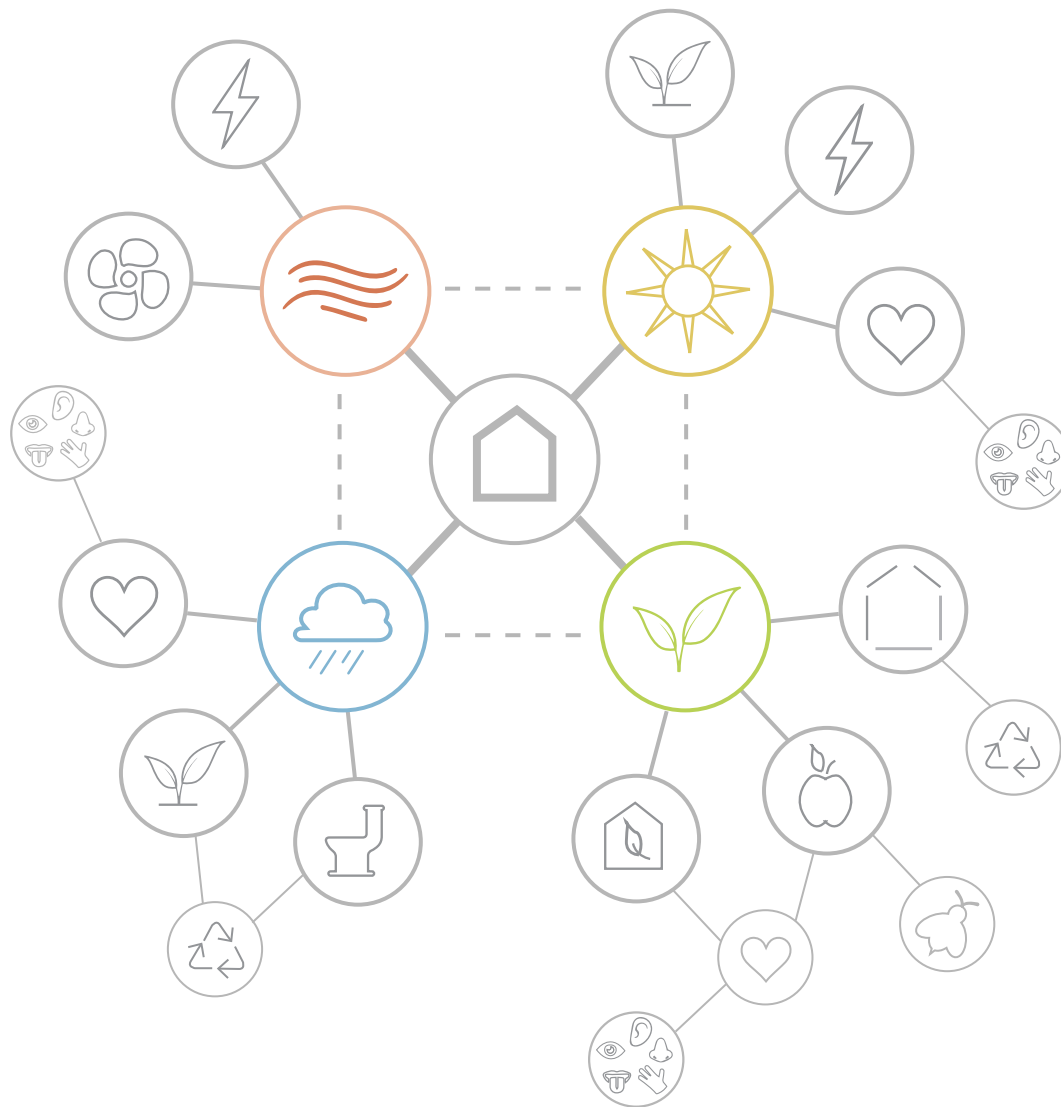


# REFLECTION

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## DEVELOPMENT OF ROPEL'S CYCLICAL APPROACH MODEL

This conceptual model is inspired and developed from Caroline Ropel's master thesis *Naturligt-vis*, 2014. It includes more aspects and could in the future be developed further as a matrix.





## SOLAR ENERGY

Photovoltaic solar panels can use solar energy for energy production. The panels have to be located on a sunny spot free from shade. If the panels are tilted (about 30-45 degrees) it increases the energy production effectiveness by 25 percent as well as facilitating snow and water run off. The energy can be stored in a battery bank or be connected to the power grid (L. Andrén, 2011).

Solar energy can also be used for water heating by using solar thermal collectors. The hot water is then distributed and used in the building as sanitary water or for heating. Similar to the solar panels, the collectors have to be tilted on a spot free from shade. They also have to be accessible for inspection (ibid.).

Additionally, solar energy is an essential catalyst in the biomass production process. Greenhouses create a micro climate which is beneficial and speeds up the growing process. Greenery generates a healthy indoor climate and contributes to biodiversity outside (ibid.).

Daylight has to be considered when designing a building as it create well being and can save energy by reducing artificial lightning (ibid.).

## SYSTEM SKETCH

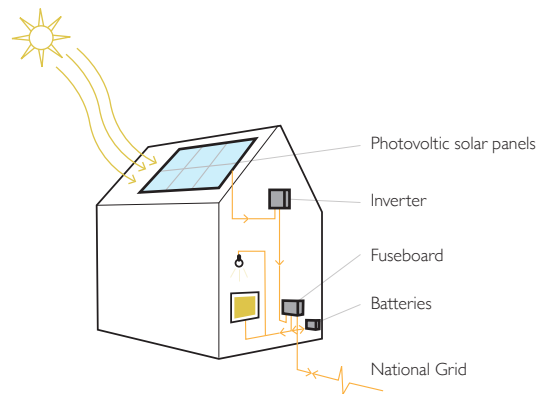


Fig. 20: Energy production, sun  
(Based on Östlund 2014, page 80)

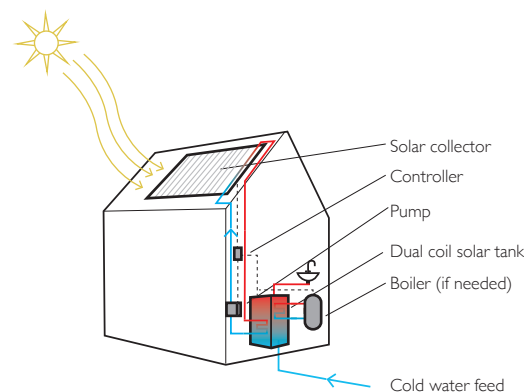
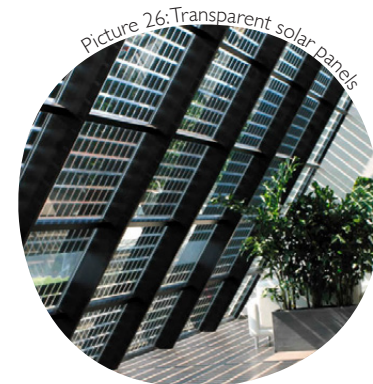


Fig. 21: Water heating  
(Based on Östlund 2014, page 80)

## POSSIBLE SOLUTIONS



# WIND



## WIND

Wind can be used for ventilation as well as energy production through the use of wind turbines. Turbines must be located on a spot where it is windy (i.e. a rooftop). The energy can be stored in a battery bank or be connected to the power grid. When choosing wind turbines one needs to consider that they make noise which can be perceived as disturbing in highly populated areas. Another problem with wind turbines is that they can kill birds.

Wind can be used for natural ventilation systems. Wind effects can create a pressure difference without assistance of mechanical equipment (air entering through openings in windows) and generate stack effect (temperature differences makes air rise). Natural ventilation is an energy efficient, silent and economic solution. The disadvantages are that it is hard to provide heat exchange, guarantee comfort and is often assisted or complemented with mechanical ventilation (Kumar, 2011).

## SYSTEM SKETCH

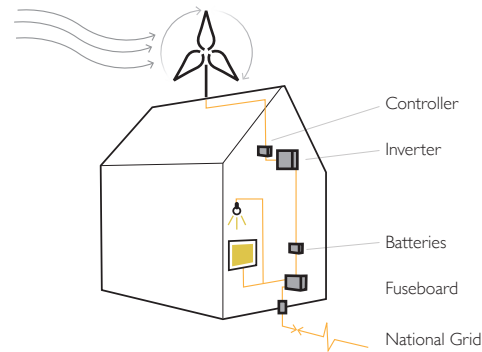


Fig. 22 Energy production, wind  
(Based on Östlund 2014, page 80)

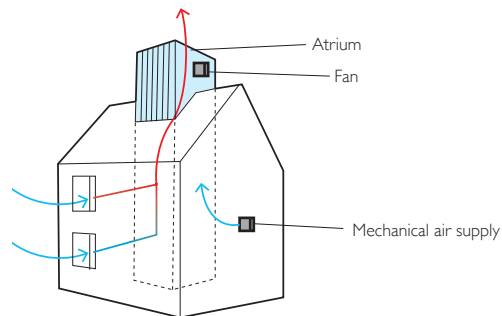


Fig. 23 Natural ventilation  
Based on Kumar, 2011.

## POSSIBLE SOLUTIONS



# WATER



The water that is used for flushing in toilets is often drinkable water. If rainwater were used instead one would save much energy and resources from the cleaning processes in the water power plant.

**Rainwater** can be collected from roofs and be stored in tanks which later can be used as sanitary water (toilets) or irrigation. If rainwater should be used as drinking water it must go through multiple processes (filters etc.) (Gyllensvärd 2009).

**Grey water** and **black water** can be clean by biological purification systems (living machine). This process uses nutrients in the water for biomass production. After the process the water is clean and can be used as sanitation water. The process requires multiple water tanks that are situated inside and outside (The looper 2013).

Additionally, water can contribute to cooling in hot climates and the sound of pouring water can generate a sense of well being.

## SYSTEM SKETCH

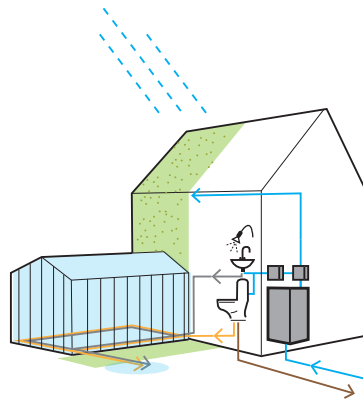


Fig. 24: Water system  
(Based on Östlund 2014, page 80)

## POSSIBLE SOLUTIONS



Picture 30: Living machine



Picture 31: The Loop (not constructed)



# NATURE



Materials and components in buildings should be defined in the biological or the technological cycle. **Reused, recycled or repaired material** is more sustainable to use than materials extracted from virgin materials. Another aspect is that the **materials should not be harmful or be unhealthy** for humans or nature while they are manufactured, used or disposed. The market for ecological solutions is increasing. Some examples are recycled concrete, steel or insulation materials made of waste products (cellulose insulation made of old newspapers). By using **locally produced materials** and skills one can reduce transportation and strengthen local communities (S.L. Cantor, 2008).

Greenery can be integrated in buildings both externally and internally. Internal greenery can be implemented through green walls, farming (greenhouse) or for water purification reasons. Indoor greenery contributes to a more healthy indoor climate as well as it affecting human senses and contributing to **well being**. External greenery can be implemented through **green walls, green roofs and urban farming**. It contributes to biodiversity and generates nutrients for humans and animals. Integration of greenery in architecture also has aesthetic qualities as it changes with seasons (ibid.).

Additionally, greenery absorbs rainwater (green roofs absorb 65-100% during dry periods and 10-35% during wet periods), has insulation qualities and could work as noise reducing. The location has a crucial role in determining what resources and systems are suitable (ibid.).

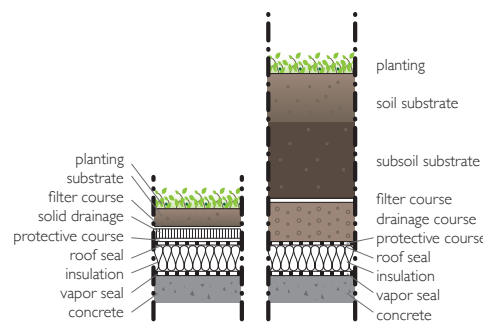


Fig 25: Examples of green roof systems (based on Zimmermann, 2009)

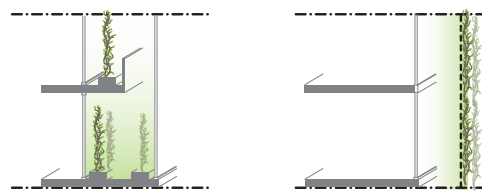


Fig 26: Example of green facade systems (based on Perini et al., 2011)

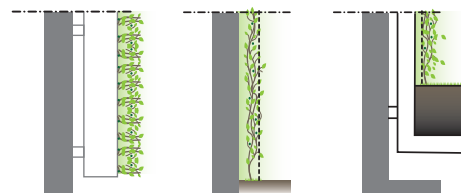


Fig 27: Example of green wall systems (based on Perini et al., 2011)

## POSSIBLE SOLUTIONS





Nature can provide buildings with heating and cooling solutions.

**Geo-thermal heating** is based upon using the constant temperatures in the earth to provide cooling and heating. Pipes with liquid or air are placed in the ground, which cool during summertime and warm during winter (Frick & Hedenmark, 2016).

**Biomass burning** and **district heating** is based on the method of burning biomass materials. A small-scale solution would be a fireplace. It is convenient if the warmth can be collected for later use by using passive heat storage. The heat can be stored in materials with a high thermal inertia (stone, concrete, bricks).

**Compost water heating** is another heating solution which uses the extracted heat produced from the biological process in composting or fermentation of organic products. By letting water pipes run through the compost, a building can be provided with hot water.

## SYSTEM SKETCH

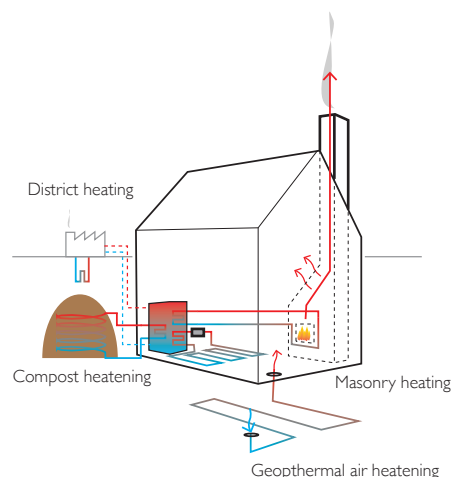


Fig. 28: Heating system  
(Based on Östlund 2014, page 80)

## POSSIBLE SOLUTIONS



# EXAMPLES

## CONCEPT OF NATURHUS

Another interpretation of cyclic thinking in the built environment is the concept of Naturhus (nature house) which Bengt Warne introduced in the book *På acacias villkor*, 1993. The concept has a strong social-ecological perspective and the building coexists with nature and uses its cyclic systems as inspiration for technical solutions. The **greenhouse** has become a significant building component as it captures nature's ecosystem in a micro format. As in permaculture, the Naturhus concept brings people closer to nature and enables them to be part of nature's processes which gives a deeper understanding of the building's systems. Warne's theory is strongly connected to human well being as the greenhouse provides a Mediterranean indoor climate (Warne 1993).

## NATURHUSSIKHALL, VÄNERSBORG

Anders Solvarm and his family live in a house which is adapted to the concept of Naturhus. A small timber cottage (made of local timber) is located inside a glasshouse. This creates a sub tropic climate on the inside which is optimal for farming. The gardens within the house receive nutrients through a **grey water system** and **composting**. A **masonry heater** keeps the cottage warm during winter. Additionally, an underground pipe uses **geothermal heating** for cooling (summertime) and heating (wintertime) the incoming fresh air. The greenhouse provides warmth daytime due to the greenhouse effect. Heat generated during the day is retained within the living quarters during night (Emulsionen, 2016).



- Natural ventilation
- Wind turbines



- Design with daylight
- Solar panels
- Solar thermal collectors



- Gray water cleaning system
- Rain water collecting system



- Green roofs
- Local materials (healthy)
- Biomass production
- Reusable/recyclable materials
- Pre-heating system



Picture 38: Naturhus Sikkhall exterior



Picture 39: Naturhus Sikkhall interior



## EKOPARK, STRÖMSTAD

The Ekopark consists of the ecological house with an interactive exhibition, a nature trail, recycling central and water treatment plant. The architecture is part of the exhibition as it provides information and showcases ecological solutions through **honesty windows**. The technical solutions are visible for the user which contributes to a deeper understanding of the systems and how the building coexists with nature. Visitors are offered dialogue and practical (hands on) activities where they can test the gained knowledge. The focus areas of the Ekopark are sustainable energy production, transportation, food (transport and ecology), water treatment and waste management (lifestyle). The building is mainly made of locally produced material.



Picture 42: Exterior Ekopark Strömstad a



Picture 41: Exterior Ekopark Strömstad b



Picture 42: Honesty Windows Ekopark Strömstad



Picture 43: Honesty Windows Ekopark Strömstad



- Natural ventilation
- Wind turbine



- Solar panels
- Solar thermal collectors



- Rain water collecting system



- Green roofs
- Ecological healthy materials

## KVERNHUSET UNGDOMSSKOLE, FREDRIKSTAD NORWAY

The vision was to build a school based on renewable resources and at the same time, work as a **learning tool** for sustainable development (through its architecture). The strategy used to achieve this was to reveal and **showcase technical and ecological solutions** for learning purposes instead of hiding them. The building uses very little energy as it works with daylight harvesting. The building only uses natural ventilation.

The school had a **holistic approach** from the beginning and focused on what local resources could be used (timber, stone, reused brick, green roofs). The spatial configuration is flexible for hosting various kinds of activities during different times of the day as it also works as a community centre (Anda, 2012).



- Natural ventilation (hybrid)



- Daylight atrium
- Solar panels



- Gray water cleaning system



- Green roofs
- Local materials (healthy)
- Biomass production
- District heating
- Reusable materials



## BRÅTA PAVILION, HÄRRYDA

Bråta is a recycling centre in Härryda municipality. A new pavilion is planned to be added to Bråta, which has a strong focus on education and social activities connected to reuse. The aim is to encourage visitors to **rethink their relationship to products and waste**. The project is divided into two phases; the first is about building a collection hall for reusable materials from reusable materials and the second is to build a multi functional space for activities regarding sustainable resource management and cyclical thinking. The Bråta pavilion took departure in the report *Bråta Paviljongen; ett varv till*, which was a combination of the Chalmers studio *Sustainable building design* and Härryda's objectives for Bråta's future. Many of the presented strategies and design solutions have a strong cyclical, ecological and pedagogical approach (Östlund, 2014).



BRÅTA  
PAVILJONGEN

Picture 48: Logo Bråta



- Natural Ventilation
- Wind turbines



- Design with daylight
- Solar panels
- Solar thermal collectors



- Gray water cleaning system
- Rain water collecting system



- Green roofs
- Local materials (healthy)
- Biomass production
- Reusable/recyclable materials
- Pre-heating system

# CONCEPT & PROGRAM

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*In this section, the knowledge gained from previous chapters will be condensed into the Returum concept. The intention is to define a design framework, location strategy, program and design strategy for a future knowledge and activity centre regarding cyclical resource management in Vänersborg, Returum.*

Returum Concept:

- Manifesto
- Design Framework
- Program & Design Strategy
- Location Strategy
- Organizational Strategy



## WHAT?

Throughout this thesis a concept of a physical meeting place has grown stronger which focuses on education and activities regarding cyclical thinking and resource management. This centre (arena) and network of agents who make this possible is called Returum.

## HOW?

The concept of Returum is developed based on the gained information in previous chapters, where the Waste Management Department and other relevant agents and their activities have been investigated. Knowledge from studying precedents and how others have done before in similar projects have contributed to the development of Returum concept.

## DESIGN FRAMEWORK

This consists of objectives to which Returum should strive towards regarding organization, program and building design.

## PROGRAM & DESIGN STRATEGY

The program describes the features that should be included in Returum in order to support the framework. Later, the functions are explained more in detail, how they support each other and contribute to Returum.

## LOCATION STRATEGY

The Location Strategy investigates the most suitable location for placing Returum in Vänersborg city.

## ORGANIZATIONAL STRATEGY

A network of agents and other aspects regarding Returum organization.



# MANIFESTO

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## RETURUM MANIFESTO



*Imagine a place where people can come and realize projects that they have thought about for a long time but did not have the time, tools, space or knowledge. A place where products and waste can get an extended or second life through activities regarding reparation, recycling, redesign, upcycling and reuse. Connected to these activities are exhibition spaces, food, urban farming, arts and crafts and other cultural activities. People with different backgrounds can come together here to learn, cooperate and create new ideas. A hub where a sense of community, sharing and collaboration contributes to a more robust local society and closes the loops of resources. This place is called Returum!*

# DESIGN FRAMEWORK

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The design framework consists of a number of conceptual aspects which have been condensed out of studied theories about cyclical product and waste management.

These concepts aim to work as objectives on a comprehensive level which one should strive to work towards in order to become more sustainable regarding resource management.

Additionally, it strives to generate a new approach to waste and products. It works as the core of the organization and design as well as it aims to create a direction for a physical meeting place.

## RETURNUM DESIGN FRAMEWORK

### TECHNOLOGICAL & BIOLOGICAL WASTE

The waste management should strive to work circularly and include upcycling. Biological and technological waste should be treated in two separated systems.

### MULTIPLE BENEFITS & NEW NETWORKS

Encourage new partnerships and entrepreneurship with a focus on a circular economy in order to strengthen local communities. Strive to create win-win situations where activities are multifunctional and support each other. Everything has several benefits including social and economic aspects. By emphasizing circular thinking with a strong focus on collaboration and sharing, synergy effects will occur and contribute to a more robust community.

### ENCOURAGE SHORT CIRCUITS

Collaborative consumption and reuse have a crucial role in the transition towards more sustainable resource management as it reduces the amount of waste and encourages product life extension. Additionally it can contribute to alternative value systems and bring positive side effects.

### ARTS, REDESIGN & UPCYCLING

Through promoting upcycling one can give products a new and better value. Returnum should strive towards the approach waste=food in order to create a positive approach to waste and innovative ideas. Activities regarding upcycling, arts and crafts can have social aspects as well as economic.

### INFORMATION, EDUCATION & SUPPORT

To reduce waste and encourage more sustainable and circular lifestyles one has to provide society with the right infrastructure. Residents need knowledge and encouragement to change their habits and arenas for this purpose will play an important role in the future. People need to see that everyone is valuable and can do something in order to create a more sustainable society.

### ENHANCE THE OVERLAP

Participants should be offered the opportunity to be part of the treatment process in order to achieve a new relationship to waste and products. By confronting waste, a new relationship and understanding of products can occur as well as it can result in knowledge transfer.

# DESIGN STRATEGY

---

Returum Design Strategy consists of concepts which strive to create a direction for the design of the centre.

It is important that visitors understand their own role in a system where waste is seen as a resource and how to improve their own product management.

## RETURUM DESIGN STRATEGY

### OPEN & INVITING



Returum has clear entrances and works to be transparent regarding the activities inside and the relationship between inside and outside. Visitors can easily drop by and as it encourages spontaneous visits (both long and short). The activities can spill outside and support everyday life.

### OVERLAPPING ACTIVITIES



Returum offers multiple activities which overlap and run parallel. This creates positive friction and contributes to a vivid centre. In this meeting, synergistic effects can occur and contribute to enrich the activities. It should be easy to interact with the activities and offer the visitor a stage wise introduction. The level of participation can be chosen based on the visitors' wishes.

### SHOW THE POTENTIAL IN WASTE



Visitors at Returum can explore the possibilities in cyclical thinking and resource management as it is integrated into the design of the centre. The building itself should, if possible, work as an exhibition in order to raise awareness and question the value of waste and products (materials, spatiality, atmosphere, activities). Returum is designed in a pedagogical and ecological way and is preferably located in an existing building (reuse).

### OFFER ALTERNATIVES & SUPPORT



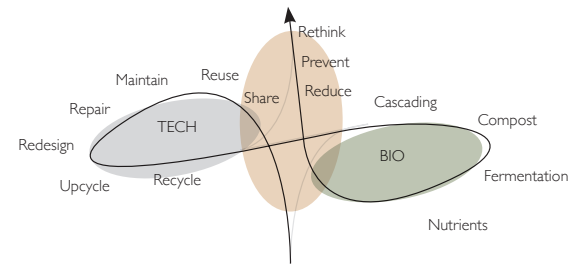
Provide inhabitants and agents the right infrastructure in order to gain knowledge about waste prevention (support, education, activities regarding waste prevention and sustainable resource management).

Returum offers alternatives to throwing things away. By emphasizing circular design, resource loops, offering products as a service, sharing platforms and product life extension (reuse, recover, upcycling, recycle) a new approach to waste and products can occur.

# PROGRAM

Returum consists of three parts: the **Garage**, **Living Room** and **Kitchen Garden**. These metaphors are used in order to categorize the activities in Returum.

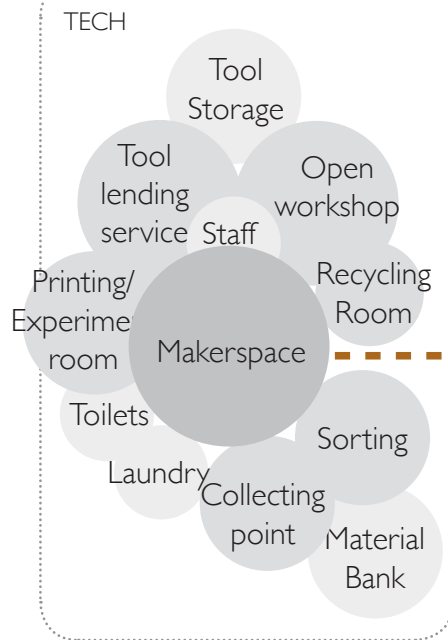
This is an estimated program which is based on experiences from study visits. The sizes of the functions are specified in order to find a suitable location and building for Returum.



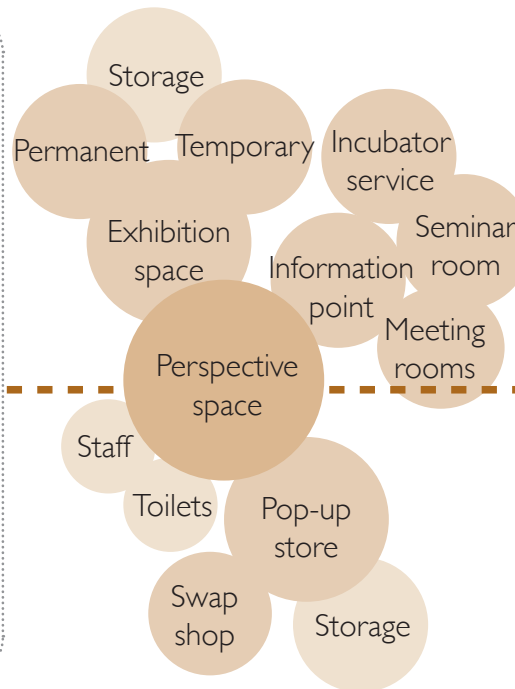
## RETURUM PROGRAM



THE GARAGE



THE LIVING ROOM



THE KITCHEN GARDEN



# PROGRAM: THE GARAGE

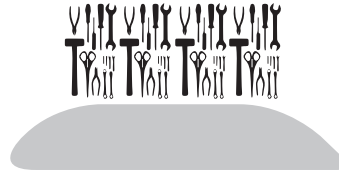
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## KEY FUNCTIONS



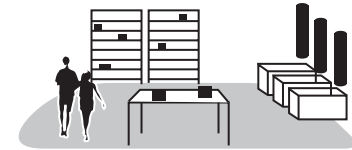
### Makerspace

The makerspace is an open space where different activities take place. Together with the workshop, it is the place where waste and products get an extended or second life. The room is flexible and can be adapted to different activities and events. Schools and AME are frequently users of the space.



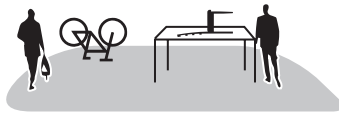
### Tool lending service

The walls are covered with tools and can be hired by visitors. It works in the same way as a library, except that you borrow a tool.



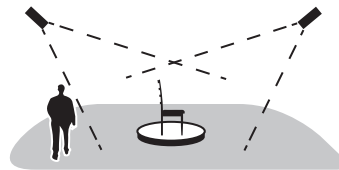
### Collecting & Sorting space

The local community (including local businesses) can deliver certain types of waste and products at Returum. The products generate a material bank for the activities in the makerspace. The material bank also serves schools in the municipality with arts and crafts material. The sorting is managed by school classes (which in the process teaches them about dangerous materials and sorting) and AME (who also transports materials to schools). This project suggests collection of paper, plastic and metal packages for the material bank. Clothes/fabrics will also be collected as well as repairable bulky waste as furnitures, bicycles etc.



### Open Workshop

The workshop is an open feature for all visitors to use. It is not an advanced workshop, more like a “garage workshop”. The walls are covered with tools which can be used in different activities. In order to use the workshop, an introduction course is needed. AME offers product reparation services and transport goods to *Knutpunkten* if they cannot be repaired in Returum.



### Experimenting & Printer rooms

The products that are made in Returum can be further explored with digital equipment in the experimenting room. A 3D printer enables visitors to print repair parts for broken products in order to minimize waste.



## PROPOSED ACTIVITIES

### Garage band concerts

In the evenings the space can be transformed into a rehearsal hall for local music bands. Concerts are also offered and many new stars are born here.

### “Make your own ....”

There are frequently *Make your own...* themed activities in Returum. The most popular ones are *build your own bird box* (which are placed on Returum’s facade), *Make your own paper/notebook* (participants see the whole process of how old paper transforms into new paper) and *Make your own Canvas bag* (by recycled fabrics).

## ESTIMATED SPACE REQUIREMENTS

100-200 m <sup>2</sup>	Workshop space
200 m <sup>2</sup>	Makerspace
50-100 m <sup>2</sup>	Stage/ Lecture space (can be combined with Makerspace)
100-200 m <sup>2</sup>	Collecting, material bank and sorting space
20-50 m <sup>2</sup>	Recycling room
100 m <sup>2</sup>	Experimenting and printing rooms
50 m <sup>2</sup>	Tool lending service (can be combined with Makerspace)
50-100 m <sup>2</sup>	Staff, toilets & laundry
100 m <sup>2</sup>	Technique rooms

Tot. 700-900 m<sup>2</sup>

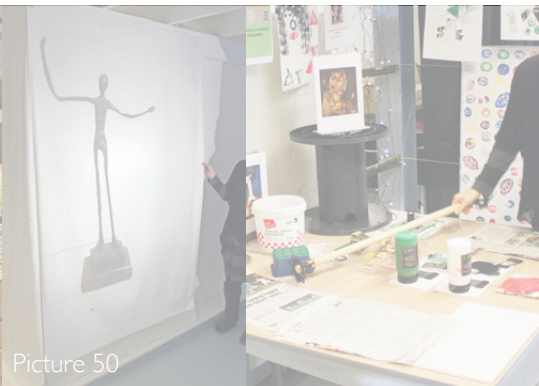
## CHARACTER



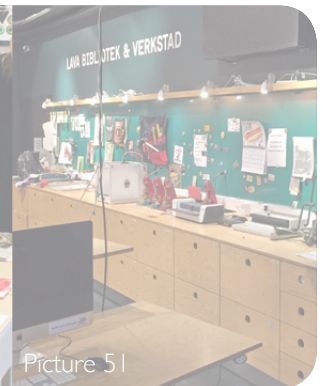
Picture 49



Picture 50



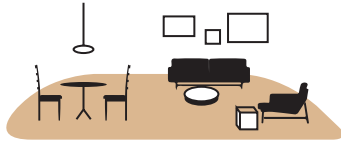
Picture 51



# PROGRAM: THE LIVING ROOM

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## KEY FUNCTIONS



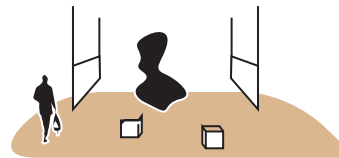
### Perspective space

This space works as an extra living room for the people in Vänersborg. Visitors can go to a lecture, arrange an event, swap/read books/magazines, play piano, use a computer/tablet, meet friends and much more. It is a free non-commercial public meeting place open for all inhabitants. The space is flexible as it can host events as well as other temporary activities. The space can be hired by inhabitants and associations which enables the possibility of activities during evenings and weekends (i.e. workshops, lectures, film screenings, hands-on activities, cultural events, swap-events etc.). The Perspective space is dynamic as it is shaped by users' ideas and opinions. It has an important role as it gives the visitor time and space for individual and group reflection.



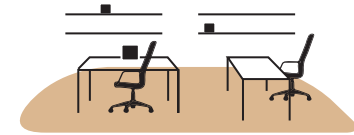
### Swap shop

As visitors get into Returnum they have the opportunity to donate their products to the Swap shop. This is a space where functional products get new owners instead of being thrown away. The swap shop cooperates with local volunteer organizations and associations who frequently collect products at Returnum.



### Exhibition space

Permanent and temporary exhibitions show the potential and importance of cyclical resource management. The space will be used as a showroom for upcycled and redesigned products, to show the visitors the potential of waste and products. The space is extrovert and located where people are circulating. The building itself should strive to work as an exhibition with sustainable and pedagogical solutions that are visible for the users. Honesty windows and visible installations are some examples in how to make this.



### Offices

In Returnum there is office space for the staff, who also work as incubators with support from the Business Development Office. There are also possibilities for people with brave ideas within Returnum's focus areas to rent office space here.



### Pop up-store

Returnum offers the possibility to try a new business within a circular economy. Local artists who want to sell their art or design (created in Returnum) can also rent it. The incubator service supervises and works in close connection with new businesses.

## PROPOSED ACTIVITIES

### In-service courses

Returum offers teachers, businesses and inhabitants courses in sustainable resource management, circular economy etc. The purpose is to accelerate a transition into a more sustainable Vänersborg through knowledge creation actions.

### Swap-events

There are frequently swap-activities in Returum. Once a week the centre turns into one big swap shop and second-hand market. It is sometimes big enough that it spills outside and occupies surrounding streets. Returum's big network of agents make the place vivid all year round.

### Returum fashion shows

Returum invites inhabitants and local businesses to take part in fashion shows, which present creations that have been redesigned in Returum by donated clothes and fabrics.

## ESTIMATED SPACE REQUIREMENTS

200 m <sup>2</sup>	Perspective space
100 m <sup>2</sup>	Exhibition space (permanent & temporary)
10-20 m <sup>2</sup>	Information point
50-100 m <sup>2</sup>	Swap shop & Pop-up store
50 m <sup>2</sup>	Offices
50-100 m <sup>2</sup>	Staff, toilets

Tot. 600-700 m<sup>2</sup>



## CHARACTER



Picture 52

Picture 52



Picture 53



Picture 54

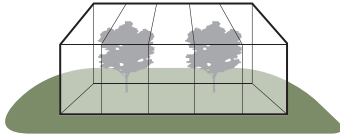


Picture 55

# PROGRAM: THE KITCHEN GARDEN

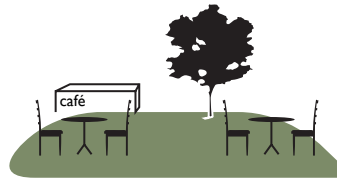
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## KEY FUNCTIONS



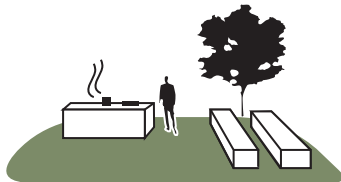
### **Greenhouse**

The greenhouse is a gathering place which has recreational qualities as it offers a Mediterranean climate. As the visitors walk into the greenhouse the biological cycle is manifested through smell, lush greenery, pouring water and a relaxing climate.



### **Ecological café**

The café gives visitors opportunity to eat and drink. It is operated by AME and offers temporary employment for people with special needs. The café can spill out in the urban farming area and the green house. There are opportunities for music, lectures and other events close to the café. Additionally, the kitchen can be rented by visitors and host private parties.



### **Urban farming & Outdoor kitchen**

Farming is an essential part of Returnum as it provides the Ecological Café with vegetables, berries and fruit. It also has a pedagogical purpose as participants can be part of the biological cycle. An outdoor kitchen is connected to the urban farming area and enables visitors to cook the produce on site. Tools can be borrowed for free and visitors can hire parts of the cultivation beds.



## PROPOSED ACTIVITIES

### Multi-cultural dining events & Language café

Food is a part of culture and Returnum could be the perfect arena for integration actions. By offering multi-cultural-themed dining events, visitors can exchange culture and experiences through food.

### Nursery

Study associations and Labour Market Services offer courses at Returnum for people who want to know more about farming, planting and how they can do it at home. Returnum also offers the opportunity for visitors to bring home baby plants and seeds produced at Returnum.

### Farmers Market

The surplus from the urban farm could be sold to local restaurants, nearby schools or inhabitants.

### Food Dairy Factory

Inhabitants can bring fruit from their gardens to Returnum and get help to process the food into products. Labour Market Services could also start a network, based in Returnum, where they help to take care of villa gardens in Vänersborg.

### Food-Waste Courses

Food waste is a big problem and Returnum can offer courses and events in order to raise awareness of the problem and demonstrate solutions.

## ESTIMATED SPACE REQUIREMENTS

100 m <sup>2</sup>	Greenhouse
100-300 m <sup>2</sup>	Urban Farming + Outdoor kitchen
200 m <sup>2</sup>	Ecological Café + kitchen
10-20 m <sup>2</sup>	Storage
10 m <sup>2</sup>	Toilets

**Tot. 500-700 m<sup>2</sup>**

## CHARACTER



Picture 56

Picture 57

Picture 58

Picture 59

Picture 60

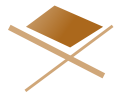
# LOCATION CRITERIA

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Four concepts have been condensed from previous chapters as important aspects to consider regarding the location of Returum. These aspects will be used to find a suitable location for Returum in Vänersborg.

## RETURUM LOCATION STRATEGY

### INTERSECTION



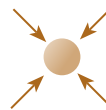
Returum is located where people are circulating in order to increase the possibility for social interactions. Returum's central location contributes to raising awareness and showing the potential in waste and product management.

### VISIBILITY



Returum is distinguishing itself in the urban context, making it easy to find by having clear entrances. Its activities can be visible from the outside and can spill out into the urban space.

### ACCESSIBILITY



Returum is easy to reach by public transportation and contributes to urban life as activities go on during different times of the day. The accessibility for people and goods is essential and it has a well-adapted product flow system accessible by multiple transportation options.

### SUPPORT LOCAL ACTORS



People come to Returum as it is fun, supports everyday life activities and offer additional values. It is about complementing other similar activities rather than competing in order to stimulate a transition.



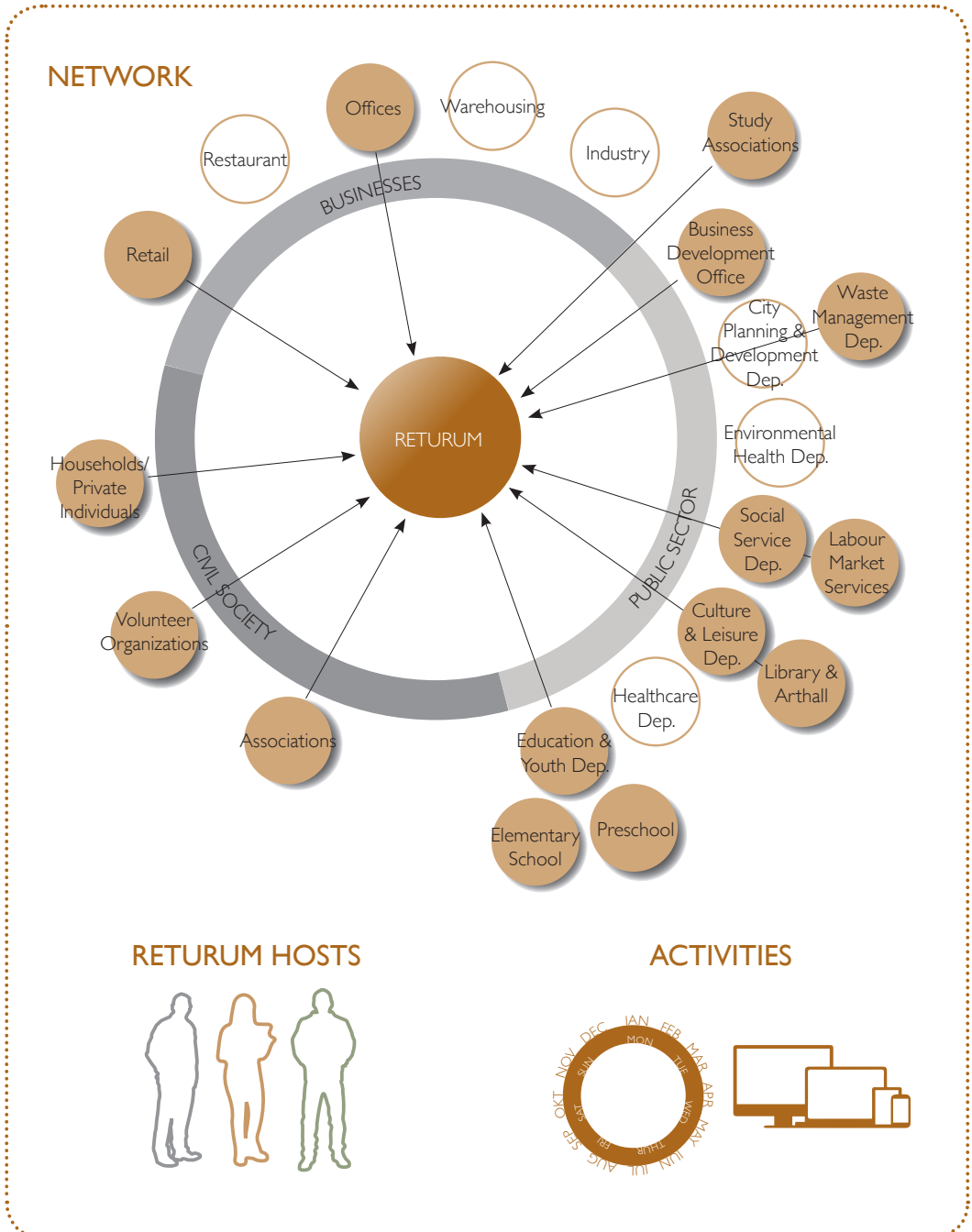
# ORGANIZATION STRATEGY

This organizational strategy presents how different agents (identified in previous chapters) can come together and accelerate the transition into a more sustainable resource management in Vänersborg. By introducing a “hub like” organization based on the theory of *Small-World Network*, a new social network is created which enhances the strength of weak ties.

The Returnum organization could be described as a network between municipal departments in Vänersborg, associations and volunteer groups. Today they work in clusters with only weak ties to each other and the reason for that could be a lack of departmentally collaboration or geographical position. By connecting these agents and their activities through Returnum, Vänersborg municipality could start to work actively with sustainable resource management and promote activities that refer to the top rungs in the Circular ladder.

By mainly focusing on departmentally collaboration within the municipality one can save resources and create synergistic effects. The aim is to start a transition from a linear resource management to a more cyclical one and show the potential and value in products and waste (establish circular economy).

## RETURUM ORGANIZATION STRATEGY



# RETURUM: ORGANIZATION

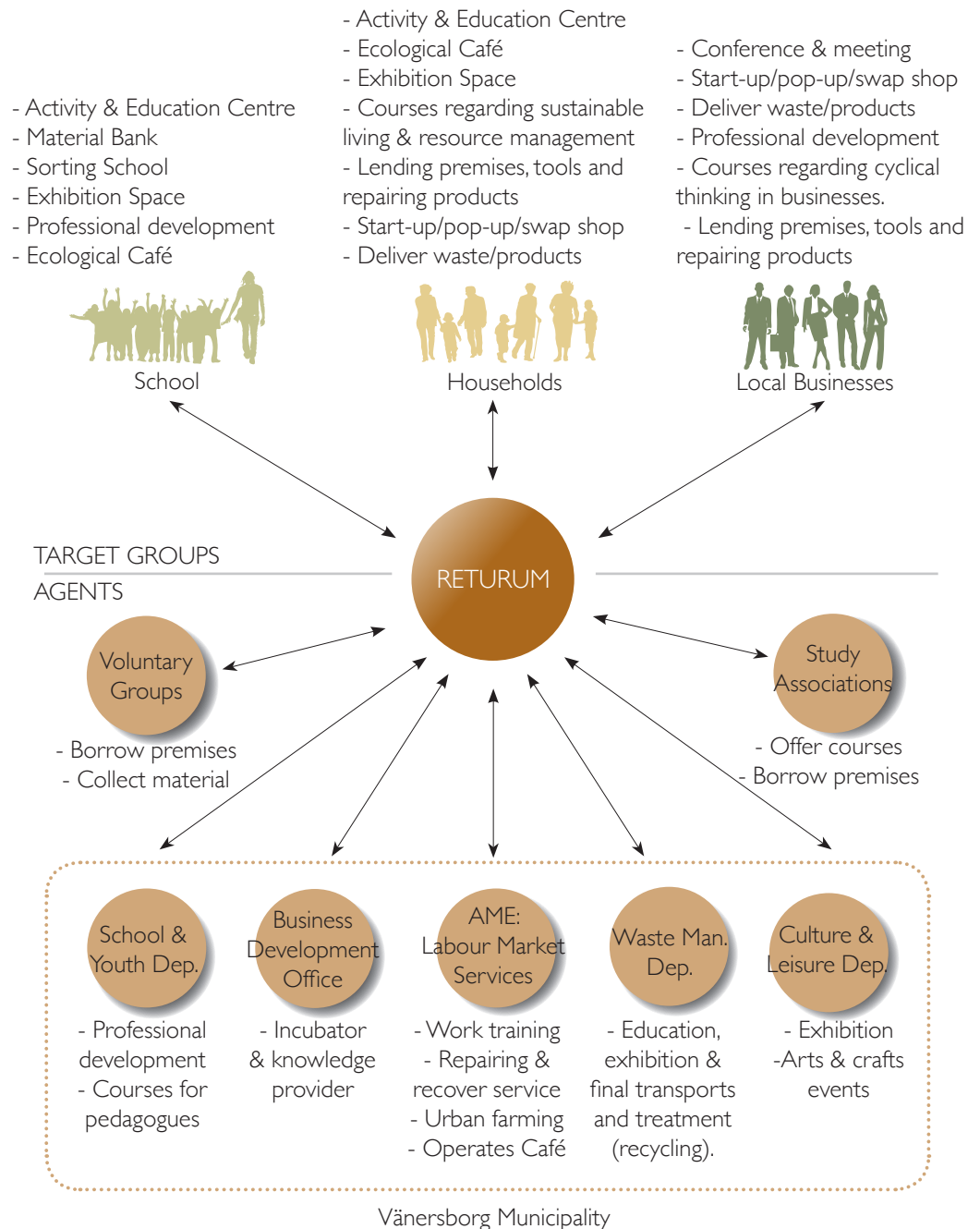
The proposed agents will continue doing their activities at the locations where they are operating today. Returnum shows the potential in connecting the agents and creating a common arena where their activities can pollinate each other and generate synergistic effects. It is about complementing rather than competing with existing agents. Returnum is one among many initiatives that has to be made in order to reach full-scale transition.

Returnum is an open and free meeting place which is characterized by strong user participation. The participants can shape the activities which contributes to a dynamic and constantly changing Returnum. One day is not like the other.

Returnum can possibly be funded by different departments of Vänersborg municipality. Since Returnum is a cross departmentally collaboration the cost can eventually be reduced for each department.

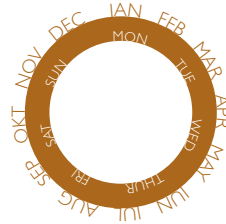
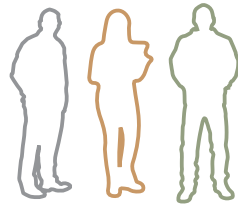
The diagram to the right shows how the agent groups and target groups can gain from each other through Returnum.

## WIN-WIN DIAGRAM



# RETURUM: ORGANIZATION

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## RETURUM HOSTS

The Returum hosts are employed by the municipality of Vänersborg and act as the “spider in the web”. They work as social incubators in order to stimulate the bridging between agent and target groups. Their role is trans-disciplinary as it includes networking with different agents and keeping Returum alive by promoting and offering activities. There is one host on each floor who circulates and supports the visitors. Additionally, there are representatives from the different agent groups in the network. The aim is that they will see Returum as an additional workspace and can work from here a few days a week.

For example, representatives from the Business Development Office can do their work from Returum once a week as it offers activity based office spaces.

## ACTIVITIES

When Returum is closed and the staff go home, Returum opens up again for associations and other organizations as they offer evening activities. Due to the big network of Returum, it offers activities every night, including weekends. It can be workshops, lectures, film screenings, hands-on activities, cultural evenings and much more. These events are free and open for the inhabitants.

Returum becomes an important node for the local community. It is an exciting and dynamic centre which offers a wide spectrum of activities.

### October Fair

Returum can act as a support-arena during big events in the city. The flexible spaces can easily be transformed into fairs, exhibitions and other activities. During the October Fair, school classes occupy Returum and sell products to raise money for future school trips.

## PROMOTION

Returum and its activities can continue during closed hours on social media. It is also a good way to spread information about on-going activities and events.

### Returum App

An app can promote upcoming events in Returum. Through this app, people can make reservations at Returum, book courses and much more. Additionally, it can be developed to become a platform which people can use to get in contact with each other if they need help with something or if they want to offer a service.

# IMPLEMENTATION

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*The concept of Returum will in this chapter be used in order to find a suitable location and building for Returum in Vänersborg.*

- Site Selection
- Building Analysis

## WHAT?

This section focuses on implementing the previously gained knowledge in order to find a location and building for Returum.

## HOW?

The Location Strategy, Program and estimated space requirements work as point of departure for choosing sites.

Three sites have been selected as possible locations for Returum. The aim was to find empty buildings which could be reused. Due to the size of the program, only a few buildings in central Vänersborg fulfilled the requirements. The central location is important for achieving a new understanding and to promote a new approach to waste and products.

## LOCATION STRATEGY



## PROGRAM



# SITE SELECTION



SANDEN- INDUSTRIAL SHED



EDSGATAN- TIMJAN HOUSE



TRENOVA- TRENOVA CENTRE

	✗	- Far away from where people move (industrial area)	✓	- Intense flows of people - Good opportunities for spontaneous meetings	—	- The new shopping center at Trenova attracts people go there (relatively close to the city)
	—	- The site is not connected to the public transport network - No existing urban life - Has product logistics qualities but not accessible for visitors	✓	- Good logistic aspects (for both people and products) - Open and inviting location - Can contribute to urban life as spontaneous visits can occur	—	- Good logistic aspects in regards to people and product flows - Lacking possibilities for spontaneous visits
	✗	- The area is disconnected to the city and dominated by industrial buildings - Does not contribute to urban street life	✓	- Unique building and possibilities to do additions - Easy to find and it has clear entrance (openness) - Activities can spill outside	—	- The area distinguish itself in the urban context - Lacks clear entrances and connection to the city centre - Does not contribute to street life
	✗	- Sanden is disconnected to the target groups but could in future be integrated - Not ideal location for meeting place	✓	- Close to target groups and can support everyday life - Good location in order to support local actors and create a more vivid city center	✓	- Close to target groups and can support everyday life. - Good location in order to support local actors

✓ The Timjan house is the most interesting site as it is located at the heart of consumption, can support actors and contribute to a more vivid and robust city centre.



## CITY CENTRE

### SANDEN INDUSTRIAL AREA

The municipality wants to move the harbour to Vargön which results in empty industrial sheds. The future of these sheds are unsure as the municipality wants to build a new residential area here. No master-plan has yet been made. Premises are over 2000 m<sup>2</sup>.



### EDSGATAN, TIMJAN HOUSE

Edsgatan could be considered as the heart of Vänersborg. The area is mainly dominated by commercial buildings. The Timjan house is an empty warehouse, about 2000 m<sup>2</sup>, and has been empty for several years due to its size.



### TRENOVA INDUSTRY PARK

Trenova Industry Park is interesting as it is central and has a long history of industry (similar to Innovatum Trollhättan). Mainly technical businesses are located here and a galleria was recently built. Premises are over 2000 m<sup>2</sup>.





# BUILDING ANALYSIS: TIMJAN HOUSE

*“Today, the Timjan house gaps empty, like a monument from another time when consumption and linear thinking was the ideal of the modern human.” (The author)*

## KEY FACTS

Name	Timjan 4
Architect	No information found
Owner	Niklasberg Fastigheter
Location	Edsgatan 18, Vänersborg, Sweden
Completion	About 1972
Style	Modernism
Size	About 2300 m <sup>2</sup>
Stories	3 (inc. basement)
Program	Previously retail (empty since 2013)




Picture: Private

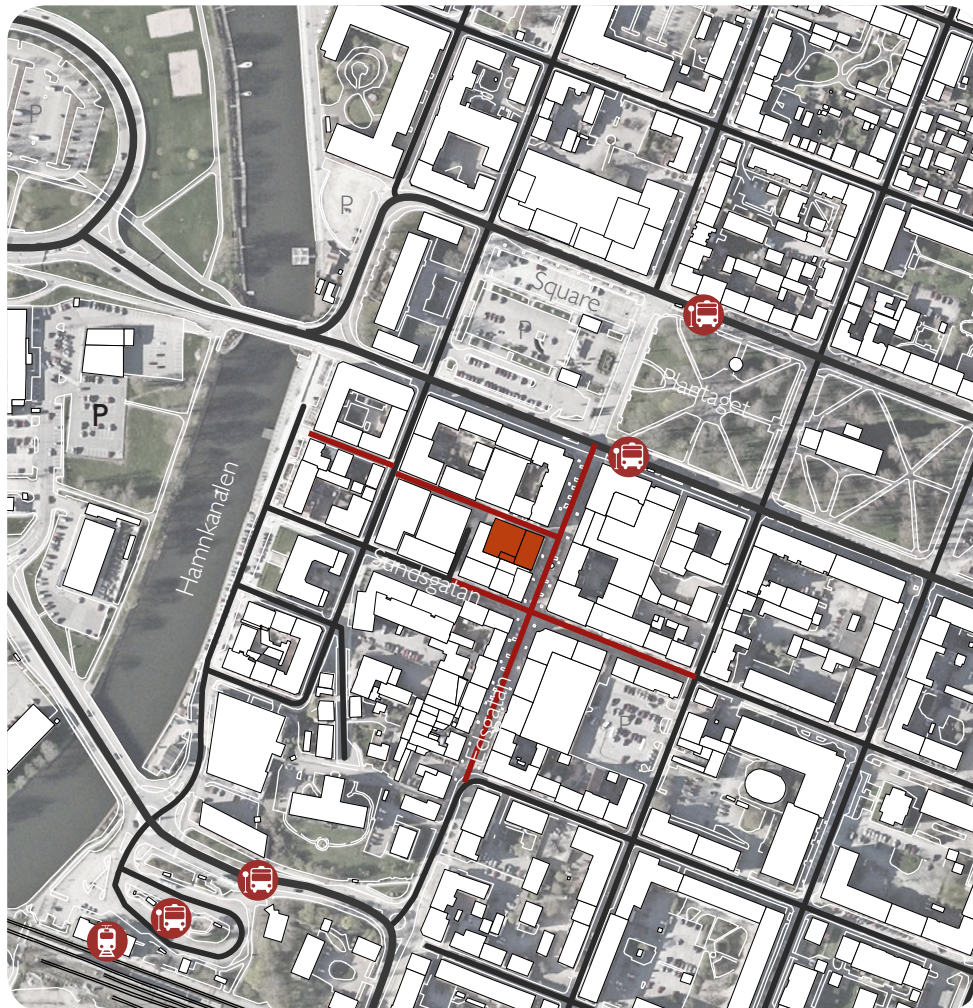


# BUILDING ANALYSIS: CONTEXT



## TRANSPORTATION

-  Cars
-  Pedestrian Area

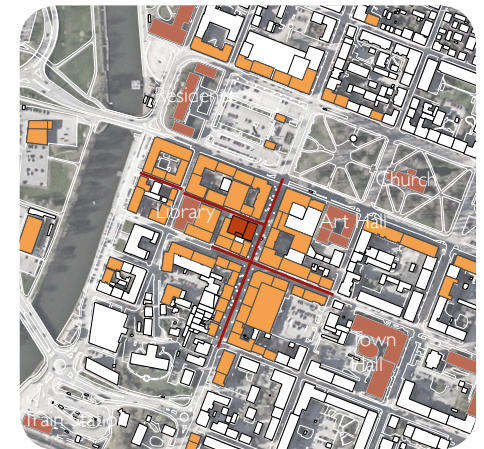
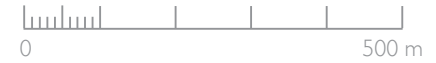
SCALE 1:5000



## MAIN FUNCTIONS

-  Public buildings
-  Mainly commercial

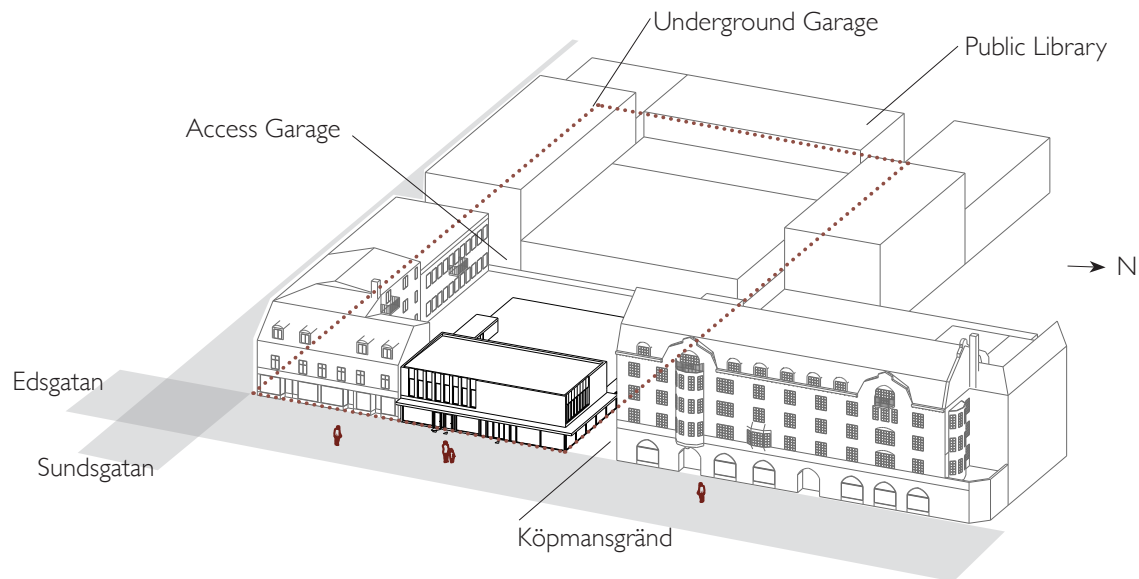
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## GREENERY



# BUILDING ANALYSIS: BACKGROUND



## HISTORY

The modernism has shaped many cities into what they look and work like today. The new modern ideals clashed with the existing urban settlements which resulted in renovation actions that reshaped cities. Roads were widened and old buildings were demolished in order to give space for the new and modern lifestyle which was dominated by car access and consumption. Increased prosperity made people consume more which became the foundation of today's linear consumption pattern. The trend could first be seen in the bigger cities (60s) but was later spread to small towns (70s). The Timjan House was built in 1972, during a period when big stores (i.e. Tempo, Domus and EPA)

started to establish in smaller Swedish city centres. Due to business fusions, mobilization, establishment of shopping centres and other trends, big businesses are no longer interested in establishing in smaller cities.

## PRESENT

The Timjan House has been empty since 2013 and its large size (in contrast to other boutiques) and central location creates a sense of a neglected city centre with a lacking urban life. The owners have proposed to renovate the building and adapt it into a culture centre. The municipality of Vänersborg has agreed upon to investigate the Timjan house as a potential site for a culture house.

## LOCATION

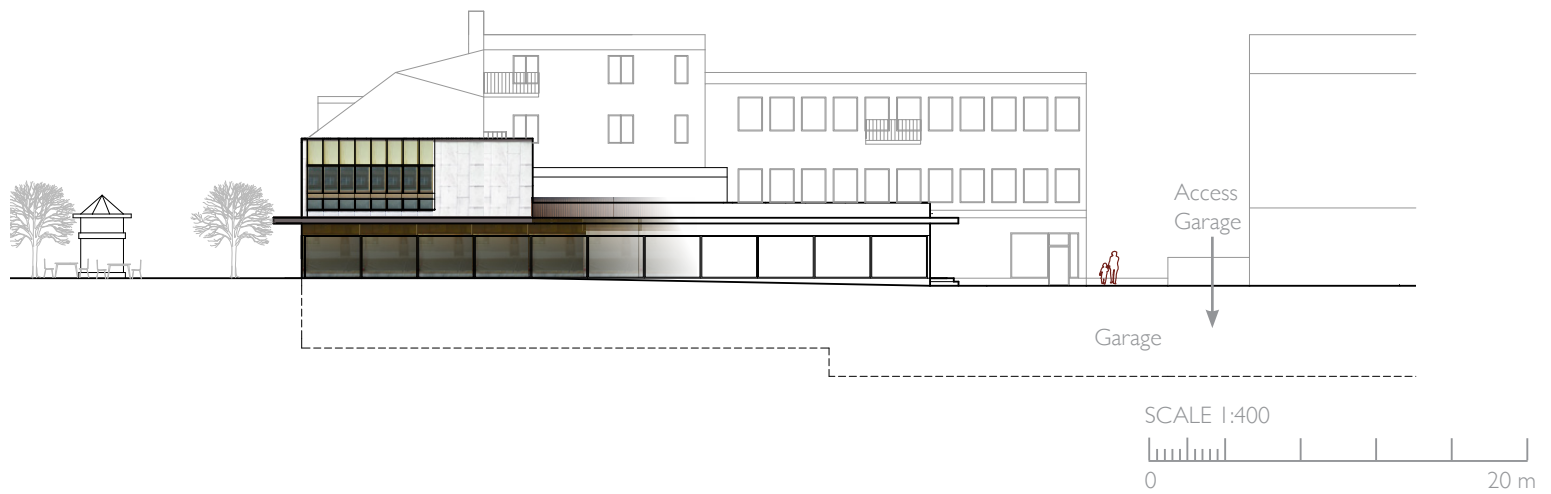
The Timjan House is located at the intersection of Edsgatan and Köpmansgränd. The surrounding streets are a pedestrian area but cars and trucks can still access the streets (only for delivering goods). The Timjan House is privileged with an underground garage which generates good logistic qualities (accessed from Sundsgatan).

# BUILDING ANALYSIS: FACADES

## WEST



## SOUTH





# BUILDING ANALYSIS: CHARACTER

## CHARACTER & MATERIALS

The exterior can be divided into 3 components. The box (1), the window strip (2) and the roof (3).

The Timjan House is characterized by its strong modernism architecture. The post and beam structure generates a flexible interior space and open facade. The box-volume has a rectangular shape and together with the window strip it generates a strong horizontal direction. On the other hand material details and window openings have a vertical direction.

In contrast to similar buildings in Sweden built at this time, the copper details and marble facade feels exclusive and similarities to famous buildings as Alvar Aalto's Finlandia Hall and Säynätsalo town hall group can be found.

White marble



Copper



Copper coloured window frames



Corrugated metal



Glass



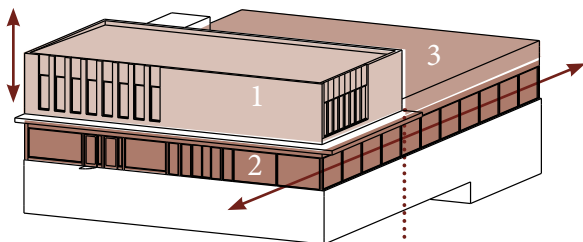
Fig 64: Domus warehouse Karlstad



Fig 65: Alvar Aalto, Säynätsalo town hall group



Fig 66: Alvar Aalto, Finlandia Hall

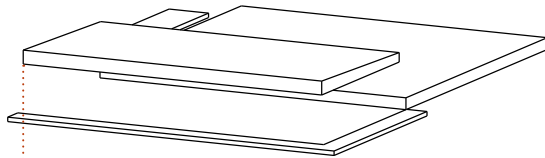
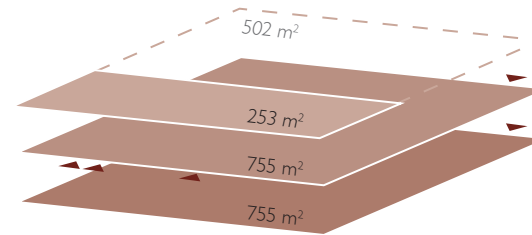
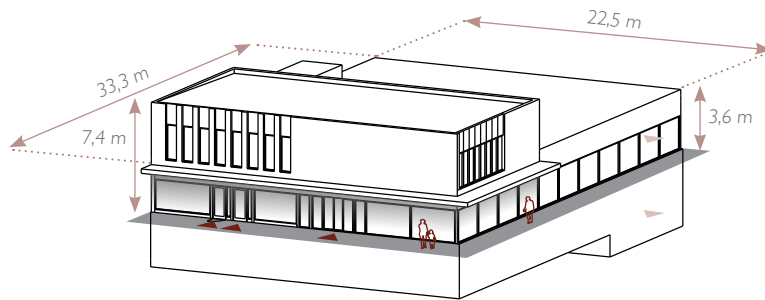


Change of character



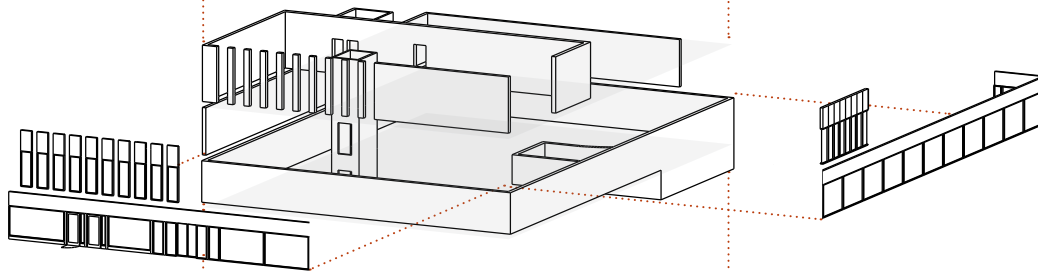


# BUILDING ANALYSIS: STRUCTURAL SYSTEMS



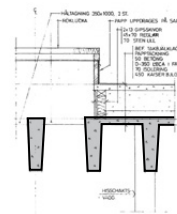
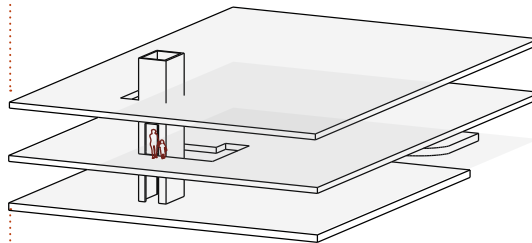
## ROOF STRUCTURE

Flat roof structure with internal storm water run-off.



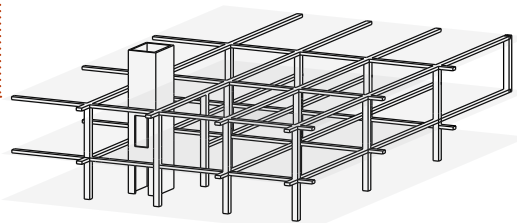
## WALLS & OPENINGS

Structural concrete walls with a curtain wall system.



## SLAB STRUCTURE

450 mm "Kaiser" concrete slab structure.

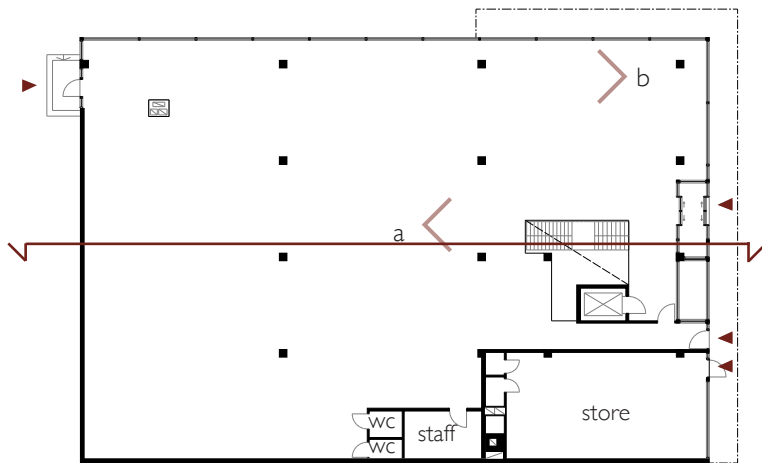


## VERTICAL LOAD STRUCTURE

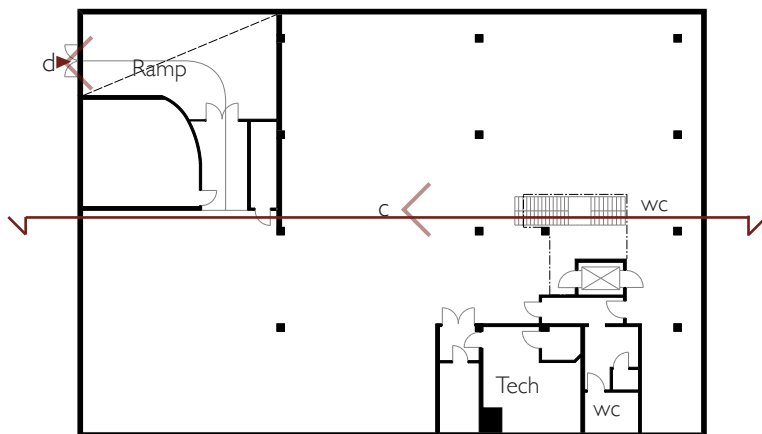
Post and beam structure is integrated in the Kaiser slabs.

# BUILDING ANALYSIS: PLANS

PLAN 0



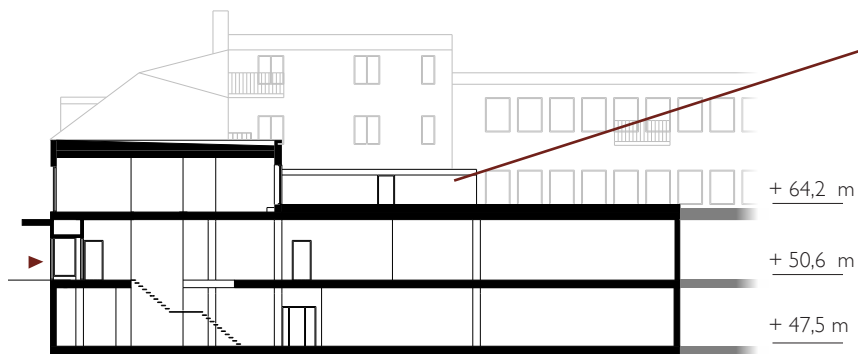
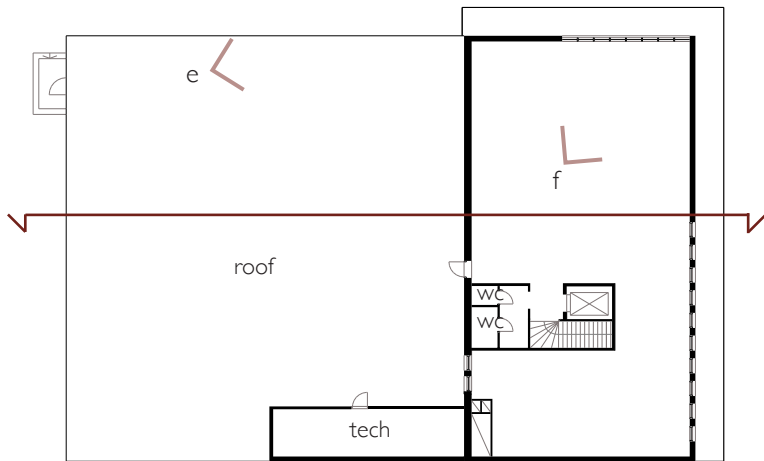
PLAN -1



SCALE 1:400



# BUILDING ANALYSIS: PLANS & SECTION

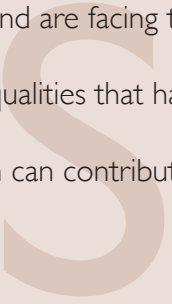



## TECHNICAL SYSTEMS

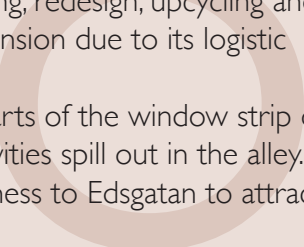
The building uses district heating and has a fully functional mechanical ventilation system. The technical installations are placed on the roof. The empty technical rooms in the basement indicates that there has been a boiler heating system before.


SCALE 1:400



- 
- Flexible floor plans.
  - Underground garage for transporting goods.
  - Fully functioning building with district heating.
  - The open facade makes the building open and inviting.
  - Entrances are visible and are facing the main street Edsgatan.
  - Unique architectural qualities that has to be preserved.
  - Closeness to Edsgatan can contribute to a vivid centre.

- 
- Poor daylight conditions.
  - The alley Köpmansgränd is lacking activities.
  - Lacking visual connection between the floor plans.

- 
- Use the flat roofs for activities as urban farming and use the solar income.
  - The basement is suitable to be used for activities regarding, redesign, upcycling and product life extension due to its logistic qualities.
  - Make some parts of the window strip openable and let activities spill out in the alley.
  - Use the closeness to Edsgatan to attract people.
  - Evening events can activate the city centre during evenings.
  - Complement the existing technical systems with sustainable and pedagogical solutions. This will make the building more resilient.

- 
- There may be a resistance among local businesses and household to place activities that focuses on waste and product management in the centre of the town.
  - Construction capacity of building (in order to have activities on the roof).

# CONCLUSIONS

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The analysis of the building has provided a deeper understanding. The main points from this analysis are:

## RESPECT THE EXISTING BUILDING

The building has architectural qualities that should be preserved. The new design must respect the heritage and build on the existing qualities of the building.

## ACTIVATE THE ALLEY

Köpmansgränd lacks urban life and Returum can with its activities and design contribute to define and activate the alley.

## COMPLEMENT THE EXISTING SYSTEMS

Use natural resources on site in order to complement existing technical systems.

## NEXT STEP

The information from this analysis will together with the Program and Design Strategy from previous chapter be interpreted into a design.



# DESIGN PROPOSAL

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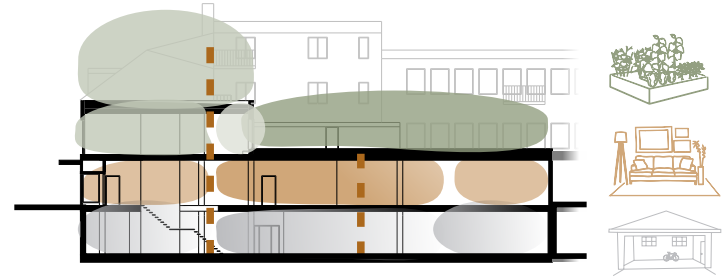
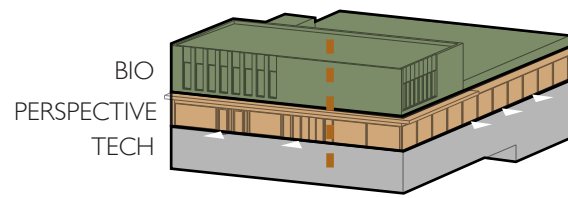
*This chapter presents the design proposal of Returum based on the gained knowledge from previous chapters.*

- Strategy
- The Living Room
- The Garage
- The Kitchen Garden
- Façades
- Sections
- Detail
- System Sketches

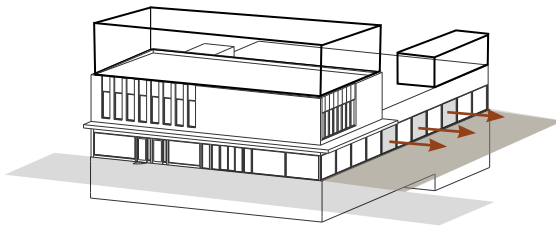
# STRATEGY

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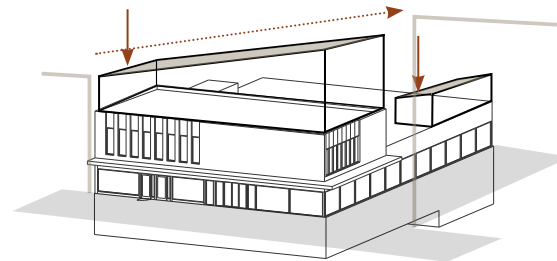
## PROGRAM IMPLEMENTATION



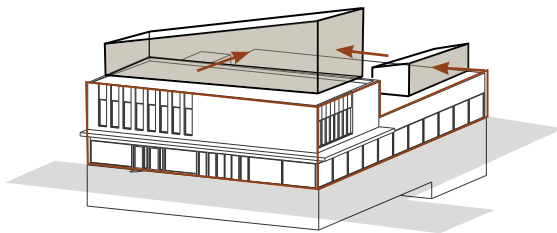
## ACTIVATE ALLEY



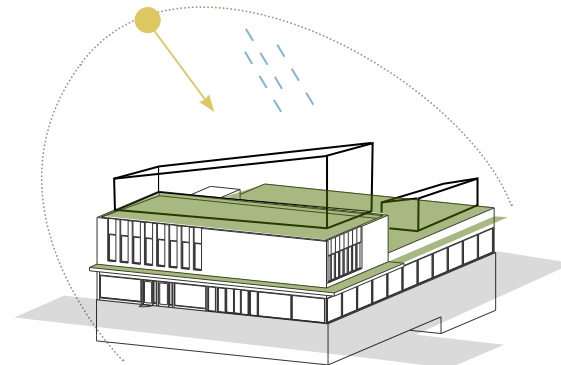
## ADAPT TO TOWNSCAPE



## RESPECT EXISTING BUILDING



## USE LOCAL RESOURCES







„VÄNERSBORG“

# RETURUM

EST.



2016





EXHIBITION

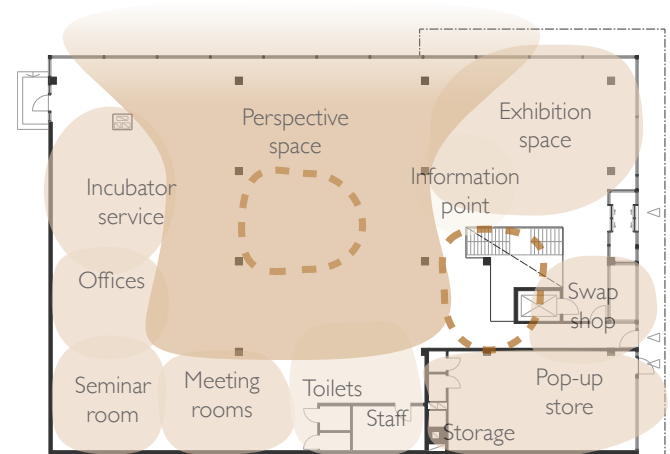
Cosmika  
HERITAGE

2007  
LAWSON  
PUBLICATION



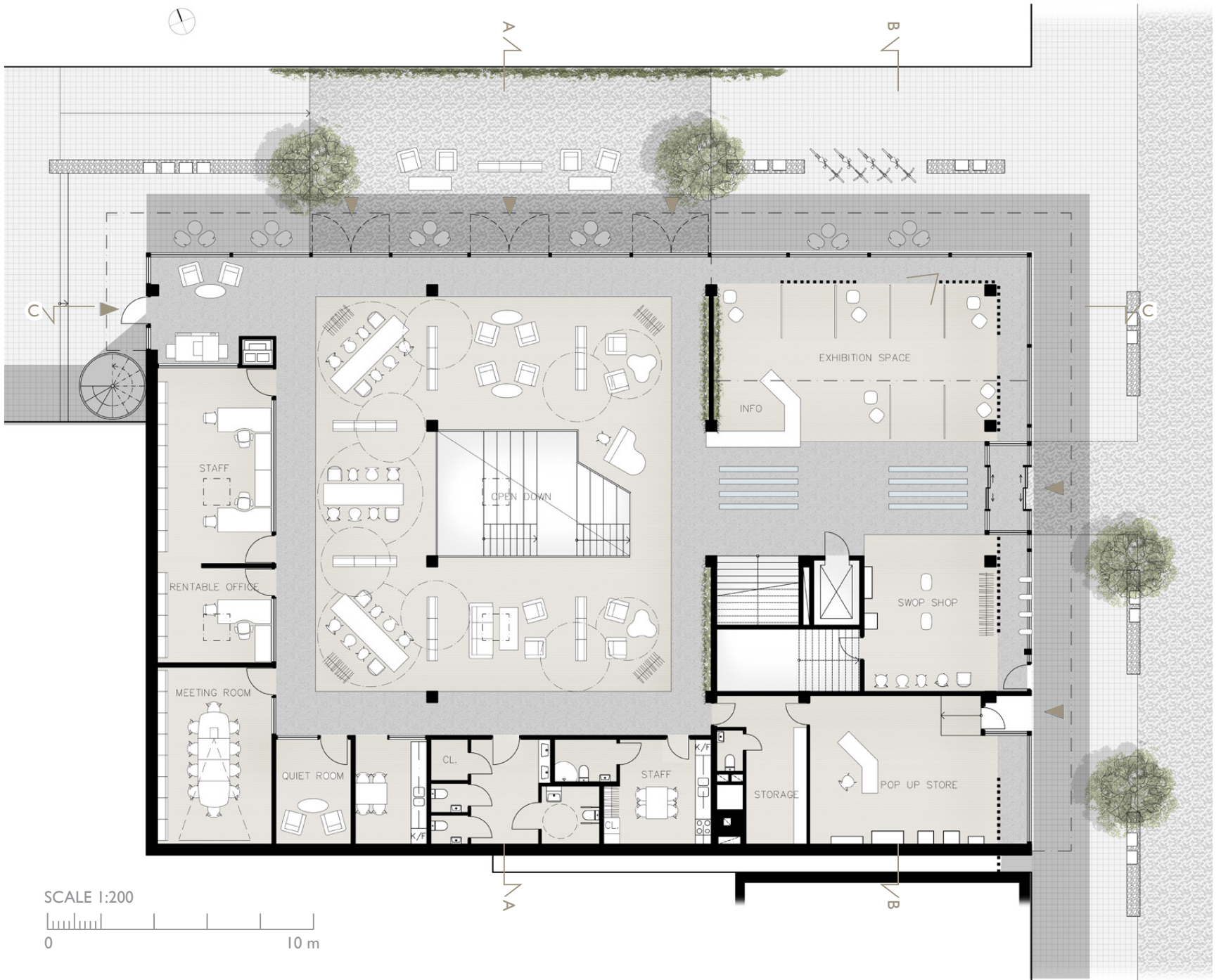
# THE LIVING ROOM

New lights and a new sign mark the entrance of Returnum and make it more welcoming. Functions in the building are defined by shifting floor material (wood is used in areas for socialization while concrete is used for communication spaces). The walls are made of reusable materials (wood, glass bottles and greenery). The furniture are donated or bought at second-hand shops which contribute to a relaxed atmosphere. Creations from the Garage are showcased at different places in the Perspective space.



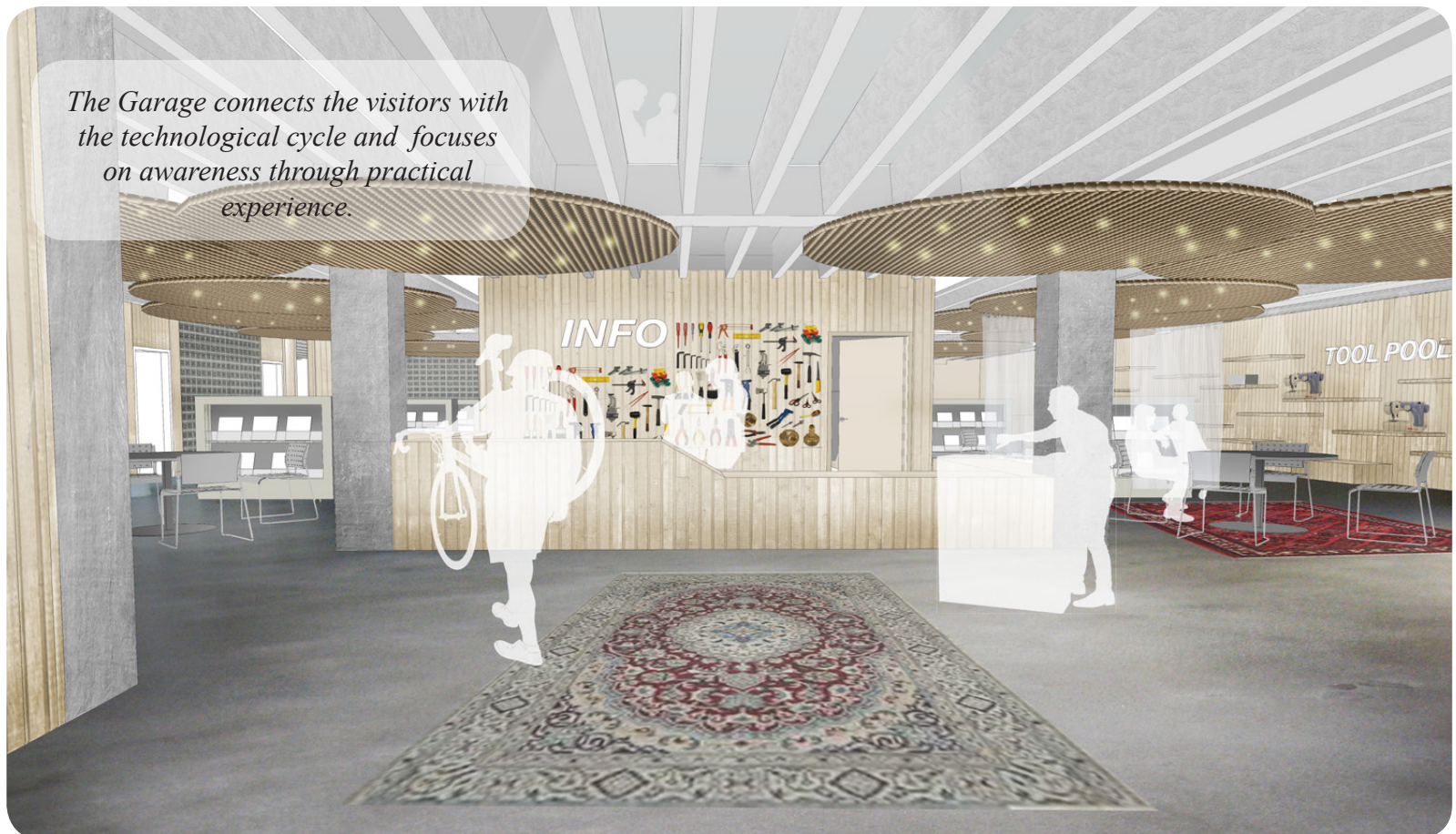
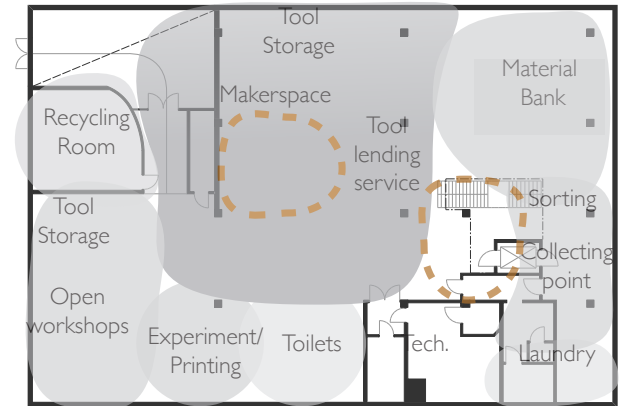


PLAN 0



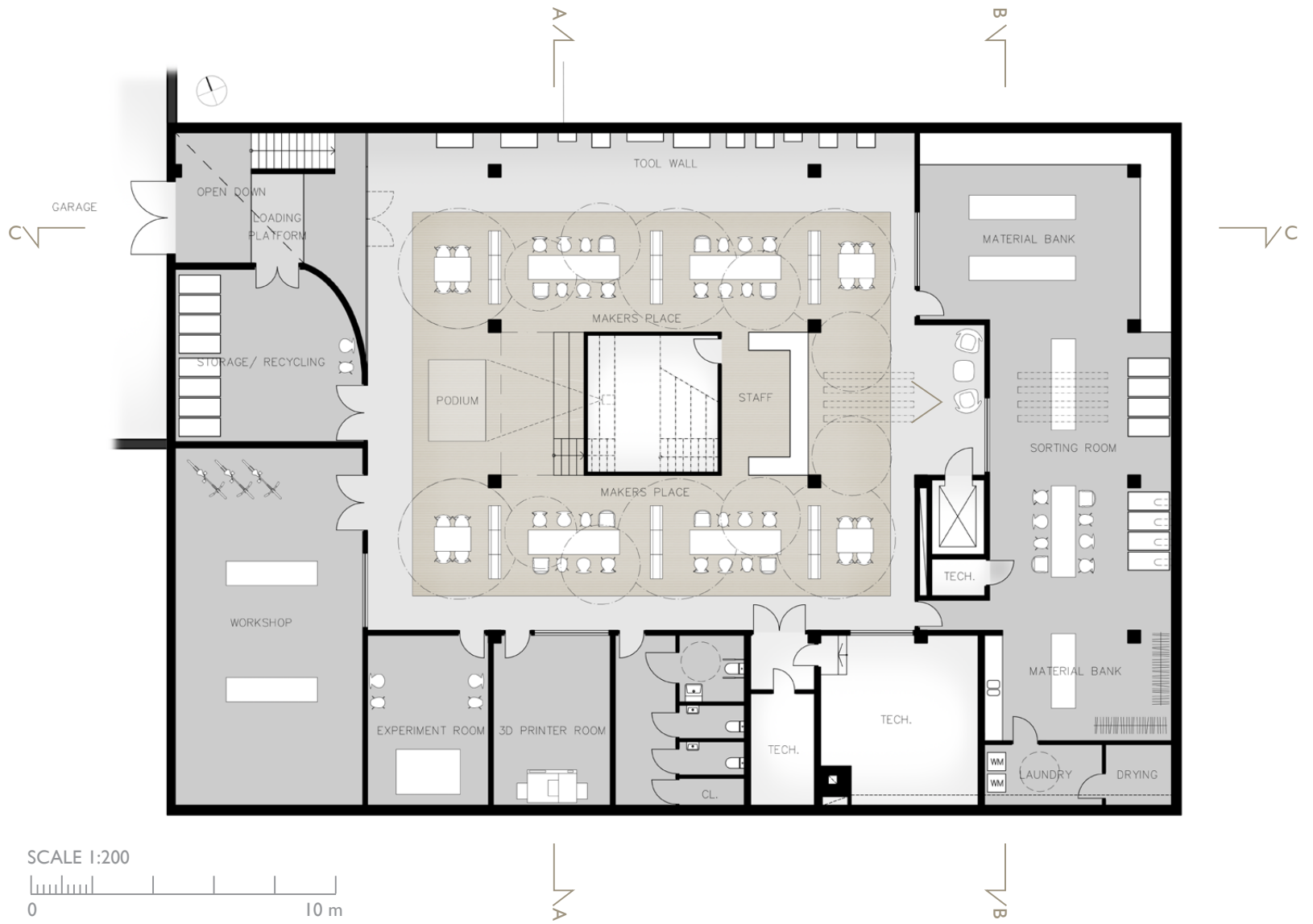
# THE GARAGE

Multiple activities go on in parallel in the Garage. The concrete floor is tolerant for all activities and the walls are covered with wooden panel which can be replaced if needed. The technique rooms are visible and showcase the building's technical solutions. Pipes are visible in the ceiling and "islands" of false ceilings (made of egg-boxes) work as sound absorbers. The stairs work as seats and can be used for lectures.



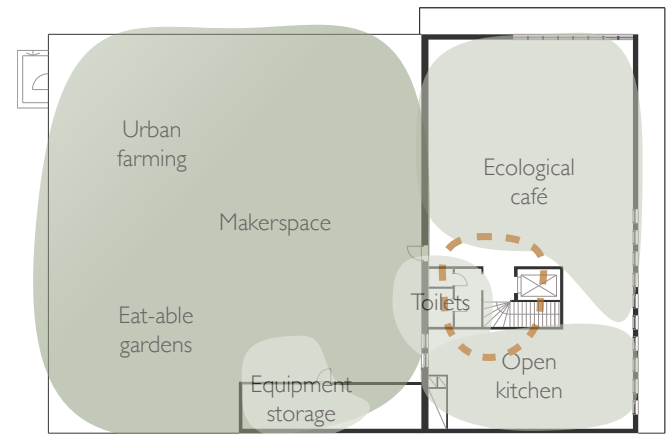


PLAN -I



# THE KITCHEN GARDEN

The ecological café offers locally produced food and drinks. The area can spill out into the urban farming area which is commonly full of activities. The outdoor kitchen is frequently used by visitors who cook the produce from the urban farm. An external stair connects the rooftop gardens with the big green house (plan 2) and works as seating during lectures or outdoor cinema events. The small greenhouse is used as a nursery.

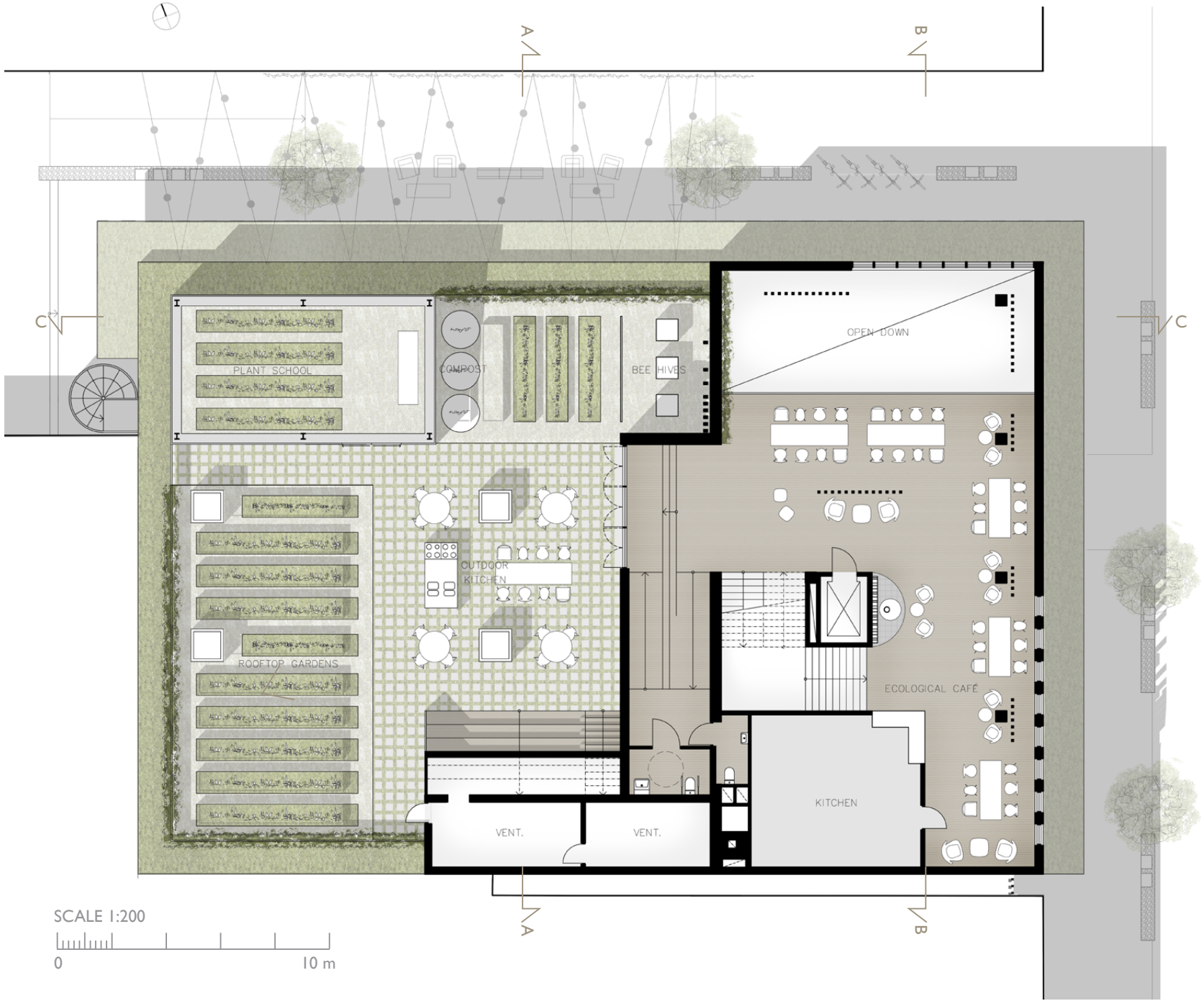


*The Kitchen garden connects the visitors with the biological cycle through activities as urban farming and cooking.*

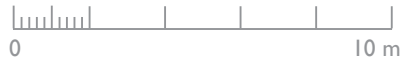




PLAN I



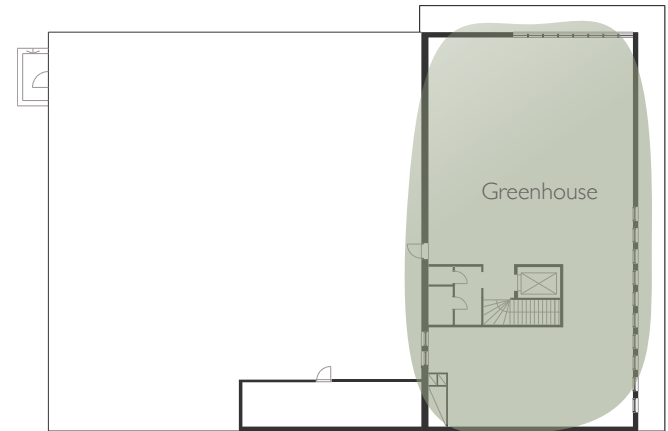
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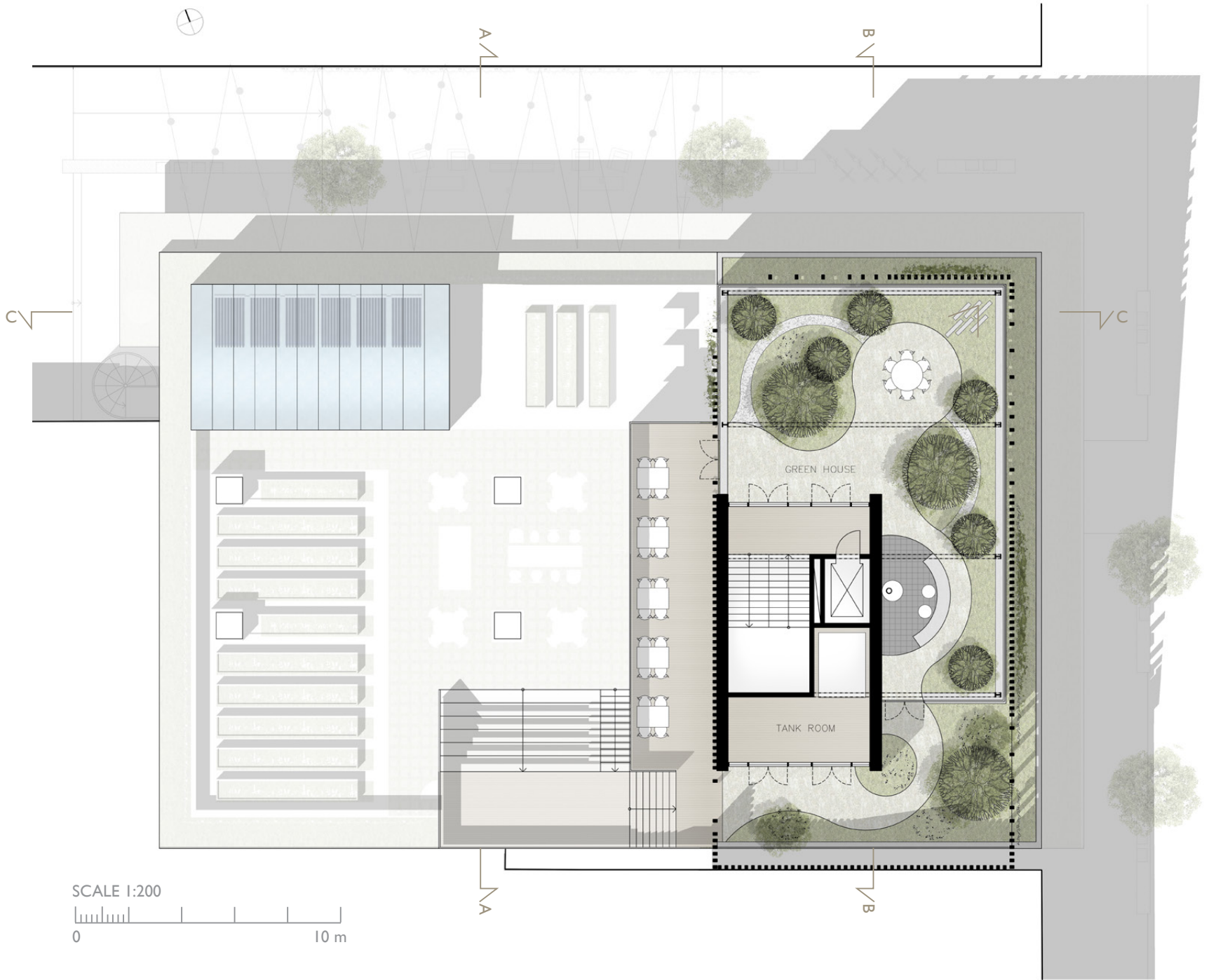


# THE GREENHOUSE

As visitors walk into the greenhouse they meet lush greenery, hear pouring water and feel the warmth which generates a sense of peace. There are hidden paths among the plants and plenty of places to sit. Visitors enjoy the evening sun from the terrace which also can be used for seating when projecting movies on the neighbour house's facade. The tank room is used for round tours in the building and digital displays explain the technical systems in a pedagogical way.



PLAN 2



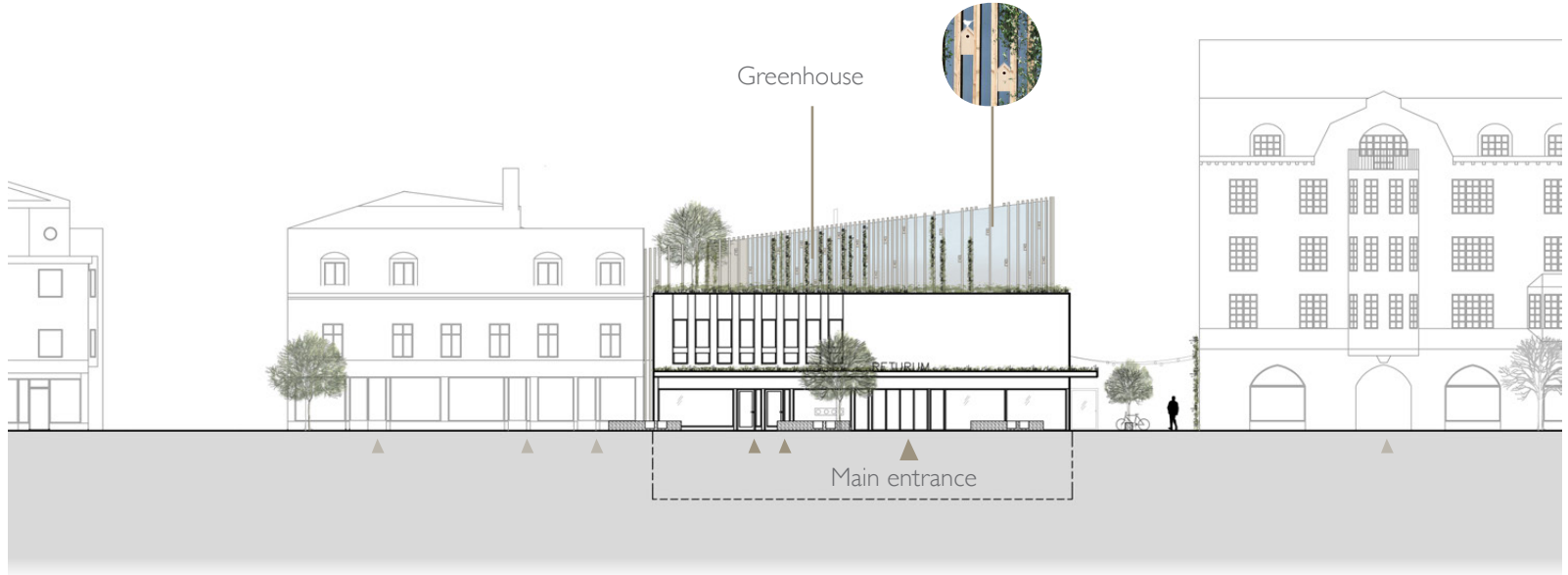
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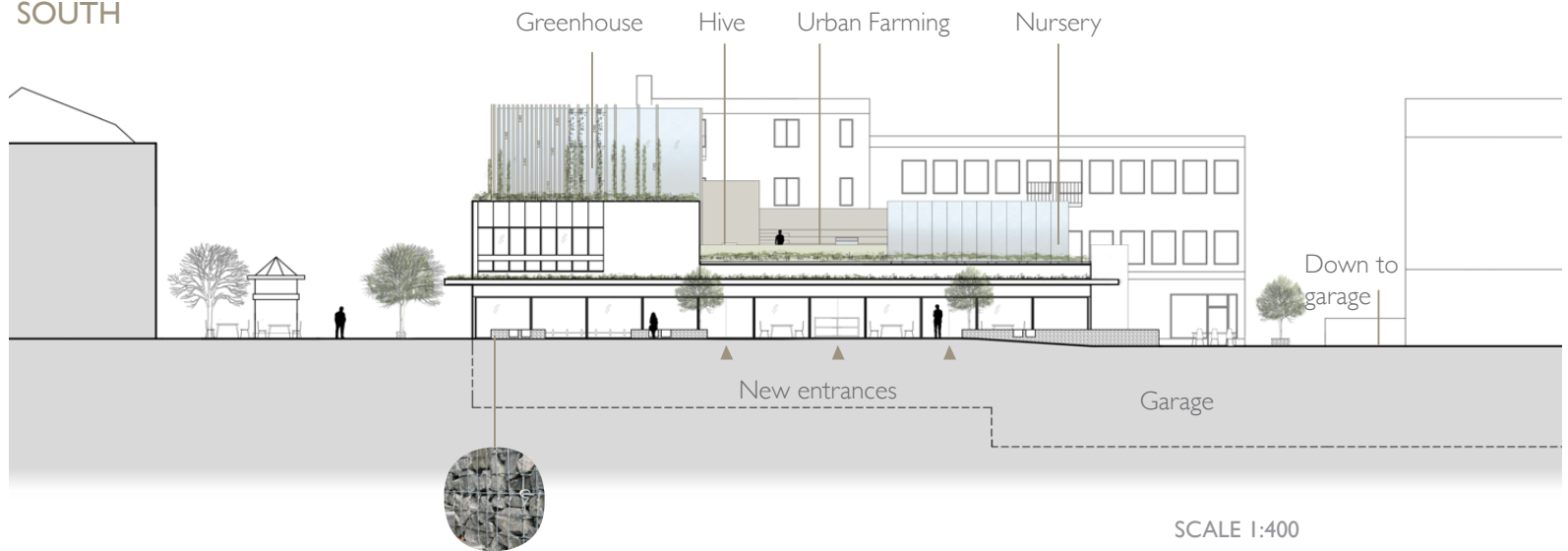


# FACADES

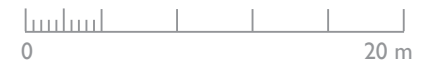
WEST



SOUTH

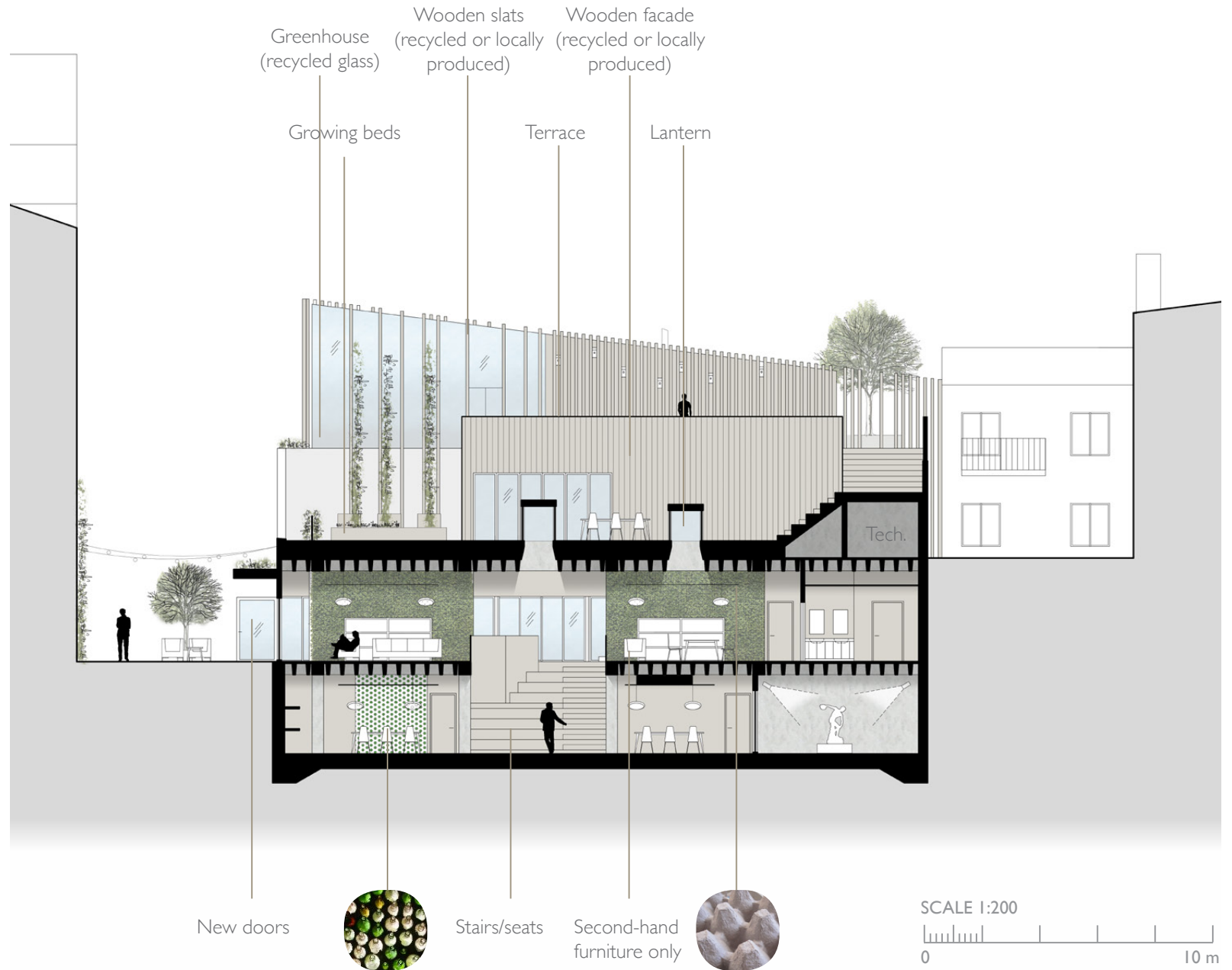


SCALE 1:400



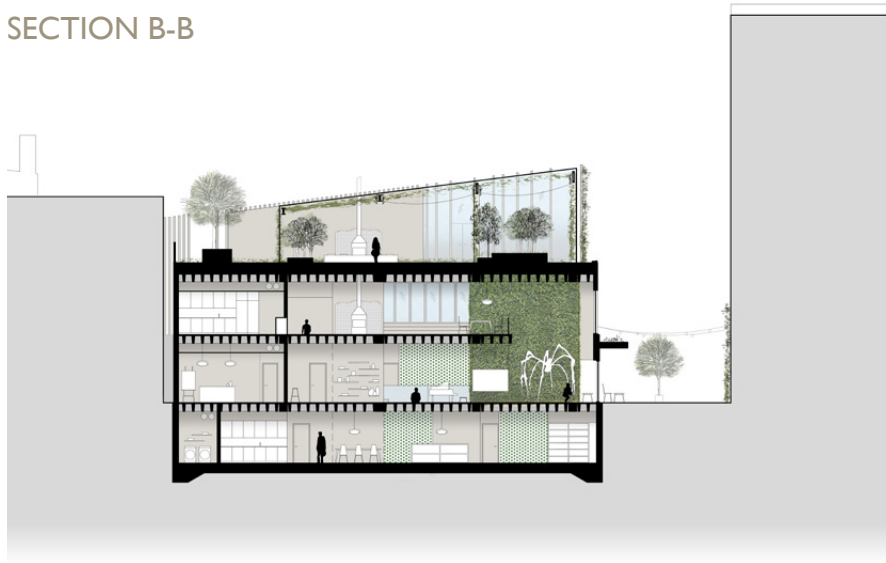
# SECTION

## SECTION A-A

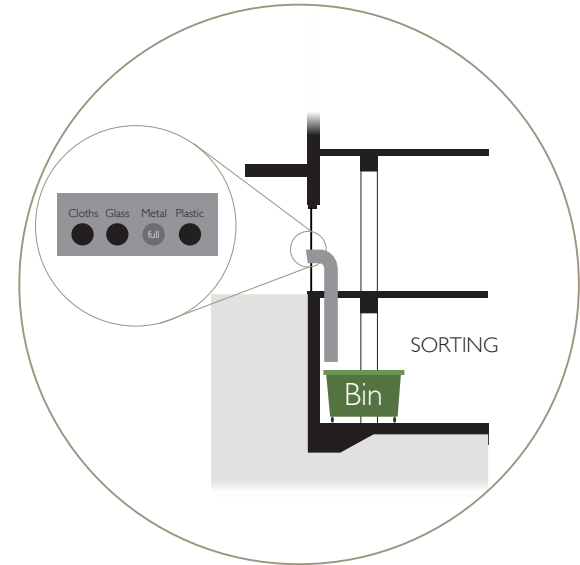


# SECTIONS

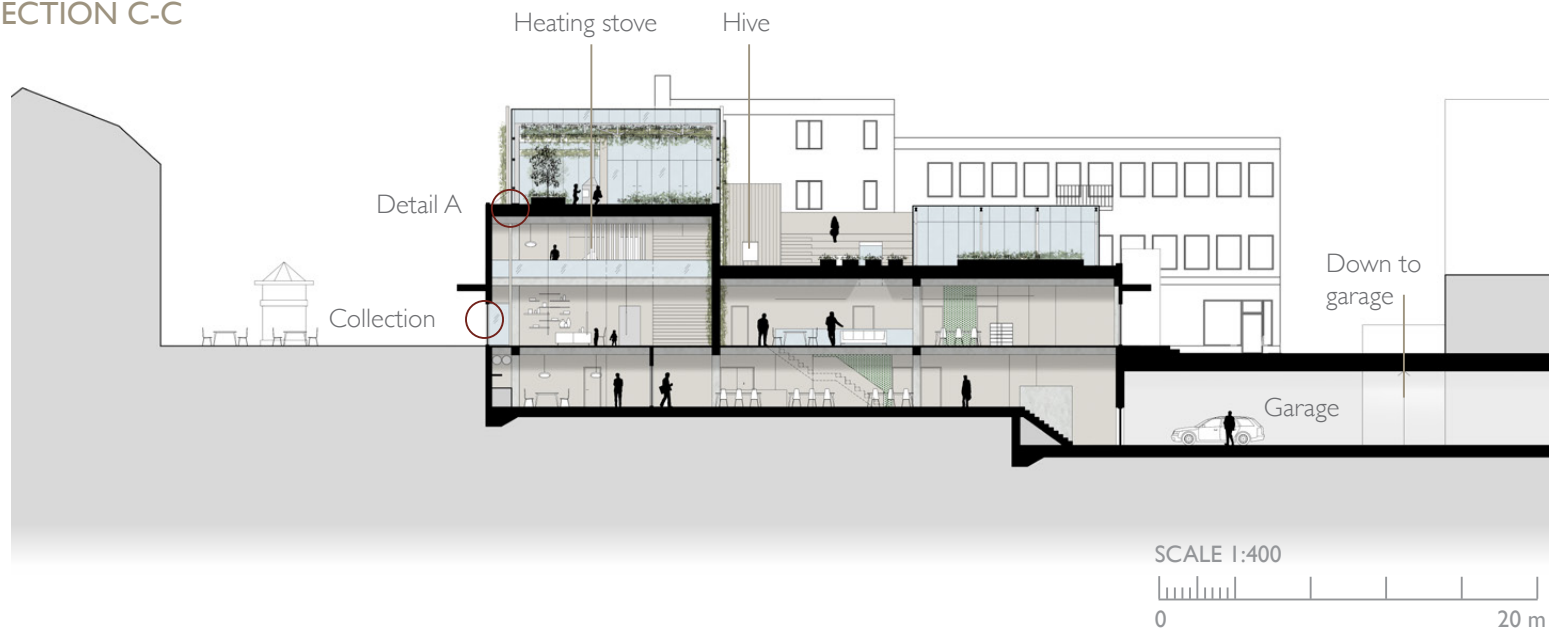
SECTION B-B



COLLECTION



SECTION C-C

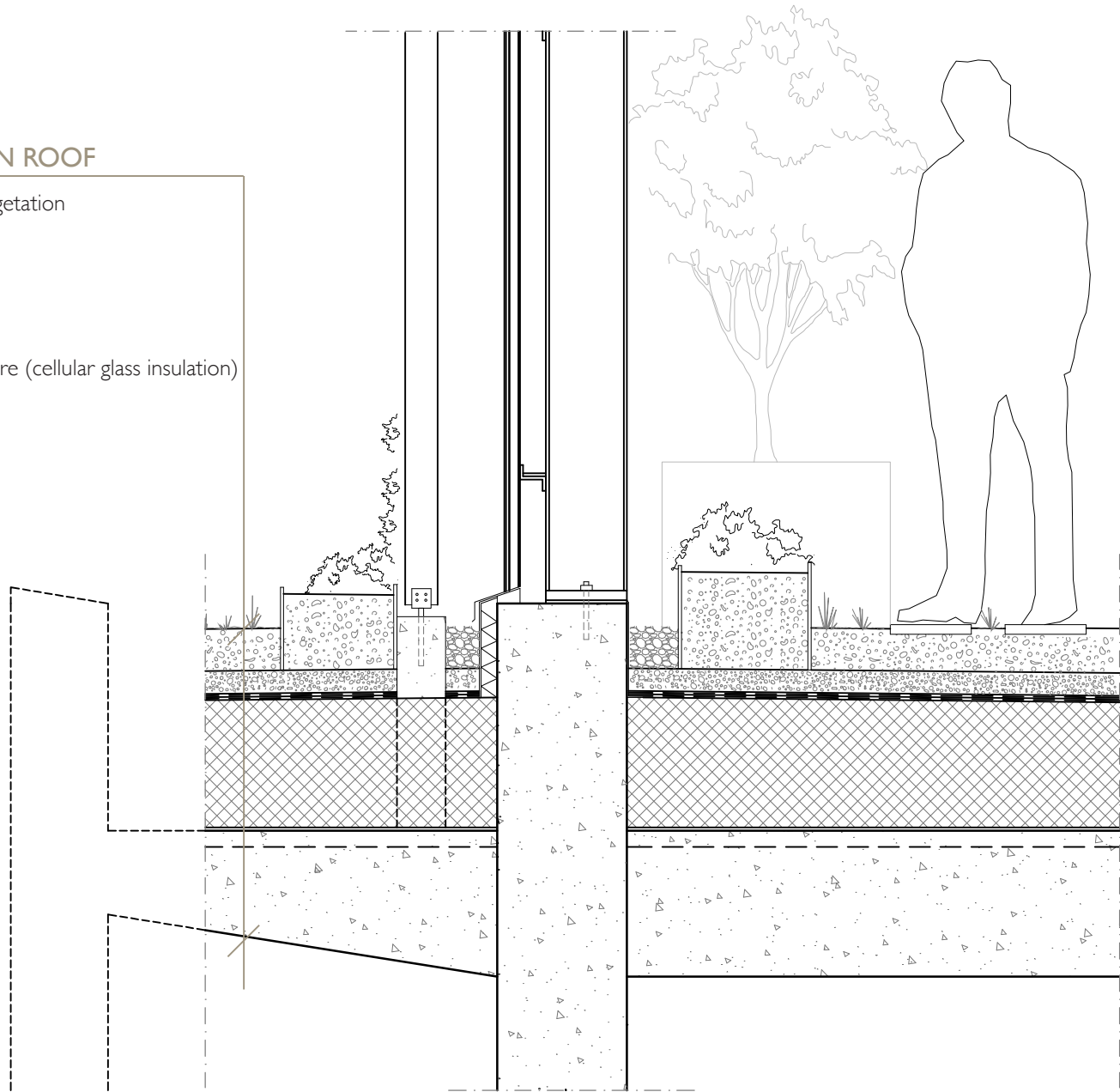




# DETAIL A

## DETAIL GREEN ROOF

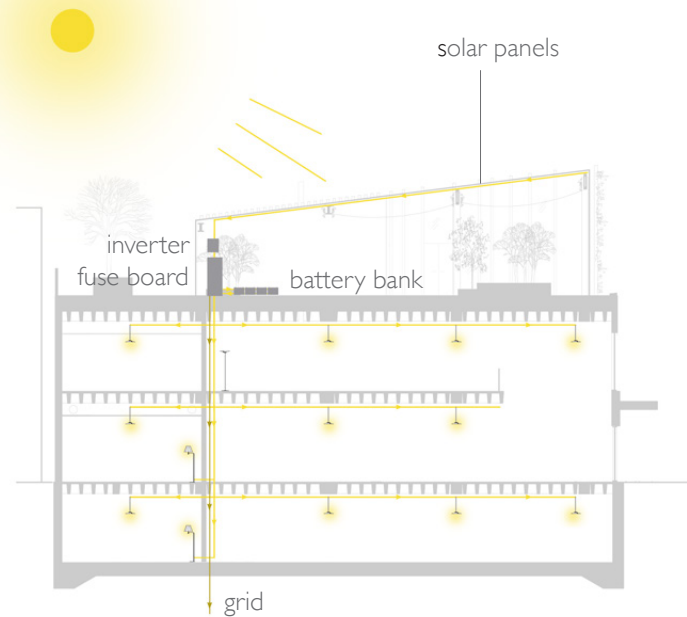
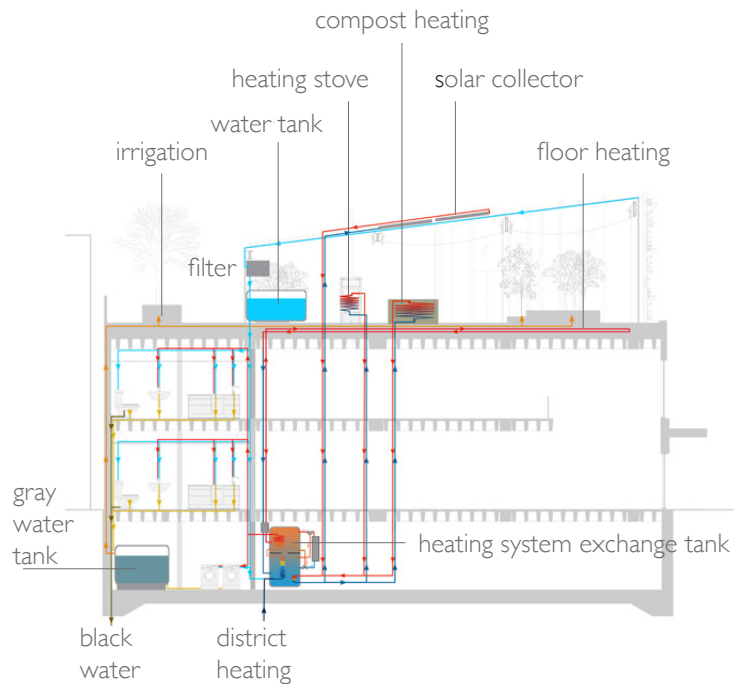
- Paving stones / Vegetation
- Soil substrate
- Filter course
- Drainage course
- Protective course
- Roof seal
- Foam glass structure (cellular glass insulation)
- Vapor seal
- Concrete



SCALE 1:20

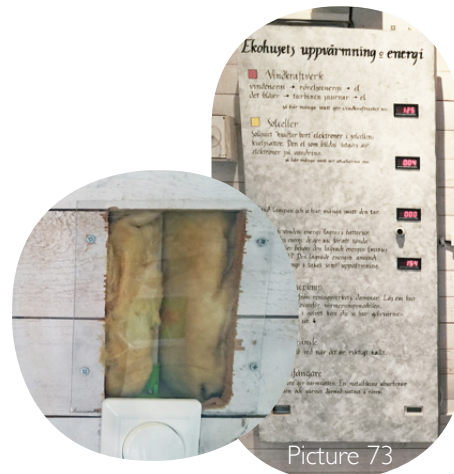


# SYSTEM SKETCHES



## WATER & HEATING

Returum collects rainwater in a tank located on the roof. The water is filtered and distributed to the buildings facilities. Grey water and urine from separation toilets is collected and used for irrigation in the greenhouse. The water works as fertilizer for the plants. New and existing technique rooms are given glass façades in order to make the solutions visible for the visitors. Today the building uses district heating which can be complemented by compost heating, solar collectors and a heating stove.

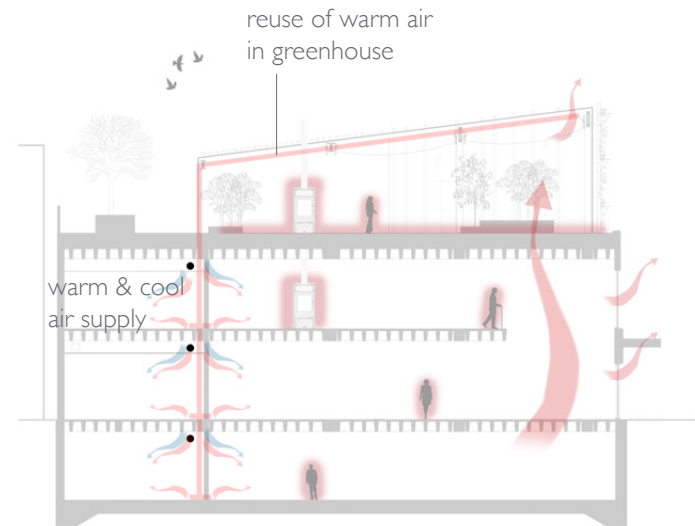
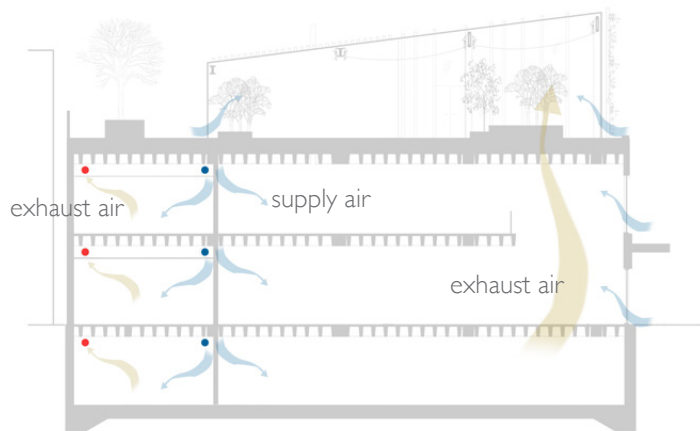


Picture 73

## SOLAR ENERGY

Returum uses solar panels to generate energy. A battery bank creates an energy buffer which can be used during cloudy days. If Returum produces more energy than it consumes it will be distributed to the grid.

The technical equipment is located in the tank room (visible for visitors). Digital displays and signs show how much energy the current solar income generates in a pedagogical way.



## VENTILATION

New openings in the slabs enable air to flow naturally through the building. Exhaust air is ventilated through the greenhouse where natural processes (via the plants) clean the air.

The new lanterns on the roof complement the mechanical ventilation with natural ventilation (not shown in the diagram). They also generate more daylight into the building.



Interior Perspective plan I  
(Author's picture)

## AIR HEATING

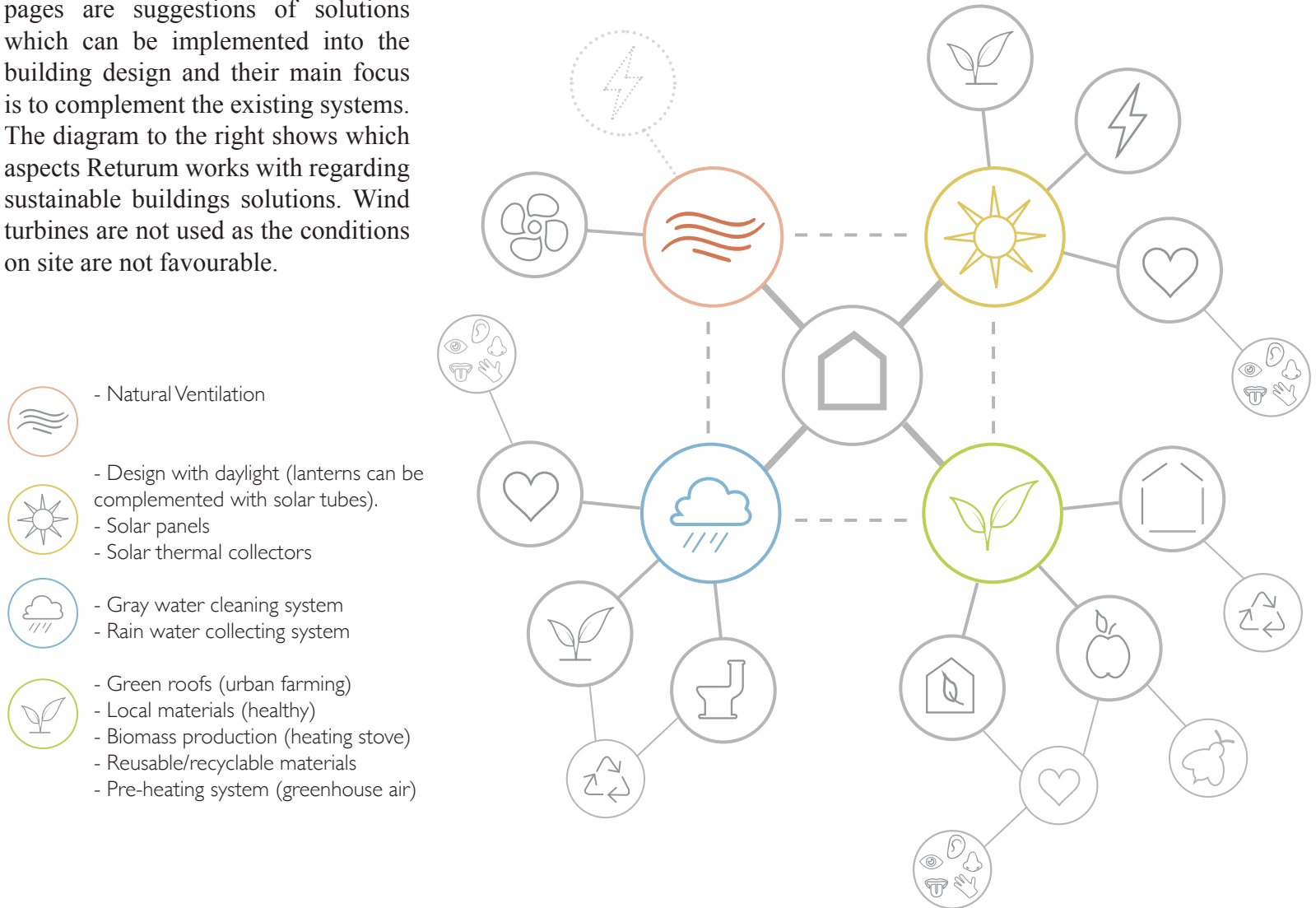
Visitors, technical equipment, heating stoves, floor heating and the greenhouse effect are generating heat. The clean and warm air in the greenhouse can be redistributed throughout the building. The district heating/cooling will be used if additional heating or cooling is needed.

The windows inside the greenhouse open automatically to adjust the indoor climate.

## A COMPLEMENTING SYSTEM

The proposed systems on previous pages are suggestions of solutions which can be implemented into the building design and their main focus is to complement the existing systems. The diagram to the right shows which aspects Returum works with regarding sustainable buildings solutions. Wind turbines are not used as the conditions on site are not favourable.

Diagram showing how Returum could use natural resources on site







RETURIM

EXHIBITION

sync



# CONCLUSIONS & REFLECTIONS

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*This part intends to conclude and reflect upon the produced material. It will reconnect to the introduction to argue if the thesis answers the research questions. It also aims to reflect upon the process and result as well as how the project could be continued.*

- Conclusions
- Reflections
- Important Sketches
- References

# CONCLUSIONS

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It is now time to look back at the work and reconnect to the research questions.

*How is Vänersborg municipality working with cyclical thinking today regarding resource management?*

The initial theoretical research of cyclical thinking created an understanding of what aspects that are important to consider regarding sustainable resource management. The Circular ladder model has been a helpful tool in order to investigate on what level Vänersborg municipality is working with sustainable resource management today. The result showed that there is a gap between the current situation in Vänersborg and their vision of sustainable resource management. A number of aspects were identified as important to work with in order to reach further regarding cyclical resource management. Collaboration, knowledge creation, waste prevention and product life extension actions are some of these aspects that were highlighted.

*- What agent-groups and activities in Vänersborg can pollinate each other in Returum and create synergy effects?*

By studying other agents in Vänersborg and how they work with resource management, a vision of a network and

arena (hub) was created. The agents were selected as their activities support each other and refer to the top rungs in the Circular ladder. By connecting these agents and their activities, a new type of centre could be created which strives to minimize waste and change people's approach to resources. If the building itself could be designed in a cyclical way one could add an additional level to the understanding and awareness of cyclical thinking.

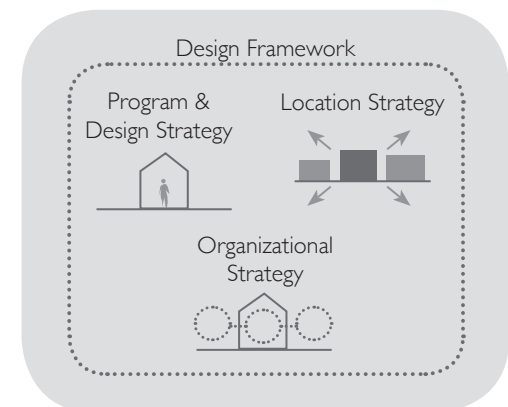
*- How would a concept of Returum work and look like in the local context of Vänersborg, through a building design?*

The gained information from the theory, analysis of the local context and studying precedents was condensed into the concept of Returum. The Returum concept consists of a Design Framework which aims to work as objectives to strive towards in order to reach sustainable product and waste management. An organizational strategy, Location strategy, Program and Design strategy was further developed from the Framework and previous analysis. The concept was then applied to a site and building in order to investigate what Returum could look and work like in the local context of Vänersborg. The Timjan House in central Vänersborg was selected for implementation due to its

central location, closeness to agents and flexibility. The design proposal is a redesign of the existing buildings and focuses on pedagogical and cyclical solutions which strive to foster a new understanding of cyclical thinking among the visitors.

The concept of Returum explores how Vänersborg municipality can support a transition into a more sustainable future where waste and products are seen as valuable resources. A new education and activity centre could create new partnerships and reinforce a new approach amongst the inhabitants of Vänersborg by promoting cyclical activities such as: repairing, reusing, recycling and upcycling. Returum should be seen as a support to existing agents and activities in order to start a transition.

## RETURUM CONCEPT



# REFLECTIONS

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## THINK GLOBALLY - ACT LOCALLY!

During this Master's program and thesis I have developed a strong belief in that one can challenge global issues on a local level. Returum has a strong bottom up approach meaning that initiatives and action on a grass root level can affect global unsustainable trends such as overconsumption and linear resource management. My intention is to show that a small municipality like Vänersborg and its inhabitants play a key role in the transition into a more sustainable future. It is important to mention that Returum does not solve all problems regarding waste and product management in Vänersborg, but it is a small step in the right direction.

In a rapidly changing world, small cities are more likely to suffer from global trends. It is therefore important to enhance and build upon local qualities and initiatives in order to build an identity, which people can relate to. An important reason for choosing to work in a local context is because it is easier to collaborate (create networks), get a holistic view and develop culture out of sustainability. On the other hand economical support, legislation, lacking knowledge and initiatives are other problems one has to face.

## SYSTEM THINKING

I see myself as a system thinker with focus on architecture and built environment. It is about seeing objects in systems rather than as isolated objects. This approach makes investigations more complex as it includes more aspects and contributes to develop the profession of architecture. It can contribute to enrich the design and anchor it in the context. During my Master studies at Chalmers I have combined hard and soft values in all my projects. The built environment and the organizational or user perspective have always driven my projects to become more holistic. According to me, both need to be considered in order to contribute to the field of sustainability.

In this Master's thesis I have tried to see Returum in relation to its context and systems but it could have been done in a broader way. The problem is that systems can be considered as infinities and it is therefore important to set a framework and delimit the scope of interest. Hence the limits of Returum could have been broadened and included more aspects.

## RETURUM

To begin with I would like to clarify that Returum is not a finished design proposal. It is a first draft, which in the next step will be discussed with representatives from the municipality and agent groups. It will also need to be refined by constructors (i.e. solve the technical details with extra loads from the green roofs).

Returum works mainly on a strategic level in order to generate a material which can be used for initiating a discussion. The broad perspective have led to that many aspects are left unexplored, for example legislation (regards product lending), energy demand (based on the existing building) and materials effect on human and environment. The project has an ecological and social perspective but the economic aspects are also important to consider when taking this project further.

Returum plays with our perception of what culture and waste is. The purpose is to see waste as valuable resource and I would like to state that Returum is a new type of culture centre (call it waste culture) which can complement today's more traditional culture centres.

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## RETURUM ORGANIZATION

The organizational strategy focuses mainly on finding agents for collaboration (network) and show how their activities can pollinate each other (multiple benefits and win-win situations). It also focuses on host-ship and activities.

There are many more aspects which have to be considered when creating an organization. Legislation, economy and ownership are some aspects which have to be looked into further. During this work I have started to question if the municipality is the right enabler of Returum. Another option would be a non-profit cooperative, which invests profit into support and expansion of the activities. It could also be run as a research project with funding from organizations or EU. Still the municipality has an important role in the change towards a more sustainable resource management as they are in charge of waste prevention actions. Another aspect is that the municipality sets economical profit aside for social and environmental aspects, which is favourable for an organization like Returum. If it could work as a free service with low costs (or non) I believe more people would use Returum which generates a more diverse meeting place. A continuation would be to investigate user groups and target groups further, how decision-making is made and how local actors would consider Returum.

## RETURUM LOCALIZATION

The decision of placing Returum in the Timjan House was made due to different reasons. The building has qualities which favoured the Returum concept, but it also aims to be a provocation (waste centre in city centre). Now with the municipality's new vision for waste management, Returum could play a key role in future urban development. In this work, Returum is integrated in an area dominated by commercial activities. This creates a tension which in my opinion generates a more interesting and diverse city centre.

The location of Returum also added more complexity to the project. The relationship to the city centre and townscape is more interesting compared to if Returum was placed in an industrial area. On the other hand it could be seen as delimiting, as the physical limitations prevent Returum from expanding further.

A respond to this would be to complement Returum with other similar centres which could be located around the city. Returum has a potential in expanding and during this project I experienced that more agents and activities (i.e. academia and local businesses) could have been included. Adding these agents to the Returum network could contribute to a more interesting meeting place.

## RETURUM DESIGN & PROGRAM

The program of Returum should be seen as a suggestion and could be further developed regarding estimated sizes, composition and functions (i.e. exploring hydroponic farming etc.). This project focuses on the activities and the relationship between the functions. An interesting continuation would be to explore the spatial and aesthetic features further in order to show the potential in waste and products (pedagogical architecture). It is important to use as many reusable materials as possible as well as local skills. Using waste in the design is essential in order to achieve a new understanding as well as it shows the possibilities in waste and products.

The proposed systems, which are shown in the system sketches, should be considered as suggestions that can complement the existing systems. Before one can implement these solutions it is important to do a deeper building analysis which focuses on energy consumption, air flows etc.



## THEMED CONTINUATIONS

This section presents three possible continuations of Returum identified from the reflections.

**Mega level:** This thesis focuses mainly on interdepartmentally collaboration within the municipality of Vänersborg. Returum has the potential to be developed into a bigger network with more diverse actors. Thus it would be collaboration between different businesses, municipalities and academia. Returum could become something similar to Innovatum Science Park in Trollhättan, but its focus will be on product and waste management. It would also be interesting to investigate if Returum could be implemented into other cultures and geographical contexts outside Sweden.

### **Micro Level:**

The material and detail level of Returum can be further developed in the future, for example by studying the technical solutions more in detail (more alternatives, composition, sizes and capacity), construction and by doing material assessments. It would be interesting to do a life cycle assessment of the materials used in the building design and investigate the existing building further (energy demand etc.).

**Apply into another municipality:** The Returum concept could potentially be implemented into another municipality (due to the similar structure of the municipal organization). It would be interesting to see what Returum would look like in another context. The investigation process used in this Master's thesis could be used again and further developed. New functions could be added to the program and its compositions and sizes could be elaborated.

Using the Circular ladder as an evaluation tool has been helpful while at the same time it has been limiting. An important experiences from this project is that it is hard to evaluate knowledge levels (reduce, prevent, rethink actions) compared to hands-on activities regarding treatment. This must be reconsidered if doing a similar investigation again.

Returum is an activity and knowledge centre with focus on cyclical resource management which strives to generate a new approach to waste and products. Through connecting agents, education and offer activities that focus on redesign, upcycling, recover, recycling and reuse, Returum aims to support a transition into a more circular and sustainable Vänersborg.

Additionally, this project shows the importance of collaboration, knowledge exchange and sharing in order to strengthen the community and reach more sustainable solutions.

Hopefully Returum could be seen as a seed that can grow bigger in the future, be reproduced and evolve into new contexts and compositions.

Hampus Larsson  
2016-06-08





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## DIALOGUES & MEETINGS

Dialogues, meetings and site visits during this thesis:

11-12-15, Round tour at Returen, Hisingen.

27-01-16, Meeting Culture & Leisure Department Vänersborg municipality.

27-01-16, Meeting with artist in Vänersborg about using waste in arts and redesign.

02-02-16, Meeting staff at Red Cross, Vänersborg.

12-03-16, Round tour at Sinkadusen, Mölndal.

16-03-16, Visiting Erikshjälpen, Vänersborg.

17-03-16, Visiting Stockholm cultural house.

06-04-16, Round tour at Ekopark Strömstad.

Sporadic meetings:

- Architect Maja Lindstedt (support and guidance regarding sustainable building solutions).

- Planning architect Pål Castell, Vänersborg Municipality (worked as a link between the municipality and the author of this project).

## PICTURE REFERENCES



Picture 1:  
Water Treatment Plant

Kävlingeå-projektet (2016). *Water Treatment Plant*. [Electronic]. Retrieved from [http://www.kavlingeaprojektet.se/res/Textbilder/jh090520\\_068.jpg](http://www.kavlingeaprojektet.se/res/Textbilder/jh090520_068.jpg)



Picture 6:  
Lyckans Second Hand  
Vänernborg

Vänernborgs kommun (2015). *Lyckans Second-Hand*. [Electronic]. Retrieved from <http://www.vanersborg.se/images/200.249b71a514dd9f679b15492dd/1435312723075/lyckan.jpg>



Picture 11:  
Oktobersmarknad,  
Vänernborg

Feldt, T (2010). *Oktobersmarknad*. [Electronic]. Retrieved from <http://www.tommyfotografen.se/wp-content/uploads/2010/10/maknad3-575x469.jpg>



Picture 2:  
Recycling Station

Vänernborgs Kommun (2016). *Recycling Station*. [Electronic]. Retrieved from <http://www.vanersborg.se/images/18.52821050136a06aef543335d/1360940533702/%C3%85terv-stat.gif>



Picture 7:  
Butik Unik, Vänernborg

Vänernborgs kommun (2016). *Butik Unik*. [Electronic]. Retrieved from <http://www.vanersborg.se/images/18.52821050136a06aef541557d/1360940391213/Butik-Unik.png>



Picture 12:  
Erikshjälpen second  
hand, Vänernborg

(Author's picture)



Picture 3:  
Miljöstation

Vänernborgs Kommun (2016). *Miljöstation*. [Electronic]. Retrieved from <http://www.vanersborg.se/images/18.52821050136a06aef542eb39/1360940533281/Vargon.gif>



Picture 8:  
Knutpunkten,  
Vänernborg

Google maps (2016). *Knutpunkten*. [Electronic]. Retrieved from <https://www.google.se/maps>



Picture 13:  
Superloppis Arena  
Vänernborg, Vänernborg

Vänernborgs kommun (2015). *Superloppis*. [Electronic]. Retrieved from [http://www.vanersborg.se/images/18.62bb710c14c585d8151266e/1427461879249Arenaloppis\\_0209.jpg](http://www.vanersborg.se/images/18.62bb710c14c585d8151266e/1427461879249Arenaloppis_0209.jpg)



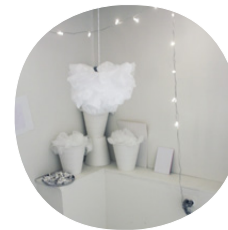
Picture 4:  
Recycling Central

Google maps (2016). *Recycling Central, Vänernborg*. [Electronic]. Retrieved from <https://www.google.se/maps>



Picture 9:  
Torpet, Vargön

Vänernborgs kommun (2016). *Torpet, Vargön*. [Electronic]. Retrieved from [http://www.vanersborg.se/images/18.52821050136a06aef5415c30/1360940390839/torpe\(3\).png](http://www.vanersborg.se/images/18.52821050136a06aef5415c30/1360940390839/torpe(3).png)



Picture 14:  
Experimental room  
Sinkadusen, Mölndal

(Author's picture)



Picture 5:  
Bins

Ardarve, L (2016). *Bins*. [Electronic]. Retrieved from [http://www.renova.se/PageFiles/2571/Poseidon\\_Morgan\\_Irez.jpg](http://www.renova.se/PageFiles/2571/Poseidon_Morgan_Irez.jpg)



Picture 10:  
Lager, Röda Korset  
Second Hand &  
Mötesplats, Vänernborg

(Author's picture)



Picture 15:  
Creative workshop,  
Sinkadusen, Mölndal

(Author's picture)



Picture 16:  
Gathering room,  
Sinkadusen, Mölndal

(Author's picture)



Picture 17:  
Material bank a,  
Returen, Göteborg

(Author's picture)



Picture 18:  
Material bank b,  
Returen, Göteborg

(Author's picture)



Picture 19:  
Material school,  
Returen, Göteborg

(Author's picture)



Picture 20:  
Experimenting a,

Innovatum (2014). *Experimenting a*. [Electronic]. Retrieved from <http://www.innovatum.se/wp-content/uploads/2014/05/thumbnails/bilar2-2570-700x.jpg>



Picture 21:  
Experimenting b,  
Innovatum Trollhättan

Innovatum (2014). *Experimenting b*. [Electronic]. Retrieved from <http://www.innovatum.se/wp-content/uploads/2014/05/thumbnails/4d-frame3-2565-1400x500.jpg>



Picture 22:  
Exterior Garaget,  
Malmö

Leander, N. and Stiltje, A. (2016). *Exterior Garaget*. [Electronic]. Retrieved from <http://malmo.se/Kultur-fritid/Kultur-noje/Garaget/Om-Garaget/Garaget-i-bilderhtml>



Picture 23:  
Interior Garaget a,  
Malmö

Leander, N. and Stiltje, A. (2016). *Interior Garaget a*. [Electronic]. Retrieved from <http://malmo.se/Kultur-fritid/Kultur-noje/Garaget/Om-Garaget/Garaget-i-bilderhtml>



Picture 24:  
Interior Garaget b,  
Malmö

Leander, N. and Stiltje, A. (2016). *Interior Garaget b*. [Electronic]. Retrieved from <http://malmo.se/Kultur-fritid/Kultur-noje/Garaget/Om-Garaget/Garaget-i-bilderhtml>



Picture 25:  
External solar panels  
on green roofs

Hansen, T. (2016). *Solar panels on green roof*. [Electronic]. Retrieved from <http://assets.inhabitat.com/wp-content/blogs.dir/1/files/2015/06/Henning-Larsen-Viborg-City-Hall-lead.jpg>



Picture 26:  
Transparent Solar  
Panels

Soltech (2016). *Transparent solar panels*. [Electronic]. Retrieved from [http://img.archiexpo.com/images\\_ae/photo-g/84068-6093591.jpg](http://img.archiexpo.com/images_ae/photo-g/84068-6093591.jpg)



Picture 27:  
Solar thermal  
collectors

Peak Solar (2009). *Solar thermal collectors*. [Electronic]. Retrieved from <http://www.cnpeaksolar.com/uploads/090907/1-0ZZH35020H8.jpg>



Picture 28:  
The Helix Wind  
Savonius 2.0

Helix Wind (2007). *The Helix Wind Savonius 2.0*. [Electronic]. Retrieved from <http://inhabitat.com/helix-wind-turbine-small-wind-gets-smart/>



Picture 29:  
Wind turbine  
integrated in  
architecture

Atkins (2007). *Integrated wind turbines*. [Electronic]. Retrieved from [http://www.e-architect.co.uk/images/jpgs/bahrain/bahrain\\_world\\_trade\\_centre\\_atkins231207\\_05.jpg](http://www.e-architect.co.uk/images/jpgs/bahrain/bahrain_world_trade_centre_atkins231207_05.jpg)



Picture 30:  
*Living Machine*

Chen, O. (2010). *Living machine*. [Electronic]. Retrieved from <http://www.inhabitat.com/wp-content/uploads/johntoddlivingmachine1.jpg>





Picture 31:  
The Looper (not  
constructed)

The Looper (2013). *The looper*.  
[Electronic]. Retrieved from <http://the-looper.com/images/looper-interior-rendering-2.jpg>



Picture 36:  
Masonry heater

Lea, K. (2012). *Masonry heater*.  
[Electronic]. Retrieved from <https://greenpassivesolar.com/wp-content/uploads/2012/03/dsc01034.jpg>



Picture 41:  
Exterior Ekopark  
Strömstad b

(Author's picture)



Picture 32:  
Urban roof top  
farming

Ore-Design (2015). *River Park Farms*. [Electronic]. Retrieved from [http://ore-design.com/wp-content/uploads/2014/03/ORE\\_Riverpark\\_Farm\\_1.jpg](http://ore-design.com/wp-content/uploads/2014/03/ORE_Riverpark_Farm_1.jpg)



Picture 37:  
Compost heater

Towerton, C. (2011). *Compost heater*. [Electronic]. Retrieved from <https://i.ytimg.com/vi/PCXSoV4jNAAmxresdefault.jpg>



Picture 42:  
Trust Windows  
Ekopark Strömstad a

(Author's picture)



Picture 33:  
Sedum Roof

Lamiot (2013). *Sedum Roof*.  
[Electronic]. Retrieved from <https://webpages.uidaho.edu/larc380/new380/assets/images/greenRoofFiles/images/CC/RunoffLanxmeerLamiotCC-BY-SA-3.jpg>



Picture 38:  
Naturhus Sikhall  
exterior, Vänersborg

Solvarm, A. (2015). *Naturhus, Sikhall exterior*. [Electronic]. Retrieved from [http://wp-assets.hemnet.se/wp-content/uploads/2015/11/utsidan\\_850px.jpg](http://wp-assets.hemnet.se/wp-content/uploads/2015/11/utsidan_850px.jpg)



Picture 43:  
Trust Windows  
Ekopark Strömstad b

(Author's picture)



Picture 34:  
Green Wall

GreenWalls (2009). *Green wall*.  
[Electronic]. Retrieved from <http://greenwalls.com/home/wp-content/uploads/2009/11/calderasmall.jpg>



Picture 39:  
Naturhus Sikhall  
interior, Vänersborg

Solvarm, A. (2015). *Naturhus, Sikhall interior*. [Electronic]. Retrieved from <http://wp-assets.hemnet.se/wp-content/uploads/2015/11/inuti-350px.jpg>



Picture 44  
Exterior Kvamhuset  
Ungdomsskole

Seilskjær, E. and NAL (2012). *Material Kvamhuset Ungdomsskole*. [Electronic]. Retrieved from <http://www.arkitektur.no/kvamhuset-skole>



Picture 35:  
Energy exchange in  
earth air tubes

Greenbau (2008). *Air tubes*.  
[Electronic]. Retrieved from <https://greenbau.files.wordpress.com/2008/12/earthube.jpg>



Picture 40:  
Exterior Ekopark  
Strömstad a

(Author's picture)



Picture 45:  
Materials Kvamhuset  
Ungdomsskole

Seilskjær, E. and NAL (2012). *Material Kvamhuset Ungdomsskole*. [Electronic]. Retrieved from <http://www.arkitektur.no/kvamhuset-skole>





Picture 46:  
Interior Kvarnhuset  
Ungdomsskole

Seilskjær, E. and NAL (2012).  
*Interior Kvarnhuset Ungdomsskole*.  
[Electronic]. Retrieved from [http://  
http://www.arkitektur.no/kvarnhuset-  
skole](http://http://www.arkitektur.no/kvarnhuset-skole)



Picture 51:  
Creative workshop,  
Stockholm culture  
house, Stockholm

(Author's picture)



Picture 56:  
Green house  
Western Harbour,  
Malmö

(Author's picture)



Picture 47:  
Bråta Pavilion

Mistraurbanfutures (2014). *Bråta  
Pavilion*. [Electronic]. Retrieved from  
[http://www.mistraurbanfutures.org/  
sites/default/files/brata\\_770px.jpg](http://www.mistraurbanfutures.org/sites/default/files/brata_770px.jpg)



Picture 52:  
Piano Playing,  
Stockholm culture  
house, Stockholm

(Author's picture)



Picture 57:  
Education space,  
Ekopark Strömstad

(Author's picture)



Picture 48:  
Logo Bråta

Mistraurbanfutures (2014). *Logo  
Bråta*. [Electronic]. Retrieved from  
[http://www.mistraurbanfutures.  
org/sites/default/files/brata\\_  
paviljongen\\_-\\_ett\\_varv\\_till\\_so.pdf](http://www.mistraurbanfutures.org/sites/default/files/brata_paviljongen_-_ett_varv_till_so.pdf)



Picture 53:  
Reading area,  
Stockholm culture  
house, Stockholm

(Author's picture)



Picture 58:  
Growing bed

(Author's picture)



Picture 49:  
Makerspace,  
Stockholm culture  
house, Stockholm

(Author's picture)



Picture 54:  
Computers, Garaget,  
Malmö

Leander, N. and Stiltje, A (2016).  
*Computers, Garaget*. [Electronic].  
Retrieved from [http://malmo.se/  
Kultur-fritid/Kultur-noje/Garaget/  
Garaget/Om-Garaget/Garaget-i-  
bilder.html](http://malmo.se/Kultur-fritid/Kultur-noje/Garaget/Garaget/Om-Garaget/Garaget-i-bilder.html)



Picture 59:  
The Grounds of  
Alexandria, Sydney

(Author's picture)



Picture 50:  
Experimenting room,  
Sinkadusen, Mölndal

(Author's picture)



Picture 55:  
Seating, Garaget,  
Malmö

Leander, N. and Stiltje, A (2016).  
*Seating Garaget*. [Electronic].  
Retrieved from [http://malmo.se/  
Kultur-fritid/Kultur-noje/Garaget/  
Garaget/Om-Garaget/Garaget-i-  
bilder.html](http://malmo.se/Kultur-fritid/Kultur-noje/Garaget/Garaget/Om-Garaget/Garaget-i-bilder.html)



Picture 60:  
Authors own garden

(Author's picture)



Picture 61:  
Sanden, Vänersborg

Google maps (2016). Sanden. [Electronic]. Retrieved from <https://www.google.se/maps>



Picture 62:  
Timjan House,  
Edsgatan, Vänersborg

Google maps (2016). Timjan House, Edsgatan Vänersborg. [Electronic]. Retrieved from <https://www.google.se/maps>



Picture 63:  
Trenova Center,  
Vänersborg

Google maps (2016). Trenova Centre, Vänersborg. [Electronic]. Retrieved from <https://www.google.se/maps>



Picture 64:  
Domus warehouse  
Karlstad

Stockholmskyline.se (2011). Domus Karlstad. [Electronic]. Retrieved from <http://www.stockholmskyline.se/wp-content/uploads/domus-karlstad.jpg>



Picture 65:  
Alvar Aalto, Säynätsalo town hall group

Zache (2010). Alvar Aalto, Säynätsalo town hall group. [Electronic]. Retrieved from [http://images.adsttc.com/media/images/56de/43fb/e58e/ced2/d400/013f/large\\_jpg/SaynatsaloTownHall4.jpg?1457406957](http://images.adsttc.com/media/images/56de/43fb/e58e/ced2/d400/013f/large_jpg/SaynatsaloTownHall4.jpg?1457406957)



Picture 66:  
Alvar Aalto, Finlandia Hall

Alvar Aalto Museum Rune Snellman (2014). Finlandia Hall. [Electronic]. Retrieved from [http://assets.dwell.com/sites/default/files/styles/article\\_photo/public/2014/03/17/alvar\\_aalto\\_finlandia\\_hall.jpg?tok=DFMD3jlg](http://assets.dwell.com/sites/default/files/styles/article_photo/public/2014/03/17/alvar_aalto_finlandia_hall.jpg?tok=DFMD3jlg)



Picture 67:  
a, plan 0, towards entrance

(Author's picture)



Picture 68:  
b, plan 0, premises

(Author's picture)



Picture 69:  
c, plan -1, stairs

(Author's picture)



Picture 70:  
d, plan -1, ramp garage

(Author's picture)



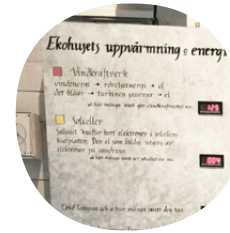
Picture 71:  
e, plan 1, roof

(Author's picture)



Picture 72:  
f, plan 1, interior

(Author's picture)



Picture 73:  
Digital display

(Author's picture)

*Any other pictures in this Master's thesis is owned and produced by the author.*



**CHALMERS**



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**RETURUM**

A Knowledge & Activity Centre Focused on Cyclical Resource Management