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Towards a Circular Regenerative Urban Model

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ONE MAN'S TRASH, ANOTHER MAN'S TREASURE. ARCHITECTURAL CIRCUITS IN A GLOBAL CONTEXT

Iben Vadstrup Holm

Abstract

The world's largest island, Greenland, is facing enormous challenges as the ice melts, minerals become available and new international industries and foreign cultures arises. Greenland calls for new solutions and the aim of the project *One Man's Trash, Another Man's Treasure* – developed in collaboration with Lise Birgens Kristensen at the School of Architecture Aarhus – is to explore how architecture can contribute to a positive sustainable development in Greenland.
The development of the project started with a fascination of the circuits of nature – the biosphere and the mindset of the "industrial symbiosis" in Kalundborg – as an example on how waste from one industry can become the raw material of another. By interpretating these concepts into the field of architecture, the project demonstrates how architecture can be a link that connects flows of resources into programmatic, ecological and social circuits.
In its overall form the project is an initiation of studies that indicate how architecture can be a tool to create sustainable design in cooperation with living resources, technology and humans beings in a network of mutually dependency.

Keywords: symbiosis, circuits, hybrid architecture

"ONE MAN'S TRASH, ANOTHER MAN'S TREASURE". I CIRCUITI ARCHITETTONICI IN UN CONTESTO GLOBALE

Sommario

L'isola più grande del mondo, la Groenlandia, si trova ad affrontare enormi sfide a causa dello scioglimento dei ghiacci, della sopravvenuta disponibilità di minerali ed il nascere di nuove industrie internazionali e di culture importate dall'estero. La Groenlandia richiede nuove soluzioni e lo scopo del progetto *One Man's Trash, Another Man's Treasure*, elaborato in collaborazione con Lise Birgens Kristensen alla School of Architecture di Aarhus, è quello di comprendere come l'architettura possa contribuire ad un relae sviluppo in Groenlandia.
L'elaborazione del progetto prende il via dal fascino dei circuiti della natura – la biosfera e l'approccio della "simbiosi industriale" in Kalundborg – che fornisce un esempio di come gli scarti di un'industria possano diventare la materia prima di un'altra. Interpretando questi concetti nel campo dell'architettura, il progetto dimostra come l'architettura possa costituire il collegamento tra flussi di risorse e circuiti programmatici, ecologici e sociali.
Nella sua forma complessiva, il progetto rappresenta l'inizio di studi che indicano come l'architettura possa essere uno strumento per ideare progetti sostenibili in un network di reciproca dipendenza e cooperazione tra risorse naturali, tecnologia ed esseri umani.

Parole chiave: simbiosi, circuiti, archiettura ibrida

1. Introduction

Through centuries, we have systemized, structured and cultivated our society with technology and the belief in our own immortality. This has gradually cleared out any connection between consumption and environmental consequences.

Rem Koolhaas describes this narrative in a presentation under the title *Apocalypse*, in which he describes the two extreme processes that has taken place over the centuries: «There is an entirely different streak in our culture. It is not a narrative of linear and reasonable progress, but a narrative of disasters and fundamental tensions between nature and mankind. It depicts nature as a kind of punishment of mankind and, occasionally, mankind as a punisher of nature. That narrative, however we look at it – religiously or otherwise – is a fundamentally anti-modern one, which insists on apocalyptic expectations».

Nature is changing to an extent where we cannot grasp the consequences. Architecture is an act of will in contrary to nature and we have to start thinking of alternative solutions and invent other ways of planning and designing our future cities. Our planets fragility, including its limited natural ressources is changing to an extent where we cannot grasp the consequences. Architecture is an act of will in contrary to nature and we have to start thinking of alternative solutions and invent other ways of doing panning and designing our future cities. Our planets fragility, including its limited resources, can be seen as an opportunity to define new approaches and rethink the role of architecture. The project described in this paper aims to explore how architecture as a tool – with nature's adaptability and symbiotic collaborations as inspiration – can reverse the human-induced, linear process to circular process, while stimulating the method of strategic urban planning and the design of new buildings.

Architecture is an act of will in contrary to nature. The projects asks the questions:

- How can resource awareness become a model for a sustainable Greenland?
- Can head to tail mindset of indigenous culture be a model for future Greenland?
- How can sustainability develop from being a general and often technological challenge to be a site-specific, architectural challenge?
- Can this take part in setting a sustainable agenda on the terms of architecture?

2. Methodological approach

The project works with two agendas divided into a global and a local level. The global level operates with the issue of waste in general and the insistent necessity to deal with these issues, raising questions to discuss new possible local solutions.

At the local level, the project points out a specific case, a company or an institution producing waste of resources. In this project, it is mainly about launching new urban developments by using the waste of shrimps to implement new programs based on a social and cultural necessity, as the direct beneficiary of the resource. The project proposes installation of a biogas plant (Cyclifier) in symbiosis with a bathhouse (Plug-in program 1), a diner (Plug-in program 2) and apartment units (Plug-in program 3) in relation to the Royal Greenland shrimp factory in Sisimiut, Greenland. Hence, the special waste challenge on the local level is triggering an architectural task demanding a specific solution.

The overall structure of the methodological work leading to the identification of the parameters in the specific case is divided into three main chronological parts. The research method based in part 1 and 2 is a theoretical, scientific approach, which contains

interdisciplinary collaborations, comparative studies and mapping of how other professionals work with exchange of resources in the field of architecture. Part 3 terminates into an architectural project. Based on sketching of an overall organization and programming of the elements linked in a network, scenarios of how the Architectural hybrid is manifested in a particular location is unfolded. In particular, the three parts are the following:

- *Identification of Mother-plug:* identification of linear processes, flow of resources and identification of a company with a waste. Parallel research on possible methods of reusing the resource as a raw material through technology.
- *Identification of contextual programmatic elements (Plug –in):* mapping of the physical layers in the specific context; existing systems and flow of resources as well as social and cultural resources and programmatic necessities in a societal development.
- *Identification of hybrid-structures:* analysis of resource requirements and a programming of the interconnections between the relevant programmatic elements, as well as the architectural spatial consequences of the architectural circuit in terms of scenarios and drawings.

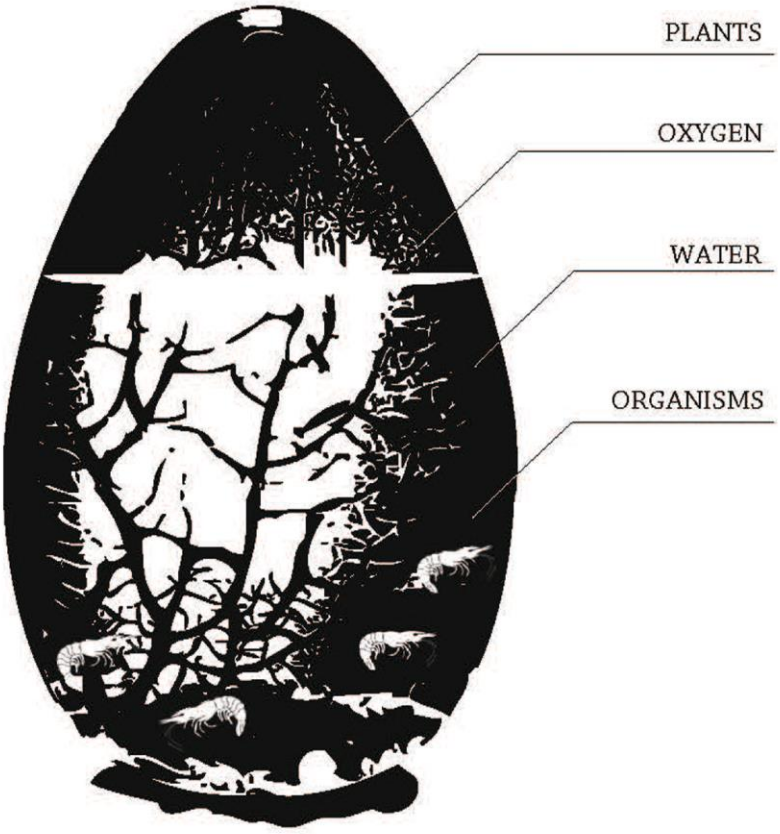
3. Mindset

Through the evolution, nature has created sustainable systems. In nature, waste does not exist. Output – such as a falling leaf – is an input in another end of an ecosystem, where the leaf turns into nutrients. This is simply the magic of the biospheric circuit. The circuit is characterized by being the place where life is lived and the precondition of life. A system which, consisting of several elements in synergy, is living in constant exchange and development (Fig. 1). With the fascination of the systems of nature, the concept of the project is based on the world-renowned human made symbiosis – the Kalundborg Industrial Symbiosis – and aims to interpret the industrial symbioses into the framework of architecture.

The concept of an "industrial symbiosis" is a collaborative and symbiotic relationship between two or more companies, where one company's waste product is purchased by another company, to be used in its own production. That is a cooperation with mutual economic and environmental benefits. Kalundborg Industrial Symbiosis is a world famous example of working with industrial symbiosis. In its more than 50-year history, Kalundborg Symbiosis has constantly been evolving.

The symbiotic collaboration originated in the 50's in the light of economics due to the high waste charges in Denmark. The consequence was both sustainability and economy. The local power plant, *Asnæsværket*, is one of many symbiotic collaborations in Kalundborg. *Asnæsværket* produces flyash as a residual product, and the flyash is purchased by a local plasterboard factory (*Gyproc*) where it is a part of the gypsum production. In addition, the power plant delivers steam to the pharmaceutical manufacturer *Novo Nordisk*, which is also a part of the symbiosis (Fig. 2). At its core, the industrial symbiosis must be understood as a crucial mindset. By getting companies to think holistically – where one company's waste is another's resource, you can create growth, maintain jobs and create sustainable production. This mindset and its development – in an architectural context, shows that it is possible to connect diverse elements and inverting linear process to circular, when using the mindset of nature combined with interdisciplinary approach and new technology.

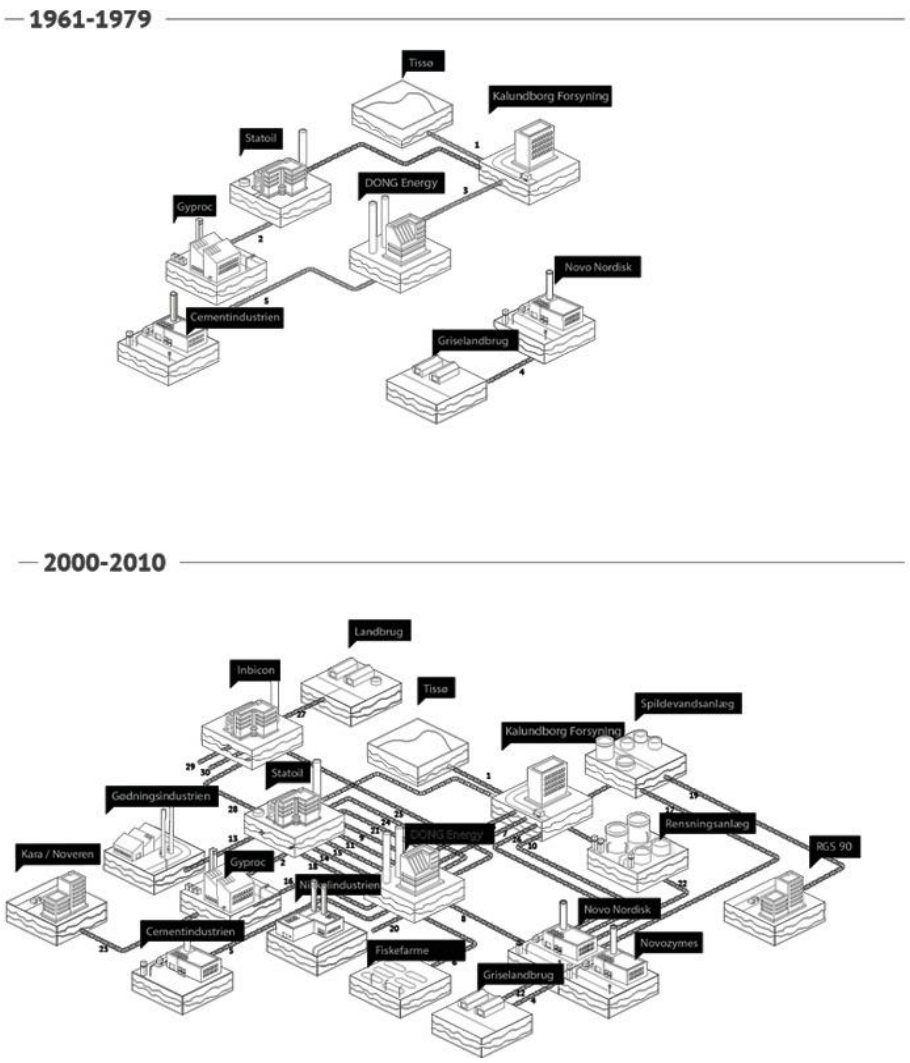
Fig. 1 – Inspired by the Biosphere: the cycle of life



For centuries, the Inuits has lived in contact with nature and adjusted to its constantly changing character. With a landscape of radsrocks and snow, The Greenlandic Seal was one of the main food resources and the Inuit people used every part of the animal. The meat was eaten, the skin was used for clothing and the bones for weapons and craftwork. They took pride in not practicing ruthless exploitation of nature. From the total utilization of available resources, a "design culture" emerged, that formed the base of survival in the extreme conditions in the Arctic North. The design culture was, besides practical, also an aesthetic and creative approach to the available resources (Fig. 3).

This so-called design culture is rethought in e.g. the Greenlandic shark *Somniosus microcephaly*, which also goes by the name *the Greenlandic gold*. The sharks are approximately 50% of the total by catch and are treated as waste in Uummannaq Municipality.

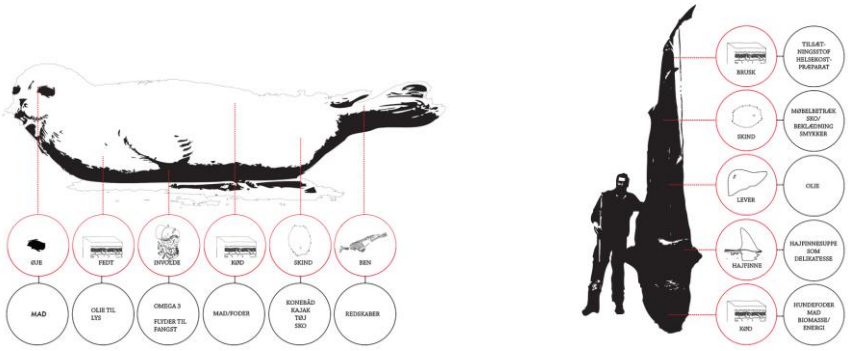
Fig. 2 – The symbiosis (the industrial circuit): local collaborations and exchange of resources



Source: www.symbiosecenter.dk

With the opportunities offered by technology, DTU Technical University of Denmark discovered a great potential in utilizing the shark to produce biogas and energy. The shark has no kidney, making its meat more or less toxic for instance to feed other animals with. However, it has been discovered that the large amount of fat in the meat is suitable for the production of bio-oil and biogas, making it possible to find usage for more of the dead animal meat. The Greenlandic shark is the contemporary answer to how technology of today and rethinking of existing resources can create new opportunities for growth, based on a traditional design culture (Fig. 3).

Fig. 3 – Design culture



a) Native knowhow *b) New technology - new resource opportunities*

4. The paradox

Today, the people of Greenland are partially promoting themselves on the pristine landscape and a sense of a people living in harmony with nature. At the same time, they throw all their waste into the ocean, the same ocean from which they feed. From slaughterhouse and fish waste to black water and industrial wastewater. The lack of waste management is starting to have serious consequences in terms of pollution of the marine environment. In the end, this will result in death of the microorganisms that the sea animals feed on. The people of Greenland are in dealing with the waste destroying the environment that covers 90% of their livelihood. By rethinking the utilizing of living resource, Sisimiut GL was chosen to exemplify how a company can give more back to society than what it takes. Hence the working title: *One Man's Trash, Another Man's Treasure*.

Sisimiut is the second-largest town in Greenland, with a population of 5,598 people. Today, Sisimiut is the largest business center north of the national capital of Nuuk, and it is one of the fastest growing towns in Greenland. The fishing industry is the main occupation and the city is known for its professional education facilities that attracts students from all over Greenland. Today the city is self-sufficient on energy through hydropower, but when the city develops further the power gained from water cannot meet the growing demand and will need fossil fuels. Decentralization, low density and a programmatic zoning of cultural, commercial and industrial facilities characterize the city. This project aims to mix new diverse programs that support the social and cultural development of the city and creates a focal point, where multiple environments can meet (Fig. 4).

In Sisimiut, the northernmost town with ice-free waters in Greenland (42 kilometers north of the polar circle), you find Royal Greenland's largest modernized shrimp factory. It makes the city stand out on the map as one of the most important ports in Greenland. Every year 20,000 tons of shrimps are hauled in, boiled and peeled. Of these, 6,000 tons of shrimp products are exported to the rest of the world. The remaining 14,000 tons are shrimp waste. Hence, 75% of the shrimp is waste and every day approximately 38 tons of shrimp waste is discharged into the sea through a piping system, leading from the shrimp factory and directly into the sea. The Shrimp Factory in Sisimiut has dispensation to discharge its waste because of the bays strong currents, leading the waste away.

Fig. 4 – Multiple environments

a) Localization of Sisimiut

b) Sewage discharge in Sisimiut

c) View of Sisimiut

d) Colors of the water in the harbor pink

Sources: a) Map of Sisimiut; b) Google Earth; c) Photo by Iben Holm; d) Photo by Frida Foberg

With the shrimp waste as a catalyst, the projects aim to exemplify how the mindset of symbiosis, can contribute to the development of new sustainable planning and designing methods that facilitate future urban development, in this case in Sisimiut, Greenland (Fig. 5).

5. Strategy of symbiosis

PESTEL is a marketing analysis model used to analyze the conditions of the external macro- environment that has impact on the business concerned. The analysis is based on six areas: political factors (P), economic factors (E), socio-cultural factors (S), technological factors (T), ecological factors (E) and legal factors (L). For an industrial symbiosis these factors are crucial to its success. The model was used on this project from the beginning in order to identify the challenges in the realization of an architectural symbiosis in Sisimiut that this project proposes.

The different factors are explained below, generally and in relation to the specific case:

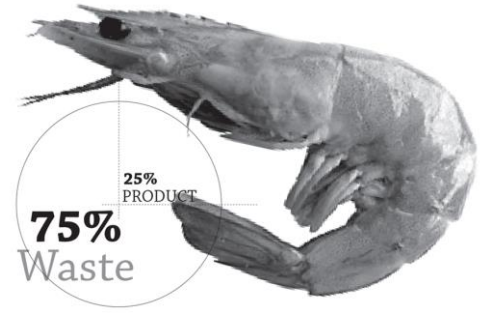
– *Political factors (P):* for the symbiosis and its mindset to gain currency and being further developed, it requires primarily dynamic and innovative forces and a unit that will facilitate this communication and launch development projects. In Kalundborg it is the Municipality that facilitates the existing symbiosis and provides financial support to its development. In Perth, AU, the industrial symbiosis of Kiwana is facilitated by

Curtin university, which has an industrial ecology research department. In Greenland it is the Self-Government, placed in Nuuk that desides which of the municipal projects that will be initiated. This can often be a longer bureaucratic process that sometimes hampers the development of the various municipalities. In Sisimiut, the Municipality has therefore begun to initiate their own projects to keep development from being detained. These actions are substantial for the future of Sisimiut.

- *Economic factors (E):* the symbiosis is emerging from an external political or economic pressure on the company. The economic element is essential for the cooperation to even be considered. The symbiosis in Denmark is particularly successful because of their fee-system in relation to waste. In this sense, it can be beneficial to find partners who can use it, and thereby acquire ones bi-current. The economical factor correlates to the development of GDP, inflation and economic growth, wage levels, public finances, unemployment, currency and the level of interest rates and cyclical factors. Sisimiut is growing, partly due to its position as Greenland's center of education, but also because of its large exports of fish. These two main players could be the leading elements to take part in a symbiosis.
- *Socio-cultural factors (S):* both cooperation, communication and trust between the companies involved are crucial factors of the symbiosis. This often works best in smaller communities where leaders know each other. The symbiosis mindset is revolving around the fact that companies are part of a dynamic collaboration, which can always be interrupted if it is no longer profitable. For boosting the mindset, it is necessary to have visionary and creative leaders. The infrastructure in Greenland is a general challenge in all towns and settlements. The inability to connect cities with roads means that no one is commuting between home and work. The symbiosis can therefore be seen as a natural tool to use in Greenland, because they are forced to stay within the limited areas when it comes to developing cities. They have to find and use the local resources.
- *Technological factors (T):* in order to realize the symbiosis, geographical proximity is an important element. The symbiosis is unfolded between to uneven units. It is not symbiotic if the exchange of bi-streams takes place within the unit itself. The academic term for an industrial symbiosis is three industries that share two bi-streams, but two industries that exchange one bi-stream is also a symbiosis. The symbiosis must be adaptable regarding the technical aspects in collaboration. These elements such as patents and products, research, public support for research and general development in technology will play a significant role in the symbiosis.
- *Ecological factors (E):* sustainability is something that is implicit in everything we do today. The symbiosis arose from a need to do things smarter. Optimization and efficiency are concepts often used when businesses modernize today, but on top of this comes the discussion, that we need to be better at taking care of our earth. Issues such as ecology, waste, energy consumption, pollution, global warming and rising sea levels are at the top of many industrial corporate agendas. The waste disposal issue is important in Sisimiut and one of their biggest challenges.
- *Legal factors (L):* regulatory requirements can generally jeopardize the symbiosis. A company can get trapped between the legislative and fiscal environment because they do not always cooperate. This can make companies deselect the exchange of bi-flows with another company, since it may be more profitable not to do. Competition law, antitrust law, and legislation on labor market conditions and product liability therefore

play a significant role in the establishment of the symbiosis. The company Royal Greenland has a department that studies the development of compaany factories. It is also aware of the vast amounts of waste in Sisimiut, but currently it is not profitable for the factory to handle their waste diefferently. Due to the lack of legislation on indirect taxation, the Royal Greenland continue to derive their waste into the sea.

Fig. 5 – Shrimp waste as a catalyst for the project



a) Waste product from the Royal Shrimp

b) The factory

c) The harbor after work

d) The front of the factory

Sources: a) Graphics by Iben Holm and Lise Birgens Kristensen; b) Google Earth; c) Photo by Iben Holm; d) Photo by Iben Holm

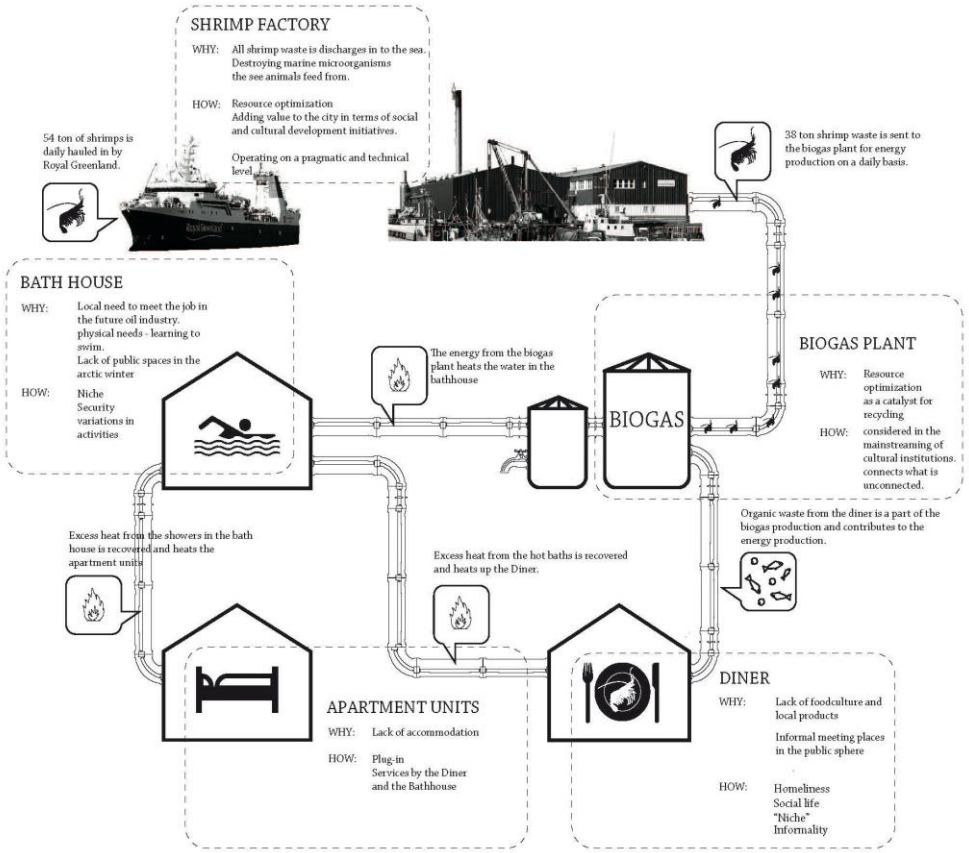
6. The circuit

Based on the issue that Royal Greenland dump their waste into the sea, we designed a circuit that utilize shrimp waste as a main resource and in synergy with new recipients and urban programs, becomes a new regenerative force in the city that contributes to welfare and social and cultural development (Fig. 6).

Alongside a mapping of local in- and output resource and waste streams, the construction and qualification of the circuit was based on research on social needs for development and research on how a waste stream, in collaboration with new technology could be a feedstock for another. Working at the interface between technology and architecture is a challenging task and calls for a wide interdisciplinary collaboration where knowledge sharing is the key

word. The design of the circuit was developed in dialog with anthropologists, engineers, Sisimiut municipality, parallel to comparative studies, fieldwork and a three-week stay in Sisimiut.

Fig. 6 – The circuit in a constellation of the shrimp factory



The match of actors in the circuit that is proposed is the shrimp factory as the main resource, a biogas plant as the main technology that sends the waste in circulation, a Bathhouse, a diner and apartment units as receivers and small processors. Receivers and small processors meaning the diverse programs feeding from the main resource and processing it into a new resource. The complex of diverse programmatic elements is gathered in a hybrid structure. The short version of the programmatic relevance criterion of the selected Plug-in programs is here described:

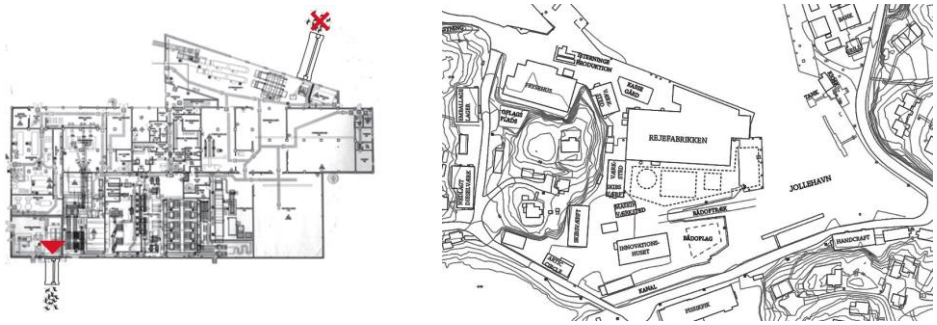
– *Biogas-plant:* the shrimp waste has a high value of COD (Chemical Oxygen Demand; COD is a unit of measurement for energy outcome of biogas production.) By implementing a biogas plant next to the shrimp factory, the waste converts into energy.

The biogas plant represents the technological machine and is the catalyst of the circuit. It is called cyclifyer, i.e. an element that has the property to send flows of resources into circuit. A term borrowed from *2012 Architechten*.

- *Bathhouse:* the relevance of a bathhouse comes from the Greenlanders' desire to hold positions in the emerging oil-industry. As in many other fishing cultures, Greenlanders cannot swim, but in order to hold jobs on drilling rigs, they have to pass a test showing that they are able to get themselves out of a helicopter under water. Furthermore, it is desired to have a public space that facilitates exercise and physical activity through the long Arctic winter.
- *Diner:* Sisimiut lacks cafes and other facilities that can run outside the tourist season. The city asks for social and public spaces that can be the base of social meetings and a place where you can actually eat the Greenlandic fish where it is caught. That is not possible today.
- *Apartment units:* This program is an add-on to the hybrid construction that can support different events throughout the year. The program will include overnight accommodation for conferences in the city and visitors from companies; it relates directly to the house of innovation that is located on the harbor next to the factory.

The hybrid is the juxtaposition of these programs in a coherent circuit. The hybrid is a plug-in for the shrimp factory in which there is a synergy between the two. The biogas plant convert waste into heat to warm up the hot baths of the bathhouse. By recollecting the heat from the bathhouse, transmitting it to the diner and the apartment units, the bathhouse also becomes a cyclifyer. In addition to the main resource, an associated internal circuitry between the diner house and the biogas plant in the form of organic waste is established (Fig. 7).

Fig. 7 – Plug-in circuit



a) Turning linear process into circular *b) Placement of the components*

7. The architectural project

The field of knowledge and knowledge processing that was unfolded in the first, and the main part of the project, was complex when attempted to take to the architectural level. The technological resources process and the relations of exchange between the different programs was established, but how do they connect visually, socially and physically? The

architectural task called for spatial guidelines and concepts from the field of architecture that could point out directions for the architectural configuration. We studied the expression of the industrial symbiosis, the concept of hybrid architecture, the Greenlandic social culture, and the environment, daily life and characteristics of the port.

To design a building that can contain these very different programs, the projects explores how we can rethink architectural programs and unfold the potentials of an architecture that has the capacity to incorporate the inherently conflictual situation between natures ecosystems and the development on our societies:

- *The hybrid:* the project introduces the "hybrid" as a concept with that ability. The hybrid stimulates the non-hierarchically and supports diversity.

  A hybrid is a juxtaposition of different elements with its own identity. Hybrid architecture can be interpreted as being an anti-typology, as it will always take shape after the programs combined. It is in this kind of anti-typology, that "the hybrid" is the key term in the design of an architectural circuit.

  In the project the programs are not seen as individual distinct objects as it is today, but as a network of programs and activities infiltrated and connected by the constant exchange of resources. The agenda is to make architecture an active and dynamic player in the exchanges that take place between buildings, people and systems and it is in the interaction between programmatic elements and the social and technological exchanges, that the architectural hybrid arises. The project investigates how a hybrid structures, inspired by nature, can be a viable new sustainable architectural typology.
- *Industrial symbiosis:* as an initiation of the architectural task, we visited Kalundborg Industrial Symbiosis and some of its collaborators to study how the circuit visually and functionally is expressed. The symbiosis is basically self-grown and this character is visible in the long lines of colored piping between the industries. Today our buildings hide everything away and do not contribute to creating awareness of our consumption, rather the opposite. The narrative expression that lies in the visible connection between industries bear witness to new collaborations and it is a strong and captivation image; the exchange and visualization of the processes required to maintain the good life promoting a new necessary awareness of resources and consumption (Fig. 8).
- *Social culture:* to identify some specific elements that could be essential for the spatial configurations of the building, we studied the living rooms, the place where the Greenlandic community unfolds. Everything in Greenland is publicly owned. This degree of publicity is also reflected in the social culture, where the private house is a more public space than for instance in Denmark. Kaffemik, a social gathering, is a very Greenlandic phenomenon that expresses this part of the culture. It is an open house, where guests enjoy themselves, drink two cups of coffee, and then make room for new guests. Through compiling and systematizing six modern living rooms, three consistent features were identified through models in order to identify possible spatial potentials – *compactness*, *lining* and *niche* – and one of these spatial investigations N*iche* was further developed (Fig. 9).
- The *Niche* shows how they use the social space in the house by creating several smaller intimate spaces. When you enter the livingroom, you do not experience that it is oriented towards a single and central meeting place, but against several small zones each containing different ways of being together.

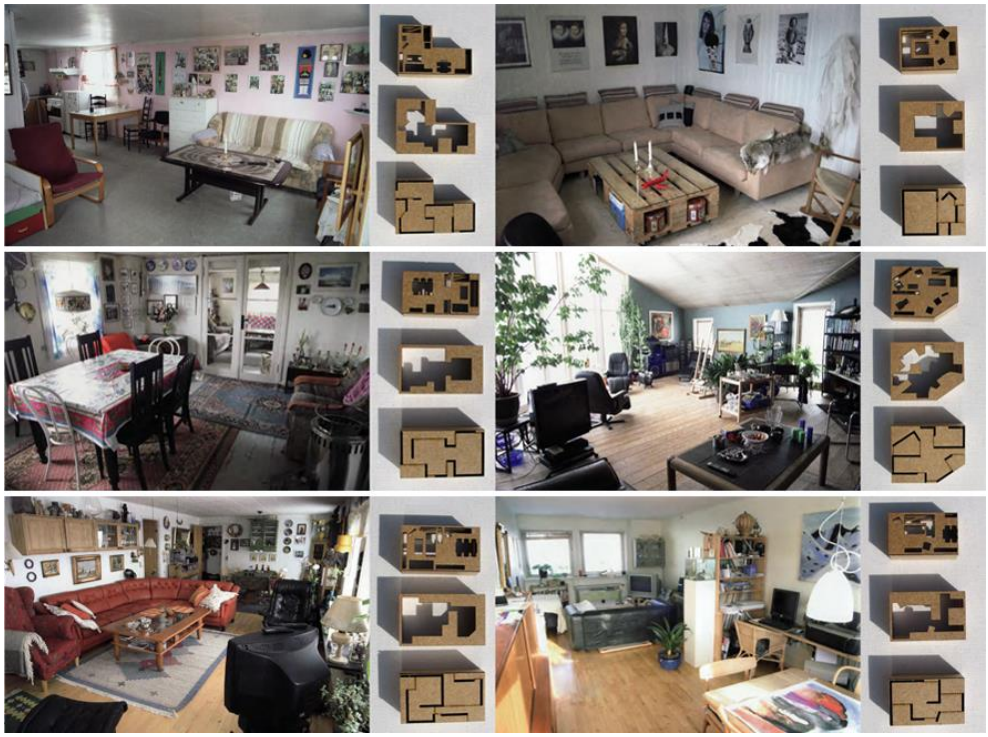
– *The Port*: The port consists exclusively of functions related to the fish industry, the import and export from Arctic Line's container ships, shrimp and crab catch from the Royal Greenland factory and the local fishermen's seal catch. The port is active around the clock and sets the frames the livelihood of the city. With a building site next to the shrimp factory architectural circuit inscribes in an active and rough environment in an immediate chaos of boats, containers, trucks, peeled seals and fish boxes (Fig 10).
  In this exemplification, the building is designed from the inside out and with the different programs added on as informal layers. It has not one but multiple entrances, and the building is organized by the logistical and programmatic exchanges of the circuit.

The spatial interpretation is visible in the drawsinmaterial presented further on.

Fig. 8 – Kalundborg Industrial Symbiosis and the aesthetics of industries

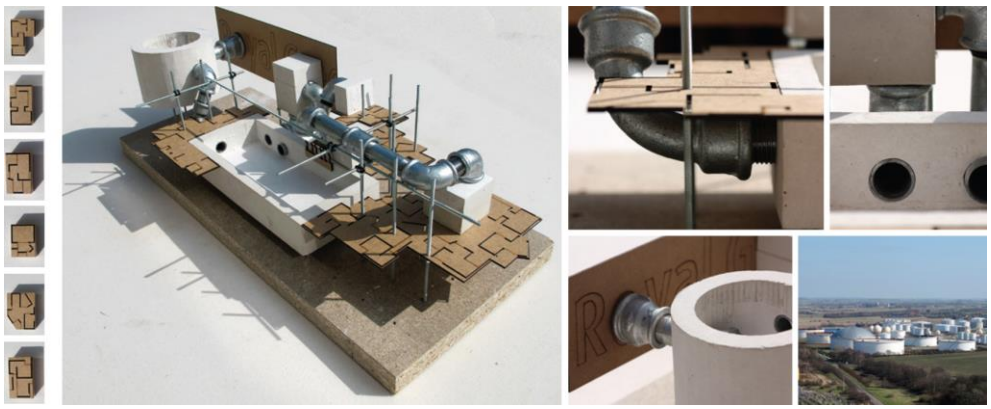
Photos: Iben Holm

Fig. 9 – The Greenlandic living room



Photos of Livingrooms: Julie Edel Hardenberg
Models and representation: Iben Holm and Lise Birgens Kristensen

Fig. 10 – Diagrammatic study of spatial and programmatic plug-in structure



Photos: Iben Holm and Lise Birgens Kristensen.

The architecture in this investigation is based on making the resource sharing visible, as a way to use the architecture as the storyteller of new connections and resource exchange that today, the project argue, is not apart of our awareness (Figs 11-18). The structure takes the expression from the industrial materials of the harbor and the visibility and coloring of the piping from the industrial symbiosis. With steel facades and the porous expression characterizing the additive and labyrinthine nature at the harbor, the structure infiltrates as just another layer to the natural character of the site.
The hot water basin in the bathhouse contains an exchange of social character and shows how the bathing house becomes a new social space and a public meeting place in the city.
The living room which is located centrally in the building acts as a living room for the apartments, the arrival for the bathhouse users, and the daily meeting area of the visitors of the house in general.

Fig. 11 – Plan showing the spine of the building with the piping everywhere visible

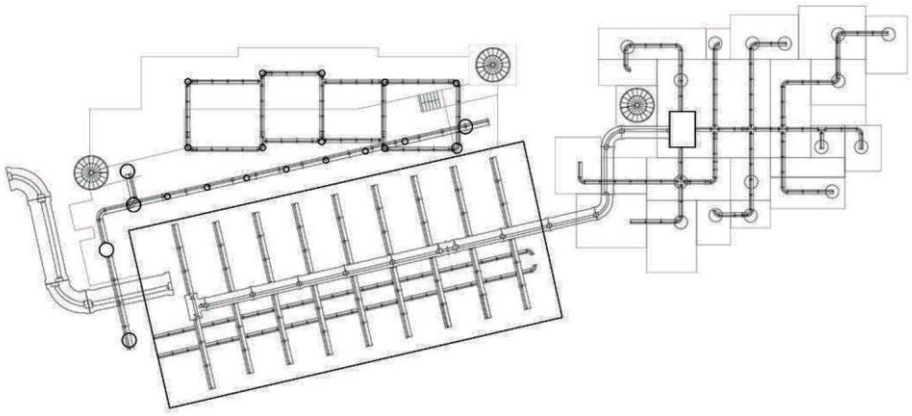


Fig. 12 – Plan

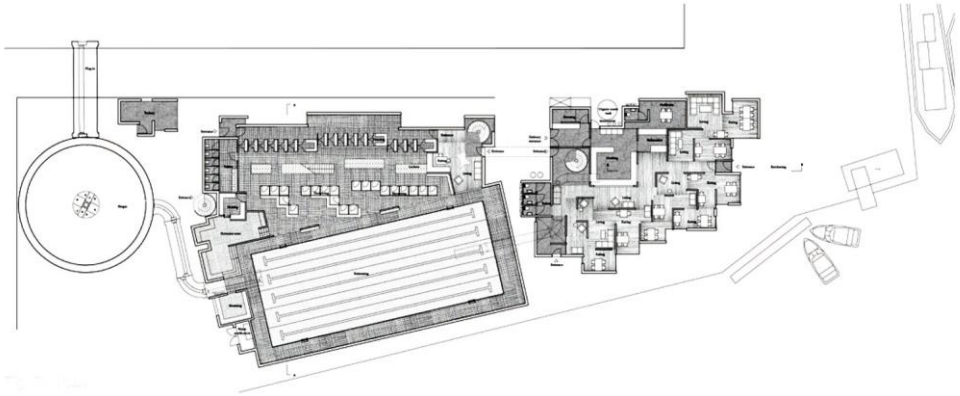


Fig. 13 – Arrival between the biogas power plant and the bathhouse facilities

Fig. 14 – West and south facade

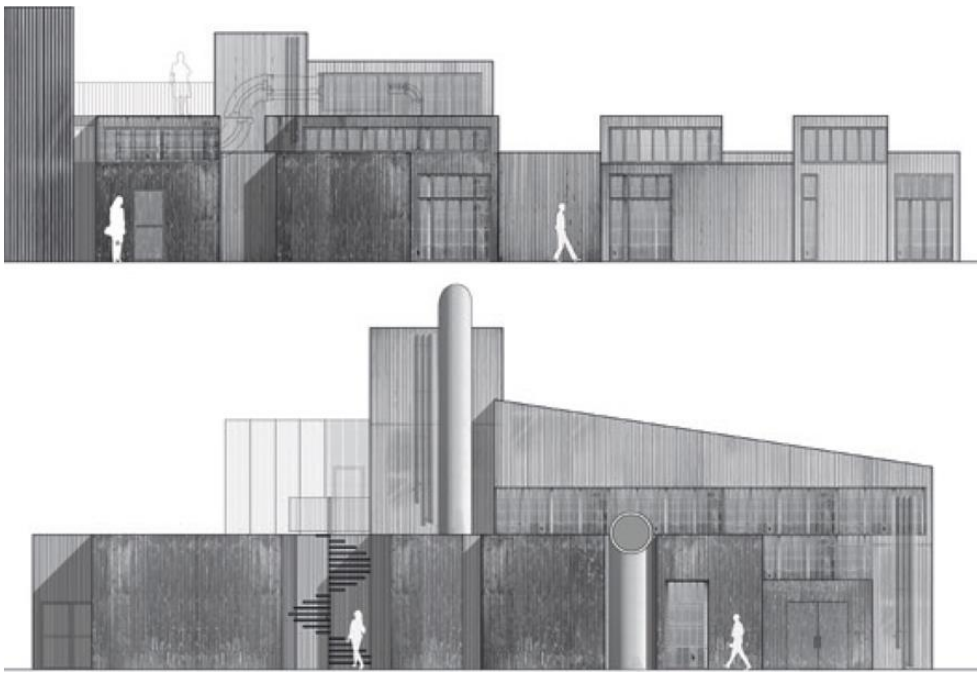


Fig. 15 – Section through the bathhouse, changing facilities and the apartment units

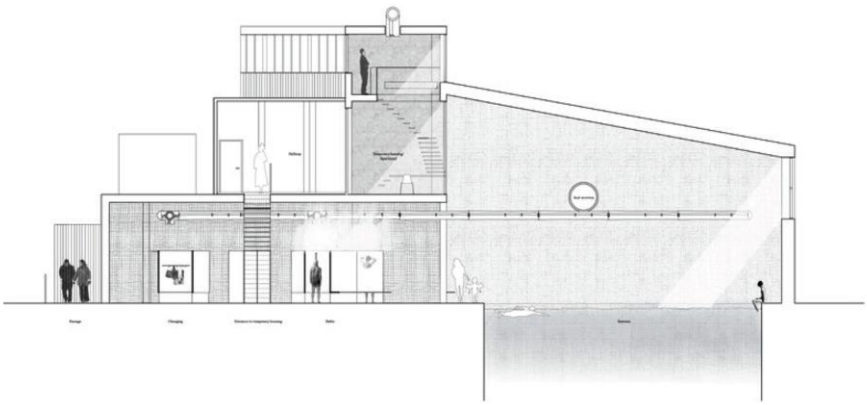
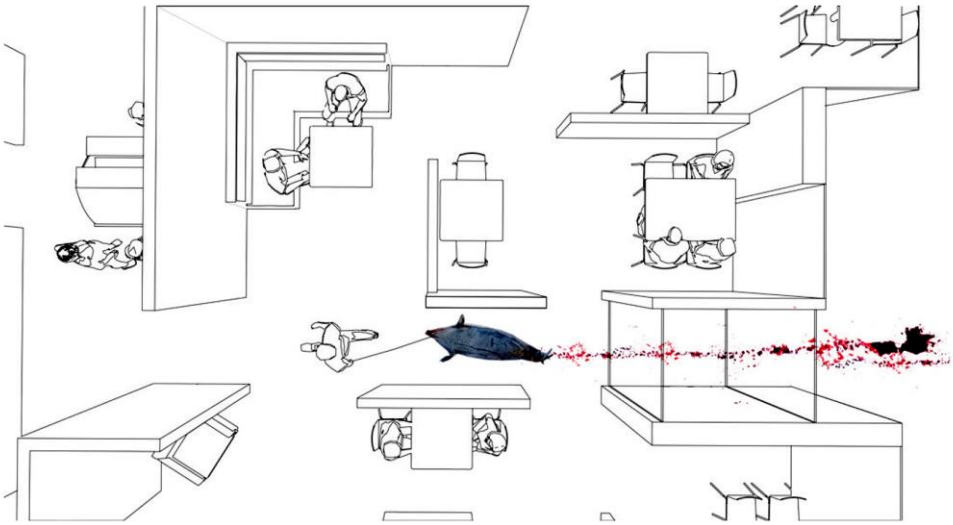


Fig. 16 – Section investigating the relationship between people, activities, pipes and spatiality

Fig. 17 – Scenario from a regular day at the diner

The diner's relevance to the harbor stands out with a clear location at the dock where the exchange between the local fishing environment and visitors of the diner will be put into play. Where the seal is brought to land, it is slaughtered and eaten, at the same time as the local culture of reuse is exposed in front of the guest of the diner. The diner becomes a place for cultural gathering that symbolizes the livelihood of the city.

Fig. 18 – The diner: a clash between food culture and food production



8. Concluding remarks

Utilization of resources is a part of the global discussion and an intrusive issue for the entire planet. One of the main points experienced in this project is that the challenge and its solution is locally anchored and need to be solved on site. This specific bottom-up challenge demands new methods of mapping, interdisciplinary analysis and research collaborations that answer to the specific culture and resources on site.

The physical project exemplified here, was developed and explored in the drawing of sections. It is here the concept of the hybrid structure is manifested and the relations between the social culture, the technological elements and the harbor environment is coming together in a complex constellation. In the plan and the spatial configuration there is still a lot of unanswered questions that calls for more exploration in the design process than the time available in the process of this project. In a wider perspective, the future work concerning the architectural project calls for focus on the development of physical appearance and a tool for reading and understanding the aesthetics in a complex constellation like this.

Our ambition is that architecture is an act of will and can make a change in a local environment. The methodological approach of this project suggests an evidence of this. However the concept does not get its validity before it is conducted in close collaboration with the local users. In this specific case, where the spatial intentions of the diner is founded in the "homeliness", which has a unique character in the Greenlandic culture, it can only succeed if it is build up by the future users of the diner. The same goes for the bathhouse. How do you build a house where both the local fishermen, the workers at the factory, children, teenagers and other parts of the population in the city will meet? For the architectural project to develop further it needs greater level of involvement than possible in this case.

Symbiosis is the phenomenon of a coherent resource utilization at a global level. But when

you dive into the local challenges, it is possible to adjust the significant parameters such as PESTEL. This makes the project interesting but also difficult and complex. The vulnerability in this project lies in the search coil between reality and ideology. In the world today, with an unstable global economy, the success of an architectural industrial symbiosis foremost depends on lobbyism to spread the concept of the mindset and political goodwill. This can only be found locally in communities with strong visionary forces. Also questions concerning the concept of the circuit, in unstable financial times like these, is insistent and needs strategic developing, e.g.what happens if an element in the circuit goes bankrupt and falls out, and what happens if a company is expanding and can no longer get enough raw material from its collaborator. The collaborative network needs flexibility at the same time as long termed contracts to make it affordable for companies to collaborate in the first place. These are questions that needs to be answered with intelligent solutions and strategies. The methodological approach described from part 1 to 3 is complex and requires interdisciplinary assistance.

Symbiosis collaborations should not only be limited to the industrial field, where machines and output play the main parts. It is important that we constantly perceive the surrounding environment, its living resources and the possibilities of new technology as a coherent whole. Instead of seeing the elements concerned as individual objects working alone, we should look at machines and new technology as natural incorporated extensions of our existents and thereby creating a sustainable development on the terms of architecture. As stated in the introduction, the project is to be seen as an initiation of studies that indicate how architecture can be a tool to create sustainable design in cooperation with living resources, technology and humans beings in a network of mutually dependency. By doing that, we believe will lead us to new forms of architecture – sustainable typologies where the architecture creates new opportunities for a more sustainable development of society, with an extent of which we have only seen the humble beginning. As in every new initiation, it needs more research and more examination, and more interdisciplinary collaborations.

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