AALBORG UNIVERSITET
STUDENTERRAPPORT

KNOWLEDGE CREATION AND SHARING BETWEEN COUNTRIES

A STUDY OF THE ZERO WASTE CO-LAB PROJECT BETWEEN BRAZIL AND DENMARK

João A. B. R. Møller – M.Sc. Thesis

Sustainable Cities / October 17th 2022

AALBORG UNIVERSITY COPENHAGEN

Aalborg University
Department of Planning - Copenhagen
Campus - M. Sc. Sustainable Cities
A.C. Meyers Vænge 15
2450 København SV
Denmark
Secretary Charlotte Wollny Risom
Phone: 9940 2446
E-mail: charlotteris@plan.aau.dk

Report Title: Knowledge creation and sharing between countries
Report Subtitle: A study of the Zero Waste Co-Lab project between Brazil and Denmark
Project Type: M.Sc. Thesis
ECTS-point: 30 ECTS-points

University: Aalborg University
Department: Department of Planning - Copenhagen Campus
Education: M.Sc. Sustainable Cities
Semester Coordinator: Helle Nedergaard Nielsen

Supervisor: Michael Søgaard Jørgensen
Co-Supervisor: David Christensen
External Examiner: Jingjing Gao

In collaboration with: BOFA, Universidade Paulista and Universidade Federal do Paraná.

Starting date: 1st of August 2022
Delivery date: 17th of October 2022
Examination: 31st of October 2022
Empiric collection period: 1st February - 3rd June 2022

Name: João Antonio Basso Rezende Møller
Study Nr.: 20191207

Signs: 123.361
Page count: 57
Table numbers: 3
Figure numbers: 17
Appendix numbers: 3

ENGLISH SUMMARY

This master thesis is a study on Zero Waste Co-Lab, a project between two Brazilian universities, a Danish University (Aalborg University) and the waste management authority on Bornholm, BOFA. The main objective of this thesis is to understand how the partners from different countries can share knowledge between both countries or even create new knowledge together. The author of this thesis was part of most of the first year of the Zero Waste Co-Lab project, collecting data by participating and organizing all activities and meetings, doing interviews with the partners, evaluating the participants of said activities and analyzing the results.
The analysis and discussion in this master thesis shows that all initial success criteria from the Co-Laborators can be achieved with collaboration of the partners. For that to happen the partners have to work towards the same goal and specific themes, those are delivered on this thesis as well. The two approaches to better create and share knowledge, based on the Zero Waste Co-Lab project, are networking with local stakeholders and collaborating with students.

DANSK RESUME

Dette speciale er et studie om Zero Waste Co-Lab, et projekt mellem to brasilianske universiteter, et dansk universitet (Aalborg Universitet) og affaldsbehandler på Bornholm, BOFA. Hovedformålet med denne afhandling er at forstå, hvordan partnere fra forskellige lande kan dele viden mellem begge lande eller endda skabe ny viden sammen. Forfatteren til dette speciale var en del af det meste af det første år af Zero Waste Co-Lab projektet, idet han indsamlede data ved at deltage og organisere alle aktiviteter og møder, lave interviews med partnerne, evaluere deltagerne i nævnte aktiviteter og analysere resultaterne.
Analysen og diskussionen i dette speciale viser, at alle indledende succeskriterier fra Co-Laborators kan opnås i samarbejde med partnerne. For at det kan ske, er partnerne nødt til at arbejde hen imod det samme mål og specifikke temaer, som også leveres i dette speciale. De to tilgange til bedre at skabe og dele viden, baseret på Zero Waste Co-Lab projektet, er netværk med lokale stakeholders og samarbejde med studerende.

RESUMO EM PORTUGUÊS

Esta dissertação de mestrado é um estudo sobre o Zero Waste Co-Lab, um projeto entre duas universidades brasileiras, uma universidade dinamarquesa (Universidade de Aalborg) e a autoridade de gestão de resíduos em Bornholm, BOFA. O principal objetivo desta tese é entender como os parceiros de diferentes países podem compartilhar conhecimento entre os dois países ou até mesmo criar novos conhecimentos juntos. O autor desta tese fez parte da maior parte do primeiro ano do projeto Zero Waste Co-Lab, coletando dados participando e organizando todas as atividades e reuniões, fazendo entrevistas com os parceiros, avaliando os participantes das referidas atividades e analisando os resultados.
A análise e discussão nesta dissertação de mestrado mostra que todos os critérios iniciais de sucesso dos Co-Laborators podem ser alcançados com a colaboração dos parceiros. Para que isso aconteça, os parceiros têm que trabalhar para o mesmo objetivo e temas específicos, que também são apresentados nesta tese. As duas abordagens para melhor criar e compartilhar conhecimento, com base no projeto Zero Waste Co-Lab, são networking com stakeholders locais e colaborando com alunos.

ACKNOWLEDGMENTS

As most acknowledgments, the relevance of this chapter to the understanding of the project for any reader is close to none. However, the importance of these couple of pages to me are immense. This is where I am able to thank people who helped me getting this far, and not recognizing them would be unacceptable from my part.

First of all, I want to thank my supervisors Michael Søgaard Jørgensen and David Christensen. Thank you for all our meetings, for the knowledge shared with me, for playing with my strengths and tackling my weaknesses. Even before I was an intern at BOFA, David already had me linked to the team who was writing the application for Zero Waste Co-Lab. When the application went through, both Michael and David welcomed me to the project and because of that I got a great network, worked in a project that made me very happy and even made friends. On the same note, I want to thank Prof. Cecilia Almeida, Prof. Aguinaldo dos Santos and PhD student Marcella Lomba for the great co-laboration and incredible talks! I hope I am able to keep working with all of you in the future.

Those people were indispensable for my master thesis, but the education is not only about the last project, but all the years of hard work. For those, I want to specially thank my groups:

1. Michelle Ochsner, Evelina Araja, Sofie Fisker, Sine Sola and Frederik Nielsen for "*Exploring the potentials, barriers, alternatives and assessment of shared waste sorting systems: the case of Gudhjem on Bornholm*".
2. Anders Nielsen, Daniel Coelho and Victoria Bryanne for "*Svaneke Bryghus Wastewater – SDGs, Circular Economy and Brewing Beer*".

The eight of you are always welcome on Bornholm and it was a pleasure to make projects with all of you!

I also want to thank BOFA and all my coworkers for the last year. My first project was in collaboration with BOFA, and being able to experience Bornholm in that semester was conclusive for my choice of moving to the island. Since then I worked in many projects at BOFA, both as an intern and as student worker. Thanks for the confidence, for the support and for the guidance. Thanks to the leadership at BOFA, to the department of environment and projects, and special thanks to David who have been my link from the university to BOFA from the first project, a exceptional boss and excellent friend.

Being a student at Aalborg University (AAU) and at the Technical University of Denmark (DTU) gave me a unique understanding of my field of work. I am forever thankful for all the capable and brilliant teachers I had along the way. Thankful for the many workers at both universities that were there to lift me and my many projects up. And of course, many friends I made, thank you: Inunnguaq, Kjøller, Christina, Emilie, Jakob, William, Kevin, Søren, Wiebke, Ida, Makena, Nicole, Amalie, Karolina, Anders, SDG Student Ambassadors, Sustainability Advocates, SustainaBeans and UNYA.

I am blessed with great people in my life, but not only fellow students from the university. Some people have been with me from literally the beginning, and even though we live over 10.300 km (in a straight line) away from each other, they manage to be part of my every day and are essential for my life. Thank you so much Hick, Cássia, Carol, Cindy, JP, Katayama and the rest of the mozões and demolays. It is an honor to have grown up with you, and to still have you all in my life. You are always welcome at my home and hope to see you all soon.

I told in the beginning of the foreword I had a lot of people to say thanks to, and they do not need to be friends I had for my whole life. Some people entered my life recently and become some of my best friends by having fun and games or for long and good discussions about politics and sustainable development. Thank you Steffan, Therese, Cecilie, Mia, Julie, Laila, Amanda, Søren, Kristoffer, Line, Søren, Yge, Jacob, Tuuma and once again David. Thank you for my friends from Radikale Ventre on Bornholm and the rest of the country.

I could not let this foreword end before thanking my sister Mimi, my mother Ligia M. S. Basso and my father Marcus V. M. Rezende that, it goes almost without saying, I would not be able to be close to where I am without their full and unconditional support and love. I do not show appreciation enough for you and all you have done for me. I build myself the person I am today, but it is all because of the strong base you provided and the support each time it was needed. Thank you so much! And talking about the base of my character and start of my life, some of the most important people in my life are my grandparents. Vovô Tunico, thank you for the strength and wisdom, Vovó Lili, thank you for the happiness and courage, dearest Vovó Irene, thank you for all the love and motivation, and for my late grandfather who died while I was studying for this graduation, thank you Vovô João for the smiles and care. You were always proud of my achievements and I wish you could be here to share this one with me, thank you!

Most importantly I want to thank my family. Thank you Oscar F. G. G. Møller, Atlas A. Møller, Anthony A. Møller and of course my wife Malene E. Møller. The four of you are the reason I want to improve myself, the reason I want to do what is in my grasp for a sustainable development. Oscar had classes with me, sitting still with his tablet while I was learning. Atlas slept outside the classroom several times in his stroller and took some of his first steps on the study rooms at AAU. Anthony was born already on Bornholm and is sitting on my lap right now as I finish this chapter and with that my thesis. I am so proud of my children and so happy I get to follow close your history. For Malene, you are everything, thank you and I love you!
The four of you are my reason to be! Thank you for choosing me as your papai!

TABLE OF CONTENTS

INTRODUCTION

Being born and raised in Brazil, and having studied in Denmark for the last nine years, I was immediately attracted by a project where researchers from both countries should work together. The attraction was not reduced by the theme of waste, as I have been specializing myself in the area for the last three years. As a cherry on top of the cake, the project has Bornholm as one of the focus locations, the island where I have lived since May 2020 and come to love.
Those are some reasons for me choosing to work with this project, and the great cooperation between inspiring people is what made me hold on to the project. I got more and more interested about the process of working together between countries, about creating knowledge with diverse academic- and life backgrounds, and about the role of students in all of this process.
This thesis is a study on Zero Waste Co-Lab. A project between Aalborg University in Denmark, with Universidade Federal do Paraná and Universidade Paulista, both from Brazil. For better introduction of this master thesis, I will zoom out and look at the challenges in holistic fashion with help of the SDGs, then present the places the project is about with more details and at last the theme I am working with and the problem analysis with the research question. The chapters thereafter will explain the activities the project group has done together with me and try to answer how it can create and share knowledge between countries and answer the research questions.

SUSTAINABLE DEVELOPMENT GOALS (SDGS)

On the 25th of September 2015, the United Nations General Assembly adopted the resolution 70/1. “Transforming our world: the 2030 Agenda for Sustainable Development”. (Assembly, G., 2015)

Researchers and experts at the United Nations did extensive work to define challenges and problems the world is facing. Therefore, the SDG’s are an excellent tool to focus where there is a need to create new solutions. In total there are 17 goals:
1 - No Poverty
2 - Zero Hunger
3 - Good Health and Well-Being
4 - Quality Education
5 - Gender Equality
6 - Clean Water and Sanitation
7 - Affordable and Clean Energy
8 - Decent Work and Economic Growth
9 - Industry, Innovation and Infrastructure
10 - Reduce Inequalities
11 - Sustainable Cities and Communities
12 - Responsible Consumption and Production
13 - Climate Action
14 - Life Below Water
15 - Life on Land
16 - Peace, Justice and Strong Institutions
17 - Partnerships for the Goals

Each goal has some number of targets that make the challenges more specific and concrete, in total there are 169 targets. For example, the SDG 13, as mentioned, is called “Climate Action”, a broad subject, and the target 13.2 is “Integrate climate change measures into national policies, strategies and planning”, (UN, D., 2015) making it more specific. Besides that, there are also indicators for each target, making it possible to measure the development for each target and goal. Keeping the same example, the indicator 13.2.2 is “Total greenhouse gas emissions per year”, (UN, D., 2015) a number that can be measured and compared.

As a student at Aalborg University, you are strongly motivated to use the SDGs at any project you make. The Times Higher Education Impact Ranking measures how universities are performing against the SDG’s, and because of the projects mentioned and the data collection from different faculties, Aalborg University was ranked at 31st place on overall impact in 2022 (Melchiorsen, PM, et al. 2020). It is worth mentioning that Aalborg University was also ranked 11th on impact for the SDG 17, and first on impact for SDG 4 (Melchiorsen, PM, et al. 2020). It would be wrong of me then, not to include the Sustainable Development Goals as a tool on a master thesis at Aalborg University, especially when the SDG 17 is such a strong element on creating and sharing knowledge and the SDG’s are a framework for action by actors and decision-makers where knowledge generation plays a role. I will come back to the specific SDGs interesting for this project in the problem analysis chapter after a better introduction of the project itself.

ZERO WASTE AND CIRCULAR ECONOMY

This master thesis is a study on the project Zero Waste Co-Lab, and this project will be better introduced later on the problem analysis chapter, but first I should introduce the theme of the project and some terms that are used.

A question that I will come back to in the analysis chapter is “What is a Circular Economy?”, and for that the Ellen MacArthur can be quoted on their answer:

“In our current economy, we take materials from the Earth, make products from them, and eventually throw them away as waste – the process is linear. In a circular economy, by contrast, we stop waste being produced in the first place.”

A definition much like the definition for the term “Zero Waste”, that according to the Cambridge Dictionary is a noun that means “a situation in which no waste material is produced”. If written with a hyphen, “zero-waste” we then have an adjective that means “not producing any waste material”.

Zero Waste and Circular Economy have many models and tools explaining the process for a more sustainable consumption, production and disposal of materials. Three important models that will be mentioned again along this thesis are the butterfly diagram, the factor four and the waste hierarchy.

THE WASTE HIERARCHY

The latest version of European Commission's Waste Framework Directive 2008/98/EC makes recommendations on the treatment of not only end of life waste but also recommends a "waste hierarchy" (Directive, E.C., 2008). According to the waste hierarchy, when a consumer has a reason to dispose of a product, there are better and worse ways to do so. A hierarchy is a system when things are arranged according to their importance. Figure 1 shows on top the most important, or the best, measure to handle waste, preventing the product from becoming waste in the first place. The bottom is then the least important, or the worst, procedure of handling waste, that being disposal as in a landfill.

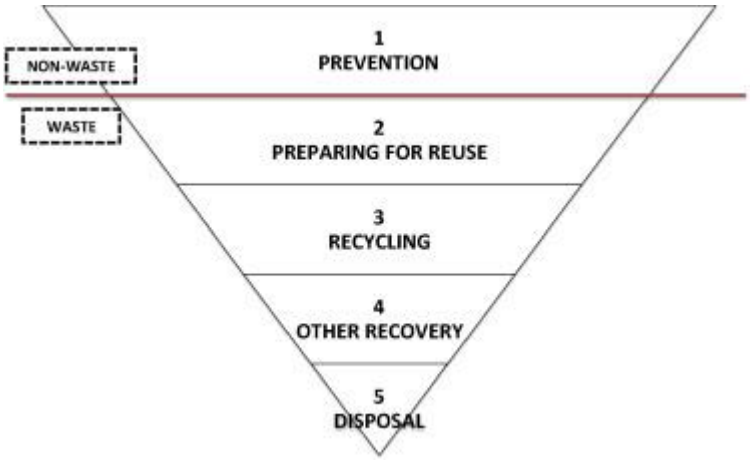


Figure 1 - Waste hierarchy as in (Directive, E.C., 2008)

On the bottom of the hierarchy is disposal, that could be landfill or incineration without energy recovery. It happens when there is no current possible way of recycling or recovering anything from the product, but it can also be a result of bad waste management, for example when people decide to burn their waste instead of properly handling it.

"Other recovery" is the process of retrieving what is possible from the wasted product in the form of fuels, heat and power. Incineration with energy recovery, anaerobic digestion, gasification and pyrolysis are examples of "other recoveries".

Recycling is the lowest step that is still included on a circular economy system. When recycling the product is wasted, but the materials get back into the system.

Preparing for reuse are actions such as cleaning, repairing, refurbishing whole items or spare parts.

Prevention is above the line that separates waste to non-waste methods. This is a category where there are many methods of preventing more waste. Avoidance, as buying fewer items or using less material per product. Reducing by keeping products for longer, or for producers reducing would be by designing products that last longer. Reuse, as in second hand shops where you can buy and sell used items. This is the top of the waste hierarchy, because it is the most important step in a circular economy.

THE BUTTERFLY DIAGRAM

Ellen MacArthur Foundation presents a butterfly diagram for circular economy, that can be seen on figure 2. They divide the waste in two groups depending on what type of material the product is made: it is either Technical (blue lines) or biological (green lines).

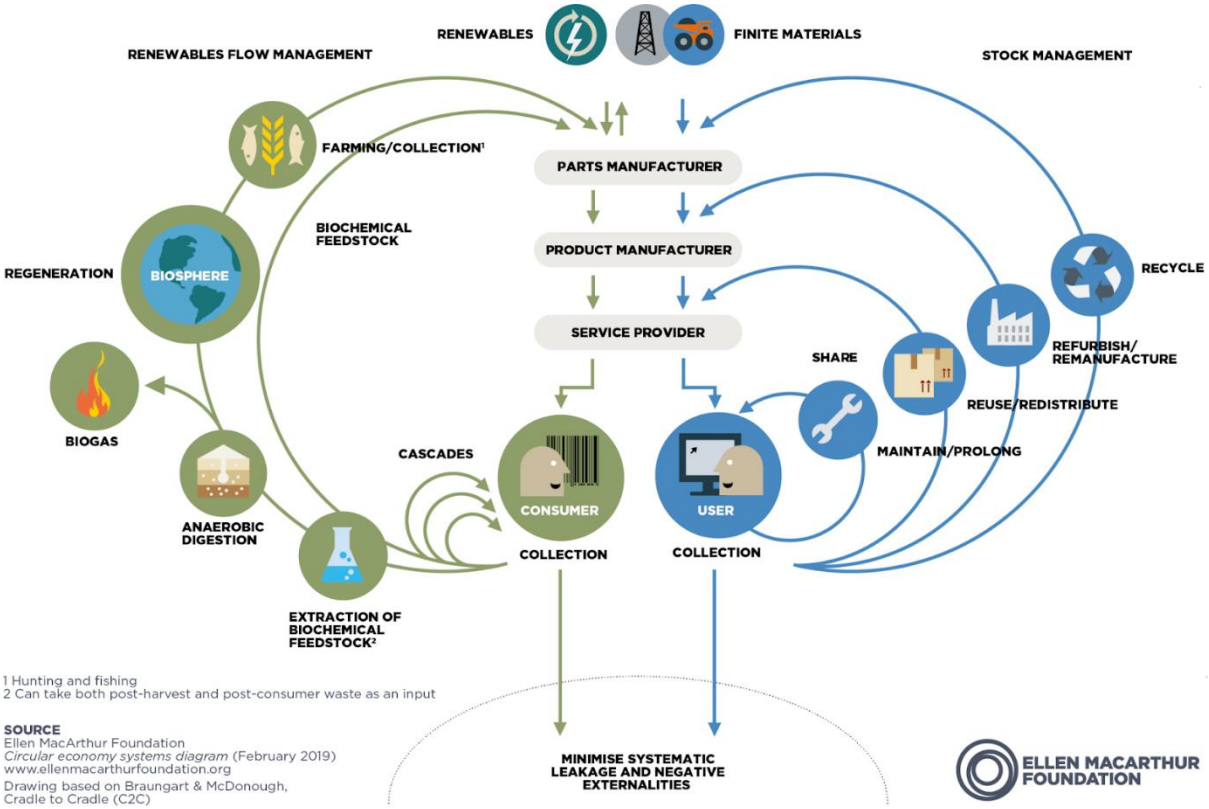


Figure 2 - The Butterfly Diagram for visualizing the circular economy. Source: Ellen MacArthur Foundation

The technical cycle is anything that does not biodegrade, for example most plastics and metals. For a circular economy model, those resources should be sorted and feeded back into the system. The technical cycle is represented with the blue lines, starting from the energy and materials that are needed to produce the said product. After parts manufacturer, product manufacturer and service provider, the product finds a place with the user. In a linear economy, the product would then be disposed of when there was no use for it anymore because of malfunction or whatever the reason the user would have to throw the product away. However, on a circular economy the product would somehow come back to the system. The first loop can be compared with the top of the waste hierarchy, making the product stay with the consumer by repairing and/or sharing. Those two solutions also decrease consumerism, which aggravates the challenges with the circular economy by creating more waste. Repairing a lawn mower stops the consumer from having to buy a new one, and sharing it stops several households from needing to own one. Reuse and Redistribute are the next loop and it also prevent products from becoming waste. A very well-known saying is “One person’s trash is another person’s treasure”. It shows well that if a person does not have interest in a product, it can very well be interesting for another person, also preventing it from becoming waste.

The next two loops are still part of a circular economy. However, it is not the product that comes back to the system, but parts of it or the materials. During recycling the value of the product is gone, but the value of the material is preserved.

The biological cycle, on the other hand, are all materials that biodegrade, as food and wood. It still starts with raw materials and energy, but notice that there is an arrow to and from the raw materials, as old biodegradable products can be part of the production of new biodegradable material.

The butterfly diagram presents several steps after the consumer on the biological cycle as the technical cycle. Producing biogas and other parts for regeneration and farming. However, the first and smaller loops are about preventing it from becoming waste, by repurposing the product.

The two types of products are naturally very distinct and therefore the butterfly diagram is very useful as it shows different strategies on both cycles.

RESOURCE FLOWS AND LOOPS

As the name suggests, circular economy refers to getting materials to come back to the system, making a loop. As the waste hierarchy and the butterfly diagram show, getting materials back into the system is not enough. There is not only need to close the loop, but also slowing and narrowing resource flows, terms illustrated on figure 3.

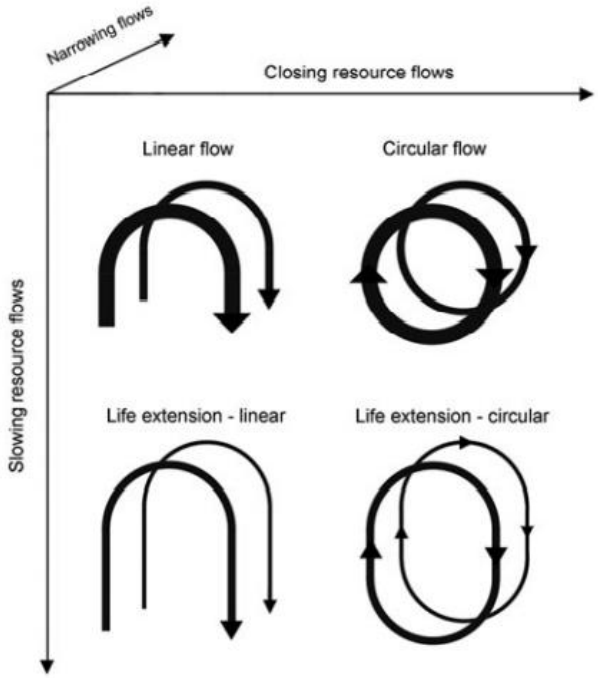


Figure 3 - Categorization of linear and circular approaches for reducing resource use (Nancy, MP., 2016).

Closing resource flows, as mentioned, is not permitting the item, or at least the materials that make the item, to leave the system. Recycling, refurbish, methods to stop waste from getting incinerated or disposed are closing the loop. Slowing resource flows is about prolonging the products lifespan, it can be by design or by repairing and reusing the product. Narrowing resource flows is a different approach than slowing it, it is about decreasing the amount of waste, reducing resource use.

DENMARK - BORNHOLM AND COPENHAGEN

Denmark is a Nordic country in northern Europe. Denmark is a small country compared to its closest neighbors, it has an area of around 43,000 km² (Denmark, S. 2022) with a population of 5,91 million people (Denmark, S. 2022-Q3). On the other hand, the country has a coastline which is unusual for the size of the country. Denmark stretches over 7,300 km of coast (Elmeskov, R.J., 2017). That is because of a characteristic feature of Denmark's geography, it has many islands, 391 in all (Elmeskov, R.J., 2017).

In Denmark there are two locations of interest in this project, the capital Copenhagen, and especially the island of Bornholm.

Copenhagen, as mentioned, is the capital of Denmark. The city has around 183 km² (Denmark, S. 2022) and a population of over 647000 inhabitants (Denmark, S. 2022-Q3). Water channels all over the city that are clean enough for bathing, an impressive number of bicycles and bike lanes, and an off-shore park of wind turbines right outside the city. Part of Copenhagen's tourist strategy is pioneering sustainable urban development with sustainable events and activities, organic restaurants and even its own sustainability build guide.

Bornholm is a Danish island in the Baltic Sea. More precisely, Bornholm is located 145 kilometers from the Danish capital, Copenhagen. It is also 37 kilometers from Sweden, 88 kilometers from Germany and 90 kilometers away from the north coast of Poland (Regionskommune, B. 2003). The proximity of the island with those countries, and many more connected by the Baltic Sea, shows already some possibilities for knowledge creation and sharing between countries. At the same time the island is far enough in the Baltic Sea, that makes it an interesting case where many projects can be applied and measured. This has been a reason for Bornholm getting to be known as Test Island.

Bornholm's area is around 588km², (Denmark, S. 2022) 158 km of coastline and on the 1st of January 2022 Bornholm had 39.552 habitants (Regionskommune, B. 2022). Bornholm is also a very popular destination for tourists, especially during summer. Tourists are important for the island's economy, but it also brings challenges for services supply such as wastewater treatment or, more related to this project, waste handling.

BOFA

BOFA is the solid waste management authority and service provider on Bornholm. In 2018 the municipal council of Bornholm unanimously backed a vision from BOFA called "Zero Waste 2032". BOFA uses the Waste Hierarchy to draw a literal line on the bottom part of it, as seen on figure 4.

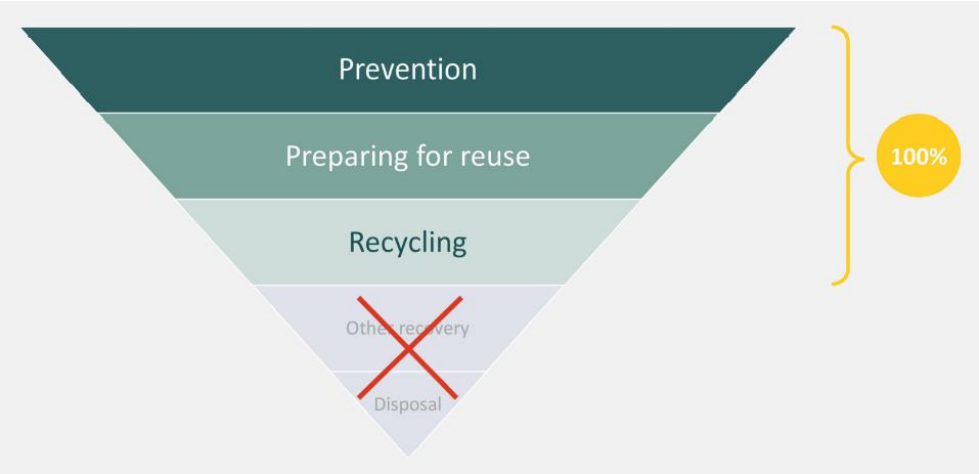


Figure 4 - BOFA's waste hierarchy for 2032 (BOFA, 2019)

Bornholm's new vision is to be the first region in Europe without waste incineration by 2032 (BOFA, 2019). BOFA, 2019 states: *"In 2032 there will be no more waste on Bornholm – all discarded items are resources that can be recirculated to the benefit of the entire community."* (p. 4).

BRAZIL - CURITIBA AND ILHABELA

Contrary to Denmark, Brazil is a very large country, in fact it is the largest country in both South America and Latin America. Brazil is the fifth largest country by area with around 8.5 million km² (IBGE, 2022a) and the seventh most populous country in the world with over 215 million people (IBGE, 2022b).

In Brazil there are two locations of interest in this project, both because they are the cities used in the application for Zero Waste Co-Lab that will be explained later in the problem analysis chapter. They are the capital of the state of Paraná, Curitiba, and the island in the state of São Paulo, Ilhabela.

Curitiba has an area of almost 435km² and has over 1,9 million inhabitants (IBGE, 2022c). The state capital is known for its sustainable urban development, and many publishers such as Greenmatters and The Borgen Project, give credit to Jaime Lerner that in 1972 became mayor of Curitiba and instituted his plan for a sustainable city. Since then the city has invested in good public transport, green spaces, recycling programs and sustainable education.

Ilhabela is an island in the state of São Paulo in Brazil. The island has around 36.000 habitants, and it has an area above 345km² (IBGE, 2022d). The island is very touristic, but differs from Bornholm in many aspects, for example it does not have high pics of tourists, meaning that the island receives tourists all year around as confirmed in internal communication with Ilhabela's secretary of environment and the director of urban services and solid waste. The waste collection of the island is very peculiar as many places are not reachable by land, so small communities have their waste collected by boats. All collected waste in the island is then transported almost 110km away to a city called Jambeiro.

TRANSNATIONAL KNOWLEDGE BUILDING AND EXCHANGE

Whether by scientific experiments, a literary analysis or a sociological case study, academic disciplines have various methods for creating reliable information. In an information literate society, scientists, scholars and researchers, who are paid to create information, are continually discovering and creating knowledge and it is transferred or shared to others through conferences, books, scholarly articles, and even in government statistical sources.

Jens Müller writes at Kuada, J.E., et al. 2003 about the transfer of knowledge, in form of technology, from one social context to another and gives three options to solve the problematic situation of the technology not fitting in the new setting (Kuada, J.E., et al. 2003):

1. The technology is fully adapted to the new setting
2. The setting is fully adapted to the new technology
3. Both the technology and the setting are changed to fit each other.

In this thesis or at Zero Waste Co-Lab we are not working with specific technologies, but with ideas and different strategies for circular economy. However, as presented before, Brazil and Denmark are still different countries, with different cultures and different settings. Therefore, the transition of information and strategies from each country should fit one of the three options presented by Jens Müller, or be created with both realities in mind.

If there is a process to share knowledge between countries, so is a process to create knowledge. The setting or, in case of multiple countries, settings, are not less important when creating new knowledge. Figure 5 presents a process for knowledge creation in a market, and although it presents linear model, the actual process progresses forming multilayered loops (Nonaka, I. 1994).

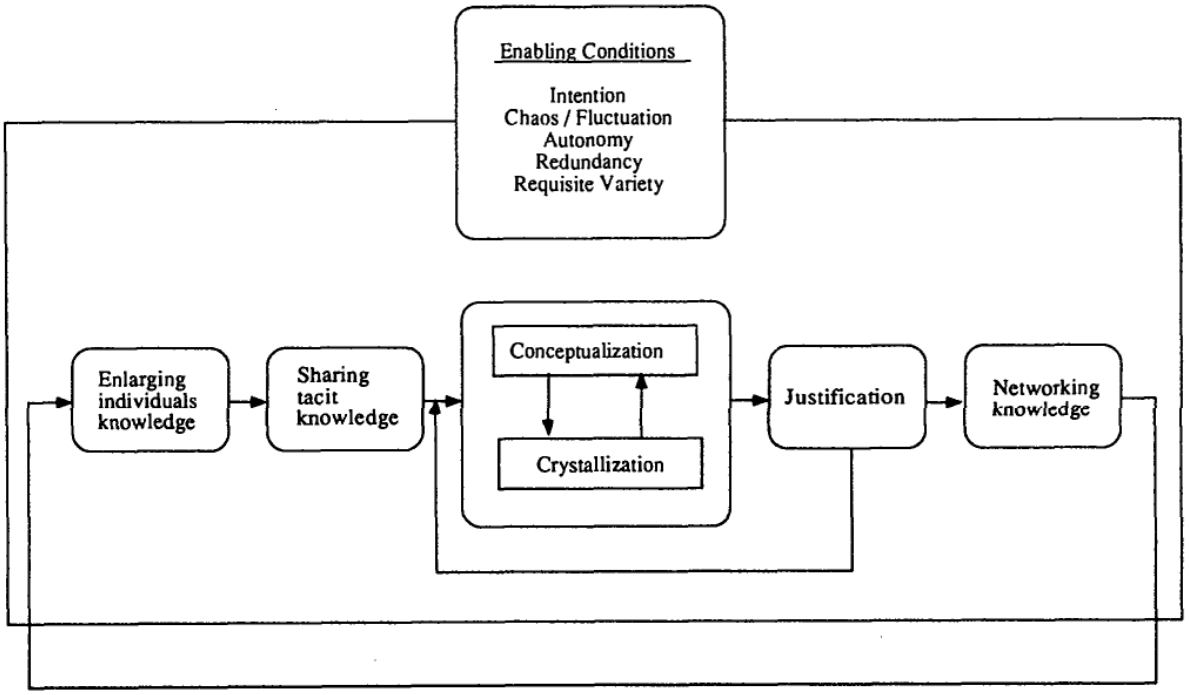


Figure 5 - Process of generating information/knowledge in the market (Nonaka, I. 1994)

The enlargement of an individual's knowledge focuses on the most important actor in the process of knowledge creation, the individual themselves. Use different approaches so new information can combine with their experience and rationality so the individual is more capable to create new knowledge.

Sharing tacit knowledge enables the individual to avoid their perspectives to remain personal. Basically, to create new knowledge it is important to learn first.

Crystallization is the process to turn the process into some “concrete” form such as a product or a system. The crystallization is accompanied with conceptualization because that stage is associated with testing of ideas.

The justification is the end of the knowledge creation, when putting all results from the process together and having it screened to determine the value of the new knowledge.

With new worthy knowledge, the last stage is to disseminate and depending on the situation I will refer to this stage as knowledge sharing or transfer.

The theoretical framework chapter will provide deeper information about knowledge creation management, including approaches for the stages of the knowledge creation process, before the analysis of the results from the methodology and the discussion after that.

KNOWLEDGE HIERARCHY

As knowledge mainly originates from an individual’s brain (Liyanage, C., et al. 2009), one of the most valuable sources of knowledge for the Zero Waste Co-Lab project is the expertise of its members who will soon be introduced in the problem analysis. Earlier I presented the waste hierarchy, and now I want to introduce another hierarchy to illustrate the difference between expertise and knowledge, the knowledge hierarchy represented on figure 6 (Bender, S. and Fish, A. 2000).

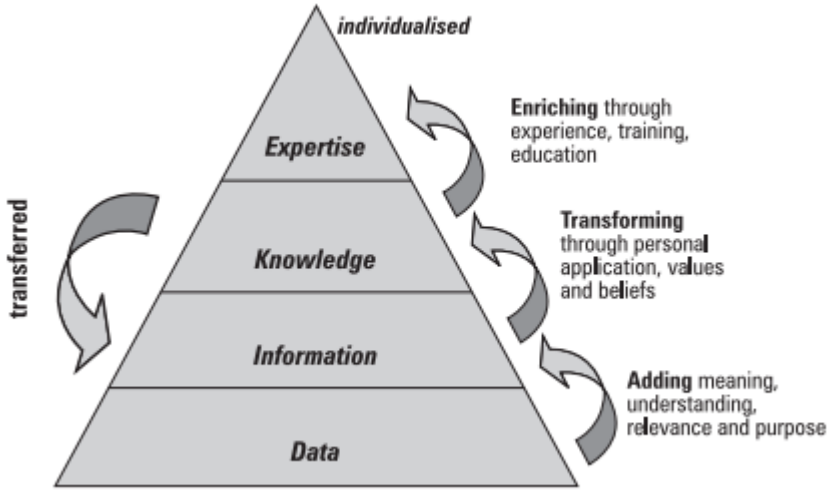


Figure 6 - Knowledge hierarchy (Bender, S., and Fish, A. 2000)

Expertise is specialized, it is gained through experience, training and education. Expertise is on top of the knowledge hierarchy because it is the higher quality of knowledge and the most difficult and time consuming to obtain. Knowledge is information that has been transformed through personal application, it has been interpreted by the individual and applied to the purpose for which it is needed. Information is data after being analyzed and has received meaning and understanding.

PROBLEM ANALYSIS

Building a construction in Denmark and a construction in Greenland are two very different practices. From the very foundation of the building, if environmental factors such as permafrost are not taken into consideration, the building will collapse (Nielsen & Rauschenberger, 1957). That is one example of technologies and strategies that cannot be simply copied and transferred from one reality to another. Nonetheless, I am not implying that all knowledge about constructions should be created in Greenland to be able to exist there.

Personally, I am very proud of living on an island that is working on its potential to be a “test island”, where innovation can begin and sustainable solutions can be found for challenges on Bornholm, in Denmark, Europe and even the world. However, what knowledge should be created here and what should be appropriated from other places? What do we already know and should use and what do we still need to figure out?

ZERO WASTE CO-LAB

The project “Zero Waste Co-Lab” tackles these questions focusing on a specific theme, Solid Waste, and two specific countries, Brazil and Denmark. That is also what I am doing in this thesis, defining the problem related to Solid Waste by referring to the SDG’s and global challenges with waste, and finding out how to best create and share knowledge between countries. Therefore, I will be researching, understanding and learning with the idea of Zero Waste Co-Lab, while participating in all meetings and organizing the workshops and other activities in the project. Hence the title of the thesis “Knowledge Creation and Sharing Between Countries: A Zero Waste Co-Lab Study”.

The Danish Ministry of Higher Education and Science supports networking activities between Danish and international research and innovation actors. For that purpose, they offer a Global Innovation Network Program as a part of the Ministry’s efforts to internationalize Danish research and innovation. The program prioritizes cooperation with a specific list of non-European countries, including Brazil, to establish relationships and carry out networking activities with relevant stakeholders. Associate professor Michael Søgaard Jørgensen from the Department of Planning at Aalborg University, hereinafter referred to as Michael, applied and received a grant for a project called “Zero Waste Co-Lab'' with the duration from January 2022

to December 2023. The other partners in the project, who also participated on the application for the program are:

- Prof. Aguinaldo dos Santos from the Design Department of the Federal University of Paraná (UFPR), hereinafter referred to as Aguinaldo,
- Prof. Cecilia M. V. B. Almeida Co-Editor-in-Chief of the Journal of Cleaner Production and Editor-in-Chief of Cleaner and Responsible Consumption from Universidade Paulista, hereinafter referred to as Cecilia,
- Postdoc David Christensen also from the Department of Planning at Aalborg University and Project Manager at BOFA, hereinafter referred to as David.

This group of people plus Marcella Lomba, a PhD student at UFPR and myself will be hereinafter referred as Co-Laborators.

“Zero Waste Co-Lab” proposes to jointly develop research and innovation activities among Danish and Brazilian partners with thematic focus on resource streams and strategies for circular economy. It takes place from January 2022 to December 2023, meaning that this thesis will end two months from the halfway point of the project. To achieve the networking and developing international relationships, which is the goal of the Global Innovation Network Program, the project have the following activities focused on Zero Waste:

- Workshops in Denmark and in Brazil
  - Workshop 1: Bornholm in June 2022
  - Workshop 2: Brazil in April 2023
  - Workshop 3: Copenhagen in August 2023
- Webinar: Zero Waste in Cities
- Implementation of a Zero Waste Co-Lab Portal
- E-Book on “Zero Waste Strategies and Visions”
- Joint Paper Submission to Key International Journal

The first Workshop and the Webinar are the two activities finished until the end of this thesis and will be described and analyzed in later chapters.

SUSTAINABLE DEVELOPMENT GOALS

The United Nations did an extensive piece of work to define challenges and problems the world is facing. Therefore, the SDG’s are a good baseline to understand the challenge this Thesis will tackle, together with Zero Waste Co-lab. The SDG’s focused in this Thesis are:

SDG 11 - Sustainable cities and communities.
This SDG is about making cities and human settlements inclusive, safe, resilient and sustainable.

SDG 12 - Responsible consumption and production.
This SDG is about ensuring sustainable consumption and production patterns.

SDG 17 - partnerships for the goals.
This SDG is about strengthening the means of implementation and revitalizing the global partnership for sustainable development.

RESEARCH QUESTION

Based on Zero Waste Co-Lab, how can knowledge about Circular Economy and Zero Waste be shared and generated between countries?

SUB-QUESTION 1

How do the Co-Laborators in Zero Waste Co-Lab understand Zero Waste and Circular Economy?

SUB-QUESTION 2

What are the initial success criteria for Zero Waste Co-Lab according to the partners?

SUB-QUESTION 3

What is the best work plan for creating and sharing knowledge between countries based on the first year of Zero Waste Co-Lab?

First Draft:
How can the SDG's play a role in knowledge building and sharing between partners in international collaborations?
Sub-question
How to build and share knowledge about the Circular Economy and Zero-Waste?

Second Draft:
Based on Zero Waste Co-Lab, how can knowledge about CE and Zero Waste be shared and generated between countries?
Sub-question 1
How well received would reuse containers, repair shops and exchange markets be on Bornholm, on Ilhabela and in Curitiba?
Sub-question 2
What is the influence of Bridging Actors during work of international knowledge sharing and creation? How do different backgrounds play a role in Zero Waste Co-Lab?

Third Draft:
Based on Zero Waste Co-Lab, how can knowledge about Circular Economy and Zero Waste be shared and generated between countries?
Sub-Question 1
How is Zero Waste and Circular Economy understood between partners?
Sub-Question 2
How have circular strategies for product lifetime extension developed and changed over the past two decades in Curitiba, Ilhabela and Bornholm and what potentials for exchange and duplication of such strategies exist?
Sub-Question 3
How can Bridging Actors support knowledge sharing and generation between countries?

LIMITATIONS

As of the day of the delivery of this Thesis, there is still over 14 months till the end of the Zero Waste Co-Lab project. Therefore, I cannot study the whole project before taking conclusions. The answer for sub-question 3 can and should evolve during the future activities for the Co-Laborators. There will certainly be more information to supply answers for sub-question 1 and 2 and even the main research question. However, this thesis is not only a product of Zero Waste Co-Lab, but an inspiration and recommendation for the Co-Laborators for the next 14 months.
The last event was a webinar that ended three weeks before this thesis was delivered, so there was no time to make an evaluation and analyze it for this thesis.

METHODOLOGY

PARTICIPATORY ACTION RESEARCH

"Experience can be a basis of knowing and experiential learning can lead to a legitimate form of knowledge."

- *Baum, F. et al. 2006 pg. 854*

Action research differs from many approaches because it is based on data collection and reflection (Baum, Fran, et al. 2006). This process gives the researcher the possibility to participate in the course of action and lead the process of change within a community, in this case the group Zero Waste Co-Lab and the island of Bornholm.

Participatory Action Research also blurs the line between the researcher and the researched, which Baum, F. et al. 2006 explains to be paying careful attention to power relationships, advocating for power to be shared between both members. This was achieved by being one of the partners on Zero Waste Co-Lab, representing both Aalborg University and BOFA. As mentioned in the introduction, I was present at meetings and organized the events with the Co-Laborators. In total we had nine meetings of one to two hours duration while this thesis was being written, plus five days of two hours each for the webinar that will be described later in this chapter, as well as seven interviews of one-hour duration each and the two days' workshop on Bornholm.

The process includes being part of every meeting and introducing my own opinions and suggestions, at the same time I am, as the researcher, collecting and analyzing data and then determining what action should follow. Some of the data collected and analyzed were in the form of email and conversations, some in the form of interviews as it will be described next in this chapter, and some data from our activities that are assembled in this thesis, and the last determination of course of action are the recommendations on the discussion chapter.

Action researchers in a project can take roles as change agents, knowledge brokers, reflective scientists, self-reflexive scientists and/or process facilitators (Wittmayer, J.M. and Schäpke, N. 2014). According to Wittmayer, J. and Schäpke, N. 2014:

- A reflective scientist would take a more observant role and be less active.
- A process facilitator includes the initiation of the project and facilitates the learning process.
- A knowledge broker is an intermediary, providing critical reflection and making the results relevant and tangible.
- A self-reflexive scientist is reflexive about his/hers position in the project and being their own research instrument.
- A change agent not only initiates and facilitates the learning process, but also participates in the process of aiming the project to real-world challenges.

A change agent would also seek to motivate and empower participants to address local sustainability challenges and network with stakeholders (Wittmayer, J. and Schäpke, N. 2014). Because of those descriptions and my part as Co-Laborator, I recognize taking a role as a change agent on my action research.

INTERVIEWS

"For as long as we know, human beings have used conversation as a central tool to obtain knowledge about others."

- *Brinkmann, S. 2014*

Early in the project, only after having two online meetings with partners for Zero Waste Co-Lab, I invited all partners to a semi-structured interview. Appendix 1 - Interviews show the questions and answers for all seven interviews.

In terms of the order of the interviews, I wanted to start with the participants that, like me, were not part of the application for the project, but joined later because of different interests. This is because I wanted to test my questions and my interview guide before I interviewed the professors that received the funds for the project. I also wanted David and Jens Hjul-Nielsen, director of BOFA, to be the last interviews, so I could gradually change the questions to something more focused on their role in the project as a waste management authority. However, I only used one interview guide with the same questions from the third to the seventh interview, the two first were my tests and a couple of the last questions were developed after our interview.

Some of my questions were very specific, for example by asking for the definition of the terms "Zero Waste" and "Circular Economy". However, I was not interested in a precise definition, but in personal experience. I, as the interviewer, should make clear that there are no right or wrong answers and that I am interested in anything they come up with (Brinkmann, S. 2014).

As for the structure of the interview, I started with a briefing and a round of presentations where I explained the theme of my thesis and heard about their background. After that I would ask the first question and explain it so we are in an agreement of what it means. The interviewee then would answer and their answer could generate a follow up question from my part, creating a conversation.

According to Brinkmann, S. 2014, after the question was answered and before I asked the next question, there were two important steps and those I did not follow. First, I should summarize and rephrase their description, then my understanding could be validated and it would provide a kind of evaluation on the question and answer.

When I was done with the last question I would have a debriefing and end the interview or talk about the next meeting/step for the project.

WORKSHOP

On the 14th and 15th of June 2022 we held a workshop on Bornholm for Zero Waste Co-Lab. There were different activities on both days, with different group targets.

The first activity for the workshop was a presentation about BOFA's history and future work with waste on Bornholm, including a walk around BOFA's facilities. BOFA's director Jens Hjul-Nielsen and Communication Chief Brian Johanson were the speakers.

On the afternoon of the first day of the workshop David Christensen presented the PBL method (Problem Based Learning) and showed how Aalborg University and BOFA works with it. We also had seven presentations from students that have been working with BOFA for the last year.

On the morning of the second day of the workshop I presented some data I have been collecting about the project Zero Waste Co-Lab and about my thesis theme, which was followed by presentations about Michael's, Cecilia's and Aguinaldo's field of work.

In the afternoon of the second day of the workshop, we received several stakeholders representing different groupings of Bornholm's society. Prof. Aguinaldo and Marcella made a presentation and explained the three parts of the workshop. For each of the three parts there were used 32 different strategies for waste handling, divided in 11 categories, them being:

- Planning & Governance
- Economic Sustainability
- Sustainable Behavior
- Social Inclusion
- Digital Transformation
- Waste Prevention
- Waste Minimization
- Waste Reuse (Extend Lifespan)
- Waste Recycle
- Waste Recovery
- Waste Treatment.

Part 1 - We were divided in groups and each group received a pile of 32 cards, each describing a strategy for waste management. As a group, we had to look through the different cards and place them in an order that would show the most relevant to the context of Bornholm, to the least relevant. Figure 7 shows one of the four groups placing the cards in order of relevance.

Figure 7 - Participants discussing the relevance of strategies. foto: João Møller

Part 2 - After that the participants received a list with the same 32 strategies on the cards for the first activity. The participant could individually rate relevance and dissemination for each strategy between non-existent (0) and very strong (4). Figure 8 shows the participants from another group filling in the forms after having placed all cards in order of relevance.

Figure 8 - Participants filling out the forms for part 2. foto: João Møller

Part 3 - Lastly all participants received three stickers that they could use to vote on the three categories they saw as most important for waste handling on Bornholm. Each group would

then present their card of the category most voted that was placed highest in the relevance line from part one, as I am doing on figure 9.

Figure 9 - Presentation of group results. foto: Marcella Lomba

EVALUATION

After the workshop the participants received a questionnaire to evaluate the workshop. The evaluation was based on chapter four “Developing an evaluation plan” from the book “Evaluation” by Green, Jackie, and Jane South 2006. As there were different target groups that participated in different activities, there are three different evaluations that can be seen on the evaluation guide on Appendix 3 - Evaluation. The first was made mostly for the Co-Laborators and a couple of guests who also participated in all activities both days. The second evaluation was for the students who participated and presented on the afternoon of the first day. As described earlier in this chapter, on the last afternoon of the workshop we received several stakeholders representing different groupings of Bornholm’s society, therefore the third evaluation was sent in Danish to the participants. The questions on the evaluation guide on appendix 3 are in both English and Danish, but the answers on appendix 3 are left in Danish and translated in the analysis and discussion chapters if relevant for an analysis or discussion.

WEBINAR

As mentioned in the problem analysis chapter, Zero Waste Co-Lab is financed by the International Network Program, but during the workshop on Bornholm there has not been much time for the Co-Laborators to network between themselves besides the morning of the second day. The webinars were a correction to that fact.
The webinar happened during five days, two hours a day. Each day was designed the same way:

1. Introduction of the day
2. Presentation from each of the Co-Laborators about one area of their expertise
3. Talk about the subject and how to implement it in the next activities for Zero Waste Co-Lab.

The presentations were recorded with the goal to be used at another activity for the Zero Waste Co-Lab project, the website, but the target audience was just the Co-Laborators.
As mentioned, each day had a theme decided by the responsible for the presentation. The responsible could upload materials beforehand, such as articles, so the other participants could be ready for the conversation after the presentation.

The first day's theme was "Results from Workshop 1" and the responsible were Aguinaldo and Marcella as they were moderators and facilitators during the workshop with stakeholders on Bornholm that is based on their research, and myself as I kept, organized and analyzed the results of the workshop. Those results and analysis will be described in later chapters, including the results of the evaluation about the workshop.

The second day of the webinar had the theme "From managing to measuring and vice-versa" and the responsible were Cecilia and her colleague Feni Agostinho, as both work with indicators.

The theme for the third day was "Students as Change Agents" with David and myself as responsible. David because of his work with bringing students to BOFA and working with them for many different projects. Myself because I also have experience working together with students and because I am one of the students David brought to BOFA.

"Transparency and Circularity" was the theme for the fourth day of the webinar with a collaboration of Marcella who is researching transparency for her PhD, and Michael who works with circular economy.

The fifth and last day of workshop had Aguinaldo and Michael as responsible for a webinar themed "Actors responsibility and Life Cycle Management". As the day before, Michael added to the conversation with his knowledge about products' life cycle and circular economy, as Aguinaldo supplemented with a take on the responsibility of stakeholders and citizens.

THEORECTICAL FRAMEWORK

KNOWLEDGE MANAGEMENT

Nonaka, I. “A Dynamic Theory of Organizational Knowledge Creation.” *Organization Science (Providence, R.I.)*, vol. 5, no. 1, 1994, pp. 14–37, https://doi.org/10.1287/orsc.5.1.14.

This paper is as old as myself. Yet I found it very relevant for this thesis. Apparently, Nonaka, I. is known as a Japanese knowledge management guru (Holden, N.J. and Von Kortzfleisch, H.F.O., 2004) and har been cited in most papers about knowledge management I used.

Figure 5 in the introduction summarizes the process of organizational knowledge creation and here I can dive deeper into the different stages of it: Enlarging individuals' knowledge, Sharing tacit knowledge, conceptualization and crystallization, justification and networking knowledge. Figure 5 shows a linear process, but in practice it forms multilayered loops and can jump forward or backward.

Before Nonaka, I., 1994 explains the different stages of the process of generating knowledge, he draws a distinction between “tacit” and “explicit” knowledge and points out that it is the conversation between both that drives the creation of new ideas and concepts. Another distinction drawn is between information and knowledge, where Nonaka, I., 1994 explains information is a flow of messages, while knowledge is created and organized by the very flow of information, anchored on the commitment and beliefs of its holder.

Nonaka, I., 1994 explains that explicit knowledge is transmittable in formal, systematic language and tacit knowledge has a personal quality, which makes it hard to formalize and communicate. He explains further that tacit knowledge is deeply rooted in action, commitment, and involvement in a specific context.

The assumption that knowledge is created through conversation between tacit and explicit knowledge allows Nonaka, I., 1994 to theorize four modes of knowledge conversation, shown in figure 10.

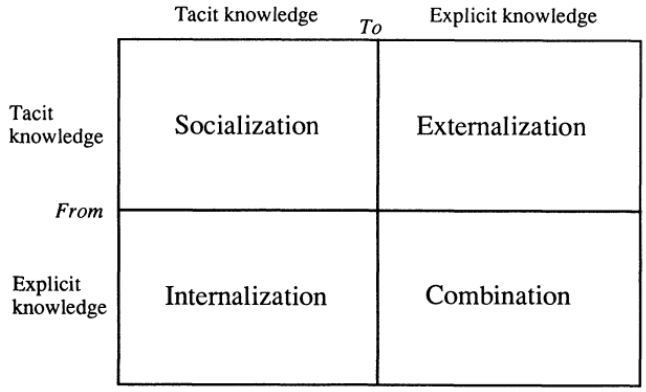


Figure 10 - Modes of knowledge creation (Nonaka, I., 1994)

Socialization is the mode of knowledge creation from tacit to tacit knowledge. Nonaka, I., 1994 explains that an individual can acquire tacit knowledge without language, for example by observation, imitation and practice. The name socialization refers to the creation of knowledge through shared experience.

Externalization is the mode of knowledge creation from tacit to explicit knowledge and Internalization is the mode of knowledge creation from explicit to tacit knowledge. Both explained by the affirmation that tacit and explicit knowledge complete each other and can expand over time through a process of mutual interaction. Internalization bears some similarity to the traditional notion of learning and externalization is not well developed because of limited analysis (at least not by the time of writing in 1994).

Combination is the mode of knowledge creation from explicit to explicit knowledge. Nonaka, I., 1994 explains this process of creating new knowledge with reconfiguring of existing information through the sorting, adding, recategorizing, and recontextualizing of explicit knowledge.

Recalling figure 5, Nonaka, I., 1994 explains the process of enlarging an individual's knowledge with different approaches, affirming that routine tasks mitigate against creative thinking and the formation of new knowledge. Therefore, one factor to enlarge an individual’s knowledge is to provide variety to an individual’s experience. However, Nonaka, I., 1994 explains that if the variety is increased, but the experiences are completely unrelated, there will be no increase of tacit knowledge.

Nonaka, I., 1994 points out that social interactions are fundamental for knowledge creation, however it can neglect the importance of reflection and logical thinking. He presents concepts of “high-quality experience” and “knowledge of experience” to be able to raise the quality of tacit knowledge. And to raise explicit knowledge Nonaka, I., 1994 presents “knowledge of rationality” which describes a rational ability to reflect on experience.

According to Nonaka, I., 1994, individual knowledge is enlarged through an interaction between experience and rationality, and crystallized into a unique perspective original to an individual.

The next stage is Sharing Tacit Knowledge and Conceptualization. The first stage creates a perspective original to an individual, and according to Nonaka, I., 1994 these perspectives remain personal unless they are articulated and amplified through social interaction. He explains that attempts to solve practical problems often generate links between individuals who can provide useful information.

Nonaka, I., 1994 affirms that in order for a self-organizing team to start the process of concept creation, it first needs to build mutual trust among members. Shared experiences facilitate the creation of “common perspective”, it can happen by socialization and create trust. Once mutual trust has been formed, the team needs to articulate the perspective through continuous dialogues.
Nonaka, I., 1994 declares that dialectic is a good way of raising the quality of dialogue. Dialectic allows scope for the articulation and development of personal theories and beliefs. Nonaka, I., 1994 presents preconditions to exploit dialectic to the full, as giving freedom to participants to speak their mind and that constructive substantiated by reasoned arguments

should be used to build a consensus. He also proposes that team leaders should not discourage the dramatic and volatile dimensions of dialogue.

Nonaka, I., 1994 presents crystallization as the process where reality and applicability of a concept created is tested. This process is encouraged by experimentation and it is a social process which occurs at a collective level. The next stage after testing is justification, the process of final convergence and screening, which according to Nonaka, I., 1994 determines the extent to which the knowledge created within the organization is truly worthwhile for the organization and society.

The last stage is networking knowledge, but as mentioned, the process of knowledge creation in not linear, but Nonaka, I., 1994 describes it as a never-ending, circular process that includes many interfaces.

Nonaka, I., 1994 is very interesting when it talks about the process of interacting with the group you are working with. The process of building mutual trust by socialization and shared experiences really shows in the activities for Zero Waste Co-Lab. I see it as a very important part of the project and the reason the workshops in the different countries are so decisive to creation of new knowledge.

Liyanage, C., et al. “Knowledge Communication and Translation - a Knowledge Transfer Model.” *Journal of Knowledge Management*, vol. 13, no. 3, 2009, pp. 118–31, https://doi.org/10.1108/13673270910962914.

Liyanage, C. et al. 2009 propose a process model for knowledge transfer based on a thorough review of literature. They present knowledge transfer as not only transfer of knowledge, but a process that involves different stages of knowledge transformation.

“Knowledge Communication and Translation - a Knowledge Transfer Model.” discusses the area of knowledge management in-general followed by a detailed review of knowledge transfer.

Liyanage, C. et al. 2009 use their literature review to explain knowledge as a “fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information” (pg.3). That means framed experience, values, contextual information and expert insight are the base for knowledge creation. However, they also explain that this framework mainly originates from individual thinking, that is the creation of knowledge is the information interpreted by someone to a specific purpose.

Liyanage, C. et al. 2009 also divide knowledge into two categories. They explain Tacit Knowledge as “non-verbal, intuitive and unarticulated knowledge”. Explicit Knowledge, on the other hand, is the knowledge that can be articulated in formal language and easily be transmitted. Liyanage, C. et al. 2009 explains that both kinds of knowledge are mutually dependent, tacit knowledge being the background that leads to explicit knowledge.

In the end of the first part, Liyanage, C. et al. 2009 explains knowledge management to be a continual process, because when knowledge is created it opens possibilities for more knowledge creation, and explains:

“Knowledge management improves decision-making, engenders learning, facilitates collaboration and networking and also encourages and promotes innovation.”
Liyanage, C. et al. 2009 pg.6

The second part of the article is about knowledge transfer, and right from the beginning Liyanage, C. et al. 2009 let us know that many authors and researchers have failed to define knowledge transfer. Therefore, they provide a definition for the purpose of understanding the paper:

“Knowledge transfer is about identifying (accessible) knowledge that already exists, acquiring it and subsequently applying this knowledge to develop new ideas or enhance the existing ideas to make a process/action faster, better or safer than they would have otherwise been. So, basically knowledge transfer is not only about exploiting accessible resources, i.e. knowledge, but also about how to acquire and absorb it well to make things more efficient and effective.”
Liyanage, C. et al. 2009

Liyanage, C. et al. 2009 write that many researchers attempt to explain knowledge transfer with help of other theories like translation theory, agency theory, intermediate modes and voice-exit and game theory. All theories have in common that there are two roles needed for transfer of knowledge, the sender who provides the knowledge and the receiver who acquires it. And the authors explain that knowledge transfer, although looks simple, is complex due to various prerequisites, factors and contextual issues surrounding the process.

Liyanage, C. et al. 2009 present the idea that the transfer of knowledge is ineffective when the receiver gets the information without contextualizing. To better fit the receiver’s reality, it is important to add or delete some knowledge, that process is called knowledge transformation. By interpreting this knowledge Liyanage, C. et al. 2009 presents “theory of translation” and they call it vital for this process, even though it has been largely ignored by the knowledge management community.

Not always this is the case, but the title of this thesis has not changed since the first draft of the research question. The term “knowledge sharing” was chosen before the review of literature and study for the theoretical framework. Reading about knowledge transfer papers assured me that, although similar concepts, for this project “sharing” is a better term than “transfer”.
Liyanage, C. et al. 2009 says that their thorough review of literature reveals that many authors and researchers have failed to provide a clear-cut definition for knowledge transfer, however knowledge transfer involves either explaining to others some information, or actively consulting others in order to learn what they know (Hooff, B. and Ridder, J., 2004). As Liyanage, C. et al. 2009 further explain, knowledge sharing is a people-to-people process. It is a process where individuals mutually exchange their knowledge. And knowledge sharing is a critical stage in the process of knowledge transfer (Nonaka, I. 2008).

TRANSLATION THEORY

Holden, Nigel J., and Harald F. O. Von Kortzfleisch. "Why Cross-Cultural Knowledge Transfer Is a Form of Translation in More Ways Than You Think." *Knowledge and Process Management*, vol. 11, no. 2, 2004, pp. 127–36, https://doi.org/10.1002/kpm.198.

Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 affirm that knowledge management is becoming increasingly the management of transfer of knowledge generated by cross-cultural teams, but they also affirm that when considering international transfer of knowledge there is a lack of personal relationship, the absence of trust and "cultural distance" all conspire to create a resistance, frictions and misunderstandings.

Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 discuss the terms transfer and translation. They point out that many authors use translation as a form of knowledge transfer, when actually they are better explained as parallel phenomenon.

Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 explains that translation is a kind of knowledge conversation which seeks to create common cognitive ground among people. They further explain that translation in form of transporting a text in one language is a form of converting tacit knowledge into explicit knowledge.

Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 explain that if during a translation process, if only the general idea is conveyed, it is not translation. It is necessary to convey sufficient information so that receivers can make sense of it. And with that information they bring the question "What is enough information?" and call the translation process in organizational setting for "a collective sense-making process".

Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 points at the three identified constraints on the production of good translation:

- Ambiguity (confusion at the source);
- Interference (intrusive errors from one's own background);
- Lack of equivalence (absence of corresponding words or concepts).

I found very interesting to read Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 because in the beginning of the project I have seen my part at Zero Waste Co-Lab only as a worker at BOFA and student at AAU. But I realize that I am actually a Brazilian working at BOFA and studying at AAU. Right in the introduction Holden, N.J. and Von Kortzfleisch, H.F.O., 2004 is attend to possible lack of relationship or absence of trust, what I have difficulty to relate. So, the choice for this paper is not because of something that was, but something that could have been if I was not familiar with all countries, languages and cultures.

But I am not saying that I could not relate, because as a person that has Danish as his forth language, living in Denmark, the explanation of the three identified constraints on the production of good translation is too relatable.

AGENTS OF CHANGE

Daneri, D.R., Trencher, G. and Petersen, J., 2015. Students as change agents in a town-wide sustainability transformation: The Oberlin Project at Oberlin College. *Current Opinion in Environmental Sustainability*, *16*, pp.14-21.

Daneri, D.R. et al. 2015 say that there is an increasing number of colleges and universities that are enabling the accelerating progress towards sustainability. However, the paper is a study at the Oberlin Project, an ambitious partnership between Oberlin College, the City of Oberlin and diverse community stakeholders.

Daneri, D.R. et al. 2015 explain that the involvement of students in the community has many good effects for several stakeholders. A university or college has scientific research promoted, products developed and technology-transferred. At the same time the students also benefit by enriched opportunities for critical thinking, linking knowledge to action, and enhancing interpersonal communication, teamwork and professional skills.

Daneri, D.R. et al. 2015 affirm that the project sets particularly ambitious sustainability goals and seeks to integrate students from diverse disciplines encompassing environmental and natural sciences, humanities, social sciences and the creative art.

According to Daneri, D.R. et al. 2015, Oberlin College already was a pioneer in different topics of sustainability, and the Oberlin Project expands the pursuit of environmental sustainability from the level of a single building to an entire town. To achieve this expansion, the project brings goals, as of climate neutrality, and replication of the project in different regions across the U.S.

Daneri, D.R. et al. 2015 point out that the vision for the project is to make it relevant to basically every discipline. At the same time, it seeks to increase sustainability literacy through student interactions with stakeholders from the local community as well as participating in real-world situations.

Daneri, D.R. et al. 2015 appoint three categories found to be particularly important for the work with students: Project-Based Learning (or Problem-Based Learning, PBL, as I am accustomed to), Transacademic Research and Internships.

Daneri, D.R. et al. 2015 explain that PBL emphasis is on experiential learning or “learning by doing it” and explain transacademic research as research that is transdisciplinary, participatory and community-based. They then describe the steps of getting the students an internship, either with interested partners, or directly at the project office. Internships are highlighted as crucial means for students to acquire first-hand knowledge, whilst building inter-personal and professional competencies.

Daneri, D.R. et al. 2015 recognize obstacles and limitations for the project related to the small size of the city and the resources needed for such a project

As mentioned in the methodology, according to the explanation from Wittmayer, J. and Schäpke, N. 2014 and my job in the Zero Waste Co-Lab, I can see myself as a student change agent. Knowing what it has done for me, for other students in the same category and for BOFA, I feel it is an important theory to have in this thesis and the Zero Waste Co-Lab

project. During the analysis and discussion, I will present the impact of students on the workshop and webinar, but both the evaluation and the interview have positive comments as this quote from Cecilia's interview:

"It's important for students because students don't have that practical side of life. And it is important for interns and those who work at BOFA to have this information that the Academy brings, because sometimes it takes a little longer to reach the market. So, it's a way to speed up plans to work. This interaction is really cool." – Cecilia in Appendix 1 - Interview

The concept of change agents is very interesting and transformative to a project, but the concept of students as change makers is even more advantageous. Therefore, I used this paper that was indicated by David to the webinar about "Students as Change Agents".

ANALYSIS

WHAT IS CIRCULAR ECONOMY?

As mentioned, one of my questions for the participants of the project Zero-Waste Co-Lab during my interviews was “how do you understand the terms Circular Economy and Zero-Waste?”. This question was very interesting to me not only because I wanted to make sure that all partners were working towards the same goal, but also because when first hearing the term I drew conclusions and misunderstood the goal for Bornholm to be a waste free island and I saw this misunderstanding on the answers of the interview as well.

Better explaining this personal misunderstanding, back in 2019 when I first worked with BOFA on a project, was also when I first heard the goal of a waste free island. At that time, I was trying to live in a minimalist way, producing very little waste myself, and the term “waste free”, just as the adjective “zero-waste” was interpreted as a reduction on the production of waste. For example, I understood the goal as the implementation of zero-waste supermarkets that sell products without plastic packaging or an investment on use of repair cafés. However, the goal is much more about stopping incinerating the waste that is produced and focus on recycling.

When looking at the waste hierarchy and the technical cycle of the butterfly diagram, both show recycling as one of the methods of handling resources in a circular economy, but both show it as a last resort.

“Most value in a phone, for example, is the phone. Of course, the components have value and of course the materials have value, and you want to recover them at the end of the life of that phone, but actually the phone itself has the most value” - Dame Ellen MacArthur.

Yet, recycling is the focus of waste management authority and service providers such as BOFA. It is BOFA’s job to make sure all waste produced is handled, and with the new vision for 2032 it means to make sure all waste produced gets recycled. However, preventing products from becoming waste or redesigning products to be easily repaired, unfortunately is not. Even if they are projects on BOFA that tackles the top of the waste hierarchy, and those I personally enjoyed very much to be involved in during my time working with BOFA, they are not their focus area. David puts it very well in during his interview:

“the placement of responsibility in the Danish waste, public waste system on waste prevention is at the national level, which is to say that we cannot use waste fees to pay for waste prevention” - David in Appendix 1

Which brings me to some of the answers from the interviews. After asking the interviewees for a short presentation and about their goals and motivations at Zero Waste Co-Lab, I asked about their understanding of the terms Circular Economy and Zero Waste. The first intention with this question was to understand the differences between the two terms, however the

answers and the literature research did not give conclusive answers. However, comparing with the tools presented in the introduction, we can understand in which aspect of the circular economy each Co-Laborator has their focus on for Zero Waste Co-Lab.

“Zero Waste and Circular Economy, are ideas that we know we're not going to achieve, but to inspire people to do things” - Cecilia in Appendix 1

Cecilia means that Zero Waste and Circular Economy are basically the same, however Zero Waste would always blame the industries for the pollution and Circular Economy is a newer concept that involves society. By including society, new concepts appeared such as sharing economy and repairing cafés. Cecilia also explains that the academic world is studying such new concepts, however they were not created by academics, but from the market.

“We are in a climate change situation and we need deeper changes, which change the patterns. So I think the best cycle of circularity is the one that doesn't exist, it's not having the need for a circular economy.” - Aguinaldo in Appendix 1

Aguinaldo has a critical view of circularity, because he sees models for circular economy as a method so the producers can keep producing. For him a circular economy is a step towards a bigger goal, towards sufficient consumption that changes consumption patterns, reduces consumption, changes lifestyles, changes business models, and changes the way you work in order to reduce consumption. He sees the term Zero Waste has a superior connotation, because he means that means no more waste is produced.

“We need to slow down the flow of resources through society. We need to reduce the resource flows by being more effective, producing less meat, etc, by using products more intensively by different types of sharing schemes. And then, the third one is the strongest idea, how can we recycle?” - Michael in Appendix 1

Michael's relation to the term circular economy is due his work with it at Aalborg University. He mentions the resource flows shown in figure 3 and explains that according to him Circular Economy is about slowing, narrowing and closing the loops. He categorized Zero Waste as a movement focusing on reducing physical waste, but was not sure of the different approaches as he does not work with said concept.

“We are aware that it's important. We're all waste professionals here, we all know what a circular economy really is, we know that it involves further upstream activity, it involves a lot of lifetime extension, it involves waste prevention. But that's outside our mandate if you are strict about it and in a place and time where we are underfunded, we have lots to do, we have to choose our battles.” - David in Appendix 1

David prefaces what was my conclusion, that both terms are understood by different people in different ways, and what is important is what the different social groups or different stakeholders come up with and construct along the way. He explains that by analyzing data from waste management, one part of the waste goes to incineration, one part to landfill and one part to recycling, and for BOFA to achieve the goal of a waste free island in 2032, the data has to show that 100% of the waste goes to recycling. Approaches before the end result is not a responsibility of waste authorities, but the result is the same, it just changes the amount of waste going into recycling.

Defining Circular Economy and Zero Waste is not an easy task. In the introduction, while explaining the waste hierarchy, I mention recycling to be the lowest step that is still included on a circular economy system. However, Kirchherr, J. et al. 2017 show few papers that even have other recovery as part of a circular economy. Even in our meetings and talks we often described reuse and repair as steps that would prevent the product from becoming waste, which contradicts figure 1 of the waste hierarchy as in the Waste Framework Directive 2008/98/EC.

"Our analysis of 114 definitions provides the first quantitative evidence that and how CE [Circular Economy] means many different things to different people"

Kirchherr, J. et al. 2017

Therefore, in the discussion chapter, there will be recommendations for specific segments of Circular Economy for further research for the Co-Laborators.

SDG SHORT ANALYSIS

According to Rodriguez-Anton, J.M. et al. 2019 the circular economy is directly involved in the achievement of SDGs 6, 8, 9, 11, 12, 13, 14 and 15. They also explain that regarding SDG 12, the circular economy is cited on page 5, stating that "resource efficiency and circular economy actions aim to decouple economic growth from resource use and environmental degradation. Rodriguez-Anton, J.M. et al. 2019 further explains that sustainable consumption will also require consumer policies that raise awareness and allow consumers to make informed decisions contributing to sustainability. Because of its strong connection to the circular economy, I will indicate SDG 12 as the most important for this analysis.

The Sustainable Development Goals are tools that help individuals, companies, governments, etc. to find and understand the biggest challenges in the world. But they also provide indicators to measure the development for each goal. Sachs, J.D. et al. 2022 present a score and ranking for 163 countries.

BRAZIL

Country score is given from 0 (worst) to 100 (best). Brazil scores 72.8.
Country ranking: 53 out of 163
Regional Average: 69.5 (Latin America and the Caribbean)

Figure 11 shows the average performance by SDG, showing SDG #10 “Reduce Inequalities to be the worst score.

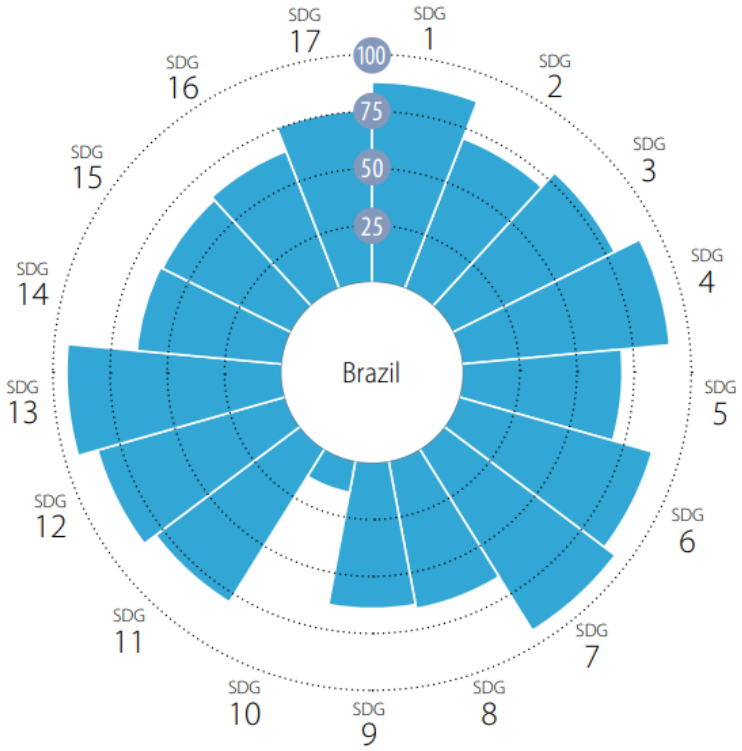


Figure 11 - Brazil’s average performance by SDG (Sachs, J.D. et al. 2022)

Figure 12 shows the SDG dashboard and trends, where we can see goals that have been achieved and goals that have some challenges, significant challenges and major challenges. The trends show in which direction the goals are going.

Figure 12 - Brazil's SDG Dashboard and Trends (Sachs, J.D. et al. 2022)

Brazil has already achieved SDG 7 - Affordable and clear energy, thanks to the amount of hydraulic energy the country produces. For the most important SDGs for this thesis, Brazil still has challenges and it is stagnated for SDG 17 - Partnership for the Goals. Has Significant challenges, but has been moderately improving on SDG 11 - Sustainable Cities and Communities. As for the most important SDG for the circular economy, SDG 12 - Responsible consumption and production, Brazil also has significant challenges, but it is stagnated.

DANMARK

Danmark scores better than Brazil in total with a score of 85.6
Country ranking: 2 out of 163
Region average: 77.2 (OECD Members)

Figure 13 and figure 14 shows that even though Denmark scores better than Brazil, and has an impressive second place between all countries, Denmark scores the lowest at the most important SDG for circular economy, SDG 12 Responsible consumption and production.

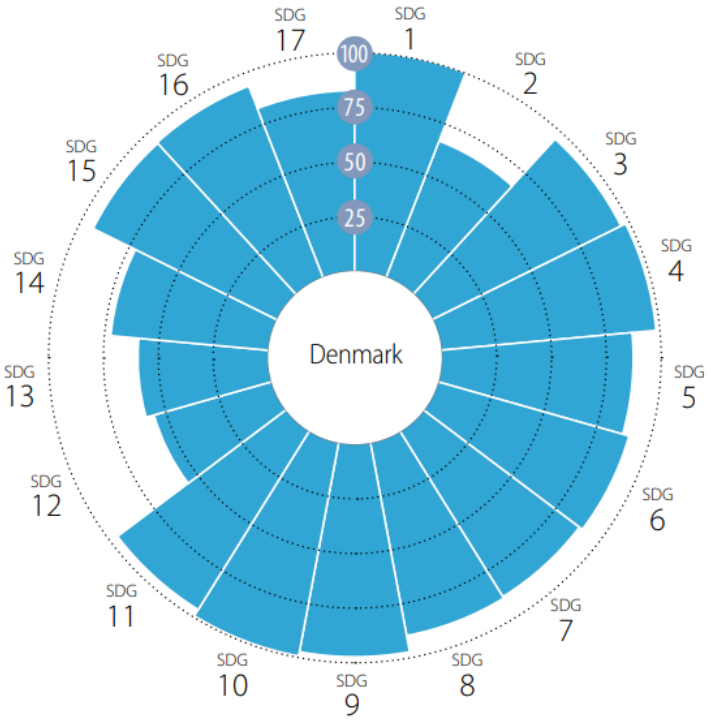
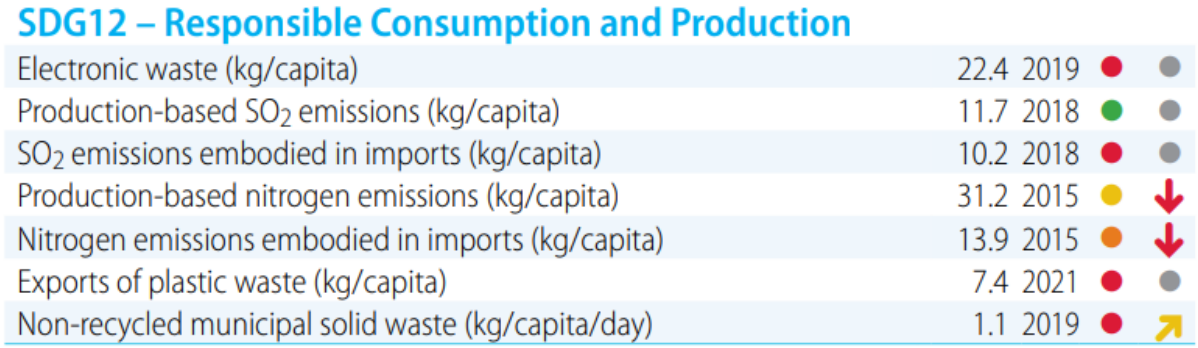


Figure 13 - Denmark's average performance by SDG (Sachs, J.D. et al. 2022)

Figure 14 - Denmark's SDG Dashboard and Trends (Sachs, J.D. et al. 2022)

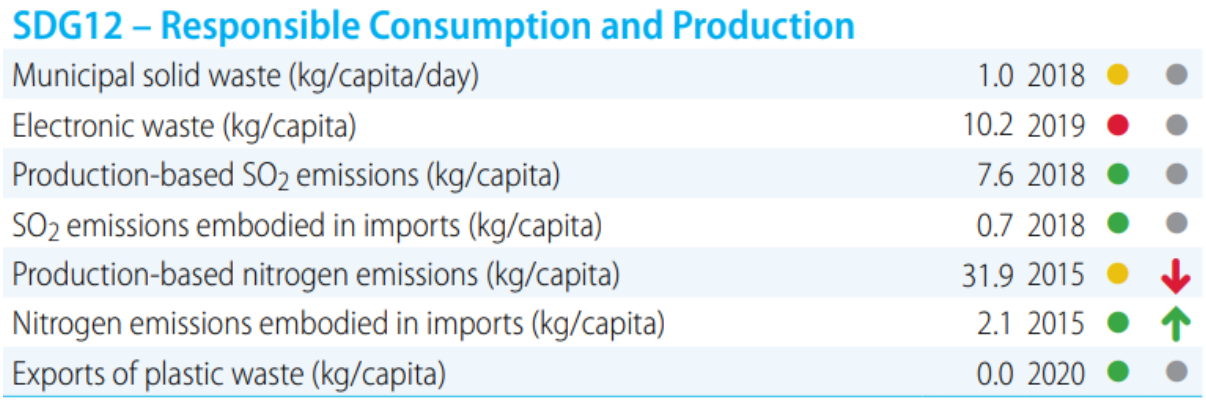
SDG 11 and SDG 17 are still classified as "Challenges remain", but both are having improvements. However not only SDG 12 is a major challenge, but it is also the only major challenge without any improvement.

The information is based on their performance by indicators, as it can be seen in figure 15 and for comparison figure 16 shows Brazil's indicators to SDG 12.



SDG12 – Responsible Consumption and Production				
Electronic waste (kg/capita)	22.4	2019	●	●
Production-based SO_2 emissions (kg/capita)	11.7	2018	●	●
SO_2 emissions embodied in imports (kg/capita)	10.2	2018	●	●
Production-based nitrogen emissions (kg/capita)	31.2	2015	●	↓
Nitrogen emissions embodied in imports (kg/capita)	13.9	2015	●	↓
Exports of plastic waste (kg/capita)	7.4	2021	●	●
Non-recycled municipal solid waste (kg/capita/day)	1.1	2019	●	↗

Figure 15 - Denmark's performance on SDG 12 by indicators (Sachs, J.D. et al. 2022)



SDG12 – Responsible Consumption and Production				
Municipal solid waste (kg/capita/day)	1.0	2018	●	●
Electronic waste (kg/capita)	10.2	2019	●	●
Production-based SO_2 emissions (kg/capita)	7.6	2018	●	●
SO_2 emissions embodied in imports (kg/capita)	0.7	2018	●	●
Production-based nitrogen emissions (kg/capita)	31.9	2015	●	↓
Nitrogen emissions embodied in imports (kg/capita)	2.1	2015	●	↑
Exports of plastic waste (kg/capita)	0.0	2020	●	●

Figure 16 - Brazil's performance on SDG 12 by indicators (Sachs, J.D. et al. 2022)

The only value that Brazil is higher than Denmark is production-based nitrogen emissions, and even then, only by 0.7 kg/capita.

WORKSHOP ON BORNHOLM

For the analysis of the workshop on Bornholm, the findings are based on the results of the activities described on the methodology that can be seen on appendix 2 – workshop results, my own experiences (action research) and the evaluation from 25 of the 36 participants.

1. BOFA's presentation

Both days of the workshop happened at BOFA's Affaldstårnet (The Waste Tower). It is a welcoming center for all kinds of guests and Brian Johansen and Jens Hjul-Nielsen have presented BOFA's message of sustainability and circular economy many times. That is how we started the workshop and the response from the guests was very positive. They had heard about BOFA before, but the presentation, the tour and the time to ask questions provided more information for a better understanding of the island's situation. On the evaluation the international guests pointed to the engagement with students all the way to school children to M.Sc. and PhDs as the biggest difference between BOFA's work and the waste management

authorities from their country. It was also pointed out that in Brazil incineration is forbidden and

"Another difference is BOFA's proactive engagement in sustainability agenda. In Brazil, similar organizations that I know are more focused on business as usual." - Marcella on appendix 1.

2. BOFA Academy

The name "BOFA Academy" was first used by Aguinaldo at the end of the afternoon, and has been used again since both in conversations in and out of the Zero Waste Co-Lab context. According to Cecilia on appendix 3 - evaluation "This was the most interesting part of the event. Students connected and committed to BOFA's activities", that opinion was shared by many participants across the evaluation, including the answer from BOFA's director for the question "During the whole two days of workshop, what made the strongest impact on you?", which he answered "The number of students who have written thesis connected with Bornholm", the very same answer as Michael's for the same question.

The positive response for BOFA Academy has been the inspiration to study the student's role in knowledge creation and sharing at Zero Waste Co-Lab, as well as a theme "Student as Change Agents" for the webinar.

From the students' side, the response for the afternoon was also positive, however I understand that the goal with the workshop was not clear to some. Yet, the feedback at the evaluation was positive both to the workshop and to general work with BOFA.
The students could also see how their work could add to each other, Anders Halkier Nielsen makes a parallel of his work to Cecilie Zingenberg's project, who proposes a conjunct project with another student based on her presentation and so does Bruna Andrade.

One of the seven answers from the student's present did not think the workshop has added value to their project, and blames the communication about the workshop's goals. But the other responses thought it was valuable for their work, either to narrow down their project scope, networking or by expanding their knowledge as Cecilie Zingenberg's comment:

"Yes! I got a lot of good and valuable feedback about my project and how I could proceed with my work, how to expand the project and how it might be transferred to another context" - Cecilie Zingenberg in Appendix 3 - evaluation.

As for general working with BOFA, Cecilie Zingenberg puts it very well when she writes "I liked it! It was like taking part of the daily life at BOFA and getting to know the people working here - it felt like it was kind of the step before being a part of the real job market, not as a student. Everybody took one seriously and were always happy to help." on appendix 3. As a previous intern at BOFA and having written this Thesis while working there, I can only agree.

3. Co-Laborators expertise

This part of the workshop does not provide much to analyze. Figure 6 shows expertise at the top of the knowledge hierarchy, and during the morning of the second day of the workshop, the Co-Laborators had an opportunity to present their expertise. A similar presentation has been conducted before online in an intern meeting for Zero Waste Co-Lab and during the interviews on appendix 1. It is an important part of the activities because the partners have to know about each other's work and area of expertise to create a good project where all can contribute. Michael has been a critic about the short amount of time used for these tasks compared to its importance. I will argue about the distribution of time in the final part of the discussion about the workshop next chapter.

The only question on the evaluation about this part of the workshop was if the presentations inspired ideas of possibilities for future collaboration between partners, and all answered yes. Marcella's answer was:

"Yes, it was a very pleasant morning and presentations. It was possible to get a preliminar picture of the possibilities of research from each professor and I suppose that further collaborations could explore the complementary knowledges in joint projects, such as:

Design for Sustainability different levels of approaches and expertises from Aguinaldo

Analytical system measurement for sustainability from Cecilia

Circularity strategies in different chains configurations from Michael"

Marcela in the Appendix 3

The answer from Aguinaldo, Cecilia, David and Michael will be added to the discussion chapter under success criteria.

4. Workshop with Bornholm's stakeholders

This activity of the workshop is analyzed here in three different parts, according to the three different parts. Then, after the analysis from each part a short list of outputs from it.

- Part One

To be able to compare results of part one and part two of the afternoon workshop of the second day, grades from "zero" to "four" were given according to the placing of each strategy card. If the card was placed from 1st to 5th place, it received a 4, from 6th to 10th place, it received a 3, and so on until cards that were placed from the 21st spot received a 0. The actual order can be seen in appendix 2 – Workshop results.

During this part of the workshop, one of the three groups talked between themselves, but did not put the cards in order. As I was not part of said group, I could not take their discussion into consideration.

The analysis of the decision of three out of four of the groups presented the three categories that mostly appeared in the area for most relevant strategies. They were **Sustainable Behavior**, **Waste Prevention** and **Waste Recovery**. **Social Inclusion** was the most present in the least relevant area.

The reaction to that analysis, according to the answers from the evaluation on Appendix xxx, was divided. Marcella pointed out that the result reflects the specifics of Bornholm's challenges and needs, and she explains that probably in other cities, especially in Brazil there would have been different results. The answer from Laura Boss also complements Marcella's comment, as she analyzes that many of the strategies for social inclusion were about getting poor people to have jobs on the waste management, and that is not an immediate problem in Denmark. Mikael Boldt, on another hand, pointed out that It is not the task of a municipal waste company to change behavior, prevent waste, and promote a circular economy. Municipal waste companies only act when the damage has occurred and the waste must be removed and therefore he agreed with waste recovery to be on the most relevant area and social inclusion to be on the bottom.

For the first day of the webinar, we highlighted some strengths and weakness for the workshop, and here are them for the first part:
Strengths:

- Comprehensiveness of heuristics
- Use of examples from around the world
- Easy understanding of the dynamics

Weakness:

- Difficulty to understand some terms/concepts
- Personal priorities affecting judgment
- Dominant participants

- Part Two

60% of the participants found it easier to grade the different technologies alone than in groups. Because of that and because of a clear grading system, the results from this part should be more accurate than the previous part.
The analysis of this part showed that the category with most relevance was **Planning & Governance**, and again was **Social Inclusion** voted as least relevant. **Social Inclusion** was in average voted the least disseminated category of strategies, however the most disseminated category was **Waste Recovery**.

Contrary to my initial statement, the evaluation on appendix 3 shows that the participants were less in agreement with the results from that part than the anterior. The absence of waste prevention or reduction was pointed out for a couple of answers and social inclusion was pointed out to be both more relevant and more disseminated and should not be at last. David makes a good analysis at his answer:
"Planning and Governance IS important and maybe there is no either/or between this and e.g. waste prevention, sustainable behavior etc. that were ranked high in activity 1. Some things can be seen as interlinked." - David

- Part Three

People were asked if the conversation during previous activities had any impact on their votes for this last part, and only four answered yes and two answered no, with all other answers being "a little". So, the discussions had some impact on these answers, but most preferences were made based on the individual's knowledge and background

From the most voted to the least voted category, those were the results: **Sustainable Behavior** had 14 votes, **Waste Prevention** had 13 votes, **Planning & Governance** had 12 votes, **Waste Reuse (Extend Lifespan)** had 9 votes. In fifth place was a three-way tie between **Digital Transformation**, **Waste Minimization** and **Waste Recycle**, with six votes each. **Economic Sustainability** and **Social Inclusion** got three votes each. **Waste Recovery** received a single vote and no votes were given to **Waste Treatment**.

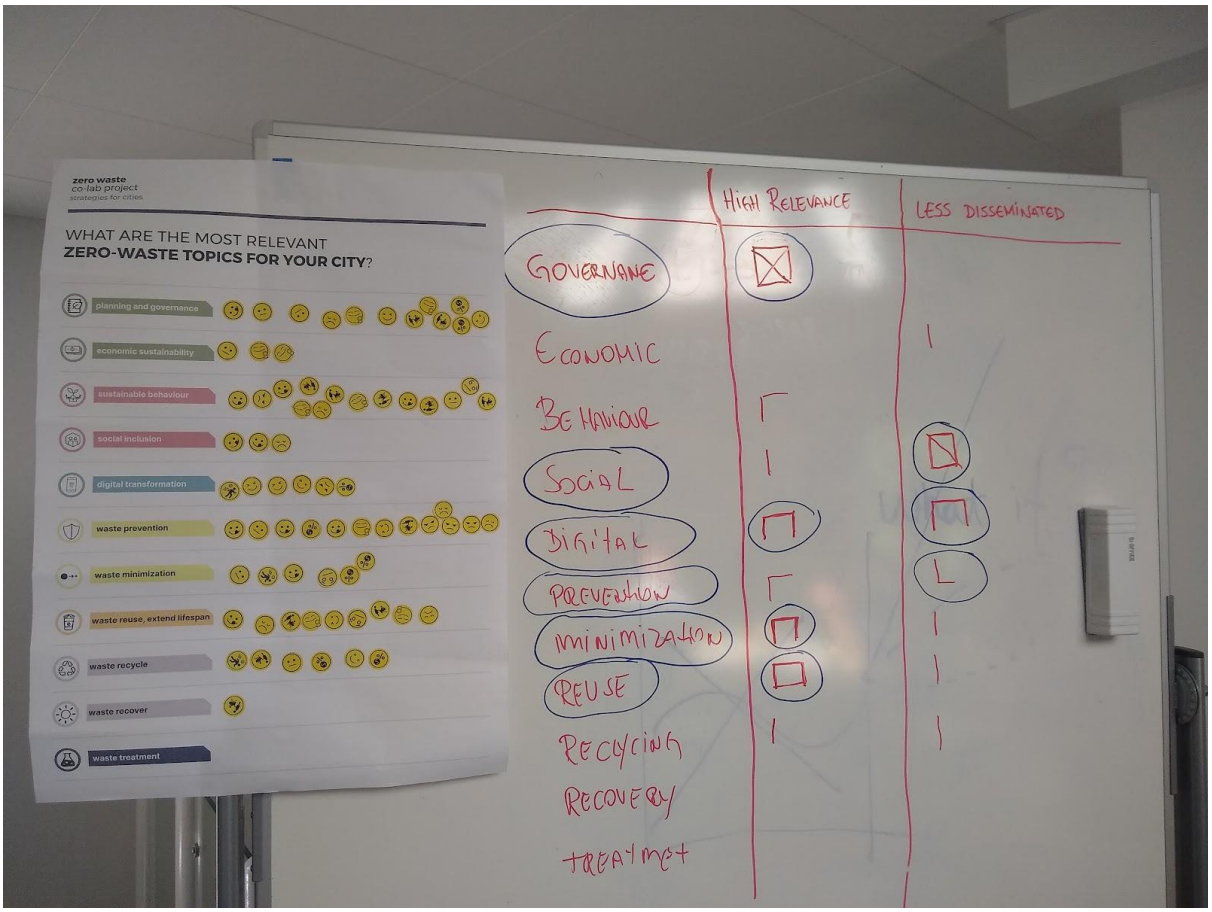


Figure 17 - Results from workshop. foto: João Møller

The evaluation showed that the three most voted categories are indeed the most important for the participants. The only comments against the final results were for those who see social inclusion as a more important category as they also answered from both previous parts of the workshop. Jens Hjul-Nielsen explains that Sustainable Behavior can be seen as a driver for many other categories, and Jens Peter Mortensen says “It is not the individual element that is decisive, but the interaction between them. Planning and policy are not worth much if they do not lead to action. Often it is also the other way around: It is action that leads to changed planning and policy.”

The highlighted strengths and weakness for part 2 and 3 for the webinar:
Strengths:

- Overall assessment followed the detailed discussions
- Wide set of policies
- Gap of “Relevance” x “Dissemination”

Weakness:

- Group profile affect the result
- No consideration of BOFA´s strategic scope
- Results based on subjective perceptions

- Overall Workshop

Unfortunately, from the participants who answered the evaluation, two participants of the last afternoon answered that they did not get anything from the workshop, and so did one of the students from the first day. Nonetheless all other comments have been positive overall.

Some of the outputs from the workshop, according to the evaluation on appendix 3, are:

- Socializing and networking
- Motivation and inspiration
- New inputs on challenges of waste management on Bornholm
- Share of knowledge about work with students, waste management and citizen participation
- "That there were so many different people gathered, with different educations, starting points, opinions, cultures, but we all agreed on the subject and that dialogue was the way forward." - Anders Madsen in Appendix 3

WEBINAR

As mentioned when introducing Zero Waste Co-Lab, there were two events during the interval this thesis was written, the Workshop on Bornholm and the week of Webinar.
The application for Zero Waste Co-Lab did not establish a framework for the webinar, other than a suggestion of "Zero Waste in Cities: theory and practice" as the subject.

During the workshop on Bornholm the Co-Laborators had discussions and many activities with university students, workers from BOFA and stakeholders from Bornholm. However, the time for the Co-Laborators to talk between each other was very short. The workshops were placed right before the Democratic Festival on Bornholm (Folkemødet) so guests on Bornholm could stay longer and enjoy the festivities while networking. However, both Michael and Aguinaldo could not stay for so long and this also reduced the time for networking, even though nothing specific to the workshop was programmed. In the discussion chapter there will be presented a recommendation for future workshops, and even if some days do not have a specific agenda, it can naturally create network environments.

This to say that the Webinar was a method to correct the lack of time during the workshop in Brazil. As each day had a presentation, followed by around one hours of discussion of how to implement the knowledge shared in the future work for Zero Waste Co-Lab.

STUDENTS AS CHANGE AGENTS

During the analysis of the BOFA Academy, I specifically mentioned three students who are good examples as Change Makers on different levels. Bruna Andrade from UFPR is working with her master thesis about strategies for waste reuse into shoe production to foster a

circular and distributed economy. Cecilie Zingenberg from AAU wrote her master thesis with BOFA about increased circularity with the Regional Municipality of Bornholm's own furniture procurement and use, in collaboration with the municipal Budget and Procurement department. Anders Halkier Nielsen, wrote his master thesis about tertiary plastic packaging in the retail sector and he also made an internship project about agricultural plastics on Bornholm in connection with BOFA's "Circlewrap" project.

All those three addresses a community sustainability challenge. They all allow applications of concepts and methods learned in formal courses. They all involve collaborative supervision from both faculty and community stakeholders. And they all aim to produce an implementable contribution to community challenge. Those four conditions are all part of the criteria for change agents at the Oberlin Project in Daneri, D.R. et al. 2015.

According to Cecilie Zingerberg's and Anders Halkier Nielsen's answers at the evaluation, their experience of working with BOFA, either at their master thesis or at an internship, has been very advantageous for their project and for themselves. Based on conversations, personal experience and the webinar discussion about students as change agents I know that it is also advantageous to BOFA to receive students. It demonstrates a win-win situation for the authority in waste management and for the student.

As mentioned in the introduction, Bornholm is also called in some occasions as a test island. Future projects are already in motion and student participation is a frequent theme. For future work at the Zero Waste Co-Lab it can be beneficial to include people working with students from other disciplines as the Oberlin Project.

Table 1 shows the key student participation and learning models from Oberlin Project, and they have much in common with BOFA's work.

Table 1 - Key student participation and learning models (Daneri, D.R. et al. 2015)

Table 1

Key student participation and learning models

Model	1. Project-based learning	2. Transacademic research	3. Internships
Description	Student teams collaborate with faculty and external partners in formal courses to design, propose (and often implement) sustainability projects and experiments	Individual students conduct research (for formal courses or graduation requirements) targeted at the local community. Results are shared with partners and stakeholders	Individual students are placed in formal work experience programmes (paid or unpaid) in local municipality, government agencies or project headquarters to assist in project design and implementation and research
Emphasis	• Hands-on knowledge production • Project conception and implementation • Team working skills	• Research and codified knowledge production	• Hands-on knowledge production • Project conception and implementation • Professional skills building
Actors	Students faculty stakeholders	Students faculty stakeholders	Students stakeholders
Contribution to stakeholder learning and progress toward sustainability goals	Planning and supply of projects, societal experiments and knowledge bases to address community challenges. Alternatively, implementation or further development of existing community initiatives	Generation of quantitative and qualitative knowledge and recommended courses of action for tackling various societal or environmental conditions. Results inform future implementation strategies and projects	Filling of community resource gaps (e.g. knowledge and manpower) through research and planning or implementation of projects

Much of my findings are based on experience for doing action research under the Zero Waste Co-Lab project. However, at this point of the thesis I am applying experiences from the very start of my education at Aalborg University. In the first semester I worked with BOFA on a PBL project exploring the potentials, barriers, alternatives and assessment of shared waste sorting systems. The group learned by hands-on knowledge production and the fostering of design, implementation and team working skills that allowed us to apply theoretical knowledge to real world problems, exactly as described by Daneri, D.R. et al. 2015.

I also did my internship at BOFA focusing on the acquisition of skills for professional development (Daneri, D.R. et al. 2015), and now I have this thesis, more focused on formal knowledge production.

DISCUSSION & PERSPECTIVATION

KNOWLEDGE CREATION AND SHARING BETWEEN COUNTRIES

In the beginning of the problem analysis I use a construction in Greenland and in Denmark as examples that a technology or strategy cannot and should not be only taken from on context and applied somewhere else before understanding the new environment. Jens Müller presents in Kuada, J., et al. 2003 that a popular rule of thumb in the 1970's was that the technologies transferred to other countries should be appropriate to the local condition. Jens Müller continues explaining that this leads to a stagnation because a technology that would be totally appropriate would already be there. Therefore, the technology introduced has to be something inappropriate and thereafter go through a process of adaptation and transformation. With those thoughts in mind, one of the products for Zero Waste Co-Lab can be a Living Lab both in Brazil and in Denmark, a space where students, researchers and other stakeholders from both countries can share knowledge and test ideas.

Taking into consideration that knowledge sharing, as presented by Liyanage, C. et al. 2009 in the theory chapter, is a people-to-people process and a process where individuals mutually exchange their knowledge, then it fits to use the term sharing for Zero Waste Co-Lab. The project is not about what one country can learn from the other, but how the Co-Laborators can collaborate. This is an important discussion, because it is easy to assume a project about knowledge in circularity between a developed country as Denmark and a new industrialized country as Brazil, would involve a one-sided transfer of knowledge. During the interviews this theme came up several times and David puts very well when he says:

"I spent a lot of time in my thesis talking about social sustainability and balance of power relations and making sure that local communities and local viewpoints are held up at the same level of respect and included in the same manner as those in the North. So, when we have to be very sensitive going forward, when working with international partners from the global South. You can discuss if Brazil is developed or developing. That's not that important, but the thing is, to really take this with the respect required." - David in Appendix 1

Aalborg University and BOFA are part of Zero Waste Co-Lab to demonstrate their experiences with circularity just as much as to learn from UFPR and UNIP. Anything else would be a waste of opportunity to work in a group of such capable participants. Especially because BOFA does not have the answers for all challenges about circularity. To become an island free of waste until 2032, there is still a lot that needs to be learned.

Nonaka, I. 1994 and Lillrank, P. 1995 present social interaction between individuals, groups and organizations as fundamental to knowledge creation. Co-Laborators' talks and socializing between discussions on group meetings, the webinar discussions and specially the workshop on Bornholm have personally increased my enthusiasm for the subjects discussed.

Nevertheless, such an approach as social interaction can fall in the category of “experencism” for knowledge creation and, as pointed out by Nonaka, I. 1994, it neglects the importance of reflection and logical thinking. The response to that, is again explained by Nonaka, I. 1994 with an “knowledge rationality” approach which describes a rational ability to reflect on experience. Therefore, social interactions are important and will be recommended for the future of Zero Waste Co-Lab activities later in this discussion chapter.

WORKSHOP ON BORNHOLM

As mentioned in the methodology, one factor used to analyze the workshops on Bornholm was an evaluation. The evaluation was not answered by all participants, and I received a couple of comments about it, pointing out that the questions were too specific and the questionnaire was too difficult. Here I can understand that I failed to present a clear objective with comprehensible questions as intended. However, all three evaluations had many open questions where the participants had space to formulate their answer, and as it can be seen on appendix 3 - evaluation, many used the opportunity to do so.

This process created a more qualitative response than the expected quantitative response from a questionnaire. As there was such a small number of participants and answers to the evaluation, numbers like the response for questions such as “To what extent did the **presentation** give you inspiration and ideas for new strategies for waste handling on Bornholm?” do not give much information to be analyzed, besides that some people enjoyed the workshop more than others. For that question, the average of the grades was 7.3, so I could argue that the presentation was somewhat inspiring, but the argument would be more speculation than a fact. The same goes for the question “To what extent did the **activities** give you inspiration and ideas for new strategies for waste handling on Bornholm?” that received an average grade of 6,5. With this information I can only conclude that the presentation before the workshop was more inspiring than the activities for our guests. However open questions as “What are your thoughts on the methodology (activities) used in the workshop? Is it relevant to Bornholm?” gave many more interesting answers because the participants could explain themselves and many times explain what worked best during the workshop.

One of the critics presented by Michael already from the planning of the workshop was about the lack of time together where Co-Laborators can sit together, share and create knowledge. This concern can already be seen during the interviews when he says:

“To get from showcasing to really interacting and discussing and exchanging, questioning and understanding.” - Michael in Appendix 1

One method of improving on the lack of time together was to rethink the webinar to something that could have a direct impact on the project Zero Waste Co-Lab. It was decided to have five days instead of one, and each day the presentation was about a topic that can be further developed on the project. Besides that, each day of the webinar had time allocated to discussion between the Co-Laborators about how to use the themes in future activities.

In future workshops the time has to accommodate more conversations and time for knowledge creation and sharing between partners. And if there is need for more time, the Co-Laborators can arrange meetings only for that purpose and not to plan and discuss future workshops, activities and travels.

FUTURE WORKSHOPS FOR ZERO WASTE CO-LAB

The Zero Waste Co-Lab group decided together to hold only one workshop in Brazil, and if possible one more in Denmark. Based on the analysis of the first workshop, on the budget for the project, on the goals described in the application and on personal goals mentioned in the interviews, there are some discussions about how to best proceed. Firstly, to correct the mistakes from the first workshop. Some recommendations described on table 2.

Table 2 - mistakes from last workshop and recommendations for future workshops

Mistake	**Recommendation**
Evaluation was sent too late.	Have a premade evaluation that can be readjusted according to what happens during the workshop.
Evaluation was not clear enough.	Clarify the aims and objectives from the start of the evaluation.
Participants of the workshop did not receive enough information beforehand.	Program who is participating in each of the next workshops and present them with some material for a better understanding of the project's background and the goals of the workshop.
Participants of the workshop did not receive follow-up material. .	Make sure to send the material as PowerPoint presentations to the participants soon after the workshop. Preferably with the evaluation attached.
There was not enough time to intern networking.	During meetings there is a lot of planning, during the workshops there are a lot of activities, so the best recommendation is to plan some time to get together online and only use for knowledge creation and sharing, without the concern of planning and organizing other activities.
BOFA's strategic scope was not considered for the activities on the workshop with Bornholm stakeholders.	Make sure to produce material that can create an impact in the location of the workshop. Be aware of the local visions, plans and situation, or use the workshop to get such information.
The results were based on subjective perception.	Be critical at the results,

After improving on the mistakes from the first workshop, I have other recommendations for the future of the Zero Waste Co-Lab project for location, schedule and theme. At last we can look at all the success criteria from the Co-Laborators and discuss what is still missing.

LOCATION AND SCHEDULE

The location is one of the topics that need attention. The first workshop happened in Bornholm in June 2022 as planned from the application for the project. However originally the second workshop would happen in Curitiba in September 2022, the third on Bornholm again in March 2023 and a forth on Ilhabela in July 2023. The decision of combining the two workshops in Brazil gives more time to preparations and more space on the budget, and a recommendation for the schedule is presented on table 3.

Table 3 - Suggestion for schedule to the workshop in Brazil

Day	Activity
1	Arrive in Curitiba.
2	Visit UFPR and talk with students and researchers.
3	Workshop in Curitiba with waste authorities and stakeholders.
4	Travel to São Paulo. Visit UNIP and talk with students and researchers.
5	Travel to Ilhabela with a visit to Jambeiro's waste station on the way.
6	Workshop on Ilhabela with waste authorities and stakeholders.
7	Network and confraternization of the Co-Laborators on Ilhabela.
8	Travel Home.

The only previous suggestion for a schedule to the workshop in Brazil was presented before the decision of moving it to April and combining both workshops in Brazil to one. Therefore, the previous suggestion only included days in Curitiba with many sightseeing in the city that was not related to circular economy, but with sustainability in general. Although very interesting, the new After being presented with the recommendation of schedule, the Brazilian group showed only concern with a long day when the participants will have to travel to Ilhabela by Jambeiro. The trip would be over 220km, but as mentioned in the introduction, Jambeiro receives the waste from the whole region, including Ilhabela, and the visit is of genuine interest for the Danish delegates for comparison with BOFA and other Danish management authorities.

During the internal communication with Ilhabela's secretary of environment and the director of urban services and solid waste, they were very focused on the projects with the 38 schools on the island, which can add to the theme of students as change agents. Besides that, there is the fact of the peculiar waste collection on small communities that are not reachable by land. Those topics can be further investigated during day 6 and 7 of the program on Ilhabela.

Ilhabela was chosen during the application phase as it can be compared with Bornholm, it has similar sizes and population, besides both are islands and touristic locations. Curitiba's population density is much higher than the two previous locations, so another recommendation

is to hold the third workshop in Copenhagen. This way there will be two pairs of cities that can be compared together. Copenhagen, just as Curitiba, is known for sustainable urban development projects as mentioned in the Introduction. As it can be seen in the appendix 1 - interviews, all interviewees mention differences between Denmark and Brazil, both in size and in culture, therefore visiting cities that have as much in common as possible geographically is important to be able to identify and/or confirm the differences in waste handling culture.

THEME

Based on the analysis of the meaning of circular economy, the personal goals from the interviews, the interests on the workshop and webinar, and the expertise of the Co-Laborators, the following themes would be a good match for the activities remaining:

1. Waste Prevention
2. Sustainable Behavior
3. Student collaboration
4. Indicators
5. Planning & Governance

My recommendation is not to use one of those five themes, but have them as focus and combine them. Sustainable Behavior can lead to better Waste Prevention, Student collaboration can impact Planning and Governance and Indicators should be used to measure progress in any of the other four themes.

Waste Prevention is chosen, firstly for being Michael's expertise area, also, the interviews in appendix 1 showed Waste Prevention as the level of waste management with most interest among the Co-Laborators. As introduced by the waste hierarchy, this is the most important and sustainable step on waste management, avoiding items to become waste in the first place. Both interviews in appendix 1 and some answers from the evaluation in appendix 3 present the idea that Waste Prevention is not the responsibility of a waste management authority like BOFA. However, the project will have other focuses that are more relatable to BOFA and the importance of Waste Prevention towards a circular economy is evident.

Sustainable Behavior and Planning & Governance are also categories from the workshop that received the most votes as most relevant categories. Sustainable Behavior is very interesting in the context of Zero Waste Co-Lab because of the different cultures between Brazil and Denmark that can be highlighted during the project in the form of a Living Lab. Planning & Governance is more relatable for BOFA, and it presents good opportunities to elevate the project to a product that can be used in a real case scenario, especially if the next workshops also could have participation of waste authorities and local stakeholders for each city. Here is Aguinaldo's expertise necessary for the design of said living lab or other form of strategy.

Student collaboration has become a central point of discussion within the Zero Waste Co-Lab project. As explained earlier during the analysis of BOFA Academy, the collaboration between BOFA and students was one of the most commented subjects during the workshop, at the evaluation and the webinar as well. By continuing to work with students, Zero Waste Co-Lab can create opportunities for students and for companies to work together for the benefit of both partners, both in Brazil and in Denmark. David's expertise is essential for this part.

Indicators, as mentioned before, can be combined with any theme and it is of uttermost importance, so the results of the project can be measured. And of course, it also includes Cecilia's expertise as an essential part of the project.

SUCCESS CRITERIA

The interviews with the Co-Laborators happened in the starting phase of the project. Before any goals were established and even before a formal conversation about the different deliverables in the application were discussed. The first question I asked was about the success criteria they thought for the project and the success criteria for themselves being part of the project. If those criteria have not been met yet, they have to be addressed on future activities or at least the Co-Laborators should be asked if their goals have changed since the start of the project.

Cecilia:

- Interdisciplinary work, playing with the different expertise
- A product in the form of a publication, a report, something that is online for people to see what we did, or an article, but not necessarily.
- Contact with new people, networking.
    - “(talking about Aguinaldo) is quite near and I didn't even know he existed, that's already a success, because I'm super interested in what he's doing.” - Cecilia
- Continue with partnerships between AAU, BOFA, UFPR and UNIP
    - “the exchange of students for internships; the visit of Professors on several occasions (...). Academically, we can exchange students, offer internships, exchange Professors: bring an AAU Professor to be a visitor here in Brazil, one of us being a visiting Professor at the AAU. Continuing to interact with BOFA, I think it's really cool because it's a practical side that we don't have at the Academy. Receive these BOFA interns at the University, so that they graduate. So, I think there's a multitude of things we can do in the future.” - Cecilia

When asked if the workshop inspired ideas of possibilities for future collaboration between partners, Cecilia’s answer was: “Sure. Michael presented data that can be interpreted using different metrics and Aguinaldo presented possible solutions, which must be quantitatively evaluated”.

Aguinaldo:

- Reflections for waste authorities and decision makers in Ilhabela, Bornholm and Curitiba
- Long time partnership
    - Events
    - Joint Publications
    - Exchange of Students
    - Partnerships for next generation
- Innovation
    - “I’m much more interested in innovative, thought-provoking themes. So what interests me a lot is exploring the new, exploring what is not yet known.” - Aguinaldo
- Create opportunities to Danish people to work with Brazilians and the other way around

Michael:

- Knowledge creation or transfer together

- Identify areas to develop long term collaborations
- Development on the educational area, transferring knowledge about AAU's work with PBL

When asked if the workshop inspired ideas of possibilities for future collaboration between partners, Cecilia's answer was: "Exchange knowledge about research and consider how analyses and strategies can be transferred between Brazil and Denmark and vice versa"

David:

- Foster collaboration
    - "I don't want to end up in the same situation (from previous example), after the project has ended where we go home and forget about the whole thing and say that it was a nice project. We did some nice things, we did some nice workshops and that's it." - David
- Strong international partnerships
    - "Because our vision is long term, our needs are long term, our ambitions are long term and we need all the support we can get. And it's simply too myopic and simply too much of an island mentality. I say that literally because we're on an island to think that we can do this alone." - David
- Have BOFA's viewpoints being challenged and get new inputs
- Research articles

João (My own success criteria):

- Write my master thesis at Aalborg University about Zero Waste Co-Lab
- Create opportunities for students in Brazil and in Denmark to work with real life challenges for sustainability.
- Create opportunities for companies in Brazil and in Denmark to receive students that can help them with their challenges for sustainability
- National and International network and partnerships for now and when I finish my studies
- Future opportunities to work with sustainability in Denmark, in Brazil and more

Most of the success criteria can be met by following the current plan and delivering the future activities for Zero Waste Co-Lab, such as the joint paper, the e-book, the Zero Waste Co-Lab portal and the next workshops.
Forster long term partnerships has been one of the success criteria for all participants. There are ideas of how to keep those partnerships, such as exchange of students, joint events, etc. However, this can naturally not be measured in the time of the project and depends on the partners to continue improving on the collaboration after the project is over on the 31st December 2023.

COCLUSION

The first conclusion I can make after the whole process of writing this thesis is that BOFA has an impressive goal for 2032, and although very competent people are working towards that goal, they need partnerships to achieve it. Knowledge management is crucial for that, as some challenges we can learn by sharing knowledge with other experts, and other challenges it is needed to go through a process for knowledge creation.

Participatory action research, interviews, the workshop, evaluations and the webinar allowed me to study all participants and partners of Zero Waste Co-Lab and shed light on the corners of the process.

From the beginning of the project, the Co-Laborators had different understandings of circular economy and zero waste. Nevertheless, during the activities at the workshop on Bornholm, some themes became stronger than others, and suddenly a specific definition of circular economy and zero waste could blend together and not make a difference on the results of Zero Waste Co-Lab.

Waste prevention and aspects of the top of the waste hierarchy appeared in interviews, the evaluation and during the webinar. Together with waste prevention, four other themes were chosen as suggestions for the future of the project: sustainable behavior, planning governance, student collaboration and indicators.

The creation of some kind of product, such as a joint paper is one of the goals for the Co-Laborators, but the most notated goal can only be measured and studied after the end of the project, as it is the wish to foster long partnerships between the participants. Joint papers, exchange students and events are concrete suggestions to keep the partnership.

For now, the Co-Laborator can think about the next 14 months after this thesis is delivered and keep discovering how to better create and share new knowledge. Until now, workshops with local stakeholders is a promising approach, but needs more work for more effective experience and a better evaluation.

Besides that, collaboration with students became a central point of the project because of impressive results BOFA has presented of knowledge creation by trusting students with tasks and information from the waste management authority.

Based on Zero Waste Co-Lab, how can knowledge about Circular Economy and Zero Waste be shared and generated between countries?

By Interdisciplinary collaboration, playing with people’s strengths, and challenging viewpoints for better discussion. And lots of it. Also, by including local stakeholders for better understanding of the region’s or country’s reality. And especially including students, for their own improvement and for the improvement of the knowledge process.

BIBLIOGRAPHY

Assembly, G., 2015. *Resolution adopted by the General Assembly on 11 September 2015*. A/RES/69/315 15 September 2015. New York: United Nations.

Basso, Lúcia Mara de Souza, et al. "Controle de larvas de Boophilus microplus por Metarhizium anisopliae em pastagens infestadas artificialmente." Pesquisa agropecuaria brasileira, vol. 40, no. 6, 2005, pp. 595–600, https://doi.org/10.1590/S0100-204X2005000600010.

Baum, Fran, et al. 2006 "Participatory Action Research." Journal of Epidemiology and Community Health (1979), vol. 60, no. 10, 2006, pp. 854–57, https://doi.org/10.1136/jech.2004.028662.

Bender, S. and Fish, A. 2000. "The Transfer of Knowledge and the Retention of Expertise: The Continuing Need for Global Assignments." Journal of Knowledge Management, vol. 4, no. 2, 2000, pp. 125–37, https://doi.org/10.1108/13673270010372251.

BOFA, 2019. Bornholm showing the way - without waste 2032, pp. 1-14. Available from: https://bofa.dk/wp-content/uploads/2019/01/Bornholm-showing-the-way.pdf

Brinkmann, S. 2014 "Unstructured and Semi-Structured Interviewing." The Oxford Handbook of Qualitative Research, Oxford University Press, 2014, chapter 14, https://doi.org/10.1093/oxfordhb/9780199811755.013.030.

Daneri, D.R., Trencher, G. and Petersen, J., 2015. Students as change agents in a town-wide sustainability transformation: The Oberlin Project at Oberlin College. Current Opinion in Environmental Sustainability, 16, pp.14-21.

Denmark, S. 2022-Q3. FOLK1C: Population at the first day of the quarter by region, sex, age (5 years age groups), ancestry and country of origin. On Q3 2022 (July-September 2022). Statistics Denmark. URL: https://www.statbank.dk/FOLK1c visited on 10-10-2022

Denmark, S. 2022. Land use accounts on 1st January 2022. Statistics Denmark. URL: https://www.dst.dk/en/Statistik/emner/miljoe-og-energi/areal/arealopgoerelser visited on 10-10-2022

Dictionary, C., 2018. ZERO WASTE meaning, definition in Cambridge English Dictionary. URL: https://dictionary.cambridge.org/dictionary/english/zero-waste visited 10-09-2022

Directive, E.C., 2008. Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. Official Journal of the European Union L, 312(3), p.22.

Elmeskov, R.J., 2017. Danmark i tal 2017.

Foundation, EM., 2012. What is a circular economy? Ellen MacArthur Foundation. 2012. URL: https://ellenmacarthurfoundation.org/topics/circular-economy-introduction/overview visited 10-09-2022

Hansen, J.A., and Lehmann, M. 2006. “Agents of Change: Universities as Development Hubs.” Journal of Cleaner Production, vol. 14, no. 9, 2006, pp. 820–29, https://doi.org/10.1016/j.jclepro.2005.11.048.

Hooff, B., and Ridder, J.A. 2004. “Knowledge Sharing in Context: The Influence of Organizational Commitment, Communication Climate and CMC Use on Knowledge Sharing.” Journal of Knowledge Management, vol. 8, no. 6, 2004, pp. 117–30, https://doi.org/10.1108/13673270410567675.

IBGE, 2022a. Countries – Brazil. 2022. Instituto Brasileiro de Geografia e Estatística. URL: https://paises.ibge.gov.br/#/dados/brasil visited on 02-10-2022

IBGE, 2022b. Projeção da população do Brasil e das Unidades da Federação. 2022. Instituto Brasileiro de Geografia e Estatística. URL: https://www.ibge.gov.br/apps/populacao/projecao/index.html?utm_source=portal&utm_medium=popclock&utm_campaign=novo_popclock visited on 02-10-2022

IBGE, 2022c. Cidades – Paraná – Curitiba. 2022. Instituto Brasileiro de Geografia e Estatística. URL: https://cidades.ibge.gov.br/brasil/pr/curitiba/panorama visited on 02-10-2022

IBGE, 2022d. Cidades – São Paulo – Ilhabela. 2022. Instituto Brasileiro de Geografia e Estatística. URL: https://cidades.ibge.gov.br/brasil/sp/ilhabela/panorama visited on 02-10-2022

Kuada, J.E., et al. 2003. Culture and Technological Transformation in the South : Transfer or Local Innovation? 1. edition., Samfundslitteratur, 2003.

Lillrank, P. 1995. “The Transfer of Management Innovations from Japan.” Organization Studies, vol. 16, no. 6, 1995, pp. 971–89, https://doi.org/10.1177/017084069501600603.

Liyanage, C., et al. 2009 “Knowledge Communication and Translation - a Knowledge Transfer Model.” Journal of Knowledge Management, vol. 13, no. 3, 2009, pp. 118–31, https://doi.org/10.1108/13673270910962914.

Melchiorsen, PM, Høj, AL, Stegger Gemzøe, A & Lykkegaard Jensen, A 2020, 'Forskning og formidling 2020: Årsplakat for Aalborg Universitet'. https://doi.org/10.5278/392337459

Nancy M. P. Bocken, Ingrid de Pauw, Conny Bakker & Bram van der Grinten (2016) Product design and business model strategies for a circular economy, Journal of

Industrial and Production Engineering, 33:5, 308-320, DOI: 10.1080/21681015.2016.1172124

Nielsen & Rauschenberger, 1957. Frost og fundering. G.T.O. Publikation nr. 1. Available at: http://www.byginfo.gl/media/1166/permafrost-frost_fundering_gto_1957.pdf

Nonaka, I. 1994 “A Dynamic Theory of Organizational Knowledge Creation.” *Organization Science (Providence, R.I.)*, vol. 5, no. 1, 1994, pp. 14–37, https://doi.org/10.1287/orsc.5.1.14.

Nonaka, I. 2008. The Knowledge-Creating Company. Harvard Business Press, 2008.

Regionskommune, B. 2003. BRK Tal og Fakta. 2003. Bornholms Regionskommune. URL: https://www.brk.dk/Om-Kommunen/tal-og-fakta/Sider/Tal-og-Fakta.aspx visited 23-08-2022

Regionskommune, B. 2022. Befolkningsprognose 2022-2033. On March 2022. Dagsorden. Bornholms Regionskommune

Rodriguez-Anton, J.M., Rubio-Andrada, L., Celemín-Pedroche, M.S. and Alonso-Almeida, M.D.M., 2019. Analysis of the relations between circular economy and sustainable development goals. International Journal of Sustainable Development & World Ecology, 26(8), pp.708-720.

Sachs, J.D., Lafortune, G., Kroll, C., Fuller, G., and Woelm, F. 2022. Sustainable Development Report 2022: From Crisis to Sustainable Development: the SDGs as Roadmap to 2030 and Beyond. Cambridge University Press. 2022. https://s3.amazonaws.com/sustainabledevelopment.report/2022/2022-sustainable-development-report.pdf DOI 10.1017/9781009210058

UN, D., 2015. Goal 13 – Take Urgent action to combat climate change and its impacts. 2015. *Department of Economic and Social Affairs. UN.Org*. URL: https://sdgs.un.org/goals/goal13 visited 10-09-2022

Wittmayer, J.M., and Schäpke, N. 2014. “Action, Research and Participation: Roles of Researchers in Sustainability Transitions.” Sustainability Science, vol. 9, no. 4, 2014, pp. 483–96, https://doi.org/10.1007/s11625-014-0258-4.