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Identifying Circular Economy Opportunities and Generating a List of Recommendations for a Case Company Operations

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<p>The purpose of this study was to identify circular economy opportunities in the case company's facilities operations and practices and generate a list of recommendations to enable circular economy. The case company located in the town of Kirkkonummi in Finland is a subsidiary of a multinational Information and Communication Technology (ICT) company. The case company wanted to find out how it could enable circular economy in its facilities operations and practices.</p> <p>The conceptual framework for the study consisted of an analysis tool that was applied to all items assessed. The analysis tool purpose was to identify circular economy opportunities. The analysis tool was based in existent frameworks and tools from literature. The list of items to be assessed were generated based on the author's empirical observations, informal pre-discussion with fifteen employees and with the facility manager and the email survey to key stakeholders. Based on the existent literature and case studies, the author and the key stakeholders identified the items with potential to circular economy and during two brainstorming sessions they generated a list of recommendations to enable circular economy.</p> <p>The list of recommendations generated aims to improve energy consumption, reduce discarded electronic, cupboard, paper, wood, lamp, battery and office furniture waste, improve meeting rooms and sport facilities usability. This study provides guidance to any organization that wants to identify potential items to circular economy and the recommendations generated based in existent literature and case studies can be something to consider by other organizations.</p>	
Keywords	circular economy, resources, scarcity of resources, improve utilization, reduce waste

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1 Introduction

1.1 Overview

The importance of the environment and social issues has increased over the last years. Problems as finite resources, climate change, greenhouse gas emission, social discrepancy, water scarcity between others brought together big leaders around the world to discuss and address these issues. We have one planet Earth and it's not renewable. There are many campaigns trying restlessly to spread the message to consciously use the resources in a way to secure they continue to exist for future generations, meaning in a sustainable way.

We live in a society that mainly use the resources in what is called linear economy. As example, we buy a product and when we do not need or we do not want this product anymore we discard it. The advance of technology increased the production and decreased the price of many if not most of the products. The easy access to products, increase of population, new style of life between other factors are increasing the amount of waste and shortening the life time of finite resources.

Can we rely in innovation for replacement of the finite resources? How much waste is acceptable? Can we do better? Concerned about the finite resources and amount of waste we will move towards a sustainable economy called circular economy where it will focus in maximum utilization of the product and securing the material in an endless loop of utilization minimizing waste.

In this research we use the definition of waste from Waste Framework Directive, Article 3(1), that defines waste as “any substance or object which the holder discards or intends or is required to discard” (European Commission, 2008, 2008/98/EC).

1.2 Case Company

The study is addressed to one of the subsidiaries of a multinational Information and Communication Technology (ICT) company located in the town of Kirkkonummi, Finland. The company worldwide has more than 100.000 employees and its represented in more than 180 countries, highly committed with sustainability and corporate

responsibility. The company for decades provides services and products empowering communication. Information and Communication Technology (ICT) Companies will be the drivers to achieve the Sustainable Development goals but the case company not only want to be the driver as also to improve its own footprint.

1.3 Business Challenge, Objective and Outcome

Circular economy Concept has been more popular in the last decade but It's still new for many organizations and many times misunderstood. The "circular economy" subject came as a teaser from the parent case company. When the researcher brought up the subject in her organization, the organization got curious and interested into the so called circular economy concept and they wanted to know where in its facilities operations and practices they could identify potential in this respect and enable circular economy.

The objective of the study is to identify circular economy opportunities and to generate a list of recommendations for the case company's facilities operations and practices located in town of Kirkkonummi, Finland.

The outcome of the study is a list of recommendations concerning case company's facilities operations and practices that is located in the town of Kirkkonummi, Finland.

1.4 Outline of Thesis Report

This study is organized as follows. **Chapter 1: Introduction.** Introduce the business context with the main problem of the case company researched in this study, the objective, the expected outcome. **Chapter 2: Method and Material.** Describes the steps taken in the research and how, from who and which data was collected. **Chapter 3: Concepts and Practices Concerning Circular Economy from Relevant Literature.** It describes the circular economy concept and the best practices from the literature. The conceptual framework is a result from literature research called "Analysis Tool to Identify Economy Opportunities". **Chapter 4: Identifying Potential items to be assessed from Case Company's Operations and Practices.** Items based in specific criteria are selected to be audited concerning potential or not to Circular economy. **Chapter 5: Assessing Potential Items to Identify Circular Economy Opportunities.**

Items are assessed using “Analysis Tool to Identify Circular Economy Opportunities”. After assessment the items are classified as potential or no potential to circular economy. **Chapter 6: Generating List of Recommendations.** During brainstorming sessions, recommendations in how to reach better utilization for the items with potential to circular economy were discussed. **Chapter 7: Key Stakeholders Feedback Concerning the Recommendations.** It was the feedback of the proposed list of recommendations from the key stakeholders. **Chapter 8: Discussions and Conclusions.** This chapter concluded the study with the learnings during the research.

2 Method and Material

This chapter describes the steps of the study and how the data was collected and analysed and the participants involved.

Buford Junker (1952) in his studies for sociologists conducting field work suggested four possible roles in theory: “complete participant, participant as observer, observer as participant and complete observer” (Junker, 1952).

In this study the research is a participant as observer: “the researcher attempts to participate fully in the lives and activities of subjects and thus become a member of their group, organization or community. This enables researchers to share their experiences by not merely observing what is happening but also feeling it ” (Gill and Johnson, 2002).

The researcher is an employee from case company that transformed her daily work into a laboratory of observation aiming to a zero-waste environment.

2.1 Research Design

“Research Design considers research strategies, choices and time horizons” (Saunders, Lewis and Thornhill, 2007).

Circular economy can be applied to anything tangible or not tangible, from a process to an object as a chair. We need to think “how I can get maximum utilization of something?” and keep that product in the loop that the waste would aim to disappear or would be reduced. It was a common agreement in the case company between researcher and key stakeholders that its facilities’ operations and practices would be the target area for this study.

In this study an overall and superficial research was chosen instead to select a single item and do deep research. The reason for overall research was because the case company didn't have any assessment focusing circular economy before an overall study would suit better in a first phase giving an idea of the big picture and introducing the concept.

The case company's facilities researched

The case company is located in the town of Kirkkonummi in Finland. It is a Development and Research Center of several software products. The site has hundreds of people from different nationalities. Most of the employees work in "open space" areas. Office Center is a complex of 3 buildings connected internally to each other were one of the buildings had being a factory before. The company's facilities researched in this study are:

- open space area. The open space covers the workplaces and common leisure areas.
- Data center. The data center covers the hardware area. It's mainly the hardware required to test the software developed by case company, the hardware type is not important for this research.
- Area A for waste collection, it was called "area A for waste collection" for this study purpose only. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility.
- Area B for waste collection, it was called "area B for waste collection" for this study purpose only. Used office furniture, kalustekierrätys in Finnish, is the waste collected in this facility.
- Area C for waste collection, it was called "area C for waste collection" for this study purpose only. It's located in the printer rooms. The printer rooms have small baskets for waste collection that is periodically transferred to area A for waste collection. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility. It varies the range of waste collected by printer room i.e. it can be one printer room has collection point only for paper and battery. The case company has several printer rooms over the 3 (three) buildings.
- Warehouse.
- Meeting rooms. Meeting rooms will be the term used for common or shared rooms for meetings including the auditorium. Most of the rooms have capacity

for audio and video conference and fully equipped with digital overhead projector. Mini meeting rooms have capacity for maximum 3 (three) persons, the auditorium has capacity for maximum 150 (one hundred and fifty) persons and the rest of the meeting rooms have varied capacity.

- Indoor and outdoor sport facilities: outdoor soccer field, outdoor tennis field, 2 (two) indoor fitness rooms, few saunas and dressing rooms in different buildings.
- Kitchen-coffee areas spread in the 3 (three) buildings equipped with coffee machine, refrigerator, microwave and kitchen utensils.

Parking place is covered in the energy assessment.

Facility management is done by an external company with the supervision of the Real Estate Manager of the case company. The focus of the facility management is cleaning, property services (energy, water, waste and land) and beverages.

The study was designed and conducted between February and December of 2017, in 5 distinct phases.

The **Literature** phase or **Existing Knowledge** was conducted to get knowledge of circular economy concept, best practices and tools used by other scholars and organizations about circular economy. How companies identify circular economy opportunities? What are the best practices? The idea was to get knowledge and act as an auditing professional during the assessment and have already in mind what to look for or how to identify circular economy opportunities.

The output of the first phase was the conceptual framework guiding the researcher to identify circular economy opportunities in the case company's facilities operations and practices.

The second phase, **Finding Potential Items to be Assessed from Case Company's Facilities' Operations and Practices** was designed to collect the first set of data (Data 1). The items to be assessed were selected based in empirical observation of the case company's facilities operations and practices, informal pre-discussions with selected employees called participants that benefit from the company's facilities and email survey to the key stakeholders of this study.

The third phase, **Assessing the Potential Items to Identify Circular Economy Opportunities** was designed for collecting the 2nd set of data (Data 2). A workshop was arranged with the key stakeholders of this study. In the workshop all the items selected in second phase were assessed using the tool “Analysis Tool to Identify Circular Economy Opportunities”, identifying the potential items to circular economy opportunities.

The fourth phase, **Generating List of Recommendations** was designed to generate the list of recommendations for the items selected as potential to circular economy opportunities as the result of the workshop in third phase. During 2 (two) brainstorming sessions, the recommendations to the potential items to enable circular economy were discussed where key stakeholders gave straight feedback about the recommendations and complemented with new ideas. The list of recommendations was the 3rd set of data collected.

The fifth phase, **Key Stakeholder Feedback Concerning the Recommendations** was designed to present to the key stakeholders the list of proposed recommendations generated from fourth phase and to collect feedback and generate the final list of recommendation, in case of any comment. The final list of recommendations is the 4th and final set of data collected (DATA 4).

The table below provides an illustration of the above discussed phases.

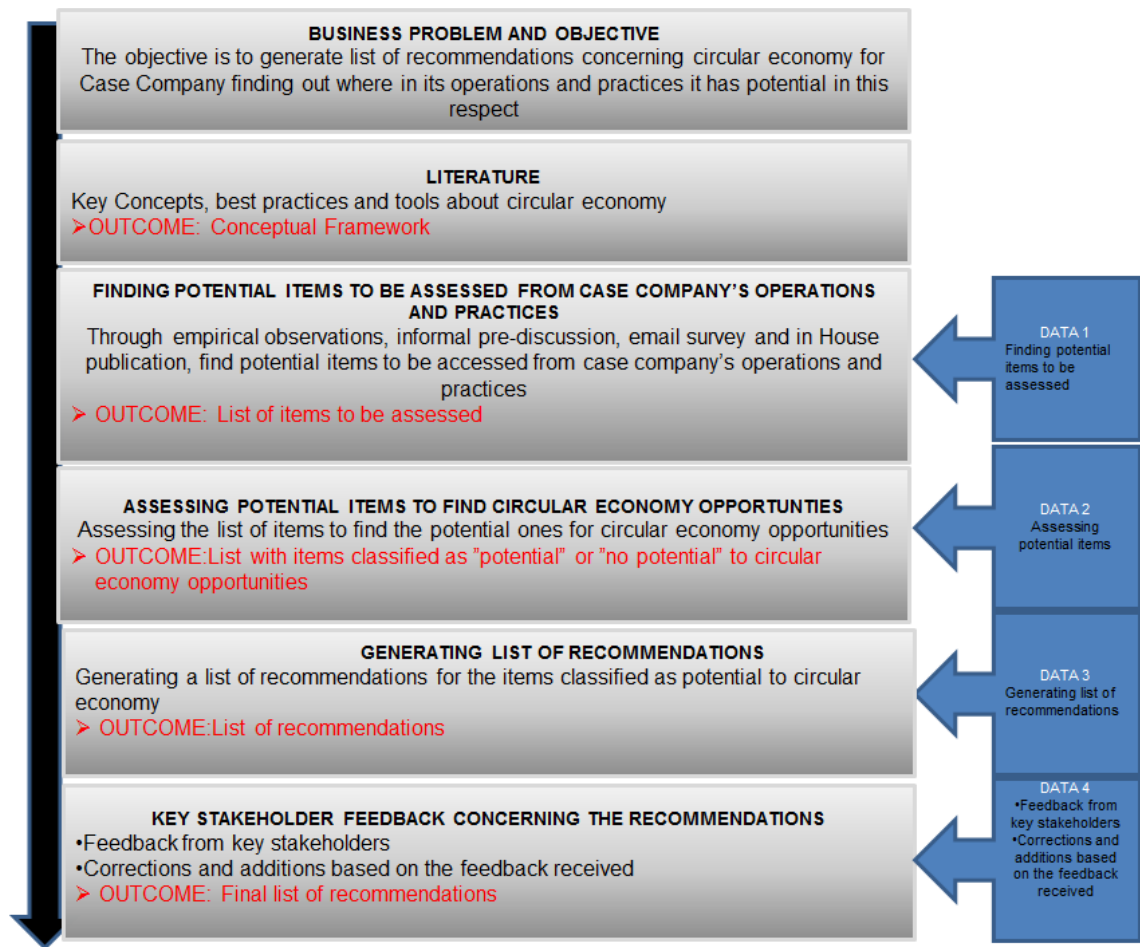


Figure 1. Project Plan.

2.2 Data Collection and Analysis

This section describes the methods used to collect the data, the personal involved in the data collection and how the data was analyzed. The data was collected with different methods as empirical observations, informal pre-discussions, in House publications, email survey, workshops and brainstorming sessions. The data was collected and analyzed in 4 different parts: Data 1, Data 2, Data 3 and Data 4 as stated in Figure 1.

The table below provides the details of the interviews, surveys, workshops and brainstorming sessions conducted for collecting the data and the participants involved.

DATA STAGE	CONTENT OF DATA COLLECTION	OUTCOME OF DATA COLLECTION	DATA SOURCE	RECORDING METHOD	DATE
DATA 1	IDENTIFYING POTENTIAL ITEMS TO BE ASSESSED FROM CASE COMPANY'S FACILITIES OPERATIONS AND PRACTICES	List of items to be assessed	<p>Empirical observations of case company's facilities operations and practices</p> <p>In house publications. Collection of internal and public documents and publications related to case company's facilities operations and practices</p> <p>Informal pre-discussion. Participants: 15 selected employees of case company and the the Facility Manager</p> <p>Email survey. Participants: Real Estate Manager 1 Real Estate Manager 2 Facility Manager Operations Manager</p>	<p>Written notes (diary)</p> <p>Transcribed</p> <p>Written notes (Face2Face) Participant 1:20min Participant 2:30min Participant 3:25min Participant 4:30min Participant 5:18min Participant 6:15min Participant 7:30min Participant 8:30min Participant 9:30min Participant 10:20min Participant 11:30min Participant 12:30min Participant 13:17min Participant 14:25min Participant 15:30min</p> <p>Written notes</p>	<p>April to August 2017</p> <p>April to August 2017</p> <p>June to August 2017</p> <p>Septmeber 2017</p>
DATA 2	ASSESSING POTENTIAL ITEMS TO IDENTIFY CIRCULAR ECONOMY OPPORTUNITIES	List of items classified as potential or no potential to circular economy opportunities	<p>Workshop using the "Analysis Tool to Identify Circular Economy Opportunities" from the conceptual framework.</p> <p>Participants: Real Estate Manager 1 Real Estate Manager 2 Facility Manager Operations Manager</p>	<p>Written notes (Face2Face) 2h workshop</p>	September to October 2017
DATA 3	GENERATING LIST OF RECOMMENDATIONS	List of recommendations for the items classified as potential to circular economy opportunities	<p>Brainstorming session using the "Analysis Tool to Identify Circular Economy Opportunities" .Participants: Real Estate Manager 1 Real Estate Manager 2 Facility Manager Operations Manager</p>	<p>Written notes (Face2Face) 2 x 2h brainstorming session</p>	November 2017
Data 4	KEY STAKEHOLDER FEEDBACK CONCERNING THE RECOMMENDATIONS	Final list of recommendation	<p>Decision maker final feedback .</p> <p>Participants: Real Estate Manager 1 Real Estate Manager 2</p>	email	December 2017

Figure 2 – Data Collection Plan.

2.3 Data Collection Stage 1

This section will describe how the researcher identified potential items to be assessed from case company's facilities operations and practices.

2.3.1 Empirical Observation

Data 1 was collected between April and August of 2017. For 5 months, the researcher visited the case company's facilities observing its operations and practices. The observations from the visits were written down in a diary. The researcher also talked to the employees that will be called participants to identify items with potential to circular

economy. Potential to circular economy means that the utilization of that item can be improved. Where there is waste there is potential to apply circular economy concept. For Data 1, the purpose was to identify items potentially generating waste.

The area for waste collection was visited systematically between April and August:

Monday from 9:00 AM to 9:20 AM

Wednesday from 11:00 AM to 11:20 noon and

Friday from 16:00 to 16:20.

The warehouse was visited 3 times a week systematically between April and June:

Monday from 8:45 AM to 09:00 AM

Wednesday from 10:45 AM to 11:00 AM and

Friday from 15:45 to 16:00.

For the kitchen coffee-area, the researcher brought her own lunch from Monday to Friday to experience the usage of the kitchen-coffee area. Lunch time in case company is around 30 min. The researcher brought her own food from April to end of this study in November but the empirical observation for this study ended in August.

The researcher used the meetings rooms at least 5 times in different time schedules. Meeting varied from 30 minutes to 1 hour. The meeting room is used by the researcher in daily routine but the empirical observation for this study ended in August.

Data Center was visited once a month from April to August systematically:

4th of April from 13:00 to 13:15,

4th of May from 13:00 to 13:15,

6th of June from 13:00 to 13:15,

4th of July from 13:00 to 13:15 and

8th of August from 13:00 to 13:15.

The researcher used the fitness room every Monday from 17:00 to 18:00 from April to June and visited the fitness room other 3 times a week systematically in May:

Tuesday from 11:30 AM to 11:45 AM

Thursday from 16:00 AM to 16:15 AM and

Friday from 08:00 to 08:15.

2.3.2 Information Pre-Discussion

In a total of 15 (fifteen) employees of case company that will be called participants and the case company Facility Manager were involved in an information pre-discussion. The selection of the 15 (fifteen) participants was based with the facilities they used. The identity of the participants is not important for this research, It's anonymous participation. The discussions were ad hoc during the researcher walking through case company's facilities. To all participants was explained the purposed of the research, the answer's key points were noted down in the researcher's diary.

Participants 1, 2 and 3 were constant visitors of the area for waste collection A and warehouse area. There are 3 areas for waste collection:

- Area A for waste collection, it was called "area A for waste collection" for this study purpose only. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility. The waste from Area A is collected periodically by an external company that will dispose them accordingly with Finnish laws. Area A has items as discarded laptop, computer mouse and internet cables between other discarded items. The electronics are discarded because they are broken or they were replaced for newer ones. Some of the electronics are still in working condition. Note that, the waste generated by open and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.
- Area B for waste collection, it was called "area B for waste collection" for this study purpose only. Used office furniture, kalustekierrätys in Finnish, is the waste collected in this facility i.e. office tables, chairs and cabinets between others office furniture. The furniture is in working condition but discarded because newer ones replaced them. Note that, the waste generated by open and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.
- Area C for waste collection, it was called "area C for waste collection" for this study purpose only. It's located in the printer rooms. The printer rooms have small baskets for waste collection that is periodically transferred to area A for waste collection. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility. It varies the range of waste collected by printer room i.e. it can be one printer room has collection point only for paper and battery. The case company has several printer rooms over the 3 buildings.

Note that, the waste generated by open and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.

The informal pre-discussion took place in the facilities visited and they had the following duration:

Participant	Duration of information pre-discussion in minutes	Participant	Duration of information pre-discussion in minutes
1	20	9	30
2	30	10	20
3	25	11	30
4	30	12	30
5	18	13	17
6	15	14	25
7	30	15	30
8	30		

Table 1. Time dedicated for the Information pre-discussion

Participants 1 to 3 collected the electronics that were interesting to them from what was called waste once and upgrade, reuse or redistribute them between family and friends. The participants were probed with questions like “which items you had found in the waste area that you reused?”, “What do you search in the waste area?”, “Do you have any suggestion to get longer utilization of the items here, in general? The purpose of the questions was to find out if the waste could be minimized.

Participants 4,5 and 6 were users of the kitchen-coffee facility. The kitchen-coffee facility has appliances and kitchen utensils that enable employees to bring and warm their own food or prepare their own tea or coffee. It's offered free beverages as coffee, tea and milk. It was observed that for the coffee machine the employee must bring its own coffee mug, the coffee machine doesn't offer disposable mugs encouraging the reuse.” Visitor mug” with company case logo is offered as borrow option to the visitor or to the employee that doesn't have a mug at that time, the mugs are reusable and located in the cabinet with a written sign in the door. The employees use the microwave to warm

their food, the refrigerator to keep their food fresh till lunch time and they borrow kitchen utensils from the kitchen. Many of the kitchen utensils are from recycle campaigns organized from case company. The participants were probed with questions like “How often do you use this facility?”, “Which items do you use from this facility?”. The purpose of the questions was to find out if the kitchen-coffee facility and its appliances were useful for the participants and if there were any waste.

Participants 7, 8 and 9 were users of the meeting rooms. The case company has meeting rooms with varied capacity for attendants, fully equipped with digital overhead projector and many of them enabled with audio and video conference system. The auditorium has capacity for maximum 150 persons. The company has mini meeting rooms not bookable (ad hoc) with capacity for maximum 3 persons. The employees were probed with questions like: “How often do you use this facility?”, “Do you always book the meeting room via some booking system?”, “How often do you use the conference rooms or the auditorium?”, “How often do you use the appliance in the conference rooms”? “Did it happen at any time that all conference rooms were busy and you could not find a place for your meeting?”, “In general would you be flexible to change the date of the meeting?”, “Is the booking mandatory?”. The purpose of the questions was to find out how the participants use the meeting rooms, if they do.

Participants 10, 11 and 12 were users of the sport facilities and dressing rooms. The case company has indoor and outdoor spaces for sports. Indoor, the case company offers 2 (two) fitness room. Outdoors, the case company has a soccer and tennis field. The participants were probed with questions like: “Do you always book the sport facility via some booking system?”, “How often do you use the sport facility or the dressing room?”, “Is there anything preventing to use more often?”. The purpose of the questions was to find out if there was waste.

Participants 13,14 and 15 were users of the data center. The participants were probed with questions like: “Is the booking mandatory to use the data center?”, “How often do you use the data center?” The purpose of the questions was to find out if there was waste.

All participants were users of the open space area, some of them used the parking and dressing room. In what concerns the open space, parking and dressing room the participants were probed with questions like: “Is your work station reserved only for you?”,

“How often do you work from office?”. “Are the seats around your busy all the time?”, “How do you commute to work place?”, “How often do you use the dressing room?”, “Do you see any item generating waste?”. The purpose of the questions was to find out if the workplace area could be underutilization and there was any waste in the open space, parking area or dressing room”.

The informal pre-discussion had duration from 15 to 30 min each.

Case company’s Facility Manager. The facility manager was one of the key stakeholders of this study. An informal pre-discussion of 30min duration was conducted where the following was asked:

- which guidelines exist to deal with the company’s facilities?
- How electricity, heating, cooling and water is managed?
- What is the process connected to the recycling of office’s furniture?

The purpose of the questions was to get in House material for the research, identifying items to be assessed with potential to circular economy opportunities.

2.3.3 In House Publications

The following publications was researched and analysed:

- guidelines to manage the facilities i.e. waste management.
- internal emails regarding the case company’s operations and practices i.e. email promoting the recycling week that happens 3 times per year
- internal publications i.e. promoting social media group of people that sells, buy or give away items still in usable condition
- internal and public internet
- sustainability reports

The purpose of the in House publications reading was to understand how the facility was managed, targeting its operations and already the best or not good practices. The “not good” practices were items for the assessment.

2.3.4 Email Survey

An email was sent to the key stakeholders asking them if they would like to take any item to the assessment.

All the data collected was analysed according to Existent Literature and resulted in a list of items to be assessed.

2.4 Data Collection Stage 2

This section will describe the assessment procedure to identify circular economy opportunities.

A workshop with total duration of 2h was organized to assess the list of items collected during the phase “Identifying Potential Items to be Assessed from Case Company’s Facilities Operations and Practices”.

The workshop required the participation of the acting Real Estate Manager and Facility Manager, at least. The workshop had the following participants:

- Case company Real Estate Manager, on duty till end of 2017
- Case company Real Estate Manager, starting from 2018
- Facility Manager
- Operations Manager

The participants were invited via email for the workshop with a brief introduction about the subject. During the workshop using the “Analysis Tool to Identify Circular Economy Opportunities”, the researcher and the key stakeholders assessed all items. A printed version of the “Analysis Tool to Identify Circular Economy Opportunities” was provided to the participants. The researcher wrote down all the answers from the key stakeholders. The goal of the workshop was to get answered the questions of the “Analysis Tool to Identify Circular Economy Opportunities” concerned the items previously selected. In a later phase the answers were analyzed and recommendations were proposed.

The notes produce by the workshop generated a list of items considered as “potential” or “no potential” to circular economy.

2.5 Data Collection Stage 3

In the Data 3 phase the findings from assessment session and case studies from existing literature, including the Conceptual Framework were presented and discussed dur-

ing 2 (two) brainstorming sessions with the Key stakeholders. The researcher presented during the brainstorming sessions the recommendations in how to reduce waste and reach circular economy based in case studies and existent literature. The recommendations presented were only for the items classified as potential to circular economy from previous phase “Assessing Potential Items to identify Circular Economy Opportunities”.

The brainstorming session had the following participants:

- Case company Real Estate Manager, on duty till end of 2017
- Case company Real Estate Manager, starting from 2018
- Facility Manager
- Operations Manager

During the 2 (two) brainstorming sessions the key stakeholders had opportunity to give straight feedback and comment the proposals as add new ones. All the feedback, comments and proposals were written down.

From the brainstorming session a list of recommendations was generated.

2.6 Data Collection Stage 4

In Data 4, a list of recommendations (summary) generated during the brainstorming session was sent via email to the Real Estate Managers. Based on the feedback received via email the list of recommendations was modified. As a result, a final list of recommendation was generated.

3 Concepts and Practices Concerning Circular Economy from Relevant Literature

3.1 Circular Economy Concept

It's not clear the exact time when circular economy concept, terms or ideas had being introduced in literature, some researchers mention Kenneth Boulding's essay "The

Economics of the Coming Spaceship Earth” from 1966. The essay talks about open and closed economy. Bouldin compares open economy called “cowboy economy” to closed economy called “spaceman economy”. The major difference would be the behaviour towards consumption. The open economy according to Boulding’s essay is “exploitative” as characteristic of the open society. Closed economy compares the Earth with a “spaceship where the all reservoirs are limited and the man must find his place in the ecological system that is capable of continuous reproduction” (Boulding, 1966).

According to Boulding (1966), the open economy relate success with consumption and production and consequentially extraction of raw material and resources. The closed economy would be the opposite of open economy, relating success with the preservation of the raw material and resources. When we think about a spaceship in the galaxy that is isolated of everything and it needs to survive with the resources that it has it because it doesn’t have where to get new resources, the same position is our planet Earth.

Stahel (2010) in 2005 wrote about an economic model that focus in the performance of products and services than owning the product with examples of companies that sells performance and not the good itself as Roy’s Royce and Michelin. The economic value brought by the utilization value.

Our society consumption relies in endless amount of resources. The economy model of our society in what is called linear model where we take the resources, we make a product, we consume it (or not) and we dispose it. Linear model is not sustainable and is not an option for future generations.

“Circular economy is restorative and regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times” (Ellen MacArthur Foundation, 2015). “The circular economy requires changes across supply chains, including in product design, business models, consumption choices, and the prevention and management of waste” (European Commission, n.d.).

The circular economy decouples economic growth with consumption of primary material.

The circular economy system diagram from Ellen MacArthur Foundation in Figure 3 presents the steps of minimizing the dependence of primary material keeping the already extracted material in highest level of utilization, trying to keep in the inner circle i.e. washing machine: 1st **maintain** - keep the washing machine running as long as possible with the best performance. It may require some preventive maintenance to avoid that wash machine breaks and in case the wash machine breaks it should be fixed 2nd **reuse and redistribute** – The service provider takes back the used machine, fix if its required and lease or sell it in a second-hand market. 3rd **refurbish and re-manufacture** – the manufacture takes back the wash machine to refurbish or remanufacture it 4th **recycle** the wash machine will be disassembled and it will become raw material to produce new wash machine.

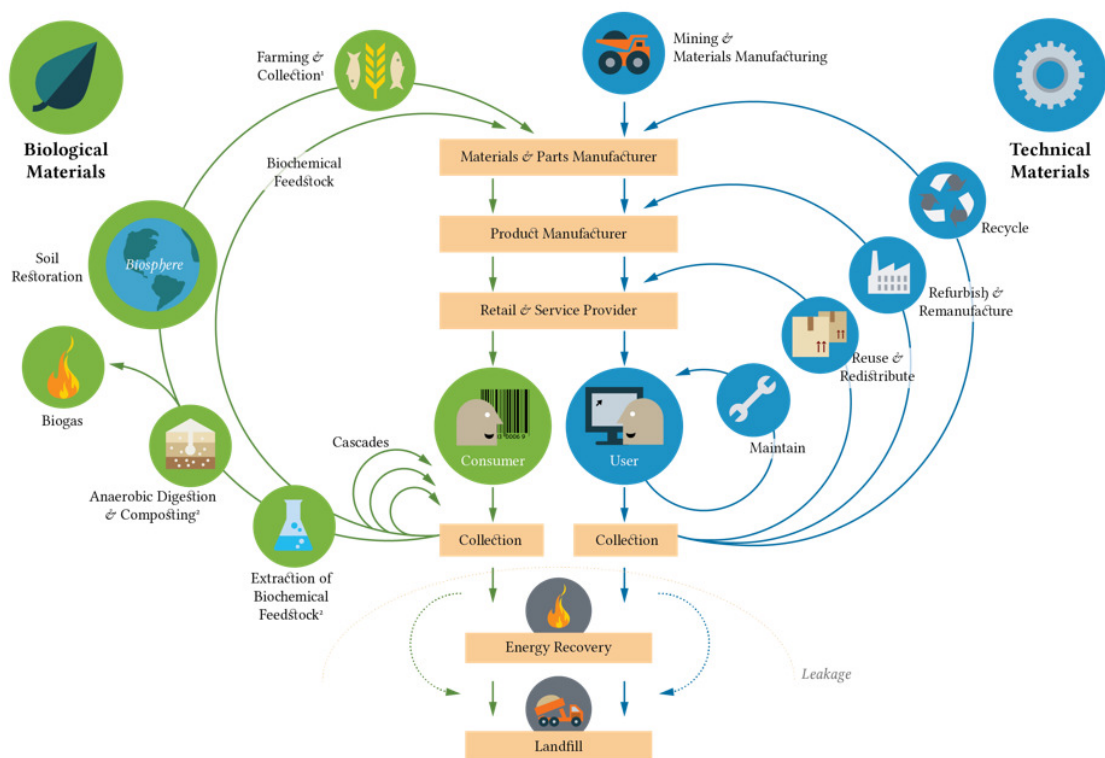


Figure 3. Circular economy System Diagram, Ellen Mac Arthur Foundation (2015).

3.2 Why circular economy?

With the advance of technology and growth of the population the consumption had increased along the time in a not sustainable way. If the world continues with same consumptions style in the future we will face economic and political crises due resource scarcity. Should we rely in innovation and continue with linear model of consumption where we take, use and dispose? Doesn't the future generation have the same rights to have access to the metals and minerals that we consume today?

According to Sitra, "the circular economy offers 2 to 3 billion euros of value potential in Finland alone by 2030" (Sitra, 2016).

There are 2 types of resources: finite and infinite resources. The finite resources are the ones that can't multiply by themselves or It can't be reproduced yet in laboratory as gold, silver, petroleum. The continue extraction of finite resources to supply the current demand of production will deplete them in near future. Infinite resources are the ones that can be regenerated as tree and fish, even that some fish species still can be vanished due the human action.

Below is the prospect of some metals and minerals availability if the society continues with the same life style consumption according to Diederer (2010):

Name	Years Left	Name	Year Left	Name	Year Left
Antimony	11	Barium	20	Nickel	31
Silver	12	Cadmium	20	Niobium	32
Strontium	12	Zirconium	21	Bismuth	35
Zinc	14	Copper	27	Rhenium	37
Tin	15	Thallium	28	Tungsten	37
Arsenic	17	Manganese	29	Yttrium	40
Gold	17	Mercury	29	Iron	46
Lead	18	Molybdenum	31		

Table 2. Metals and Mineral Availability (Damen, 2012)

Circular economy suggests a different model of economy to guarantee the existence of resources reducing the dependency of primary material and enabling economy growth.

3.3 Identifying Circular Economy Opportunities

3.3.1 ReSOLVE Framework

The ReSOLVE framework proposed by Ellen Mac Arthur Foundation (2015) proposes 6 initiatives to identify and enable the circular economy:

- **“REGENERATE.** Shift to renewable energy and materials; reclaim, retain, and regenerate health of ecosystems; and return recovered biological resources to the biosphere “(Ellen Mac Arthur Foundation, 2015).

Case study: Koli National Park in Finland installs geothermal heat system to decrease its dependency of oil. Up to 180 000 liters of oil per year has being used for heating and an average of 75 to 80 percent of the oil can be cut down to geothermal (Yle, 2016).

- **“SHARE.** Increase product utilization by sharing or re-using it. During development design it for longer life utilization and include options for repairing and upgrading it” “(Ellen Mac Arthur Foundation, 2015).

Case study 1: Re-Tek, UK market provider of IT Asset Disposal and wrap for IT Lifecycle. Re-Tek donated 3 (three) reconditioned iPads to Strathcarron Hospice (www.strathcarronhospice.net) in Scotland. The iPads help in the patients’ reconditioning (Re-Tek, n.d.).

Case study 2: car2go, car sharing option. You pay for the minutes you use. The members get an access code where they can pick the car up or return it in an operating area near to the driver (car2go, n.d.). According to Ellen Mac Arthur Foundation (2017) a typical European car has a private owner and stays parked 92% of the time.

- **“OPTIMIZE.** Increase performance/efficiency of a product; remove waste in production and the supply chain (from sourcing and logistics to production, use, and end-of-use collection); leverage big data, automation, remote sensing, and steering” (Ellen Mac Arthur Foundation, 2015).

Case study 1: “Cisco Excess Used Product Offering, Cisco optimizes the value of the entire technology portfolio based in the fact that it ends up with an excess used product inventory that still has a useful life but limited demand from tradi-

tional channels” (Cisco, n.d.). Cisco created the “Cisco Excess Used Product Offering” that sells used products to a secondary market (Cisco, n.d.).

Case study 2: Increasing performance applying Lean. According to Modig (2012), Lean is the term given by westers for the Toyota production system. Lean seeks to identify and remove what doesn't add value to the product. After second World War Japan suffered a scarcity of resources what made Toyota focus in flow efficiency. The concept had widely been used by different industries and in different sectors.

- “**LOOP**. Keep components and materials in closed loops and prioritise inner loops. For finite materials, this means remanufacturing products or components and as a last resort recycling material, as Caterpillar, Michelin, Rolls Royce, and Renault are doing. For renewable materials, this means anaerobic digestion and extracting bio-chemicals from organic waste” (Ellen Mac Arthur Foundation, 2015).

Case study: Mud Jeans where the customer can buy or lease a pair of jeans. With the monthly fee of 7.5 EUR the customer can lease a pair of jeans. With the performance model they guarantee the keep ownership of the raw material and get them back into use (MUD jeans, n.d.).

- “**VIRTUALISE**”. Virtualize (Ellen Mac Arthur Foundation, 2015) your product delivering what customer wants i.e. amusement and entertainment instead of paper (books) and plastic (CDs and DVDs)

Case study 1: Amazon via an application called Kindle Books sell books that can be read online.

Case study 2: Spotify, from Spotify application the members can listen to their favourite music from their catalogue.

- “**EXCHANGE**. Replace old materials with advanced non-renewable materials; apply new technologies; choose new products and services” (Ellen Mac Arthur Foundation, 2015).

Case Study: Philips is one of the companies that offers lighting per Lux (Philips, 2015), where the consumer gets luminosity and Philips installs and maintain the installations providing the correct luminosity for the area.

3.3.2 The Circular Design Guide

The Circular Design Guide is a collaboration between the Ellen MacArthur Foundation and IDEO aiming to help organizations with step by step guide in how to identify the opportunities and how to enable circular economy. There are cases studies and guides that can be downloaded and adapted to the organization. It constitutes of 3 parts: Introduction, Methods and Mindset (Circular Design Guide, n.d.).

- Introduction. It gives an introduction of “The Circular Designer Guide” and also remind us why we should enable circular economy. It brings case studies.
- Methods. It constitutes from several activities and exercises to prototype the idea. There are guides in how to identify circular economy and tips about some exercises in how to get the idea forward as brainstorming. It’s important to the organization to understand the need to enable circular economy and have all team members engaged in the process. This section will bring exercises to identify and enable circular economy
- Mindset. It will give recommendations in how to think circular since early design. The mindset play an important role to enable the circular economy. It’s crucial that circular economy is though since the design of the product. This section will give some insights in how to think circular.

3.3.3 Circular Economy Toolkit

The circular economy toolkit is a project from the University of Cambridge. The online assessment tool brings a combination of existent “literature, survey results and observations from workshops” (Circular Economy Toolkit, n.d.). According to circular economy toolkit web page the assessment tool provides an indicator to enable circular economy and improve performance according company and product type (n.d.).

The online Assessment tool makes specific questions for the product pre-selected and based in the answers It provides recommendations to reach circular economy, an example is presented in the picture below.

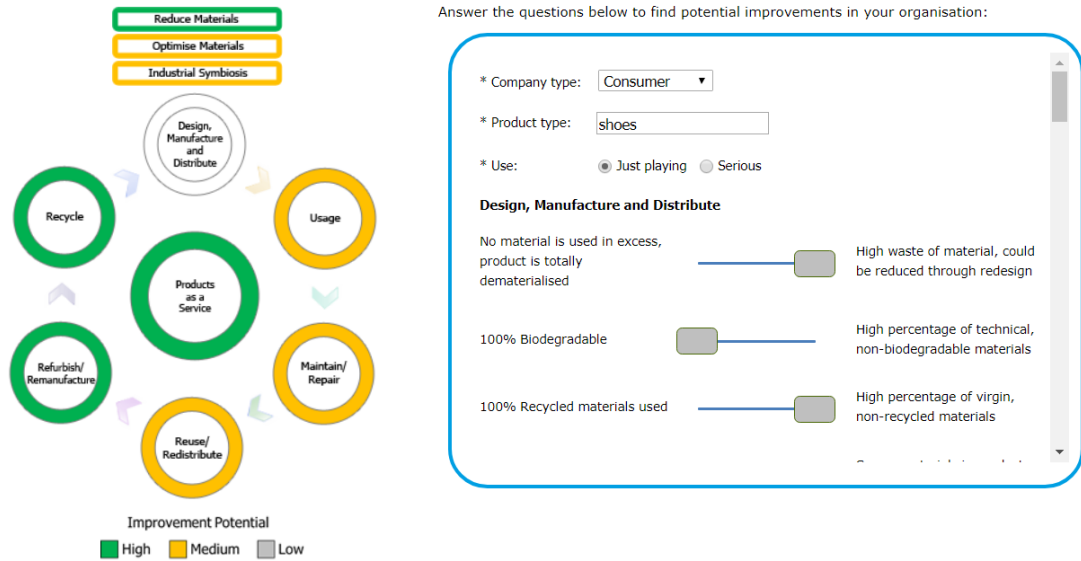


Figure 4. Circular Economy Toolkit (n.d.).

3.4 Conceptual Framework

The conceptual framework used in this project is a combination of the ideas from ReSOLVE framework proposed in the by Ellen Mac Arthur Foundation (2015) , the questionnaire style of “Assessment tool” from Cambridge University and the” The Circular Design” by Ellen Mac Arthur Foundation and IDEO. The ReSOLVE framework was chosen because can be applied to any industry, asset, resource or process and It offers company’s case examples. “Assessment tool” style of questioner used by Cambridge University and by “The Circular Design” was chosen because It’s a simple and easy strategy to identify the opportunities to circular economy.

To identify circular economy opportunities the “Analysis Tool to Identify Circular Economy Opportunities” is created based in the 6 initiatives from ReSOLVE framework from Ellen MacArthur Foundation (2105) and using questions as “Assessment tool” from Circular economy toolkit (n.d.) and by “The Circular Design” (Circular Design Guide, n.d.).

Analysis Tool to Identify Economy Opportunities:

ReSOLVE fra- mework	Item to be audited	Question addressed to the item audited	Answer should be,	Some examples as way forward from
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			or check next column:	ReSOLVE framework and case studies
REGENERATE	ENERGY	Is it monitored how much is spent?	Yes	Measure and monitor to pin point where it needs improvement.
		Is powered by renewable energy?	Yes	Change to renewable energy.
		Is the lighting system by latest technology? Which?	Yes	Eliminate waste (smart building). Research latest technologies.
		Is lighting traded as a service?	Yes	Buy luminosity, instead of lamps.
		Is heating/cooling traded as a service?	Yes	Buy heating or cooling as service.
		Is it powered off when there is no need?	Yes	Smart building. Re-use wasted heating/cooling. Use automated system to turn off when there is no use. Research latest technologies.
	WATER	Is it monitored how much is spent?	Yes	Measure and monitor to pin point where it needs improvement.
		Is it traded as a service?	Yes	Change to performance model.
		Is water consumption efficient?	Yes	Eliminate waste (smart building). Research latest technologies.
		Does it produce negative externalities?	No	research newer technologies and case study to eliminate the negative externalities.
		Does it generate any waste?	No	Eliminate waste (smart building). Research latest technologies and use of rain water.
		Is it returned to the environment in a sustainable	Yes	return clean water for the environment, research

		way?		newer technologies to eliminate the negative externalities.
	WASTE	Is It monitored how much waste is produced?	Yes	Measure and monitor to pin point where it needs improvement. Classify the type of waste generated.
		Is it used as raw material to other process?	Yes	Design all process flow to have clear view if the waste can be reused. Search product/process innovation to use waste as raw material. Make partnership with companies that can reuse your waste. Promote idea box and hackathons in how to reuse the waste. Educate and encourage personal to be more conscious about waste.
		Is it stimulated selective collections of waste?	Yes	Stimulate and promote waste sorting creating recycling areas with clear indication how and where waste should be disposed.
		Are there instructions in how to handle it?	Yes	Make clear instructions about sorting, disposing and all necessary management that can be follow by the employees.
		Is waste traded?	Yes	Make partnership with companies that can reuse the waste.
	LAND	Is it monitored how much is spent?	Yes	Measure and monitor to pin point where it needs improvement. Classify all kind of waste generated.
		Does it degrade?	No	Research newer technologies and case study to eliminate the negative externalities. Promote brainstorming sessions or idea box to get ideas in how to eliminate the negative externalities.

		Is it returned to environment in a sustainable way?	Yes	Research newer technologies and case study to eliminate the negative externalities. Promote brainstorming sessions or idea box to get ideas in how to eliminate the negative externalities.
SHARE	ASSET (ex: tangible or not tangible as table or room) PROCESS, SUPPLY CHAIN RESOURCE	Is It shared?	Yes	Increase utilization by sharing and reusing the product. Offer/change to performance model. Design the product to be upgradable and maintainable and make it robust that can have longer life of usability. Design the parts easy to be exchanged and disassembled.
		Is measured the utilization rate?	Yes	Measure and monitor to pin point where it needs improvement. Automate the process to visualize the utilization.
		Is it bought or sold as service?	Yes	Give preference for service/leasing and reusing (performance model).
		Does it generate waste?	No	Prefer service/leasing then buying. Make partnership with companies that can reuse your asset. Offer a different purpose for your asset.
OPTIMIZE	ASSET, PROCESS, SUPPLY CHAIN, RESOURCE	Is It efficient?	Yes	Increase performance eliminating the waste. Research new technologies and case studies. Have a clear flow of the process to identify the waste.
		Does it generate waste?	No	Design all process flow to have clear if it needs improvement. Search product/process innovation to optimize. Promote idea box and hackathons in the company to get ideas in how to optimize.

		Is it automated?	Yes	Automate.
		Is it measured?	Yes	Measure/monitor then you can pin point where it needs to improve.
LOOP	ASSET, PROCESS, SUPPLY CHAIN, RESOURCE	Does require new raw material?	No	Search product/process innovation to use recycled material.
		Is there transparent resource flow?	Yes	Design all process flow to improve visibility, the start is since the extraction of the material used till how is treated after disposing.
		Is the asset used as something else than was designed?	Yes	Promote idea box and hackathons in the company to get ideas in reusing the asset for different needs.
		Is the asset reused?	Yes	Promote idea box and hackathons in the company to get ideas in how to re-use the asset or make it re-usable. Educate and encourage the personal to be more conscious about waste. Instead of buying thinking about as having the product as service/leasing/reuse.
		Is the waste of one process used as input of other process?	Yes	Research ways to have closed loop in the process.
		Does it keep the material or nutrients in the system?	Yes	Research ways to have closed loop in the process.
		Is the life of the asset prolonged through maintenance or upgrade?	Yes	Design the product to be upgradable and maintainable and make it robust that can have longer life of usability. Design the parts easy to be exchanged and disassembled.
		Is It resilient?	Yes	Design the product to be upgradable and maintain-

				able and make it robust that can have longer life of usability. Design the parts easy to be exchanged and disassembled.
		Is there available maintenance or repair options for It?	Yes	Design your product to be maintainable and repairable
		Is possible to disassemble easily?	Yes	Design your product by modules, that easily can be assembled/disassembled and small parts exchanged and repaired.
		Is possible to upgrade parts?	Yes	Design your product by modules, that easily can be assembled/disassembled and small parts exchanged and repaired..
		Is stated the composition or labeled?	Yes	Label your asset with all material/components that is made of
		Is it returned to environment in a sustainable way?	Yes	Redesign it.
VIRTUALIZE	ASSET, PROCESS, SUPPLY CHAIN, RESOURCE	Is It virtualized?	Yes	virtualize.
		Is it self-repairing?	Yes	Redesign it to be self-repairable.
		Do you own it?	No	Search for leasing options (performance model).
		Is the performance and utilization measurable?	Yes	Measure/monitor then you can pin point where it needs to improve.
EXCHANGE	ASSET, PROCESS, SUPPLY CHAIN, RESOURCE	Does require new raw material?	No	Replace for renewable and biodegradable materials.
		Is the process by module?	Yes	Design by module or boxes that can be easily repairable.
		Is the asset used as something else than was designed?	Yes	Promote innovation box idea.
		Does it generate waste?	No	Research how to reduce and eliminate the waste.

		Is it returned to environment in a sustainable way?	Yes	Replace for renewable and biodegradable materials. Redesign it.
Does the company" own it?				
Are there instructions in how to handle it?				
Which are the waste (garbage)that the company produce?				

Table 3. Analysis Tool to Identify Circular Economy Opportunities

4 Identifying Potential Items to be Assessed from Case Company's Facilities Operations and Practices

This section describes the researcher journey to identify potential items to be assessed from case company's facilities operations and practices and which items were selected. This section presents the result of the empirical observation, the key points written down of the informal pre-discussions, the in House publications researched and the email survey result.

Cleaning, property services (energy, water, waste and land) and beverages are the responsibility of the external company that provides facility management. The facility areas researched are:

- open space area. The open space covers the workplaces and common leisure areas i.e. coffee area.
- Data center. The data center plan covers the hardware area. It's mainly the hardware required to test the software developed by case company, the hardware type is not important for this research.
- Area A for waste collection, it was called "area A for waste collection" for this study purpose only. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility. The waste from Area A is collected periodically by an external company that will dispose them accordingly with Finnish laws. Area A has items as discarded laptop, computer mouse and internet cables between other discarded items. The electronics are discarded because they are broken or they were replaced for newer ones. Some of the electronics are still in working condition. Note that, the waste generated by open

and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.

- Area B for waste collection, it was called “area B for waste collection” for this study purpose only. Used office furniture, kalustekierrätys in Finnish, is the waste collected in this facility i.e. office tables, chairs and cabinets between others office furniture. The furniture is in working condition but discarded because newer ones replaced them. Note that, the waste generated by open and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.
- Area C for waste collection, it was called “area C for waste collection” for this study purpose only. It’s located in the printer rooms. The printer rooms have small baskets for waste collection that is periodically transferred to area A for waste collection. Discarded electronic, cupboard, paper, wood, lamp and battery are the waste collected in this facility. It varies the range of waste collected by printer room i.e. it can be one printer room has collection point only for paper and battery. The case company has several printer rooms over the 3 buildings. Note that, the waste generated by open and common leisure space areas, meeting rooms, kitchen-coffee area and toilets called mixed waste and biowaste are not disposed in this area.
- Warehouse.
- Meeting rooms. Meeting rooms will be the term used for common or shared rooms for meetings including the auditorium. Most of the rooms have capacity for audio and video conference and fully equipped with digital overhead projector. Mini meeting rooms have capacity for maximum 3 persons, the auditorium has capacity for maximum 150 persons and the rest of the meeting rooms have varied capacity.
- Indoor and outdoor sport facilities: outdoor soccer field, outdoor tennis field, 2 (two) indoor fitness rooms, few saunas and dressing rooms in different buildings.
- Kitchen-coffee areas spread in the 3 (three) buildings equipped with coffee machine, refrigerator, microwave and kitchen utensils.

Parking place is covered in the energy assessment.

4.1 Identifying Potential Items to be Assessed

The best practices and case studies read during literature research helped the researcher to have an auditor behaviour focusing in the circular economy concept. The researcher visited the facilities during different time of the day to observe the accuracy that other employees, called participants, visited the facilities.

Identifying potential items to be assessed from the areas for waste collection based in empirical observation and informal pre-discussion

About electronic and electric waste, it was observed that the waste is not only generated from case company but also employees bring their waste from home to be disposed in the company area for waste collection, in general small size electronic or electric equipment. According to Finnish law, electronic and electric waste (e-waste) can't be disposed in normal mixed waste at home but in proper recycling areas. The convenience and flexibility offered by the case company stimulates employees to recycle their e-waste in their facilities. It's not state at any place that is forbidden or allowed to employees to bring their e-waste and dispose it in the areas for waste collection at the case company.

The researcher observed that the waste areas A, B and C received visitors at different time and the researcher found many items in usable condition or whose parts could be reused from the recycling baskets. The following material attracted recyclers:

- wood pallet
- cardboard box
- laptop
- laptop mouse
- laptop monitor
- cable (electric, optical)
- cell phone
- cell phone charger (battery)
- clock
- cabinet
- table

Researcher: "which items had you found in the waste area that you reused?"

Participants:

... I found few laptops and I upgraded them. I changed the Operating System and I added more memory, they still can be reused. Besides, I collected few laptop mouse's still in good working condition that I use to distribute to friends and colleagues that ask me to their personal use. I found this watch that I'm using now, I just needed a new bracelet ...

... I asked for few pallets. I wanted to do a shelf in my balcony to support the flower box. I got 3 (three) pallets, painted them and they are in my balcony now. I got also some used cupboard boxes when I was moving ...

... I got a laptop mouse and cupboard boxes for my moving...

Researcher: "Do you search for any specific item in the waste area?"

Participants:

... I search for electronics that can be fixed and reused, I have this hobby of fixing them. I collect computer memory cards. Besides, anything nice ...

... When I need something to home that comes to my mind that I can find in the waste area I come here ...

... I search for cell phones and other small electronics that I can take to my home country to be re-used by the low-income community. Sometimes I donate to schools or just drop them in the stores that fix electronics, they can fix and sell them or just reuse some parts ...

Researcher: "Do you have any suggestion to get longer utilization of the items here, in general?"

Participants:

... Changes people's behaviour ...

... We need repair shops at low cost, if buying a new product is cheaper than fix old ones, it's practical to buy new products ...

... Of course, maybe not for the company but many people could reuse them as schools, children or even adults that don't need so powerful laptop ...

Identifying potential items to be assessed from the kitchen-coffee area based in empirical observation and informal pre-discussion

The case company offers few kitchen-coffee areas spread in the buildings with kitchen appliances where employees can store and warm their food. The kitchen is composed

by microwave, refrigerator, sink and coffee machine that offers for free a combination of beverages as tea, coffee and milk. The employees highly visit the kitchen area specially to get coffee and milk. It's observed as a popular place for informal conversation. During lunch time the employees that bring lunch visit the kitchen to warm and have their lunch. Near the kitchen-coffee areas the case company offers tables and chairs. The coffee machine doesn't offer the disposable mug, employees need to bring their own. The case company offers washable mugs that are located inside the cabinet in the kitchen. Inside the cabinets are available for borrowing kitchen utensils as cups, dishes, spoons, forks and knives, many of them were collected from the Recycling Week that is an event organized by the case company 3 (three) times per year. Inside the lower cabinet there are 3 (three) bins for waste recycling: biowaste, mixed waste and energy waste.

The researcher observed that employees do use the kitchen utensils even that most of them bring their own. The kitchen-coffee areas have higher number of visitants and many occasions during lunch time there is queue to warm the food.

Researcher: "How often do you use this facility?"

Participants:

.... every day during week. I prefer to bring my own food ...

... every day during week, many times a day to have coffee or tea...

... several times a day, I take coffee from the machine and I use the milk left in the refrigerator ...

Researcher: "Which items do you use from this facility?"

Participants:

...I keep the food in the refrigerator in the morning, during lunch time I warm it in the microwave. Sometimes I use the plates and spoon from the kitchen. I also wash here what is left dirty from the lunch, then I use the brush and the soap. When I bring cake to my team we use everything that is available to borrow. During the Recycle Week if we notice some kitchen utensils that can be useful for employees I take them to leave in the kitchen ...

... I use the refrigerator to keep my yogurt and I take milk from the refrigerator to mix with my coffee. I have my own mug and if we have visitors I show them where the mugs are. I have been using some kitchen utensils I find in the cabinet even that I don't know from who they belong ...

... I have my coffee or tea from the coffee machine. In case we have someone bringing desert we use the kitchen utensils available ...

Identifying potential items to be assessed from the meeting rooms based in empirical observation and informal pre-discussion

Meeting rooms is the name used for common or shared rooms for meetings including the auditorium. Most of the rooms have capacity for audio and video conference and fully equipped with digital overhead projector. Mini meeting rooms have capacity for maximum 3 (three) persons, the auditorium has capacity for maximum 150 (one hundred and fifty) persons and the rest of the meeting rooms have varied capacity.

The mini meeting rooms are not bookable by any tool, anyone can take them for unlimited time. The auditorium is reserved when there is some special event and for the few times the researcher passed by, it was empty. All meeting rooms except the mini meeting rooms are available and advertised in internet for renting (rated by hour).

Researcher: "Do you always book the meeting room via some booking system?"

Participants:

...yes, because It can be you ended up interrupted by someone, but if it's an ad hoc conversation there are plenty of non-bookable meeting rooms and I just take what is available...

... not for the mini meeting rooms ...

... not necessarily, I can take some meeting rooms that is empty ...

Researcher: "How often do you use the meeting rooms?"

Participants:

...the conference rooms at least twice a week, the auditorium is mostly reserved for bigger events...

... years ago, during consecutive 2 years I booked a meeting room once a week for a group study. I think it depends of the project. Now, I have three meetings per week where we need the audio and video conference system because we have participants from abroad ...

... I use the mini meeting rooms when I need to make a private phone call, there is no privacy in open space area...

Researcher: "How often do you use the appliances in the meeting rooms?"

Participants:

... I believe I and my colleagues use all the time the audio and video conference system because we have colleagues in different countries ...

... digital overhead projector and the audio system is necessary for us ...

... every meeting ...

Researcher: "Did it happen at any time that all meeting rooms were busy?"

Participants:

... depending the time of the year It can be more challenge to find some specific meeting room but if you are flexible about appliances, capacity or time you always find an available one ...

... it happened once but because it was last minute booking and I was not flexible about time and appliances ...

... never ...

Researcher: "In general would you be flexible to change the date of the meeting?"

Participants:

... it depends who are the participants and the purpose of the meeting...

... yes ...

... yes ...

Identifying potential items to be assessed from the sport facilities based in empirical observation and informal pre-discussion

The facilities include outdoor soccer field, outdoor tennis field, 2 indoor fitness rooms, few saunas and dressing rooms in different buildings.

One of the fitness room is used for classes as stretching, kickboxing and dancing. Outdoor, there is a soccer and tennis field. The researcher observed that the fitness rooms have different occupancy during the day time with higher usability by the employees during lunch, before and after working time. Dressing rooms are also used by employees commuting by bike or running to work.

Researcher: "How often do you use the sport facility?"

Participants:

... once a week I use the fitness room ...

... few times a week I use the gym. I go there during lunch time ...

... sometimes for stretching classes and dance ...

Researcher: "Do you always book the sport facility via some booking system?"

Participants:

... yes, I receive a normal meeting invitation for the kickboxing classes ...

... yes, the classes go via invitation system and I think the place needed to be booked

...

... no, no booking is needed for the fitness room downstairs ...

Researcher: "Is there anything preventing you to use more often the facilities?"

Participants:

... yes, the place is far from city and public transportation is not so good after work time ...

... no, I think I use enough ...

... the weather and sometimes classes are during normal work time and I have meeting at the same time. it would be nice to play tennis during summer but generally It's cold and raining ...

Researcher: "How do you commute to work?"

Participants:

... I take bus ...

... I come by car. I live in Kirkkonummi but the public transportation is not good ...

... I come by bike, even during winter ...

Researcher: "Do you use the dressing room?"

.. yes, every work day (biker)...

... yes, if I go to the gym ...

... I was using when I had pipe renovation at my home ...

Identify potential items to be assessed from the data center based in empirical observation and informal pre-discussion

The data center is located in one the case company's building. The employees accessing this facility work with the hardware. The researcher observed that the place had high concentration of hardware that is used by different departments located in different countries.

Researcher: "How often do you use the data center?"

Participants:

... Not often I go there, I access the equipment remotely ...

... Often, I maintain the hardware ...

... seldom, only if I must check the hardware ...

Researcher: "Is the booking mandatory to use the data center?"

Participants:

... In my case, yes ...

... It depends of the department, but I would say for most of the equipment's exist some booking system ...

... yes, avoiding that different people are doing different tests at same time. It would not be nice if someone restart the machine during my tests ...

Identifying potential items to be assessed from the open space area based in empirical observation and informal pre-discussion

The case company had transformed most of its office rooms in open space area for almost a decade. The usability of the space depends of the work done by the employee. The departments where employees have frequent business trip have more empty spaces (desks and chairs). In the Research Center department where employees generally don't travel the usability of the space is higher. In general employees work from office. The open space area offers individual table, chairs, garbage can and cabinets, a common coat area. The Office Center as Real Estate, is administrated by an external company. Office Center is already home of 100 companies according to their web page and case company is one of them.

Researcher: "How often do you work from office?"

Participants:

... I come to office every day unless I or my children are sick and need my assistance at home. At home my children would not let me to work in peace...

... I work from home most of the time...

... I work from home once a week ...

Researcher: "Is your work station reserved only for you?"

Participants:

... yes, and It has my belongings here ...

... no, we travel a lot then the place is not fixed ...

... yes, I appreciate that ...

Researcher: "Are the seats around your busy all the time?"

Participants:

... yes, too many people actually ...

... depends, sometimes many of us are travelling then the places are empty ...

... yes ...

Researcher: "Do you see any item generating waste?"

Participants:

... no

... maybe furniture ...

... no

Identifying potential items to be assessed from the warehouse based in empirical observation and informal pre-discussion

What is in the warehouse? The warehouse is shared between all companies that rent space in Office Center. For the facilities operation, a minimum or almost nothing is kept in the warehouse. Material is brought for refilling when the ones in use are near the end. Case company already do a step forward to circular economy sharing the place. Because of the size of the area, complexity of the space and what is stored, warehouse deserves to be treated as a separated research.

Identifying potential items to be assessed in cooperation with Facility Manager

Researcher: "which guidelines exist to deal with the company's facilities?"

Facility Manager: ...They exist, not sure for all facilities. I need to check ...

Researcher: "How electricity, heating, cooling and water is managed?"

Facility Manager: ...We monitor the electricity consumption and we compare with other companies ... in general we monitor all consumption. We have all the reports monthly that we provide to (case company)

Researcher:” what is the process connected to the recycling of office’s furniture?”

Facility Manager: “We have the backyard for furniture recycling and other rooms are full of them. We donated some furniture to a non-governmental organization and we also promote to the employees that they can pick up for free ...

Email survey

The researcher asked the key stakeholders if they would like to bring any item considered as potential to circular economy to be assessed during the workshop. The key stakeholders didn’t propose any new item to be assessed.

4.2 List of Items to be Assessed

This section describes the items selected and the reason for their selection to be assessed.

The following first 5 (five) items according to literature and case studies should be always assessed because they offer potential to circular economy:

- **ENERGY (luminosity/heating/cooling)**
- **WATER**
- **WASTE**
- **LAND**

The following items according to existent literature and the researcher empirical observations, informal pre- discussions and in House publications have potential to circular economy opportunities:

- **OFFICE FURNITURE**

The Case company has around hundreds of employees. The number of employees can vary time to time. The furniture includes between others, individual chair, table and cabinet, furniture in the meeting rooms, sofas and dining tables and coffee tables spread in the buildings. It’s not frequent that employees change furniture but what

happen with the hundreds used furniture when they do change? This is a potential item to be assessed because from the circular economy point of view it should be no waste.

- **KITCHEN-COFFEE AREA**

The kitchen-coffee areas are used by many employees and are equipped with different kitchen utensils. From circular economy point of view, we should research if this area with its kitchen utensils are used at its maximum capacity and if its produce any waste.

- **MEETING ROOMS**

From circular economy point of view, we should research if the meeting rooms are producing any waste. The Case company has meeting rooms with varied capacity for attendants, fully equipped with digital overhead projector and many of them enabled with audio and video conference system. The auditorium has capacity for 150 (one hundred and fifty) persons. Beside the conference rooms and the auditorium, the company has mini meeting rooms not bookable (ad hoc) with capacity for maximum 3 (three) persons.

- **SPORT FACILITIES**

From circular economy point of view, we should research if the sport facilities are producing any waste. The case company offers indoor and outdoor sport facilities. Indoor offers 2 (two) fitness room equipped with dressing room and sauna. Outdoor, there is a soccer and tennis field.

- **OPEN SPACE AREA**

From circular economy point of view, we should research if there is any waste of open space area. Office Center is a complex of 3 (three) buildings. Case company occupies part of the Office Center. How is the building utilization? Is the Case company satisfied with its utilization and does it match with circular economy values and principles?

This session closes with the following items selected to be assessed: energy, water, waste, land, office furniture, kitchen-coffee area, meeting rooms, sport facilities and open space area.

5 Assessing Potential Items to Identify Circular Economy Opportunities

A workshop with total duration of 2h was organized to assess the list of items collected during the phase “Identifying Potential Items to be Assessed from Case Company Operations and Practices”.

The workshop had the following participants:

- Case company Real Estate Manager, on duty till end of 2017
- Case company Real Estate Manager, starting from 2018
- Facility Manager
- Operations Manager

The participants were all invited via email for the workshop with a brief introduction about the subject. During the workshop using the Analysis Tool to Identify Circular Economy Opportunities, the researcher and the key stakeholders assessed all items. Item by item was selected for the assessment and the researcher wrote down the answers given by the key stakeholders, the comments and questions raised.

The following items were selected to be assessed: energy, water, waste, land, office furniture, kitchen-coffee area, meeting rooms, sport facilities and open space area.

5.1 Assessing the List of Items

The full table of “Analysis Tool to Identify Circular Economy Opportunities” can be found from chapter “Concepts and Practices Concerning Circular Economy from Relevant Literature”. The answers marked in red represent circular economy opportunities according with Analysis Tool to Identify Circular Economy Opportunities.

ENERGY ASSESSEMENT

ReSOLVE FRAMEWORK	ITEM TO BE AUDITED	QUESTION ADDRESSED TO THE ASSET/ITEM AUDITED	Answer from Key Stakeholders	Additional information
REGENERATE	ENERGY	Is it monitored how much is spent?	Yes	They compare also with other companies
		Is powered by renewable energy?	Yes	Case company buys 100% renewable energy
		Is the lighting system by latest technology? Which?	Partly	(1)
		Is lighting traded as a service?	No	

		Is heating/cooling traded as a service?	No	(2)
		Is it powered off when there is no need?	Small part	(3)

Table 4– Energy Assessment Result

1. The Case company is replacing all indoor lights to low energy lighting, project is on-going.

** The parking place doesn't have any automatic or smart system to turn on the light or increase the luminosity just in presence of a car or pedestrian.

*** Electrical outlets are provided in the parking place and the drivers can bring their own power cord to connect to the block heater of the car.

The electricity is provided from 13:00 to 00:00 AM (EET).

2. The heating produced by the data center is used for own facility services as heating the water used at the premises and as district heating system in Kirkkonummi and Espoo. Previously the excess heat was processed by chillers with free cooling.

** Case company uses district heating to heat the indoor facilities.

3. One of common meeting areas and some of the bathrooms have motion sensors to turn on/off the lights. Most of the premises has manual system to turn on/off the lights. Security personal during evening walk may turn off some of the lights if there are no employees. The first employees arriving to office in the morning turn on the lights if they are off. It's responsibility of employees to turn on-off the lights of the meeting rooms.

WATER ASSESSEMENT

ReSOLVE FRAMEWORK	ITEM TO BE AUDITED	QUESTION ADDRESSED TO THE ASSET/ITEM AUDITED	AD- ANSWER FROM KEY Stakeholders	Additional information
REGENERATE	WATER	Is it monitored how much is spent?	Yes	(1)
		Is it traded as a service?	Not applicable	
		Is water consumption efficient?	Yes	The water is just for employee's usage and cleaning.
		Does it produce negative externalities?	No	All sewage is piped to public system for treatment
		Does it generate any waste?	No	little usage
		Is it returned to the envi-	Yes	All sewage is piped

		ronment in a sustainable way?		to public system for treatment
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Table 5 – Water Assessment Result

1. water consumption had decreased over the last few years. Case company spends water just in cleaning, gardening, bathroom and kitchen-coffee area.

WASTE ASSESSEMENT

ReSOLVE FRAMEWORK	ITEM TO BE AUDITED	QUESTION AD-DRESSED TO THE ASSET/ITEM AUDITED	Answer from Key Stakeholders	Additional informa-tion
REGENERATE	WASTE	Is It monitored how much waste is produced?	Yes	(1)
		Is it used as raw material to other process?	Don't know	(2) not internally
		Is it stimulated selective collections of waste?	Yes	(3)
		Is waste traded?	No	Case company pays for waste to be collected

Table 6 – Waste Assessment Result

1. There are reports provided by the external company that collects the waste about how much and which type of waste is produced. Paper waste had decreased over the years due digitalization and globalization. The employees have 2 (two) monitors beside own laptop. Many people read from their computer screen than printing. The advance of technology made the laptop lighter and cheaper, every employee has his/her own laptop and they bring the laptop to read documents from it and take notes on it, making the paper obsolete. With globalization the team members are located in different countries and send via email the notes and comments are more effective.

Printing phases:

- **Printer name and IP** - Many times, the printing was sent to wrong printer, that could be even in different countries and the printing was lost. Once a colleague located in different country contacted the researcher to collect and throw way some printing wrongly sent to Finland. Printing confidential papers could be risk and to avoid mistakes employees used to print a test version before that would be thrown way. **How to identify the owner of the copies** - To solve the issue the first printer paper had the employee ID to identify his/her printing what generated huge

amount of useless printing. **Equipment problem** - Other problem was to send a printing and not get anything from the printer due to queue or printer problem, then the employee sent again resulting in equal copies printed.

- Now, the printing is just done when the employee passes his/her access card in the printer. The printer has a backlog with all printing sent by the employee and he/she can confirm what they want to print. There is a pool of printers, a single address is configured in the laptop and the printing is retrieved from any printer.
2. An external company is responsible for collecting the waste to the final waste area. The material sorted by case company as paper, cardboard, organic waste, metal between others may be recycled but It's not responsibility of case company.
 3. Case company's printing rooms have small boxes for sorting the waste. In the boxes is informed the kind of material to be sorted, also there is a guideline for sorting attached to the wall near the sorting boxes.

LAND ASSESSEMENT

ReSOLVE FRAMEWORK	THE ITEM TO BE AUDITED	QUESTION AD-DRESSED TO THE ASSET/ITEM AUDITED	Answer from Key Stakeholders	Additional informa-tion
REGENERATE	LAND	Is it monitored how much is spent?	Not applicable	It's not as agriculture business
		Does it degrade?	No	It's not as agriculture business
		Is it returned to environment in a sustainable way?	Yes	It's not as agriculture business

Table 7 – Land Assessment Result

OFFICE FURNITURE ASSESSEMENT

ReSOLVE FRAMEWORK	ITEM TO BE AU-DITED	QUESTION AD-DRESSED TO THE ASSET/ITEM AUDITED	Answer from Key Stakeholders	Additional informa-tion
SHARE	OFFICE FURNITURE	Is It shared?	No	(1)
		Is measured the utiliza-tion rate?	No	lifetime long in some cases (2)

		Is it bought or sold as service?	No	Case company owns it
		Does it generate waste?	Yes	(3)
OPTIMIZE	OFFICE FURNITURE	Is It efficient?	Yes and No	(4)
		Does it generate waste?	Yes	(3)
		Is it automated?	Not applicable	
		Is it measured?		lifetime long in some cases (2)
LOOP	OFFICE FURNITURE	Does require new raw material?	I don't know	(5)
		Is there transparent resource flow?	No	from raw material to end life cycle
		Is the asset used as something else than was designed?	Not applicable	ex: table is used as table
		Is the asset reused?	Part of It	(6)
		Is the waste of one process used as input of other process?	Part of It	(7)
		Does it keep the material or nutrients in the system?	No	(8)
		Is the life of the asset prolonged through maintenance or upgrade?	Yes	(9)
		Is It resilient?	Yes	
		Is there available maintenance or repair options for the asset?	Yes	
		Is possible to disassemble easily?	Yes	
		Is possible to upgrade parts?	Yes	
		Is stated the composition or labeled?	Not applicable	
		Is it returned to environment in a sustainable way?	Yes	mixed waste and metal

Table 8 – Office Furniture Assessment Result

1. In general, each employee has his/her own table, chair and cabinet. There are special cases for employees whose work requires travel most of the time, in this specific department there are free seating.
2. Chairs and cabinets can be for lifetime long and they are replaced only if its broken, the same applies for the furniture in the meeting rooms
3. During last years all tables with manual lift where replaced by electric lift tables and when the furniture is broken
4. Yes: the amount of furniture for individual use matches with the number of employees. There are sofas, tables and chairs in the coffee areas used by employees and visitors
No: It generates waste.
5. Case company doesn't handle the purchase process.
6. Used furniture is offered to the employees to take home(recycle). The broken or the ones not taken by employees are disassembled where metal goes to metal waste and wood to mixed energy waste. Reuse is firstly supported. Case company tried to sell used furniture but its difficult business. They donated to a non-profitable organization some of them. The piece of furniture that can be reused is stored in the backyard and/or kept in empty space areas to rent
7. Office Center can rent furnished space, using the old furniture from case company.
8. There is low demand for used office furniture and it may be ended up as mixed waste.
9. Case company repairs sofas, chairs and tables. Sofa can have the fabric changed, chairs and table depending what is broken can have just the broken part replaced.

KITCHEN-COFFE AREA ASSESSEMENT

ReSOLVE FRAMEWORK	THE ITEM TO BE AUDITED	QUESTION AD-DRESSED TO THE AS-SET/ITEM AUDITED	Answer from Key Stakeholders	Additional informa-tion
SHARE	kitchen-coffee area and its appliances	Is It shared?	Yes	
		Is measured the utiliza-tion rate?	Not applicable	(1)
		Is it bought or sold as service?	partly	(2)

		Does it generate waste?	No, from utilization rate point of view	(3)
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Table 9 – kitchen-Coffee Area Assessment Result

Does the company” own it? (2)

1. the coffee machines are visibly highly used by employees and visitors. All the beverages offered by the machine is free of charge. The user needs to bring his/her own mug.
2. coffee machine belongs and its maintained by external company. Kitchen electric appliances belongs to case company but some are from “Recycling Week” event or brought from employees, kitchen cleaning products are provided by external company that manage and maintain case company’s facilities. The only kitchen utensil belonging to the case company are the reusable mugs to visitors once the coffee machine doesn’t provide disposable mugs, the visitors can borrow the mugs.
3. the only waste may be the one generated by employees during their lunch or snack. The kitchen offers 3 (three) sorting bins for waste collection: biowaste, mixed waste energy and mixed waste. Bellow the description provided by case company of the type of waste that can be sorted in the bins:

*biowaste, the waste bin bag for the bio waste is biodegradable. The waste is biodegradable as food leftovers, fruit and vegetables peels, tea bags, kitchen paper and wooden spoons.

** Mixed waste, it’s the waste that can’t be recycled or reused, such as leather and damage office supplies. The waste bin bag for the mixed waste is black.

*** Energy waste, the waste goes to energy. Most plastics such as food casings, plastic foils, detergent flasks, plastic coated papers, polystyrene. No PVC.

The paper with the description is located near the waste bin.

MEETING ROOMS ASSESSEMENT

ReSOLVE FRAMEWORK	THE ITEM TO BE AUDITED	QUESTION ADDRESSED TO THE ASSET/ITEM AUDITED	AD-AS-	Answer from Key Stakeholders	Additional information
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SHARE	meeting room space	Is It shared?	Yes	
		Is measured the utilization rate?	No	(1)
		Is it bought or sold as service?	yes	(2)
		Does it generate waste?	yes	when its not used
OPTIMIZE	Process for booking the meeting rooms	Is It efficient?	Not know	
		Does it generate waste?	yes	When meeting room is empty
		Is it automated?	Yes, partly	(3)
		Is it measured?	No	(1)

Table 10 – Meeting Rooms Assessment Result

1. the utilization rate can be taken from booking system when required. Some people also use the meeting rooms when not booked to an ad hoc private conversation or can be a not expected extension of a meeting.
2. Some of the meeting rooms and the auditorium are offered to rent in Office Center web page
3. The internal process of case company for booking the meeting rooms works ok where we find information about the capacity, availability, and the appliances available. If an external person or company wants to rent a meeting room they need to call Facility Manager to get a login and password to access the system and be able to book the meeting room. It's not possible to see via web when the meeting rooms are available and the type of appliances offered, only price and size of the meeting rooms.

SPORT FACILITIES ASSESSEMENT

RESOLVE FRAMEWORK	THE ITEM TO BE AUDITED	QUESTION AD-DRESSED TO THE AS-SET/ITEM AUDITED	Answer from Key Stakeholders	Additional informa-tion
SHARE	Sport Fa-cilities	Is It shared?	Yes	Between employees
		Is measured the utilization rate?	No	
		Is it bought or sold as service?	No	
		Does it generate waste?	yes	(1)

OPTIMIZE	Process for booking Sport Facilities	Is It efficient?	No	(1)
Does it generate waste?		yes	when it's not used	
Is it automated?		Not applicable		
Is it measured?		No		

Table 11 – Sport Facilities Assessment Result

OPEN SPACE AREA ASSESSEMENT

RESOLVE FRAMEWORK	THE ITEM TO BE AUDITED	QUESTION AD-DRESSED TO THE AS-SET/ITEM AUDITED	Answer from Key Stakeholders	Comments
SHARE	Open space area	Is It shared?	Yes	(1)
		Is measured the utilization rate?	Yes	
		Is it bought or sold as service?	Yes	(2)
		Does it generate waste?	No	(2)

Table 12 – Open Space Area Assessment Result

Does the case company own it? Yes

Are there instructions in how to handle it? Yes

1. Some spaces are shared between employees that don't require fixed seating place but most of the employees have fixed seating
2. Empty spaces are available to rent by Office Center

5.2 List of Potential Items to Circular Economy Opportunities

According to the “Analysis Tool to Identify Circular Economy Opportunities” the following items have potential to circular economy opportunities:

- ENERGY
- WASTE
- OFFICE FURNITURES
- MEETING ROOMS

- SPORT FACILITIES

No Potential to circular economy opportunities means that the items have already good utilization rate and they don't have a significant waste detected

- WATER
- LAND
- KITCHEN-COFFE AREA
- OPEN SPACE AREA

6 Generating List of Recommendations

During 2 (two) brainstorming sessions the researcher and the key stakeholders discussed options to reach better utilization of the items classified as "Potential" to circular economy assessed from previous chapter "Assessing Potential Items to Identify Circular Economy Opportunities". The researcher brought to the brainstorming session some recommendations in how to reach better utilization based in the literature research and case studies.

The follow items were in the agenda as potential to circular economy:

- ENERGY
- WASTE
- OFFICE FURNITURES
- MEETING ROOMS
- SPORT FACILITIES

6.1 Generating List of Recommendations for the Items Classified as Potential to Circular Economy Opportunities

6.1.1 Recommendation to Improve Energy Consumption

Recommendations to improve lighting (luminosity) system

The following alternatives were brainstorming in how to reach energy efficiency and save in energy cost:

1. Reduce energy cost by using Lighting by sensors – Smart Building with Intelligent energy management. The sensors in the lighting structure enable the detection of occupancy providing the right amount of luminosity. It's not always required initial investment to change the actual system to smart system. Nowadays there are business models whose payment of the service is based in the savings and some companies offer free assessment.
2. Reduce energy cost by changing to performance model and buying luminosity as service - Pay per LUX. The company pays per luminosity used, the supplier provides and maintain all structure. Some benefits: the supplier is interested to keep the installations running with the best performance and low maintenance or equipment's replacement once the customer doesn't pay per lamps or lamp structure, more lamps changed lower profit to the supplier. The supplier is highly interested and committed in taking back material for recycling to lower operation costs. The customer doesn't have to worry with installations or have hired personal in the company just for this service.
3. Reduce energy costs and carbon footprint by using newer technologies as solar panels. Finland gives the first impression as not favourable place for solar panels once the summer is short, but many companies in Finland had being installing solar panels and getting benefits from it. Pros vs cons should be analysed.

Comments:

- According to case company replace the actual system for smart system is an expensive project to an already existent building (old installation). It's easier to project to a new building.
- All lamps are being replaced by low energy lighting, the case company expects to reduce costs with electricity
- Case company already buys 100% renewable energy and they are a member of WWF (World Wide Fund for Nature) Green Office

Case studies:

- Esco, Energy Service Contracting, Project in Vantaa – Finland. Launched in Vantaa to improve the energy efficiency of 14 municipal buildings. Key points of the project:
 - “Annual savings of over EUR 200,000 in the energy costs” (Smart'n'Clean Helsinki, n.d.).

- “The project investment of EUR 1.5 million will not incur any costs to the City of Vantaa, but the costs will be covered with the savings produced by the project within the agreed time” (Smart’n’Clean Helsinki, n.d.).
- “Lumine’s control system eliminating energy waste on empty streets, Project in the town of Vantaa in Finland. Project to a bike route in neighbourhood of Kivistö. Lumine system is designed so that the changes in light brightness don't happen too fast. At idle state the luminaires are dimmed down. When a passer-by approaches the Lumine sensor, it detects motion and gradually brightens up nearby luminaires” (Smart’n’Clean Helsinki, n.d.)
- Philips providing Light as a Service to Schiphol Airport in the town of Amsterdam, Lounge 2. “Schiphol Group, Cofely and Royal Philips have entered into a collaboration for the new lighting in the terminal buildings at Amsterdam Airport Schiphol. The light as a service means that, Schiphol pays for the light it uses, while Philips remains the owner of all fixtures and installations. Philips and Cofely will be jointly responsible for the performance and durability of the system and ultimately its re-use and recycling at end of life. By using energy-efficient LED lamps, a 50% reduction in electricity consumption will be achieved over conventional lighting systems” (Philips, 2015).

Recommendations to improve heating and cooling system

The following alternatives were brainstormed in how to reach better efficiency and save in energy cost:

1. improve energy consumption by using heating and cooling as a service. There are companies offering performance model, where the customer pays per warm or cool air used. The supplier has the ownership of the equipment and the installations and its responsible for its maintenance.
2. Reduce costs changing the system to use newer technologies as geothermal energy that comes from the Earth. There are companies that offers lease model with low initial costs at installation and payment is based in the savings.
3. Use Smart System to reduce waste and save costs - Intelligent system monitors the temperature, detecting wasted heating or cooling.

4. Contribute to a sustainable environment avoiding to waste heating and cooling produced by hardware. The residual waste can be reused as complement to heat or cool the air in other installations and/or premises.

Comments:

- Case Company already uses the extra heating from data center to warm houses in the town of Kirkkonummi and Espoo.

Case Study:

- Kaer company provides air-conditioning as a service. kaer have many projects in Singapore where operates the chiller plants and maintain the system efficiency (Kaer, n.d.). Parliament House and Setia City mall between others are the customers from Kaer.

6.1.2 Recommendations to Reduce Waste

It was discussed in how to extend the utilization of some discarded products and materials.

1. contribute to extend the life of a product or material identifying potential materials that could be reused. The first step would be to make a list of the type of waste collected. Once there are answers for these questions is possible to make an action plan in how to get better utilization from them. A sign could be created to identify product or material broken that can't be reused.
2. Contribute to reduce the waste creating different sorting containers for different products and material, i.e. cell phones, computers, etc. During the empirical observation and the pre-discussions, the researcher noticed that computers and in general electronic devices were the most hunted products between the recyclers. Having a separated sorting container for them would give the company an indication of the amount of waste generated by these items and also would make easier for recyclers to collect and recycle the items.
3. Create a group of volunteers from different departments to join the Green Office Team. It could be a test project, 1(one)-year duration, with the aiming to reduce the amount of waste generated. Promoting regular brainstorming sessions in how to reduce, reuse or recycle the material.
4. Partnership with companies as Helsinki Metropolitan Area Reuse Center (Kierätyskeskus), Fida, Red Cross or Public Companies interested in reusing. There are few alternatives: the recycling companies could leave their container al-

ready at case company with an indication of what they recycle or they could visit case company regularly and collect what they want.

5. Redesign the printer room as a sorting and recycling point. All printer rooms could be redesigned to collect all items (beside biowaste, energy waste and mixed waste). Install a shelf where working products, but to be disposable, could be left where employees could drop or collect what they want.
6. Create a permanent library with recycled books, DVD's and games brought by employees.
7. Create a permanent area for recycling instead of twice a year event.
8. Send short stories by emails with examples of sorting, reuse, recycle, circular economy, etc. involving the employees and their personal experiences.
9. Bring Red Cross/FIDA/UFF containers to Office Center parking area. People recycle if it's convenient to them.
10. Use Earth Day to bring outside or inside speakers, promote sustainable actions and projects from case company.
11. Encourage employees to change phone just when it reaches maximum utilization
12. Make campaigns and idea box in how to reduce the waste and increase performance of the products and prize the better ideas.
13. Eliminate individual waste bin.

Case Studies:

- Plan B – Kierrätyskeskus. Kierrätyskeskus, the recycling center available in different towns in Finland make handmade products using only recycled material. "Plan B project is a unique line of fab upcycled products locally handmade using only recycled materials" (Pääkaupunkiseudun Kierrätyskeskus Oy, n.d.). The recycled products have a stylish design making them attractive to the consumer. Kierrätyskeskus in Finland receives products in working condition as donation from the residents. The items are available for purchase for affordable price.
- Social Media Group in Facebook called "Helsinki Buying, Selling, Giving Way". It's a group that anyone can request to be a member. Members can sell, give way or buy any item announced.
- Building complex located in Santakatu street in Helsinki leaves a shelf in the area for waste collection where residents can leave goods in working condition

that can be reused by other residents i.e. used, clothes, furniture, book, kitchen utensils were between the items exchanged.

Comments:

- Case company promotes Recycling Week event twice a year where employees can bring any small, easily portable and in good condition product to be recycled. The items are exchanged between employees. A space is reserved in one common area where employees leave or collect the products. The products left without a new owner are transported to the recycling center (Kierrätyskeskus).
- The company promotes and support recycling of products between employees not only during recycling weeks but also in groups created in social media.
- Case company is part of World Wild Fund for Nature (WWF) Green Office. “WWF Green Office is a practical environmental management system for offices helping to reduce the ecological footprint and greenhouse gas emissions of the office” (WWF, n.d.).
- Case company had brought some speakers and organized recycling awareness roadshow i.e. case company invited RenoNorden to explain about waste sorting. RenoNorden is one of the companies responsible for collecting the waste and transport to the final waste area. RenoNorden promoted a competition between employees where the task was to sort few examples of waste, correct sorting would give points and the one with higher point was the winner.

6.1.3 Recommendations to Reduce Office Furniture Waste

How to solve the issue of used furniture once new ones replace them:

1. Donate via partnership to nonprofit, charity or public organizations i.e. schools, hospitals, libraries, Red Cross, Kierrätyskeskus, etc. Suggest organizations to contact case company when they need a furniture, make a waiting list.
2. Partnership with a furniture dealers, architect & construction companies and recyclers to find an appropriate donee. I.e. every construction of new building requires that the construction company provides a kind of container transformed into an office to the employees in the surroundings, they need office furniture.
3. Consider lease option instead of owning the furniture.

4. Sell the furniture via online channels, i.e. huutokauppa kiertonet.fi/toimisto-jakalusteet.

Comments:

- Case company had tried to sell used furniture but the demand is low. They have donated some to non-profitable organizations
- Case company do not own the purchase process, they don't have how to change the business model of office furniture to lease. Office furniture purchase process is done via parent organization.

6.1.4 Recommendations to Improve Meeting Rooms Usability

How to get better usage of the space and meeting rooms available for renting:

1. measure usage of the facilities. Measuring the usage of the meetings rooms can help the company to decide if an action plan is required to increase the usage or use the meeting room to something else than was designed.
2. Modernize Office Center Web Page. I.e.:
 - the web page had been designed some years ago and with the advance of web page development more applications are available that can help renting the available places to external companies or people with easier and convenient booking system.
 - Add the more detailed description of the meeting room, picture and the list all devices included in the renting. Give ideas of room usage i.e. as training, interview, courses, etc.
 - In the web page new pictures with better resolution and purpose should replace the old ones.
 - A 360-degree video would give to the future tenant a better overview of the area.
 - The web page has different text' styles, a single and more modern style would make it more attractive.
 - Promote the meeting rooms in external booking pages.

6.1.5 Recommendations to Improve Sport Facilities Usability

How to get better usage of the sport facilities:

1. promote to the case company's employee's availability of the football field by employees and their children. I.e. It can start as a campaign for a single year and case company evaluate in the end of the year if its feasible or not. It will bring brand value for the company.

2. Measure the usability of the facilities. Based in the results case company can decide if it requires any action plan.
3. Promote in the Office Center web page the sport facility for the companies renting office space. Promote packages including sport facility and office space.
4. Add pictures of the sport facilities in the Office Center web page.
5. Rent the sport field for events organized by external companies.

Comments:

- Case company is not interested in renting sport facility to externals because would require investments in the dressing rooms and bathrooms. Dressing rooms and bathrooms are located inside the case company's premises and for accessing them authorization and authentication is required. Renting outdoor fields would also require more maintenance. Case company prefers to let the sport facilities available only for employees

6.2 Summary of Recommendations

Below the summary of recommendations based in the brainstorming session.

ENERGY
<ul style="list-style-type: none"> • Smart Building: lighting, cooling and heating only when its needed. • Research performance model. • Research newer technologies as solar panels and geothermal energy.
WASTE
<ul style="list-style-type: none"> • Contribute to extend the life of a product or material identifying potential materials that could be reused. • Contribute to reduce the waste creating different sorting containers for different products and material, i.e. cell phones, computers, etc. • Create a group of volunteers from different departments to join the Green Office Team. It could be a test project, 1-year duration, with the aiming to reduce the amount of waste generated. Promoting regular brainstorming sessions in how to reduce, re-use or recycle the material. • Partnership with companies as Helsinki Metropolitan Area Reuse Center (Kierätyskeskus), Fida, Red Cross or Public Companies interested in re-using. • Redesign the printer room as a sorting and recycling point. All printer rooms could be redesigned to collect all items (beside bio waste, energy waste and mixed waste). Install a shelf where working products, but to be disposable, could be left where employees could drop or collect what they want. • Create a permanent library with recycled books, DVD's and games brought by employees. • Create a permanent area for recycling instead of twice a year event. • Send short stories by emails with examples of sorting, re-use, recycle, circular economy, etc. involving the employees and their personal experiences. • Bring Red Cross/FIDA/UFF containers to Office Center parking area. People recycle if it's convenient to them. • Use Earth Day to bring outside or inside speakers, promote sustainable actions and

<ul style="list-style-type: none"> projects from case company. • Encourage employees to change phone just when it reaches maximum utilization. • Make campaigns and idea box in how to reduce the waste and increase performance of the products and prize the better ideas. • Eliminate individual waste bin.
OFFICE FURNITURE
<ul style="list-style-type: none"> • Donate via partnership to non-profit, charity or public organizations i.e. schools, hospitals, libraries, Red Cross, Kierrätyskeskus, etc. • Partnership with a furniture dealers, architect & construction companies and recyclers to find an appropriate donee. • Consider lease option instead of owning the furniture. • Sell the furniture via online channels, i.e. huutokauppa kiertonet.fi/toimisto-jakalusteet.
MEETING ROOMS
<ul style="list-style-type: none"> • Measure usage of the facilities. • Modernize Office Center Web Page.
SPORT FACILITIES
<ul style="list-style-type: none"> • Promote to the case company's employee's availability of the football field by employees and their children. • Measure the usability of the facilities. Based in the results case company can decide if it requires any action plan. • Promote in the Office Center web page the sport facility for the companies renting office space. Promote packages including sport facility and office space. • Add pictures of the sport facilities in the Office Center web page. • Rent the sport field for events organized by external companies.

Table 13 – Summary of Recommendations

7 Key Stakeholders Feedback Concerning the Recommendations

This chapter describes the final list of recommendations and the feedback from the key stakeholders.

7.1 Feedback Received and Corrections to Recommendations

During the brainstorming sessions the researcher got straight feedback concerning the recommendations and case studies presented.

In what concerns to energy or electricity consumption for case company the impediments to reach circular economy is the initial investment and projecting it to an old building. I.e. changing the actual lighting system for smart lighting would require a reasonable investment.

In what concerns to office furniture, the case company is not the responsible for the purchase process what not allow them to influence the business model (leasing then owning). According to key stakeholders used office furniture market is saturated and consequently to sell or even give way used office furniture is not easy.

In what concerns to sport facilities, case company want to keep the facilities only for employees' usage.

In what concerns waste, many new ideas were discussed. One of the new ideas from the Real Estate Manager was to eliminate the personal waste bin i.e. if a company has 300 employees means that exist 300 personal waste bins! Case company offers common mixed waste bins few steps from every work station what doesn't justify the personal waste bin.

7.2 Final List of Recommendations

The final list of recommendations continues as its once they are recommendations that can be adapted at any time according to company needs and strategy, it's not a must do list. The item pointed by case company as not suitable at the moment for the organization are in bold letters. Some of the recommendation deserves a separated research by itself i.e. if solar panel is worth taking into use in case company would require a business case. All recommendations are based in data collected and analyzed till December 2017 according to existent literature and case studies. The recommendations are not based in profitability but in sustainability principles. The summary of the final list of recommendations:

ENERGY
<ul style="list-style-type: none"> • Smart Building: lighting, cooling and heating only when its needed. • Research performance model. • Research newer technologies as solar panels and geothermal energy.
WASTE
<ul style="list-style-type: none"> • Contribute to extend the life of a product or material identifying potential materials that could be reused. • Contribute to reduce the waste creating different sorting containers for different products and material, i.e. cell phones, computers, etc. • Create a group of volunteers from different departments to join the Green Office Team. It could be a test project, 1-year duration, with the aiming to reduce the amount of waste generated. Promoting regular brainstorming sessions in how to reduce, re-use or recycle the material. • Partnership with companies as Helsinki Metropolitan Area Reuse Center (Kierätyskeskus), Fida, Red Cross or Public Companies interested in reusing. • Redesign the printer room as a sorting and recycling point. All printer rooms could be redesigned to collect all items (beside bio waste, energy waste and mixed waste). Install a shelf where working products, but to be disposable, could be left where employees could drop or collect what they want. • Create a permanent library with recycled books, DVD's and games brought by employees. • Create a permanent area for recycling instead of twice a year event. • Send short stories by emails with examples of sorting, re-use, recycle, circular economy, etc. involving the employees and their personal experiences. • Bring Red Cross/FIDA/UFF containers to Office Center parking area. People recycle if it's convenient to them.

<ul style="list-style-type: none"> • Use Earth Day to bring outside or inside speakers, promote sustainable actions and projects from case company. • Encourage employees to change phone just when it reaches maximum utilization. • Make campaigns and idea box in how to reduce the waste and increase performance of the products and prize the better ideas. • Eliminate individual waste bin.
OFFICE FURNITURE
<ul style="list-style-type: none"> • Donate via partnership to non-profit, charity or public organizations i.e. schools, hospitals, libraries, Red Cross, Kierrätyskeskus, etc. • Partnership with a furniture dealers, architect & construction companies and recyclers to find an appropriate donee. • Consider lease option instead of owning the furniture. • Sell the furniture via online channels, i.e. huutokauppa kiertonet.fi/toimisto-jakalusteet.
MEETING ROOMS
<ul style="list-style-type: none"> • Measure usage of the facilities. • Modernize Office Center Web Page.
SPORT FACILITIES
<ul style="list-style-type: none"> • Promote to the case company's employee's availability of the football field by employees and their children. • Measure the usability of the facilities. Based in the results case company can decide if it requires any action plan. • Promote in the Office Center web page the sport facility for the companies renting office space. Promote packages including sport facility and office space. • Add pictures of the sport facilities in the Office Center web page. • Rent the sport field for events organized by external companies.

Table 14 – Final List of Recommendations

8 Discussions and Conclusions

8.1 Summary

The idea of the research come from parent organization as a teaser. The need for this research is imperative for all the companies that want to stay competitive, decrease carbon footprint and be sustainable. The importance of the subject is already in the agenda of European Commission that adopted “an ambitious Circular Economy Package, which includes measures that will help stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs” (European Commission, n.d.). The study identified circular economy opportunities in case company facilities operations and practices. The data was collected through empirical observations, informal pre-discussions, reading in House publications and email survey. The research found potential items for circular economy opportunities and a list of recommendations was generated. The recommendations are based in the existent literature and case studies that show the best practices applied by other companies.

8.2 Conclusion

If the company wants to reduce their own carbon footprint and reduce waste it needs to adapt to the circular economy concept and not the circular economy to adapt to company's policies and way of work. I.e. countries adapting their law to have Airbnb as a legal service offering accommodation. Airbnb is based in the share concept to increase utilization rate of the accommodation. New business model reducing waste should be considered and supported by the organization and the parent organization.

There are many impediments to apply circular economy as initial investment and people behavior. People's behaviour and mindset is difficult to change and many times to force a change of behaviour the countries implement laws. Everybody wants to save the planet but only few make compromises thinking about environmental issues. Concerning initial investment nowadays there are companies that offers the service with little or no investment and the pay back is based in the savings, it's a solution where everyone benefits. Other option is to lease the service and pay only what is consumed, in this case there is no initial investment. Involving employees and supporting them in projects towards circular economy would increase the acceptability.

The list of recommendations not only will help case company to reduce waste and carbon footprint but also save money and increase brand value becoming more sustainable.

8.3 Evaluation of the Thesis Trustworthiness

According to Shenton (2004) the researcher should complain with 4 criteria to ensure trustworthiness of its research: credibility, transferability, dependability and confirmability. This session describes how this study fits with Shenton's criteria.

Credibility

Credibility ensures that the findings are true ones.

To ensure credibility the researcher and all key stakeholders of this study participated of the workshop and the brainstorming sessions where selected items were assessed brainstormed. The researcher and the key stakeholders discussed the recommendations to enable circular economy proposed by literature and case studies. The partici-

pants selected for the informal pre-discussion and the key stakeholders are employees of the organization familiar with the facilities.

Transferability

Transferability is about providing details that other researchers can use this study in different organizations.

The findings of this study can give ideas or be considered as insights to others researchers and/or organizations interested in enabling circular economy opportunities. The analysis tool to identify circular economy opportunities can be applied to any item in any industry, It's not specifically to case company.

A single organization located in the town of Kirkkonummi participated in this study.

15 (fifteen) participants for the informal pre-discussion and 4 key stakeholders were involved in this study. A workshop and 2 (two) brainstorming sessions were hold with the key stakeholder's presence. The data was collected solely from employees of case company and from case company's facilities. Data was collected from April to September 2017. Data was collected by empirical observation, informal pre-discussion and email survey. The informal pre-discussions took from 15min to 30min with each participant, the workshop took 2 hours and the 2 brainstorming sessions 2 hours each. Around 90 hours were used for empirical observation.

Dependability

Dependability ensures that repeating the work in same in same context and with same participants the other researchers obtain similar results. It's about providing details and being consistent. (Shenton, 2004)

For details about what kind of data was collected, how the data was collected and analysed and the participants involved please refer to session 2: Methods and Material.

For details about identifying the items to be assessed please refer to session 4: Identifying Potential Items to be Assessed from Case Company's Facilities Operations and Practices.

For details about how the items were assessed and which tool was used please refer to session 5: Assessing Potential Items to Identify Circular Economy Opportunities, and session 3: Concepts and Practices Concerning Circular Economy from Relevant Literature.

For details about how the researcher and the key stakeholders generated the list of recommendations please refer to session 6: Generating List of Recommendations.

Confirmability

Confirmability ensures that the findings comes from data collected under certain criteria and not from the researcher's mind.

All participants and key stakeholders were employees of the organization. The selection of the participants was based in the facility researched i.e. if facility A was under research the participant was a user of facility A. All key stakeholders were responsible in case company for the subject researched.

All key stakeholders were present at the same place and together the researcher and the key stakeholders assessed the items with potential to circular economy and discussed during the brainstorming sessions about the recommendations based in case studies and exist literature. During the Face2Face sessions the researcher got straight feedback from the key stakeholders about the recommendations' applicability. For more details about the selection of the items to be assessed, the assessment session and the brainstorming sessions please refer to sessions 4,5 and 6.

Session 4: Identifying Potential Items to be Assessed from Case Company's Facilities Operations and Practices.

Session 5: Assessing Potential Items to Identify Circular Economy Opportunities

Session 6: Generating List of Recommendations

Based on the evaluation done it can be concluded that most of the items pointed by Shenton (2004) to ensure trustworthiness are fulfilled on satisfactory level in this study.

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Appendices

Appendix 1

Qualitative Sample for Guiding the Informal Pre-Discussion

Hi, my name is Raquel. I work in the virtualization department. I'm student of Metropolia and I'm doing my thesis in the Business area. My thesis is about Circular Economy that aims to minimize waste getting maximum utilization of the resources. My study is targeting the facilities area. I'm researching the company's facilities and trying to identify good things we could utilize more. Would you mind helping me in my research talking about this facility that you visit? It's anonymous, your name will not be mentioned. Do you mind if I take notes of the key points of our conversation?

Thanks.

Area for waste collection:

- 1- which items had you found in the waste area that you reused?
- 2- Do you search for any specific item in the waste area?
- 3- Do you have any suggestion for get longer utilization of the items here in general?

Kitchen-Coffee area:

- 1- How often do you use this facility?
- 2- Which items do you use from this facility?"

Meeting rooms:

- 1- Do you always book the meeting room via some booking system?
- 2- How often do you use the meeting rooms?
- 3- How often do you use the appliances in the meeting rooms?
- 4- Did it happen at any time that all meeting rooms were busy?
- 5- In general, would you be flexible to change the date of the meeting?

Sport Facilities:

- 1- How often do you use the sport facility?

- 2- Do you always book the sport facility via some booking system?
- 3- Is there anything preventing you to use more often the facilities?
- 4- How do you commute to work?
- 5- Do you use the dressing room?

Data Center:

- 1- How often do you use the data center?
- 2- Is the booking mandatory to use the data center?

Open Space:

- 1- How often do you work from office?"
- 2- Is your work station reserved only for you?
- 3- Are the seats around your busy all the time?"
- 4- Do you see any item generating waste?

To who is responsible to the facilities:

- 1- Which guidelines exist to deal with the company's facilities? Can I access them?
- 2- How electricity, heating, cooling and water is managed?
- 3- what is the process connected to the recycling of office's furniture?