# Benchmark study: Open data solutions in Circular Economy

FINAL REPORT

15.8.2019

*Mari Saario, Anna Kortesoja, Suvi Häkämies, Katja Lähdesmäki-Josefsson, Ringa Sirppiniemi and Rasmus Viitala*
*Gaia Consulting Oy*

# TABLE OF CONTENTS

# 1   Summary: Open data in circular economy

The study mapped open data solutions used in the circular economy business in Finland and internationally.

"Open data" is data in digital form that can be freely used, re-used and redistributed by anyone, for any purpose. The study takes a broad and permissive perspective into the definition, allowing for more examples to be considered.

The work was carried out by benchmarking international and domestic companies who inform that they utilise data according to the principles of open data. At the same time, cases where the business utilizes some features of open data, even if not directly disclosed, were also recognized as expert work. The study was supplemented by interviewing domestic circular economy companies about the current state of open data usage and prospects.

Based on the results, companies have successful business and customer interface concepts that incorporate open data approaches. In general, however, these solutions rely on existing commercial or publicly available platforms, which are not by definition classified as fully open data. The most typical example is Google Maps. In addition to spatial data, other typical data categories are weather data and statistics published by actors such as Statistics Finland.

The needs and aspirations of companies towards open data are largely directed at material held by public operators, which is hoped to be made publicly available. Some of the companies interviewed also identified opportunities in open data from the point of view of themselves acting as data providers. However, total openness according to the definition is not an end in itself and, for example, replacing the well-known and used Google Maps with a fully open solution does not appear to be a relevant option.

According to the study, utilization of open data related to resources and material flows in the circular economy business is problematic or non-existent, at least for the time being. There is very limited information available. Successful business is often related to the knowledge and control of existing material streams (side streams, waste), and opening such information would expose companies in the industry to competition. Information sources are direct customer relationships that are protected as part of business risk management. Instead, limited access to self-generated data (processed materials, effects) for own customers to improve service has been considered.

Based on interviews the biggest obstacle for exploiting open data is lack of knowledge about existing data publishing bodies and their data reserves. Another common concern was the reliability of open data, which is still linked to liability issues. Furthermore, the question of who has the responsibility for the quality, accuracy and impartiality of the data transmitted came up. In the field of circular economy this can mean, for example, the accuracy of information

on the quality of the reported side stream or other material. The interviewees were cautious about setting up business based on open data, unless the issues of responsibility and quality were clear.

# 2    *Preparation of the study*

Gaia carried out the study by the commission of Turku University of Applied Sciences (TUAS). The work is connected to the Open DaaS (Open Data as a Service) project[1] funded by ERDF, where TUAS is in charge of a work package related to the development of the utilisation of open data in circular economy.

The Open DaaS- project is attempting to boost circular economy, mobility, digital renewal, as well as challenging and colliding business models. It also creates a model for co-development using data and digitalisation that is open to micro companies and SMEs. During the project it has been noticed that in the circular economy not much data is collected yet and, therefore, it is also not transparent so open data solutions cannot be implemented as fast as e.g. in the transport sector. The project started in September 2017 and will continue until August 2019. It is implemented by Turku University of Applied Sciences, South-Eastern Finland University of Applied Sciences (Xamk), University of Turku and Metropolia University of Applied Sciences.

The purpose of the study is to expand the work already done during the project. The report is openly accessible to businesses so that everyone can benefit from its results.

The starting point of the work was to find out how companies, organizations, cities and networks in Finland and in the rest of the world are using open data in circular economy activities (e.g. services, products and operating models).

The main focus was to identify circular economy solutions that utilize open data to conduct commercially viable business. The case studies of open data in the circular economy business focus primarily on companies, with other organizations, cities and networks playing the role of open data provider

The study was carried out in two stages:

> 1. collecting examples of interesting circular economy companies that use open data or open information successfully in their business; and

> 2. interviewing Finnish companies operating in the circular economy about their interest in utilizing open data for business development.

---

[1] Open DaaS -project, https://opendaas.turkuamk.fi/daas/

Case descriptions were carried out as expert work based on publicly available material. Finnish circular economy companies were interviewed by telephone and the results were summarized in this report. The case examples illustrate the use of open data in the circular economy business through selected domestic and international examples, as well as the current situation and future hopes of the utilization in Finnish circular economy enterprises.

# 3 Introduction to the study

## 3.1 What is open data

All information freely available on the internet does not meet the data definition used in the study. The machine-readable structure of the information is essential, which enables it to be downloaded and edited in other ways that manual labour.

**Open data refers to information in digital and structured form, which is freely accessible, editable, sharable and usable by anyone, including commercial use, free of charge.**

**Transparency is guaranteed to the user by a license granted by the publisher, which is in practice subject only to identification of the original source. In practice, the license is either Creative Commons BY 4 or CC0 1.0.**

Typical open data sources so far have been primarily public organizations' data reserves, such as statistics, which are motivated not only by increased transparency in democracy and governance, but also by the idea of promoting new markets and innovation.[2] For certain types of information, public administrations have an obligation to publish the data, but the obligation does not require the form of publication to be open data. There are also various challenges to publishing public sector data, e.g., data from registries and population surveys can only be opened once the data has been modified so that individual subjects can no longer be identified.[3]

Compared to public organizations, companies have been found to be much more reluctant to open their own data, mainly for fear of losing control. By opening their data, the company gives up its right to control the innovation process and as the outcomes are uncertain, it is also very difficult for a company to estimate the benefits they might gain. It has been estimated that due to different starting points and motives, it will be difficult to access business data as openly as government-produced data even in the future.[4]

---

[2] Avoindata.fi, Mitä on avoin data, accessed 3/7/2019
[3] THL, Avoin data on nykypäivää ja tulevaisuutta Suomessakin, accessed 08/08/2019
[4] LUT University, Väitös: Yrityksen eivät ole valmiita siirtymään datan avaamiseen tai avoimen datan käyttöön, accessed 3/7/2019

Open data as a service (DaaS), is hoped to generate new business innovations in the circular economy[5]. The topic has attracted a great deal of enthusiasm among others with the circular economy developers and public administrations, but tangible examples of successful open data innovations are still missing.

## 3.2 Regarding circular economy operating models

The purpose of this study was to provide an overview of the current use of open data in the circular economy as well as of the wishes of enterprises regarding open data.

The added value of open data to business is understood in two ways in this report. In the first approach, ready-to-use, open data can be *used* to support one's own business, or a business can be set up around available open data. In the second approach, the company itself *produces* open data for others to use in a profitable way.

Due to the fact that identifiable business based on genuinely open data is still very rare, a broad, permissive view about the concept of open data has been taken in this work. Thus, in some cases, open information, such as individual sales announcements, that is outside the definition of open data itself is understood to be open data. The criterion for including these cases is that the openly published information can be converted into open data by certain measures.

A broader, more permissive perspective will help to identify the potential associated with the circular economy business, as well as the potential challenges associated with the use of open data in the circular economy and business in general.

In this study, open data is examined in the context of the circular economy. The circular economy is an economic model that seeks to preserve resources and their value within the economic system. Consumption is based on the use of services rather than ownership; sharing, renting and recycling. Loss and waste are minimized in order to preserve the value of the introduced materials in society.[6]

Five circular economy business models have been considered:

1. **Product as a Service:** The minimization of materials so that the function corresponding to the use of the product is achieved by providing the service.

2. **Renewability:** using renewable and recyclable materials as well as renewable energy in product design and manufacturing.

3. **Sharing platforms:** maximising the usage of goods and resources and extending their life cycles by using digital platforms for renting, selling, sharing and reuse.

---

[5] Ammattikasvatuksen aikakauskirja, University-company collaboration: A platform for open data innovations in the circular economy, accessed 5/7/2019
[6] Sitra, Mitä nämä käsitteet tarkoittavat?

4. **Product-life extension:** using products according to their original purpose for as long as possible or enabling multiple instances of reuse through means such as maintenance, repair and refurbishment.

5. **Resource efficiency and recycling:** material and energy-efficient solutions, and the collection and reuse of products and raw materials that have reached the end of their life cycle.

In the circular economy, it should also be noted that operators are subject to regulatory constraints. Everyone cannot become a waste recycler. With regard to municipal waste, the obligation to organize waste management is limited to municipalities under the Waste Act and competing activities cannot be organized. An exception to this is waste under producer responsibility, where the obligation to recycle falls on the party that has delivered the product on the market. In addition, there are material cycles between citizens, such as flea markets and online auctions, where sales articles are not classified as waste but are considered to be ordinary commerce. Instead, it would not be possible, for example, for a private individual to sell or utilise their own waste through an online marketplace according to the Waste Act.

On the other hand, if e.g. a business side stream requires treatment and there is no market for it, it is classified as waste or separate consideration should be given to declassifying it as waste. If the value of the material is not yet sufficient to cover the processing costs, utilisation is based on a port fee charged by the recipient. Reception and utilisation of waste requires registration of the operation and e.g. an environmental permit.

# 4 Case examples of open data utilisation

Selected examples of open data utilisation in business described in this chapter have been examined based on publicly available sources (corporate websites, news sources, etc.). Each case description presents an overview of the business concept of the company, an assessment of the role of open data in the business, and the opportunities and challenges of open data related to the concept. In addition, the share of open data in the business has been qualitatively estimated, since it is not possible to quantify it based on publicly available materials. Three different ways of using open data were identified as qualitative categories for evaluation: (a) open data is used in own business, (b) open data is used in the customer interface, and (c) open data is not used but publicly displayed information is produced.

## 4.1 Scrap Monster (CA)

Founded in 2009, Scrap Monster is a Canadian electronic sales and purchasing platform for recycled industrial waste and materials. The company provides site users with up-to-date information, news, and information on world market prices for materials, which is an essential part of the platform. Sales and purchase announcements are partially downloadable free of charge, but e.g. getting the detailed contact information necessary for trading requires a paid

monthly subscription. There are three membership options, the more expensive of which include different levels of visibility for companies and up-to-date market information.

Scrap Monster announces that it gathers near real-time (updated daily) information on material price trends from vendors and other sources [7]. Based on this information, the company compiles an average price list, which has a prominent role for its business and the site users[8]. The site offers this information openly, gathered into tables and graphs for the site visitors to utilise. Users can even embed graphs freely on their own web pages, provided that the code is not modified, that is, a reference to their own pages embedded in Scrap Monser's code must be displayed[9]. The most up-to-date price information is only available to paying customers, but slightly older data and longitudinal data showing price trends are visible to unregistered users. The provision of open data[10] for free therefore serves as an advertisement for the operator itself, thereby consolidating its position and expertise in the market.

In addition, Scrap Monster offers a Scrap Yard Finder search function that utilises Google's open[11] spatial information on the Google Maps platform. Using this function, the site visitor can conduct business searches based on material or geographical location (country, city, post code).

Scrap Monster's turnover is estimated to be around 1,5 million dollars.[12] Scrap Monster utilises open data in their business (publishing price information), as well as in the customer interface (spatial data). However, it is difficult to assess the value of open data for the business. Spatial information is not necessary for the business model (publishing sales and purchase announcements), although it is a factor that increases the usability of the service and thus adds value to customers. On the other hand, the publication of price data for scrap materials seems to be a more important factor in terms of turnover than spatial data, as it has a more specific role in attracting paying users and thereby generating revenue.

The challenges of open material price data compiled by Scrap Monster are minimal, as pricing data from platform users is easily automated through algorithms. The problem of using Google Maps has been analyzed on a general level in the report's conclusions.

## 4.2 Netlet (FI)

Netlet, established in 2016, offers a service concept for collection of usable surplus materials from construction sites. The target group are construction professionals. The collected

---

[7] Note. Detailed information about sources is not available on the site.
[8] ScrapMonster, Scrap metal prices, accessed 25/6/2019
[9] ScrapMonster, Free metal price charts, accessed 25/6/2019
[10] Openness of data is questionable here, as modification of the data is limited.
[11] Openness of data is questionable here also because Google collects a fee if usage of the service exceeds a certain limit.
[12] Owler, ScrapMonster, accessed 31/7/2019

materials are then sold in the Building outlet (Rakennusoutlet) webshop and at the warehouse store in Vantaa with prices that are 50-80% more affordable compared to hardware stores.[13] The business turnover was 33 000 € in 2018. [14] Business model is based on the construction companies giving away the surplus goods for free (the construction sites save on the hassle of disposal and waste costs), Netlet's revenue is made up of resold materials. [15]

Pickup is ordered over the phone or by filling out a pickup order on the company website, so Netlet's core business in this regard is not based on utilizing open data at all. In this study, Netlet is rather perceived as a producer of open data with respect to the sales announcements it publishes in the Building outlet. So, Netlet does not use open data, but produces openly displayed information that could be transformed into open data by certain steps. If sales announcements were to be compiled as open data with the correct definition of the concept, the benefits of the metadata they contain, in particular, could relate e.g. to monitoring price trends or availability of surplus materials, as in the case of Scrap Monster above (chapter 5.1.1).

Netlet's freely available online information on products for sale can be interpreted as a business that promotes the circular economy, especially a business that serves consumers. However, the strictly interpreted definition of open data is not fulfilled, as it lacks both the machine-readable structure and the license for further open utilisation. In addition, the third-party benefits of individual announcements may be questionable, because they are essential, openly published information for the end users in e-commerce.

Even if it is technically possible to open data, the idea of opening data explained above is a challenge rather than an opportunity for Netlet's business model. For example, if an entity producing surplus material, such as large construction companies, maintained an up-to-date open database or other platform for surplus materials, an actor such as Netlet would be more readily aware of the materials available. At the same time, competition would likely increase if the same information was equally accessible to competing operators. In addition, purchasers of surplus materials could obtain the materials directly from their suppliers.

## 4.3 Enevo (FI)

Enevo is a Finnish waste technology company operating in the European and US markets. In Europe, the company sells smart waste management solutions to cities. In the US Enevo also operates in day-to-day waste management. In the United States, the company has a network of subcontractors for emptying waste bins, whereas in Europe the company only sells the technology used by the municipal waste management companies to cities.[16]

---

[13] Netlet, Usein kysytyt kysymykset, accessed 2/7/2019
[14] Finder, Yhteystiedot accessed 2/7/2019
[15] Netlet, Yrityksen websivusto, accessed 2/7/2019
[16] Talouselämä, Jättitappiot pakottivat hakemaan uuden bisneksen - Enevo sai 10 miljoonaa lisää Yhdysvaltojen valloittamiseen, accessed 03/07/2019

Enevo's operations are based on sensors and analytical software that monitor and predict the degree of filling. Based on sensor and analytical data, the information is transmitted to Enevo through the cellular network, and the company's routing software plans which waste bins should be emptied at a given time for waste trucks. Conventional waste management is based on fixed routes with planned schedules, regardless of how much waste is in the bin. The company estimates that sensor technology can deliver on average 20% savings compared to the conventional method. At the same time, mileage is said to be halved and collection visits 75% less compared to the conventional option. This results in reductions in emissions, noise and traffic.[17]

Enevo does not appear to be utilizing open data in its technology business. Waste bin sensors are owned by the company and transmit data to the company's software, which requires a paid monthly subscription. The company states on its website that it will disclose its information and technology for free to its customers and subcontractors. However, a paid subscription or a subcontracting agreement is a prerequisite here. The company's software also includes a Google Maps-based map application that displays the best service routes for waste collection trucks calculated by the application. [18] The company has raised nearly 29 million € capital through several financing rounds, among others from Finvera, EIB and Lifeline Ventures, and in 2018 net sales totalled 2,257 million €.[19] It is likely that Enevo utilises open data to support their business by using Google Maps, but it is not possible to evaluate the value of open data to the business as information regarding the utilisation of open data is not publicly available. The use of Google Maps is not entirely clear from an open data perspective, and this has been further elaborated in the report's conclusions.

## *4.4 Eniram (FI)*

Eniram is a Finnish technology company aiming at optimizing maritime operations, which aims in particular to reduce fuel consumption, hence reducing both operating costs and emissions. The company offers solutions for large vessels from cruisers to tankers and cargo ships. Eniram's business is based on data collected by sensor technology, which is analyzed using real-time predictive algorithms. Software designed for various maritime activities produces reports that enable those in charge of ship operations to make decisions to optimize vessel flow.

Depending on the type of contract, the service that is billed monthly will include on-board data capture, data traffic, reporting, and necessary software.[20]

---

[17] Enevo.com, What is dynamic routing? ja How trash companies make money v. How Enevo makes money, accessed 03/07/2019
[18] Google Cloud, Enevo: making waste collection more sustainable, accessed 02/08/2019
[19] Asiakastieto, Enevo Oy, accessed 03/07/2019
[20] Eniram, Fleet efficiency, accessed 4/7/2019

Most of the data Eniram uses in its business is collected through its own on-board sensors. These send information for analysis, e.g. about ship speed, position and fuel consumption. Data collected by sensors is supplemented with data from third parties, such as weather information and weather forecasts. This allows the inclusion of external factors influencing the vessel's performance such as wind speed and waves in the calculations.[21]

Many organizations that collect meteorological data around the world have opened their data for free use, which has given rise to a wide range of applications for weather data end users.[22] A general challenge in exploiting weather data is probably the difficulty in discovering commercial potential. For large-scale commercial utilisation weather data seems most applicable the way Eniram uses it, by combining it with the non-open data from their own technology.

Eniram's turnover is 12.7 million € (2018).[23] Eniram utilises open data but the share of the open data utilisation in the business is difficult to estimate. For some of the company's services the role of weather data is a critical factor that adds value. This is needed in the core business of optimizing maritime operations.

## 4.5 Gasum (FI)

The energy company Gasum is a natural gas and biogas expert operating in Finland, Sweden and Norway. The company imports natural gas to Finland, produces and refines biogas in Finland and Sweden, and transmits and supplies them to energy production, industry, households, as well as land and sea transport. Gasum has 12 biogas plants in Finland and Sweden and operates through partners in Finland and Sweden. The company's turnover in 2016 was 843 million €.[24]

In the context of the circular economy, Gasum offers renewable domestic biogas as an alternative to import-dependent non-renewable natural gas. Gasum has an extensive distribution network in Finland, which is helpful in expanding the biogas market. The company produces biogas from partners' waste and returns it for use as energy in the partner's product manufacturing. The nutrients are also returned in the field and closed circulation loops are thus created.[25]

Gasum seems to utilize open data in its operations. Gasum has a map service based on Google Maps on its website. The platform shows all the filling stations of Gasum and other gas producers, as well as the locations of upcoming gas stations. The map provides customers with an easy way to find the nearest gas station. The Gasum website also has a link to the tankille.fi map application, where gas station information can be found with price information. The application is not owned or developed by Gasum, but Gasum appears to have provided their

---

[21] Eniram, Eniram Insight factory, accessed 4/7/2019
[22] ks. esim. Ilmatieteenlaitoksen datan pohjalta kehitetyistä sovelluksista, accessed 4/7/2019
[23] Finder, Eniramin yhteystiedot, accessed 4/7/2019
[24] Gasum, Yritysvastuuraportti 2016, accessed 26/06/2019
[25] Sitra, Uusiutuvaa energiaa ja orgaanisia ravinteita biohajoavista jätteistä, accessed 26/06/2019

information about filling stations to the application developer. The application includes refueling stations for different chains and covers not only gas stations but also normal gas stations (ABC, Seo, etc.). In addition, users are able to update price information in the app.

The company seems to have recognised the potential of open data; according to an article on the company's website, Gasum organized a "HackTheGas" event where they opened their information to coders to find solutions that promote sustainable development and the Nordic gas ecosystem.[26] However, there is no information on the continuity of the operation on the site.

According to the company's Q1 / 2019 earnings report, the biogas business had a sales volume of 105.4GWh and net sales of € 11.1 million (Group-wide net sales of € 61.1 million). Natural gas and LNG account for a much larger share of the business; 8.3 TWh and 1.63 TWh over the same period. Open data is likely to be used in the company's own business as well as in the customer interface, but its exact share cannot be estimated from public data.

The company is expanding its biogas production in Finland and Sweden by building new plants and modernizing existing ones. The biogas (and natural gas) distribution network is also being expanded.[27]

The potential of the feed needed by the biogas plant is highly relevant for profitability of biogas plants. The amount of biodegradable waste or side streams in an area can be estimated based on public, open statistics. This is clearly an opportunity for companies in the industry to exploit open data. There is no mention of the use of open data on the company's website but based on Gaia's expertise this type of information is typically used in the biogas industry.

E.g. the Natural Resources Institute Finland's harvest statistics are data that can be used to estimate the amount of side streams generated in different areas and thereby map optimal locations for new biogas plants. Information on the amount of municipal waste is obtained, for example, from Statistics Finland, but regional data are not publicly available. It is logistically important to know how much waste is in the operating range of the plant and this information is not available. When planning a biogas plant or filling station, public information on spatial planning and, to a limited extent, information on the environmental permits of large waste producers can also be utilised.

## 4.6 Ycloset (CN)

YCloset from China offers a monthly subscription fee based clothing rental service online (starting from 42 USD).[28] The clothing on offer is casual, from mid-priced brands to luxury brands. The difference with other similar services is that the service does not only offer festive

---

[26] Gasum, Digital solutions to promote the Nordic gas ecosystem produced at HackTheGas, accessed 05/08/2019

[27] Gasum, Gasum-konsernin taloudellinen katsaus Q1 2019, accessed 28/06/2019

[28] YClosetin internetsivu; https://www.yi23.net/

or more expensive clothes. The value of the service is that it provides access to a huge selection of clothing that allows customers to try out new styles regularly. Target audience are 20-35-year-old urban women who are under pressure to dress well at work.[29]

YCloset is a wardrobe as a cloud service that is easily accessible via a mobile phone app and the clothes are delivered within a day. The operation model is based on easy delivery, functioning technology, and good quality cleaning service. YCloset operates in cooperation with a dry cleaning service, which guarantees clothes cleaned to a high standard to the customers. Partnerships and increased clothing utilization make the operation a circular economy business model. This way, the garment circulates in use for a longer period of time and the company has found that up to 40 consumers can wear the same durable garment.

The information openly available to the customer at YCloset consists of rental clothes announcements (catalog) requiring the download of the YCloset application and user registration. In 2018, the platform was reported to have from 7 to over 15 million registered users, depending on the source (the number of estimated users varies considerably) and is said to be constantly growing. It also allows users to communicate, share styles, and create their own online community.[30] Approximately 30% of turnover comes from selling clothing (the customer can decide to purchase the rented piece of clothing) and the rest from the monthly subscription fees of clothing rental.[31]

YCloset shares its product range openly compared to e.g. similar domestic services, where clothing is rented at a walk-in shop rather than the Internet. However, the clothing announcements published by YCloset do not fit into the strictly interpreted definition of open data, meaning that YCloset does not use or produce actual open data. Instead, it produces open information that can be converted into open data by certain steps. Benefiting from data opening would require new business innovations alongside existing ones.

The company utilizes RFID tracking technology, which enables the type of clothing to be identified in the laundry, and includes associated washing instructions and history. The average user is reported to open the YCloset app 2-3 times a day and spend 5 minutes there renting clothes once a week. This information does not appear to be openly accessible, e.g. through an application or website, but is based on information obtained through interviews. It is challenging to verify this as the information sources are available in Chinese only.

The company has gone through several financing rounds since its establishment in 2015. They have raised more than $ 70 million capital from investors. Major investors include Sequoia Capital, SB China Capital and Alibaba Group.

---

[29] Ellen MacArthur Foundation, A wardrobe in the cloud, accessed 25/06/2019
[30] Inside retail Asia, Alibaba takes stake in garment sharing platform YCloset, accessed 26/06/2019
[31] Julien Isaacs U.S.-China Brand consultancy, New Retail models: YCloset, Clothes sharing+, accessed 26/06/2019

From Alibaba, a massive player in the Chinese market, YCloset believes it will gain growth and attract business from competing services. Through Alibaba's collaboration, YCloset's Ali-pay online payment service users who have a 'Sesame credit' rating above a certain value avoid paying a deposit of around € 40, which is also thought to attract customers to the service. With the acquired funding, the company is also planning to develop AI-based algorithms to better support its operations. [29]

According to the study, the circular economy chain is not yet fully implemented in YCloset's operations, as the business model does not include the utilization of clothing material at the end of its life. According to some sources, the company is developing its operations from buying clothes to brand partnerships with clothing brands. In this way, the company would share the revenue and YCloset's consumer behavior data directly with its partners, which would increase knowledge sharing, though such data would probably not be shared openly, but rather between business partners. From the point of view of material utilization, the responsibility would remain with the brand producing the garment, which would facilitate the recycling of the materials, albeit subject to the interest of the brand.

# 5   Views about the utilisation of open data

It is reasonable to assume that new ways of utilizing data in business are becoming more common as businesses become more aware of existing data streams and the opportunities they offer. Rather than utilising fully open data, solutions that partially apply the principle of openness are more likely to become commonplace. An example of such an applied solution is the more limited opening of data generated by the company's own operations to its own customers. The same applies to the use of existing data, for which a nominal user fee may be charged.

Interviews were used to gather information on the use of open data and future prospects. Companies were selected for the interviews from Sitra's The Most Interesting Companies in The Circular Economy in Finland List. Interviews (8) were conducted by telephone. The companies interviewed are listed in Annex 2, the answers of the individual companies and their representatives are not identified in the analysis. According to the interviews, open data is not a very unambiguous concept. Level of information varied according to the person's background, although the concept was not completely foreign to anyone.

Finnish companies operating in the circular economy typically use open data in the form of maps or spatial data. In addition, companies apply weather data, trade sector data and statistical data published by operators such as Statistics Finland. Statistical information was not in all cases conceived as open data, although its use is apparently widespread as support to all kinds of business-related decision-making.

The utilization of data in business is based on the identified needs of the business, e.g. for the interaction with customers, rather than on open data capabilities and principles. It can be

concluded that the potential of open data in business has not been very extensively explored in companies.

The biggest obstacle to exploiting open data was the uncertainty about existing data publishers and their data reserves. Another common concern was the reliability of open data, which is still linked to liability issues. The question of who has the responsibility for the quality, accuracy, and impartiality of the data transmitted also came up. In the field of circular economy this can mean e.g. the accuracy of information on the quality of the side stream or other material to be reported. The interviewees were cautious about setting up business on open data, unless the issues of responsibility and quality were clarified.

The potential of open data for enhancing operational processes such as logistics or for generating sales forecasts was recognised by the companies. Real-time information on flows and availability of various materials was repeatedly raised when asked about the potential of open data. On the other hand, the topic is problematic as the core business of many actors is based on the management of material flows and related information.

The interviewees were also asked about the company's wishes and needs regarding open data. Some companies have considered the use of open data in the future and identified data that would benefit the company. Most of this information is related to public sector activities: licensing information, demographics, planning and tendering of construction projects, preparation of laws and regulations, and public assets. In addition, various statistical data and improved access to scientific information as well as market data were considered interesting and useful.

Some of the interviewed companies also identified opportunities in open data in terms of being a data provider themselves. However, there is a need to find out exactly what kind of data can be shared and what kind of information one wants to publish. Guaranteeing the quality of the data and the added value of the data to your own business motivates interviewees to openly open their data to their customers or potential customers. However, the production of open data was still mostly at the idea level in the companies that were considering this and actual implementation was not on the agenda yet.

Finally, the interviewees were asked for views on the materiaalitori.fi service developed by the Ministry of the Environment and Motiva to support the circular economy. Not all companies were familiar with the service. Some companies saw the service as a competitor to their own business rather than a useful service to the company. Not all interviewees were dealing with material or raw materials, and this type of companies did not see the service as meaningful to their business. Some companies saw potential in the service, either for sharing their own side streams or for obtaining material, but the use was not yet active.

# 6  Conclusions

## 6.1 Open data and the circular economy – not yet connected

The potential related to open data has not been thoroughly considered in the circular economy related business of companies, and it does not exist as a strategic point of view for the business. The companies in circular economy do not actively communicate about the utilisation of open data on their websites or attempt to distinguish from others using this type of data. When asked about the matter, it appears that companies have not always examined their business opportunities according to the open data principle and the connection between circular economy and open data is not very clear. Openness is primarily understood to refer to publicly available data bases, which are considered essential.

Based on the case descriptions and interviews, companies have successful business and customer interface concepts that have adopted open data approaches. However, these usually rely on existing platforms that are not by definition classified as fully open data, such as Google Maps. The large market share of an operator such as Google not only guarantees the coverage of the map service, but also gives Google the power to influence the terms of use of its data and any changes to it arbitrarily[32].

Possibly conducted risk assessments related to the role of a company as a large platform operator have not been mapped in this study. On the other hand, in the current market situation it would not be profitable even for a large company on the Finnish scale to set up their own "Company Maps" -service, because stakeholders, customers and consumers would not find it, and construction and launch would be expensive. Alternative, genuinely open data based map services include the user developed and operated OpenStreetMap[33], awareness of such services is, however, generally low.

Broadly speaking, the commercial potential of weather data varies, but there are opportunities in operations where the weather affects resource efficiency or material quality. The case descriptions include an example of this and some of the companies interviewed use weather data. Many meteorological data collection organizations around the world have opened their data for free use, which has given rise to a variety of applications, especially for weather data end users.[34] This is useful for weather-dependent activities such as agriculture.

For agriculture, the benefits are based on long-term data and forecasts based on them. Another application of weather data are the various weather-dependent hobbies, mainly coded by

---

[32] City Dev Labs, GoogleMapsin API-hinnoittelu muuttui, mitä ja miten?
[33] OpenStreetMap, About
[34] See e.g. Ilmatieteenlaitoksen datan pohjalta kehitetyistä sovelluksista

enthusiasts themselves. For these, weather statistics are irrelevant, but precise weather information is interesting.

Both the case studies made, and the data collected through interviews show that utilizing open data - other than spatial or weather data - in the circular economy business is challenging. In many cases, the circular economy business requires knowing and controlling material flows, and the disclosure of this information exposes companies in the industry to more intense competition. Businesses also want to protect their data sources as a part of risk management. Thus, even seemingly traditional practices, such as a collection order by telephone or via an electronic form for Netlet that runs an e-commerce business for building surplus materials, are well justified.

In some cases, opening up own data to customers to improve service has been considered.

Nutrient recovery from waterways is one of the business opportunities for the future of the circular economy, which is opened up by open data on the state of nature [35][36]. Sales of the recovered nutrients are probably not profitable enough, so it is worthwhile for nutrient recovery companies to base their business on offsetting nutrient emissions.

## 6.2 Material platforms of circular economy

The number of interviews was low, but they highlighted the cautious attitude of several actors towards the Materiaalitori platform. The potential intensification of competition on side streams as a result of the service, which could lead to market overheating was seen as a threat to the widespread use of this type of services.

The importance of places like Materiaalitori for the circular economy is twofold. First, they do not in themselves increase the total amount of materials, but they may reveal some hidden material streams. Second, awareness can improve the quality of materials when the producer of the waste or side stream is aware of the importance of sorting.

During the study, it was not observed that the presence of public open services as such would generate or present untapped material flows of high volume and high value added. These are already known to companies in the circular economy and they are competing for the utilisation if the material has added value. Instead, in complementing local ecosystems or improving the resource efficiency of smaller players it can play a role. However, the service is not intended for individuals or companies seeking raw materials, due to legal requirements. In order to avoid abuse, only those business owners who produce, utilize or provide waste or side streams or provide related services can access the Materiaalitori.

Previous studies have identified the importance of exploring how different customer segments are motivated, monitoring the impact of operations, and ensuring effective communication

---

[35] Velmu karttapalvelu
[36] Vesikartta - paikkatietopalvelu vesien tilasta

when designing services such as the Materiaalitori. Economic benefits are often the most important motivation for companies to get involved, and the service should be able to clearly demonstrate how the company will benefit. Companies are attracted by demonstrable cost savings (e.g. if a side stream previously classified as waste can be exploited in an economically viable way), an opportunity for new markets or new business. Examined from these perspectives, the interviewed actors had not yet produced or noticed examples of the benefits of the service.

At the same time, fully or partly public funds are constantly used to collect material information that is not open to all. For example, waste data reported by companies subject to environmental permits, municipal companies' data on waste composition or background data from Statistics Finland's statistics are not openly available. Even in the case of various regional projects, data is not usually exported to spatial data. It could be possible to link this information to the platform in the future, if so decided. However, this is only speculation and there is no apparent political pressure for this issue.

## 6.3 Possible side effects on actors

Presently, information on valuable material flows is a key competitive factor and covered by the business secrets of circular economy companies. The question is whether limited and closed data slows down investment and competition - and what is the importance of open material data to the market. Studies on such scenarios have not been identified, so the estimates are related to Gaia's previous expert work, interviews with operators and knowledge of the field.

The utilisation of large waste and side streams between companies often requires a partnership where the producer of side streams gets, for example, fuel for their use and increases the sustainability of their activities. The same actor could take care of valuable side stream, as well as harmful and dangerous waste fractions. The partnership can also include e.g. real estate services, as well as managing internal logistics for wastes and side streams. In such cases the partnership is deeply embedded in the customer's process. The cost of wastes and side streams can be so insignificant for a larger company that a short competition-based cycles or trading-type operation processing materials bit by bit is not profitable. Possible negotiations, liability issues and logistics cause additional costs.

The circular economy companies look for long standing partnerships that enable growth and investments. If the availability of materials is uncertain, there is no incentive to build a facility. The Finnish waste management market is relatively consolidated and competition law determines the responsibilities of private and municipal companies, as well as the management of different waste streams.

The Waste Act aims to guarantee the availability of waste management for everyone, including sparsely populated areas and smaller companies. The different responsibilities, obligations, authorization procedures, and investment needs created by processing technologies and storage capacity make the entry of a new player capital intensive. Some players only focus on

certain types of material flows but excluding industry and trade metals and certain pure plastics, business still relies heavily on port fees. That is, waste and side streams are dealt with by those who provide the services at the lowest cost or are able to sell the added value of their operations, such as carbon footprint information, circular economy expertise, and responsibility. For large companies, knowledge of proper waste management and reliability is important. In contrast, many small operators or individuals are likely to be interested in price, especially if the waste item is one-off or exceptional.

One could speculate on what would happen if all the information were publicly produced open data - either through coercion or through incentives. As stated earlier, the amount of waste would not increase. Competition between operators providing waste management services could increase and the service would probably be used to leverage prices in business-to-business contract negotiations and to seek alternatives.

Effective control is required to avoid misuse and sub-optimization. A single batch of waste may have a significant value (for example metals) or may require expensive treatment and possibly permanent disposal (permanently contaminated soil). Partnerships needed in these cases are completely different, one is a raw material to be sold and the other may be a significant expense. The largest volume of waste is soil. According to a study, activities related to the illegal treatment of waste, in particular soil, are highly profitable criminality due to the limited control and the very limited sanctions[37]. According to the Police Board, a new phenomenon is the creation of a company specifically designed for the circular economy. A company receives but does not treat waste – instead, it stores it in a suitable property and then goes bankrupt.

## 6.4 Open data motivators

Reliability and liability issues of open data are closely linked to the use of open data in business. Businesses are right to ask who has the responsibility for quality, accuracy and impartiality of the information transmitted by data. When talking about open material flow data in a circular economy, it is also important to determine who is responsible for ensuring that the quality and accuracy of the information is correct, i.e. that the material reported is in fact what has been reported. If the responsibility is perceived as the sole responsibility of the material buyer to check the quality of the material, the risks associated with the material will slow down the development of the market.

In order to develop use of open data in the circular economy, the circular economy actors should be made more aware of existing data reserves. Increased cooperation between the various parties and a joint debate on the quality, accuracy and accountability issues of potential open market material and similar trading platforms could also be needed. As companies become more aware of open data streams and their opportunities, the utilization of data in

---

[37] Interview of a representative of the police force at YLE 5.8.2019

business is also expected to increase. As such, developing and sharing good tools for managing information becomes increasingly important.

# ANNEX 1: Companies interviewed

Encore Ympäristöpalvelut Oy

eRent

Konecranes

KotkaMills

Maapörssi

Silmusalaatti

Soilfood

Solnet

# ANNEX 2: Interview questions

1. Utilisation of open data presently: What role does open data play in the business?

2. Utilisation of open data in the future: Does the company have plans or interest to utilise open data more in the future?

3. What kind of opportunities are there in open data? What kind of challenges do you see?

4. Wishes regarding open data: What kind of open data would support your business development?

5. Ministry of the Environment and Motiva are preparing a material market place for companies and organisations, enabling professional exchange of wastes and side streams (https://www.materiaalitori.fi ). What would you hope to get out of Materiaalitori (e.g. data, material)?

# *Disclaimers*

The report shall be provided based on the facts and instructions in the specific assignment considering the circumstances at the time of the assignment in accordance with the respective scope of work. We assume that all the information provided to us is accurate and complete and that you have verified the correctness of the disclosed information.

We assume no responsibility and make no representations with respect to the accuracy or completeness of the information in this report unless otherwise stated. The report should not be regarded, or be relied upon, as a recommendation in decision making concerning any matter referred to in it.

It should be understood that we do not assert that we have identified all matters included in these documents that may be relevant if these documents are included as disclosures against the warranties of the future agreements. Our review of the documents has only been what we consider appropriate in the context of the scope of our work as set out in our offer.

Further, we accept no responsibility to update the report in light of subsequent events (after the date of this report).

gaia