

Article

Sustainability Perspectives of the Sharing Economy: Process of Creating a Library of Things in Finland

Anna Claudelin ¹, Kaisa Tuominen ² and Susanna Vanhamäki ^{2,*} 

¹ School of Energy Systems, Lappeenranta-Lahti University of Technology LUT, Mikkulankatu 19, 15210 Lahti, Finland; anna.claudelin@lut.fi

² Department of Technology, LAB University of Applied Sciences, Mikkulankatu 19, 15210 Lahti, Finland; kaisa.tuominen@lab.fi

* Correspondence: susanna.vanhamaki@lab.fi

Abstract: The transition from a linear economy to a circular economy requires a new way of thinking. In a circular economy, products are used more intensively, for example, by sharing them with others. To understand the possibilities of the sharing economy, environmental, social and economic impacts all need to be considered. The purpose of this paper is to shed light on the importance of the sharing economy as well as to increase understanding of how public sharing-economy services can be launched. The research methods used include a case-study approach and assessment of greenhouse gas emissions. In this paper, an implemented cooperation process of creating a tool and device library (the Library of Things) in a small Finnish municipality is described. Furthermore, the library's impact on greenhouse gas emissions during the first 14 months of operation is assessed. The results indicate that approximately 5752 kg CO₂eq was avoided during the 14-month period, assuming that with each loan, manufacturing of a new good was avoided. In addition, strong implications of local positive effects on social sustainability were found.

Keywords: sharing economy; case study; Library of Things; greenhouse gas emissions



Citation: Claudelin, A.; Tuominen, K.; Vanhamäki, S. Sustainability Perspectives of the Sharing Economy: Process of Creating a Library of Things in Finland. *Sustainability* **2022**, *14*, 6627. <https://doi.org/10.3390/su14116627>

Academic Editors: Libena Tetrevaova and Jan Vávra

Received: 26 April 2022

Accepted: 24 May 2022

Published: 28 May 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Achieving a more sustainable future is a current hot topic, both in policy and practice as well as in academic discussion. The circular economy (CE) and sharing economy (SE) can be seen as significant drivers of sustainable development [1] and thus a means of contributing to solving the sustainability challenge.

Numerous international, national, regional and local policy initiatives support the change towards a sustainable and circular future. The European Commission has widely promoted the shift through policies, such as the CE action plans in 2015 and 2020 [2,3]. Several European Union member states, including Finland, have set national targets to enhance the CE [4]. Furthermore, at the regional level, the Finnish Päijät-Häme region has set up a regional CE roadmap to draw a path towards sustainability [5]. One of the goals of the regional CE roadmap is related to developing new business models, including the SE.

The CE is usually defined as an economic system that aims to close material loops, reduce the need for raw materials, reduce waste and maintain the value of products and resources for as long as possible [6–8]. However, in the production and consumption of goods and services, environmental and social sustainability both remain central challenges [9,10].

The CE has been criticised for lacking a social perspective [8,11]. Yet, Korhonen et al. [12] defined the social objectives of the CE as being related to the SE and encouraged community use as well as increased employment. The shift in roles from the consumer to the user is an important feature of developing the CE [13]. In this process, the SE plays a central role. The SE entered the public discussion about a decade ago [14]. The SE can be defined as entailing temporary access to underutilised goods [15,16], as it helps use resources inside a community without the need to buy new goods each time [17]. However, no common

definition exists for the SE, and the use of the term is still developing. This is because the term “sharing” can have numerous meanings. In addition to the abovementioned information, several other researchers have provided their views on the topic. For example, based on systematic literature research, Schlagwein et al. [18] defined the SE as “an IT-facilitated peer-to-peer model for commercial or noncommercial sharing of underutilized goods and service capacity through an intermediary without a transfer of ownership”. In addition, Mi and Coffmann [19] provided a similar definition. Additionally, Sutherland and Jarrahi [20] point out that digital platforms are the core of the SE. In fact, the SE can also be called a platform economy, or a collaborative platform economy, as interactions among groups of people supported by digital platforms enable them to exchange, that is, share, and collaborate in the consumption and production of activities and goods [21]. The platforms connect supply and demand, and enterprise-based platform trading has become particularly popular in the logistics industry [22]. Markman et al. [16] highlight that the SE is actually a subset of the broader economic sector that is based on digital platforms; however, the assets shared in the SE are not owned by platforms. Even if some definitions highlight the “peer-to-peer” perspective [18,23], others do not [9]. Moreover, sharing does not necessarily involve fees [15], even though several definitions do include the market exchange [1,18].

Both the CE and SE have only recently been actively included in both academia and policies. Consequently, the academic debate on these concepts is lagging behind [1,8,9,12,17,24]. Henry et al. [1] discussed the links between the concepts and pointed out that researchers see the SE as a subset of the CE. SE business models are seen as one application of the CE.

The SE contributes to the sustainability discussion through its aim of using tangible and intangible resources more efficiently. The idea is that a consumer does not necessarily need to own things that are less often needed. In this way, the SE can help “meet the needs of the present without compromising the ability of future generations to meet their own needs” [25]. The SE is seen as an opportunity to promote sustainable consumption practices [9]. Furthermore, as the significance of the existential problems of our planet have emerged, the intent to protect the environment through pro-ecological or environmentally sustainable behaviour among people is increasing, as demonstrated by Ober and Karwot [26] and Arnold et al. [27]. The growing ecological awareness and understanding of the importance of a citizen’s actions can positively affect economic development in accordance with ecology [26]. According to Joshi and Rahman [28], environmentally sustainable behaviour is often described as green consumption in the consumer behaviour literature. Consumers can be seen to possess the capability to prevent or decrease environmental damage by consuming green products [28]. Increased personal affluence can also allow for ecological engagement through, for example, giving money to environmental groups or buying certified organic foods; however, it also can enable more consumption [27]. Due to this, studies explaining the potential and proved benefits of the SE and a possibility of decreasing consumption in order to protect the environment are important.

In the last decade, the SE has grown to be considered a socioeconomic trend of huge importance. However, the concept does not come with only positive effects; it can also create questionable situations, as explained below [29].

Sharing and the SE are mainly seen as having a positive effect on all dimensions of sustainability: economic, social and environmental [17,30,31]. Furthermore, the SE can contribute to sustainable development, especially through positive social and environmental effects [9,31]. The social benefits are related to improving quality of life [17] and to providing individual well-being, building social capital and improving a sense of community while simultaneously reducing environmental effects or problems [31,32]. The SE also strengthens social relations between local communities [33]. Still, Sutherland and Jarrahi [20] state that the economic, and social aspects of the SE have not been satisfactorily drawn together into an integrated understanding of the technological element of the SE.

Positive environmental effects emerge when sharing material, redistributing products or intensifying the use of products [31] leads to reduced consumption of new goods and thus results in decreased amounts of emissions and waste [17]. When demand for the purchase of, for example, new products and vehicles is reduced, the SE can reduce carbon footprints (CFs) while still meeting consumer needs and maintaining quality of life [34]. An environmental analysis performed in Greater London indicated that, with a peer-to-peer food sharing app, 87–156 tons of CO₂eq were avoided over 19 months [35]. Concito [36] estimated that sharing five electric drills between 30 people via Danish online service Lejdet reduced greenhouse gas (GHG) emissions by 700 kg CO₂eq during one year. The assumption was that the production of 25 drills was suppressed by the sharing. In addition to reducing GHG emission, SE reduces the need for raw materials and thus is also a way to lower the material footprints of households. Lettenmeier et al. [37] suggest that a sustainable material footprint related to household goods would be 500 kg/person/year instead of the current 3000 kg/person/year.

However, cheaper accommodation and transportation offered by the SE might also result in a growth in travel that, in contrast, harms the environment [33]. Akbari et al. [32] also pointed out rebound effects where the reduction in consumption of some goods might increase the use of others and thus reduce the overall positive environmental effects. Makov and Font Vivanco [38] found a rebound effect of 29% on average in the United States for smartphone reuse. In other regions with different consumer patterns, they found that rebound effects could even be higher than 100%, leading to a backfire effect. Similarly, Makov et al. [35] estimated that peer-to-peer sharing of food waste could lead to significant re-spending effects of the saved money, which could even increase overall GHG emissions. Nevertheless, research on the environmental benefits of LoTs is still scarce.

Regarding economic sustainability, the benefits lie in the fact that the SE creates new business opportunities, and from a consumer perspective, it also reduces costs [32]. However, the increase in profits for new businesses can result in a decline for others, for example, in the case of Airbnb vs. hotels [39]. Additionally, conflicts between business profits and creating social well-being may arise [19]. Furthermore, critiques have been directed towards the SE's actual opportunities to support the transition to sustainability. Martin [14] noted a dilemma in that the SE has been presented as reducing "hyper-consumption", while it has, in fact, been reframed to a purely economic opportunity.

In an SE, tools or devices can be shared among citizens through tool libraries or libraries of things (LoTs) [29,40,41]. An LoT is defined as extending the library concept from lending books, periodicals, sound and video recordings, and the digital versions of these formats, to lending other items [40,41]. LoTs are appreciated among citizens for both social as well as practical and financial reasons [29,42]. However, even if these are called libraries, several of them include membership and hiring fees. For example, a study conducted on six LoTs in the United Kingdom explained that all LoTs involved charge fees from the borrowers [40].

In North America, some LoTs are connected to public libraries [43]. This supports easy access and relatively good opening hours compared to, for example, voluntarily run libraries. In addition, citizens are accustomed to public libraries, they are easily found, and they can also be seen as platforms for items other than books. When a public actor provides sharing for citizens, the aim is not to seek growth or revenue maximisation but to serve needs and create communality. In Berkeley (California), a tool-lending library service was established in 1979 and is still running [42]. In Sacramento (California) and Hillsboro (Oregon), public libraries opened LoTs in 2014 [41]. Lax [41] explained the development of the Hillsboro LoT. The library development included benchmarking similar public library services in California. They organised a dialogue with the citizens to develop a collection of items. Citizens also donated items to the collection. The Hillsboro library also offers a physical space for meetups where citizens can learn to use the devices [41]. Lax [41] sees one of the success indicators of the public LoT as the fact that the community embraces the collection by utilising and developing it, both through increasing community spirit

and developing the collection of items. According to the examples of LoTs from North America [41,42] and a case study in the United Kingdom, LoTs have positive social benefits in strengthening the local community. However, not much academic research has been found on public LoTs.

In this paper, the development process and environmental sustainability aspects of a public LoT are described for the municipality of Asikkala. Asikkala is a small rural municipality with 8000 residents located in the Päijät-Häme region, southern Finland. During holiday seasons, the number of residents nearly doubles because of temporary residents. The municipality of Asikkala has set climate targets and aims to achieve carbon neutrality, for example, by belonging to a network of Finnish carbon neutral municipalities. The network's target is to reduce GHG emissions by 80% by 2030 from 2007 levels [44]. Asikkala has successfully reduced its GHG emissions over the past few years [45].

The municipality of Asikkala was a partner in the Sharing and Service Economy in Rural Päijät-Häme project, where the service trial of the LoT was implemented [46]. Asikkala has one municipal library, which became an important partner in implementing the LoT. The project aimed to increase knowledge about the SE and accomplished three different types of service trials in rural Päijät-Häme. The project was implemented during 2019–2021 and was funded through the European Agricultural Fund for Rural Development.

The purpose of this paper is to enlighten the importance of the SE as well as to increase understanding of how public SE services can be launched. The research questions of this paper are: (1) How can a goods-lending service, or an LoT, be successfully implemented in a rural area? and (2) Does the lending service enable environmental benefits, more specifically, decreased GHG emissions? The article describes a participatory process of creating a public LoT in a small rural Finnish municipality and explains the LoT's environmental sustainability aspects through GHG emission examination. In addition, social sustainability is considered. The paper contributes to the academic discussion on SE through filling the research gap on implementing the SE through public LoTs in smaller communities and on defining the environmental sustainability of an LoT through a concrete example. The hypothesis is that the LoT has a positive impact on the environment.

The structure of the remaining part of the manuscript begins with presenting the material and methods used in the research. This section presents the case-study methodology, and the GHG assessment undertaken. This is followed by a presentation of the results and a discussion divided into two sections: the first one concentrating on the process of creating the LoT and the second one on assessing the GHG emission reductions of the LoT. At the end, the outcomes of the research are concluded, and limitations and possibilities for future research in the area are pointed out.

2. Materials and Methods

The case presented in this paper includes two perspectives. First, the implementation of an LoT process is described together with the local community. Thereafter, the GHG emission reductions caused by the LoT are studied based on 14 months of lending activities.

The development process of the LoT is explored as a case study. A case study is an appropriate method for conducting qualitative, applied “in-depth” research for investigating complex phenomena that are not easily separated from their real-world contexts [47,48]. The case study is typically utilised in the social sciences when there is a need to understand a complex phenomenon that should involve several actors and perspectives. It should cover an entire process and allow for the observation of how the case developed over time [49]. An in-depth focus on a unique case supports the understanding of the context. However, to increase the validity, it is important that the case study includes a variety of data collection methods to enable the best possible understanding [47,49]. However, the case-study method can also be questioned. This method can be criticised as being only descriptive, as the researcher might have challenges gathering all available data [50]. Yet, based on the inclusive understanding of one specific case or setting, other similar cases can be better understood and developed.

In this research, the process of setting up an LoT was suitable for illuminating the phenomenon of the development of a local SE service. The case involved versatile actors and cooperation with stakeholders; it covered the entire cooperative process and allowed for observation of how an SE can be implemented in practice together with public actors over time, as a case study should.

In this case study, multiple data collection techniques were used: desktop research, discussions and meetings with stakeholders, small-scale surveys, a workshop and practical involvement, as well as other types of informal cooperation with stakeholders, through bilateral discussions and e-mails. The process of implementing the LoT in Asikkala and the most important multiple data sources of this case study are listed in Table 1. The process began in 2019, and the operation of the LoT was monitored until January 2021.

Table 1. The process of setting up an LoT in Asikkala, Finland.

Activity	Topic	Date	Stakeholder Included
Survey	Sharing and service economy needs in rural Päijät-Häme	July–September 2019	Permanent and temporary residents ($n = 175$)
Meeting	Discussion about survey results	17 October 2019	Asikkala municipality staff
Desktop research	Different lending services in Finland and internationally	October–December 2019	Project team
Workshop	Lending service planning	20 November 2019	Asikkala residents
Meeting	Discussion on placing the lending service in a municipal main library	11 December 2019	Asikkala municipality and main library staff
Project-steering group meeting	Discussion and decision on the plans	7 February 2020	Project-steering group
Survey	More detailed survey about the content of the lending service	17 February–9 March 2020	Municipal library customers and residents ($n = 25$)
Meeting	Discussion about survey results, follow-up measures and lending service operation model	25 March 2020	Asikkala municipality and main library staff
Donation campaign	Goods for the lending service were collected through donation campaign	6 April–15 May 2020	Residents
Practical implementation	Building a shelf for the LoT	19–20 May 2020	Project team
Preparations of service implementation and content creation	Instructions and visual material were completed	9 June 2020	Project team and main library staff
Practical implementation	The shelf and the content were transported to the main library	10 June 2020	Project team, main library staff
Administrative activities at the municipal library	The goods were added to the library's lending system and arranged on a shelf	11–17 June 2020	Main library staff
Opening ceremony	LoT was opened for municipal library customers	18 June 2020	Municipal library staff, residents and local media
Maintenance discussion via e-mail	Focus on how the maintenance of the goods will be assured	September 2020	Main library director, the project team
Communication meeting	Discussion about communication activities to strengthen customers' awareness of the LoT	2 February 2021	Main library director, project team
Meeting about continuation of operations	Discussion about how the municipal library will continue maintenance and possibly upgrade the LoT	12 October 2021	Main library director, the project team

Upon starting the LoT pilot, the assumption was that it would have positive effects related to climate change, that is, that it would reduce GHG emissions. Thus, the effects of the pilot on GHG emissions were assessed. No exact data on CFs of the goods involved were available. Therefore, the CFs were assessed using emission intensities (kg CO₂eq/EUR)

from the environmentally extended input model ENVIMAT conducted for Finland [51]. The emission intensity factors are presented for various consumption classes, and they can be used for rough estimations of items' carbon intensities rather than for calculating exact CFs. As the use of these intensity factors is based on EUR, the values of the items were needed to calculate the CFs. It was decided to use the defined reimbursement values that the customer would have to pay if they did not return the loaned good. Table 2 presents the goods available in the LoT, the used intensity factors, prices of the goods and the number of loans during the first 14 operating months.

Table 2. Goods available in the LoT, the used GHG factors, prices of the goods and number of loans during the first 14 operating months.

COICOP ¹ Class	Factor (kg CO ₂ eq/EUR)	Good	Price (EUR)	Number of Loans
C053 Household appliances	0.4	ice cream maker	65.95	7
		plant drier	55.50	15
		juicer	79	6
		steam juicer	59.90	1
		food processor	92.15	1
		blender	39.90	0
C055 Tools and equipment for house and garden	0.7	drill	89.90	2
		steam cleaner	99	23
		sander	29.95	6
		tree pruner	92.15	0
		sewing machine	99.90	17
		overlock sewing machine	209.90	15
C093 Other recreational equipment, gardens and pets	0.4	tent	64	4
		FigureTwister	6	2
		sleeping pad	21.9	3
		travel bed	78.90	1
		Monopoly	38	1
		Pictionary	34	1
		miniature chess game	14.30	3
		doorway pull-up bar	32	2
		hiking backpack	69.90	8
		Trangia stove	49.90	5
		exercise wheel	6	0
Total			123	

¹ Classification of Individual Consumption According to Purpose.

The environmental impact in terms of GHG reductions was assessed based on information presented in Table 2. If it is assumed that each loan from the LoT reduced the need to buy a new item, the avoided GHG emissions per good can be calculated using Equation (1). The total amount of avoided emissions is presented when the avoided emissions of the loans of each good are summed up. The equation does not consider the possibility of increased driving kilometres.

$$E = p_g * f_c * (n_l - 1) - n_r * p_g * f_c \quad (1)$$

where E is the avoided emissions (kg CO₂eq), p_g is the price of the good (EUR), f_c is the intensity factor of the class (kg CO₂eq/EUR), n_l is the number of loans of the good, and n_r is the number of times the good has been replaced due to, for example, breakage.

3. Results and Discussion

3.1. Process of Creating an LoT in Finland

The LoT examples presented from North America define tight cooperation with the local community [33]. This was also the case in Asikkala. The process of building the LoT can be viewed to have begun by conducting a survey with Päijät-Häme residents and visitors from July to September 2019. The survey aimed to discover rural residents' needs for services and their attitudes and wishes towards the SE. The survey was available via local Facebook groups. The survey could also be completed at a few local summer events, where older people in particular were reached. Altogether, the survey reached 175 residents, including temporary residents, of which 57 represented the municipality of Asikkala. The survey was not designed for the LoT process; it was rather a starting point for a broader project focusing on SE. Questions of the survey related to this paper are listed in Appendix A.

The results of the survey revealed that residents would be interested in loaning or renting cooking, cleaning and gardening equipment and tools either for free or for a fee. Residents were also interested in offering cars, boats and space for overnight stays for a fee.

The survey results were discussed with Asikkala municipal staff who were interested in starting a lending service trial together with the project team. In that meeting, other ways for implementing the device and tool sharing were also discussed; for example, an online platform and a communal potting shed offering gardening tools and a fishing rod available on loan. It was decided that the project team would organise a workshop for residents to find out their opinions about the lending service.

The workshop was organised in November 2019, with 11 residents as attendees. In the workshop, the attendees discussed the location and type of lending service, liability issues when lending from peer-to-peer and what goods they would be willing to offer for loan or rent. Various digital platforms were considered, but as a result, the municipal library was seen as the most appropriate and trustworthy place for organising the lending service.

After the workshop, the project team met with Asikkala municipal staff and the director of the municipal library. In the meeting, the idea of an LoT was developed. At this point, the lending service's title changed to the LoT. The director of the municipal library presented an idea of where the LoT could be located, and the municipal staff proposed that residents could donate goods for the LoT. In the project-steering group's meeting in February 2020, the plans were approved, and the practical implementation of the LoT could begin.

From February to March 2020, another survey was conducted, this time for the municipal library customers. The survey more specifically targeted what goods customers wished the LoT would contain. The survey was physically available in the municipal library, on the library's website and in local Facebook groups. It received 25 responses.

Even with a small sample, the answers began to repeat themselves. A sewing machine, a drilling machine and steam cleaner were requested by several respondents. The responses were discussed with the municipal library staff via e-mail, and a list was drawn of which donations were to be collected. Some of the requested goods were not suitable for a municipal library; for example, a chainsaw was left off the list. The list of requested goods contained a sewing machine, an overlock sewing machine, a textile or steam cleaner, a cordless drill, a surface grinder, a thermal camera, a children's travel cot, board games, a sled, musical instruments, a plant or mushroom dryer, a tent, a Trangia stove, a backpack, a humidity-measuring device, a travel radio, a blender, a wok pan and forest skis.

The collection of goods was implemented through a donation campaign from April to May 2020. The donation campaign was announced on social media and local newspapers. Donors contacted the project team via phone or e-mail, and a time was agreed upon for when the donation could be collected. Due to the COVID-19 pandemic, the donations were collected from outside the donors' houses, without human contact.

After the donations were collected, all the goods were tested, and care was taken to ensure that the original instructions were included with every good. The project team also

prepared additional instructions for cleaning and returning the goods. The project team built a new shelf for the LoT. The municipal library staff wanted the shelf to stand out from the rest of the municipal library's offerings, so the shelf was painted partly green. The project team also purchased storage boxes and add-ons for some goods.

In June 2020, the donations, the shelf, storage boxes, instructions and other materials were transported to the municipal library. The municipal library staff added the goods into the lending system. The opening ceremony of the LoT was held on 18 June 2020.

In general, the LoT works in the same way as the rest of the municipal library: the goods can be loaned for two weeks for free with a library card. The differences are that the goods of the LoT can only be returned to the Asikkala municipal library, not other libraries in Päijät-Häme, and the goods can be reserved only by phone, not over the internet.

After opening the LoT, the maintenance and repair of goods were discussed and considered. After some discussions between the project team and the municipal library, the municipal library made an agreement with a local maintenance service provider to collect and repair the goods if needed. Some goods, including textiles, can be fixed in local youth employment workshops. If some goods cannot be repaired, the municipal library can ask for new goods as donations from the library customers. The decision to send goods for repair is based on customer feedback; the library staff does not test the goods when they are returned.

The social aspects of the LoT were observed by the project and library staff. The first observation was that information about the opening of the library spread rapidly on social media by residents. The LoT was seen as a positive thing, and residents seemed to be proud of the new service—after all, some residents had been involved in its design and had donated items to it. In addition, the local media were interested in this CE solution and its close relationship with the residents. At the end of the project, it was stated that the information about the LoT's presence had reached the residents well. This interpretation was made on the following grounds: When the project team presented the LoT at local events, about one-third of the residents already knew about the existence of the LoT. In discussions with local nongovernmental organisations, their view was that the LoT was well-known. The project-steering group saw that the project had been successful in its communication.

Municipal library staff and a sample of 13 library customers were interviewed after the library had been running for about eight months. From the perspective of both the staff and customers, the LoT was seen as a positive addition to the municipal library. The staff said customers had told them that the LoT allowed some products to be tested before making a purchase decision. Additionally, some customers decided not to buy a product because they were able to borrow it. By using the LoT, the customers' interest in the SE, that is, borrowing goods instead of buying, had grown. Overall, residents felt that the library was useful to both themselves and the community. The results related to social benefits are similar to those highlighted in earlier research (e.g., [40,42]).

After the LoT had been in operation for more than a year, there was a feedback discussion with the municipal library about continuing the operation. In just over a year, the library's experiences with the LoT had been largely positive. Of the items borrowed, only the sewing machine had been out of order a few times, but replacing the sewing machine with a new one had eliminated these problems. The LoT had brought new customers to the library and it was perceived overall as a nice addition to the library.

For now, the municipal library will continue with the LoT operation. When discussed at the feedback session, renewing or updating the selection of goods was not seen as necessary at that moment; however, if the municipal library wants to do so in the future, collecting goods as donations was seen as a good idea.

From the point of view of the municipal library, LoT is seen as a valuable addition to the library's operations and is considered to have brought new customers to the library. The library wanted to carry out a donation campaign in cooperation with another party, so that residents would not donate unusable goods directly to the library. The library's view

is that the goods borrowed would preferably be easy to use, making it easy for library staff to determine when the goods require repair or maintenance and when the customer has not been able to use the goods. The LoT has aroused interest in borrowing goods in other libraries, which has also brought the library a positive reputation.

To strengthen the residents' awareness of the LoT, the project team, together with the municipal library staff, planned communication activities in February 2021. The project team implemented a poster for the library and municipal information boards. In addition, the project team filmed and published a video for social media, where the LoT was introduced.

In the example of Hillsboro, it was explained that the city grounded the collection of things in the library's strategic plan to "stimulate the imagination and provide leisure activities and experiences" for the citizens [41]. Additionally, in Asikkala, the next steps could be to include the development of the LoT in the library's and municipality's strategic development by supporting the CE and SE. The example of a public actor implementing the SE can increase citizens' local interest in developing sustainable lifestyles.

The economic impact of the LoT was not studied, as, in this case, no turnover is generated or expected when the LoT is operated by a public actor. On an individual level, the financial impact is reflected in the fact that residents are saving money by using the LoT. However, this could even have a negative effect on the turnover of companies if residents do not buy some products. In contrast, in the small municipality of Asikkala, it may not be possible to obtain all the LoT's items. In this case, residents would, for example, order similar products online from large companies, which does not benefit regional companies. In this case, the economic impacts are not large, as the Asikkala municipality is small and loan volumes are small. One relevant point of view from the perspective of economic sustainability is that the LoT supports local repair services when maintaining the quality of the goods.

3.2. Assessing GHG Emission Reductions of the LoT

Assuming that, with each loan, the purchase of (i.e., manufacturing) a new good was avoided, the total sum of avoided GHG emissions would be 5752 kg CO₂eq. The GHG emission reductions achieved via the five most often loaned items are presented in Figure 1. This value includes replacing the sewing machine, which broke down once and was replaced. However, it is unlikely that a goods purchase was actually avoided with each loan. Even if it was assumed that buying a new item was avoided with 50% of the loans, the avoided GHG emissions would be 2876 kg CO₂eq. As the emissions of goods are estimated based on their prices and intensity factors, these are only rough estimations. There are, however, some existing LCA studies on household appliances according to which the CF of a vacuum cleaner is approximately 40 kg CO₂eq [52], the CF of an electric kettle is approximately 10 kg CO₂eq [53] and the CF of a coffee machine is 8–30 kg CO₂eq [54]. In comparison, when using the prices and intensity factors, the CF of a blender is 20 kg CO₂eq, and the CF for an ice cream machine is 33 kg CO₂eq. For the more expensive goods, the CFs are possibly somewhat overestimated when using intensity factors. For example, the CF of a sewing machine is 70 kg CO₂eq, and the CF of a drill is 63 kg CO₂eq, while Concito [36] estimated the CF of a drill to be 28 kg CO₂eq.

It is worth noting that the LoT might have caused some additional GHG emissions in the form of transportation, as it is possible that people drove to the library to borrow items. If it is assumed that each person drove a 20 km roundtrip to the library, the total driven kilometres would have been 2460. Using an emission factor of 178.5 g CO₂eq/km, which includes emissions from fuel production [55], the emissions caused by driving would be 439 kg CO₂eq. This is noticeably lower than the avoided GHG emissions. Makov et al. [35] had similar results, where the added travel did not outweigh the climate benefits of food sharing, except for in the worst-case added-travel scenario. In the case of some goods, it is, however, possible that additional transportation leads to overall increasing GHG emissions. For example, if customers drive long distances to loan a good with low carbon intensity, it

might be better from a GHG emission perspective for the customers to buy the items rather than loan them. However, from a raw materials perspective, using LoT would be better. In addition to increased transportation kilometres, GHG impacts from, for example, servicing the goods, were not considered in the calculations.

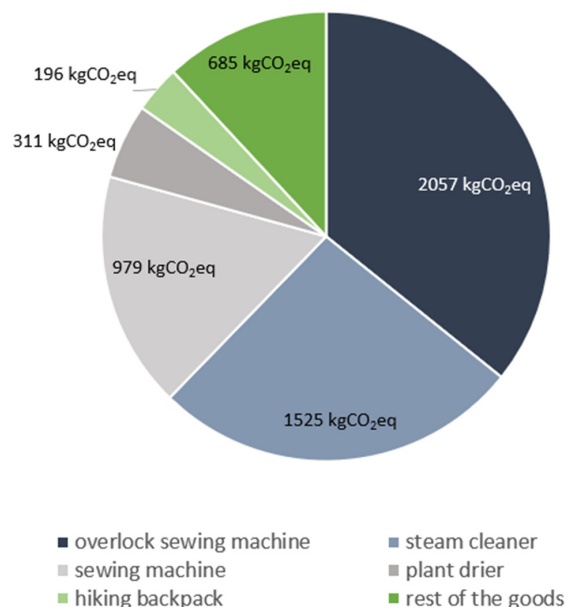


Figure 1. Avoided GHG emissions via the five most often loaned goods during the 14-month period.

As discussed in previous research [32,35,36,38], the LoT may cause rebound effects similar to those of other SE services. Instead of spending money on goods, customers of the LoT have an opportunity to borrow goods free of charge. This leads to economic savings, and customers have more money available to spend on other goods and services or for investments. The magnitude of the rebound effect is highly dependent on what the saved money is used for. In future research, a point of interest would be to further study the rebound effects of LoTs.

The LoT may have caused some additional reductions in GHG emissions. For example, borrowing a sewing machine may have made it possible to repair or remodel an already existing piece of clothing, and thus, buying a new one may have been avoided. Only impacts on GHGs were assessed. The LoT likely has positive impacts on other environmental areas, such as land use change and acidification, due to the lower demand for raw material- and production-related energy.

As mentioned, the LoT was implemented in a small municipality of 8000 people. If similar services are created in other municipalities, more significant reductions in greenhouse gas emissions can be achieved. The total number of loans was 123. If it is assumed that each loan was made by a different person, the percentage of residents using the LoT in Asikkala was 1.5%. As Finland's population is 5,548,000 [56], in Finnish level this would equal 85,300 potential users. If, on average, each user would avoid GHG emissions as much as customers in Asikkala, the total avoided emissions would be 3989 t CO₂eq if it was assumed that with each loan, manufacturing a good was avoided and no additional driving was considered.

This example suggested that the LoT also improved the communality of the residents. As the LoT creates both ecological and social sustainability, municipalities and local governments could recommend and support the launch of similar services elsewhere to support sustainability change. As in this case, public libraries could act as administrators of the LoTs. Cities, municipalities, or, for example, publicly owned housing associations could also operate the LoTs.

In larger cities, interest in borrowing or renting goods may be higher than in rural areas due to limited storage capacity. When consumers have a good experience of borrowing, their interest in borrowing or renting goods instead of buying them may increase. This creates a foundation for the growth of the rental businesses, which supports the transition to a sustainable circular economy.

4. Conclusions

This paper presents the process of creating the new service, an LoT, in close interaction with local residents, and a study of environmental impacts of the LoT. This LoT was one of the first goods-lending services in rural Finland. According to the case study, there is interest and demand for the service, and residents perceive it as a positive addition to the municipal library's offering. In this case study, a donation campaign was used to collect the goods which, as far as the authors are concerned, was a new implementation in Finland. The goods-collection campaign was very successful. Smooth and transparent communication and co-operation with the municipality was important in the implementation of the campaign.

The LoT has achieved positive environmental impacts by avoiding GHG emissions. If it is assumed that, with each loan, the manufacturing of a new good was avoided, the total amount of avoided GHG emissions would have been 5752 kg CO₂eq. However, it is unlikely that all customers would have bought the goods for themselves. Possible additional driving and rebound effects also lower the amount of avoided GHG emissions to some extent. Studying the rebound effects in more detail would be a point of interest in further research. Similarly, as only GHG emissions were considered in this study, how LoTs affect other environmental impacts and material usage could be studied in future. In the current study, the carbon footprints of products were estimated based on carbon intensity factors, which affect the results. More accurate results would be achieved with exact carbon footprints as well as with data on avoided purchases and additional driven kilometres.

It strongly seems that the LoT has locally achieved positive social impacts. The LoT provides individual well-being and contributes to building social capital and strengthening social relations between local actors. Its economic impact has not been studied. In this case, no turnover is generated, as the LoT is operated by a public actor.

When creating and researching similar services more broadly, it would be interesting to examine in more detail how LoTs and similar goods-lending services affect the social well-being and community spirit of residents, and how such well-being could be further developed through supporting activities or services.

Sustainability awareness is increasing in society, and the SE is one example of this development. Sharing and the SE have the potential to contribute to sustainable development from the point of view of economic, social and environmental responsibility. All the sustainability aspects can motivate citizens from different perspectives. The case study of an SE implementation process in a small Finnish municipality, Asikkala, included citizens and central stakeholders who built a joint understanding of a more sustainable way of life. The LoT created during the process supported environmental sustainability, and the implications of the social benefits were also promising. In the shift towards the CE supported by the SE, public actors can serve as trailblazers by providing new services for local citizens. For example, as the LoT introduces the services of the SE, residents are more likely to be motivated to use paid rental services, which can support the sustainability transition.

Author Contributions: Implementing the LoT, K.T.; designing and analysing the survey, A.C. and K.T.; environmental assessment, A.C.; writing—original draft preparation, A.C., K.T. and S.V.; and writing—review and editing, S.V. and A.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was supported by the European Agricultural Fund for Rural Development through the Centre for Economic Development, Transport and the Environment in the Häme Region, Finland.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Not applicable.

Acknowledgments: We were very grateful to the European Agricultural Fund for Rural Development through the Centre for Economic Development, Transport and the Environment in the Häme Region, Finland.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses or interpretation of the data; in the writing of the manuscript; or in the decision to publish the results.

Appendix A

Questions from the survey used for background of the LoT process.

1. I am ...
 - a. Summer resident in Asikkala
 - b. Summer resident in Hollola
 - c. Resident of Asikkala
 - d. Resident of Hollola
 - e. I live elsewhere in a city
 - f. I live elsewhere in rural areas
2. Could you offer something for people living nearby? In the following questions we are mapping out which goods/spaces/skills you could offer to others, either for free or for a fee? Answering options include no/for free/for a fee.
 - a. I could offer ...
 - (a) Extra living space, also for spending nights
 - (b) Extra living space during daytime
 - (c) Extra storage space (incl. vehicles)
 - (d) Space for eg. woodworking or vehicle repairing
 - (e) Space in the garden
 - (f) Sauna
 - b. I could offer ...
 - (a) A car
 - (b) A boat
 - (c) A motorcycle
 - (d) An ATV
 - (e) Gardening tools
 - (f) Trailer
 - (g) Tools
 - (h) Cooking tools such as plant drier or juicer
 - (i) Cleaning tools such as steam cleaner
3. Which goods you would like to loan for yourself? Answering options include no/for free/for a fee.
 - c. A car
 - d. A boat
 - e. A motorcycle
 - f. An ATV
 - g. Gardening tools
 - h. Trailer
 - i. Tools
 - j. Cooking tools such as plant drier or juicer
 - k. Cleaning tools such as steam cleaner

References

- Henry, M.; Schraven, D.; Bocken, N.; Frenken, K.; Hekkert, M.; Kirchherr, J. The Battle of the Buzzwords: A Comparative Review of the Circular Economy and the Sharing Economy Concepts. *Environ. Innov. Soc. Transit.* **2021**, *38*, 1–21. [CrossRef]
- Closing the Loop—An EU Action Plan for the Circular Economy. Available online: <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52015DC0614> (accessed on 10 March 2022).
- A New Circular Economy Action Plan. For a Cleaner and More Competitive Europe. Available online: <https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1583933814386&uri=COM:2020:98:FIN> (accessed on 10 March 2022).
- Fitch-Roy, O.; Benson, D.; Monciardini, D. Going around in circles? Conceptual recycling, patching and policy layering in the EU circular economy package. *Environ. Politics* **2020**, *29*, 983–1003. [CrossRef]
- Vanhamäki, S.; Virtanen, M.; Luste, S.; Mankinen, K. Transition towards a circular economy at a regional level: Case study on closing biological loops. *Resour. Conserv. Recycl.* **2020**, *156*, 104716. [CrossRef]
- Towards the Circular Economy Vol. 1: An Economic and Business Rationale for an Accelerated Transition. Available online: <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf> (accessed on 9 March 2022).
- Ghisellini, P.; Cialani, C.; Ulgiati, S. A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *J. Clean. Prod.* **2016**, *114*, 11–32. [CrossRef]
- Kirchherr, J.; Reike, D.; Hekkert, M. Conceptualizing the circular economy: An analysis of 114 definitions. *Resour. Conserv. Recycl.* **2017**, *127*, 221–232. [CrossRef]
- Heinrichs, H. Sharing economy: A potential new pathway to sustainability. *GAIA Ecol. Perspect. Sci. Soc.* **2013**, *22*, 228–231. [CrossRef]
- Liu, X.; Chen, H. Sharing Economy: Promote Its Potential to Sustainability by Regulation. *Sustainability* **2020**, *12*, 919. [CrossRef]
- Merli, R.; Preziosi, M.; Acampora, A. How do scholars approach the circular economy? A systematic literature review. *J. Clean. Prod.* **2018**, *178*, 703–722. [CrossRef]
- Korhonen, J.; Honkasalo, A.; Seppälä, J. Circular economy: The concept and its limitations. *Ecol. Econ.* **2018**, *143*, 37–46. [CrossRef]
- Lazarevic, D.; Valve, H. Narrating expectations for the circular economy: Towards a common and contested European transition. *Energy Res. Soc. Sci.* **2017**, *31*, 60–69. [CrossRef]
- Martin, C.J. Sharing Economy: A Pathway to Sustainability or a Nightmarish Form of Neoliberal Capitalism? *Ecol. Econ.* **2016**, *121*, 149–159. [CrossRef]
- Belk, R. Sharing Versus Pseudo-Sharing in Web 2.0. *Anthropologist* **2014**, *18*, 7–23. [CrossRef]
- Markman, G.D.; Lieberman, M.; Leiblein, M.; Wei, L.Q.; Wang, Y. The Distinctive Domain of the Sharing Economy: Definitions, Value Creation, and Implications for Research. *J. Manag. Stud.* **2021**, *58*, 927–948. [CrossRef]
- Boar, A.; Bastida, R.; Marimon, F. A Systematic Literature Review. Relationships Between the Sharing Economy, Sustainability and Sustainable Development Goals. *Sustainability* **2020**, *12*, 6744. [CrossRef]
- Schlagwein, D.; Schoder, D.; Spindeldreher, K. Consolidated, systemic conceptualization, and definition of the “sharing economy”. *J. Assoc. Inf. Sci. Technol.* **2020**, *71*, 817–838. [CrossRef]
- Mi, Z.; Coffman, D. The sharing economy promotes sustainable societies. *Nat. Commun.* **2019**, *10*, 1214. [CrossRef] [PubMed]
- Sutherland, W.; Jarrahi, M.H. The sharing economy and digital platforms: A review and research agenda. *Int. J. Inf. Manag.* **2018**, *43*, 328–341. [CrossRef]
- Fuster Morell, M.; Espelt, R.; Renau Cano, M. Sustainable Platform Economy: Connections with the Sustainable Development Goals. *Sustainability* **2020**, *12*, 7640. [CrossRef]
- Xu, X.; He, Y.; Ji, Q. Collaborative logistics network: A new business mode in the platform economy. *Int. J. Logist. Res. Appl.* **2022**, *25*, 791–813. [CrossRef]
- Gobble, M.M. Regulating innovation in the new economy. *Res. Technol. Manag.* **2015**, *58*, 62–67. [CrossRef]
- Geissdoerfer, M.; Savaget, P.; Bocken, N.M.P.; Hultink, E.J. The Circular Economy—A New Sustainability Paradigm? *J. Clean. Prod.* **2017**, *143*, 757–768. [CrossRef]
- World Commission on Environment and Development. Report of the World Commission on Environment and Development: Our Common Future. *United Nations*. Available online: <https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf> (accessed on 8 April 2022).
- Ober, J.; Karwot, J. Pro-Ecological Behavior: Empirical Analysis on the Example of Polish Consumers. *Energies* **2022**, *15*, 1690. [CrossRef]
- Arnold, O.; Kibbe, A.; Hartig, T.; Kaiser, F.G. Capturing the Environmental Impact of Individual Lifestyles: Evidence of the Criterion Validity of the General Ecological Behavior Scale. *Environ. Behav.* **2018**, *50*, 350–372. [CrossRef]
- Joshi, Y.; Rahman, Z. Factors Affecting Green Purchase Behaviour and Future Research Directions. *Int. Strategy Manag. Rev.* **2015**, *3*, 128–143. [CrossRef]
- Cherry, C.E.; Pidgeon, N.F. Is sharing the solution? Exploring public acceptability of the sharing economy. *J. Clean. Prod.* **2018**, *195*, 939–994. [CrossRef]
- Jelinkova, M.; Tetreva, L.; Vavra, J.; Munzarova, S. The Sharing Economy in the Context of Sustainable Development and Social Responsibility: The Example of the Czech Republic. *Sustainability* **2021**, *13*, 9886. [CrossRef]
- Plewnia, F.; Edeltraud, G. Mapping the Sharing Economy for Sustainability Research. *Manag. Decis.* **2018**, *56*, 570–583. [CrossRef]

32. Akbari, M.; Foroudi, P.; Khodayari, M.; Fashami, R.Z.; Shahabaldini, Z.; Shahriari, E. Sharing Your Assets: A Holistic Review of Sharing Economy. *J. Bus. Res.* **2022**, *140*, 604–625. [\[CrossRef\]](#)
33. Tussyadiah, I.P.; Pesonen, J. Impacts of peer-to-peer accommodation use on travel patterns. *J. Travel Res.* **2016**, *55*, 1022–1040. [\[CrossRef\]](#)
34. Schor, J. Debating the sharing economy. *J. Self-Gov. Manag. Econ.* **2016**, *4*, 7–22.
35. Makov, T.; Shepon, A.; Krones, J.; Gupta, C.; Chertow, M. Social and environmental analysis of food waste abatement via the peer-to-peer sharing economy. *Nat. Commun.* **2020**, *11*, 1156. [\[CrossRef\]](#) [\[PubMed\]](#)
36. Deleøkonomiens Klimapotentiale. Available online: https://concito.dk/files/dokumenter/artikler/deleøkonomi_endelig_100615_2.pdf (accessed on 29 March 2022).
37. Lettenmeier, M.; Liedtke, C.; Rohn, H. Eight Tons of Material Footprint—Suggestion for a Resource Cap for Household Consumption in Finland. *Resources* **2014**, *3*, 488–515. [\[CrossRef\]](#)
38. Makov, T.; Font Vivanco, D. Does the Circular Economy Grow the Pie? The Case of Rebound Effects from Smartphone Reuse. *Front. Energy Res.* **2018**, *6*, 39. [\[CrossRef\]](#)
39. Aznar, J.P.; Sayeras, J.M.; Rocafort, A.; Galiana, J. The irruption of Airbnb and its effects on hotel profitability: An analysis of Barcelona's hotel sector. *Intang. Cap.* **2017**, *13*, 147–159. [\[CrossRef\]](#)
40. Baden, D.; Peattie, K.; Oke, A. Access Over Ownership: Case Studies of Libraries of Things. *Sustainability* **2020**, *12*, 7180. [\[CrossRef\]](#)
41. Lax, B. What Are These Things Doing in the Library? How a Library of Things Can Engage and Delight a Community. *OLA Q.* **2020**, *26*, 54–61. [\[CrossRef\]](#)
42. Söderholm, J. Borrowing Tools from the Public Library. *J. Doc.* **2016**, *72*, 140–155. [\[CrossRef\]](#)
43. Ameli, N. Libraries of Things as a new form of sharing. Pushing the Sharing Economy. *Des. J.* **2017**, *20*, S3294–S3304. [\[CrossRef\]](#)
44. Hinku Network—Towards Carbon Neutral Municipalities. Available online: <https://www.hiilineutraalisuomi.fi/en-US/Hinku> (accessed on 8 April 2022).
45. Ilmastotyö. Available online: <https://asikkala.fi/asuminen-ja-ymparisto/ymparistonsuojelu/ilmastotyö/> (accessed on 18 March 2022).
46. Maallemuuttajat 2030. Available online: <https://www.lab.fi/en/project/maallemuuttajat-2030> (accessed on 18 March 2022).
47. Yin, R.K. *Case Study Research: Design and Methods*, 5th ed.; SAGE Publications: Los Angeles, CA, USA, 2014.
48. Yin, R.K. *Case Study Research and Applications: Design and Methods*, 6th ed.; SAGE Publications: Los Angeles, CA, USA, 2018.
49. Eisenhardt, K.M.; Graebner, M.E. Theory building from cases: Opportunities and challenges. *Acad. Manag. J.* **2007**, *50*, 25–32. [\[CrossRef\]](#)
50. Lune, H.; Berg, B.L. *Qualitative Research Methods for the Social Sciences*; Pearson: Harlow, UK, 2017.
51. Nissinen, A.; Savolainen, H. *Julkisten Hankintojen ja Kotitalouksien Kulutuksen Hiilijalanjälki ja Luonnonvarojen Käyttö*; Finnish Environment Institute: Helsinki, Finland, 2019; p. 59.
52. Gallego-Schmid, A.; Mendoza, J.M.F.; Jeswani, H.K.; Azapagic, A. Life cycle environmental impacts of vacuum cleaners and the effects of European regulation. *Sci. Total Environ.* **2016**, *559*, 192–203. [\[CrossRef\]](#)
53. Gallego-Schmid, A.; Mendoza, J.M.F.; Jeswani, H.K.; Azapagic, A. Life cycle environmental evaluation of kettles: Recommendations for the development of eco-design regulations in the European Union. *Sci. Total Environ.* **2018**, *625*, 135–146. [\[CrossRef\]](#) [\[PubMed\]](#)
54. Brommer, E.; Stratmann, B.; Quack, D. Environmental impacts of different methods of coffee preparation. *Int. J. Consum. Stud.* **2011**, *35*, 212–220. [\[CrossRef\]](#)
55. Claudelin, A.; Uusitalo, V.; Kareinen, E.; Callahan, S.; Efe, M.; Hakan, M. *The Carbon Footprint Calculation Model for the CAMPAIGNers app. Deliverable 2.1 of the CAMPAIGNers Project Funded under the European Union's Horizon 2020 Research and Innovation Programme*; GA No: 101003815; European Commission: Brussels, Belgium, 2022; in press.
56. Statistics Finland. Population and Society. Available online: https://www.stat.fi/tup/suoluk/suoluk_vaesto_en.html#Population%20structure%20on%2031%20December (accessed on 22 May 2022).