Aalto University
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Calculating and Tracking the Environmental Impact of Everyday

An overview of Finnish footprinting tools

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Abstract

Considering efforts to mitigate the negative impact of human activities on the environment, a strong emphasis from all three sectors, in Finland and internationally, has lately been turned toward carbon footprint calculators. Calculators represent a branch of communication methods which aim to foster knowledge of individuals' environmental impact and to change consumption habits. The variety of different types of calculators are in this thesis called footprinting tools (FPT).

In Finland, footprinting tools targeted to individuals have existed already for two decades, but it is yet unclear what their actual effect on making our lifestyles more environmentally friendly are, or what kind of different ways they use for fostering awareness and provoking sustainable action. To guide the development of current and future footprinting tools, this thesis aims at building an overview of the different characteristics of Finnish footprinting tools and discuss their key differences and similarities. Additionally, the study presents suggestions for FPT development according to the results of the analysis of the tools. The study is conducted by analyzing currently available footprinting tools with an adaptation of textual and visual grounded theory method. In total 37 currently active tools were examined during the study.

The key findings of the study remark, that Finnish citizens are offered a broad variety of online tools. It seems, that despite providing a seemingly similar service, each FPT has a unique purpose and they utilize different types of features and functionalities to provide information and provoke action. The key differences in the methods which tools use can be found by comparing calculators and trackers, calculators being tools which require consumption data input from the user, and tracker representing the types of tools which utilise consumption databases for generating personalized information of individuals environmental impact. Since footprinting tools can be built to fit every need, the suggestion for FPT development focuses on guiding tool concept design to best fits tool host goals and resources, and to take into consideration the common pitfalls of FPT's.

Implications of this study are valuable for both research and practice. For instance, an overview of Finnish footprinting tools has not been made in earlier research as extensively as was done in this thesis. Both the list of existing tools and the analysis of their characteristics can be valuable for further research on Finnish and potentially international FPT's. In practice, this study is useful for organizations who aim to use and develop FPT's. Organizations can use the results of this study as a toolbox of different footprinting tool features and functionalities, which can help them in the development of a tool which best supports their goals.

Keywords Overview, Finland, footprinting tools, environmental awareness, sustainable lifestyles, grounded theory

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Abstrakti

Ihmistoiminnan aiheuttamien negatiivisten ympäristövaikutusten ratkaisemisessa on viime aikoina saanut vahvasti huomiota, sekä Suomessa että kansainvälisesti, hiilijalanjälkilaskurit. Laskurit edustavat viestinnällisiä välineitä, jotka pyrkivät edistämään yksilöiden tietoisuutta ympäristövaikutuksestaan ja tiedostamisen kautta muuttamaan kulutustapojaan. Joukkoa erilaisia laskureita kutsutaan tässä Pro gradu -tutkielmassa jalanjälkityökaluiksi (footprinting tool, FPT).

Suomessa jalanjälkityökaluja on tarjottu yksilöille jo noin 20 vuotta, mutta työkalujen todellisesta vaikutuksesta ympärisöongelmien ratkaisuun ei ole varmuutta. Samoin tietoa kaikista työkalujen käyttämistä tiedon levittämisen keinoista ja kestäviin elämäntapoihin kannustavista toiminnallisuuksista ei ole jäsennelty kattavasti, vaikka aikaisempaa tutkimusta työkaluista on saatavilla laajalti. Jalanjälkityökalujen kehittämisen tueksi tämä tutkielma pyrkii rakentamaan yleiskatsauksen suomalaisten työkalujen ominaisuuksista ja esittelemään laskureiden eroavaisuuksia ja yhtäläisyyksiä. Lisäksi, tutkielma esittää tuloksiin perustuen suosituksia jalanjälkityökalujen suunnitteluun. Tutkielma on toteutettu hyödyntäen ja yhdistäen visuaalista ja tekstuaalista grounded theory -menetelmää. Tutkielmassa tarkasteltiin yhteensä 37 aktiivista jalanjälkityökalua.

Tutkielman keskeisenä tuloksena voidaan esittää, että suomalaisille on tarjolla laaja kattaus erilaisia netissä käytössä olevia jalanjälkityökaluja. Vaikka työkalut tarjoavat näennäisesti samankaltaisia palveluita, jokaisella työkalulla on oma tarkoituksensa ja ne hyödyntävät erilaisia ominaisuuksia tiedon tarjoamiseen ja kestäviin elämäntapoihin siirtymiseen. Keskeisimmät eroavaisuudet voidaan havaita laskureiden ja seurantatyökalujen välillä. Laskurit ovat työkaluja, joihin käyttäjät itse syöttävät omat kulutustietonsa, kun taas seurantatyökalut hyödyntävät erilaisia tietokantoja yksilöllisen ympäristövaikutuksen laskentaan. Koska työkaluja voidaan rakentaa lukuisilla tavoilla vastaamaan kulloiseenkin tarpeeseen, suositus työkalujen suunnitteluun sisältää ohjeistuksen työkalujen konseptin suunnitteluun tavalla, joka parhaiten vastaa työkalun tekijän tavoitteita ja resursseja. Ohjeistukset ottavat huomioon myös tutkimuksissa havaitut työkalujen yleisimmät heikot kohdat.

Tutkielman tuloksilla on käyttökohteita jalanjälkityökalujen tutkimuksessa ja toteutuksessa. Yhtä laajaa katsausta suomalaisiin laskureihin ei ole aikaisemmin tehty, jolloin esimerkiksi käytössä olevien työkalujen listausta ja niiden ominaisuuksia käsittelevän analyysin tuloksia voi hyödyntää suomalaisten tai kansainvälisten laskureiden jatkotutkimuksessa. Käytännössä tutkielman tulokset ovat hyödyllisiä jalanjälkityökaluja kehittäville organisaatioille. Erilaiset toimijat voivat käyttää tutkielman tuloksia jalanjälkityökalujen ominaisuuksien työkalupakkina, jonka avulla organisaatiot voivat paremmin saavuttaa tavoitteensa.

Hakusanat Yleiskatsaus, Suomi, jalanjälkityökalut, ympäristötietoisuus, kestävät elämäntavat, grounded theory

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Abbreviations

FPT	Footprinting tool, in this context always meaning tools targeted for individuals
FPT host	Footprinting tool host
GT	Grounded theory

1. Introduction

Various environmental hazards originating to human activity endanger life on earth. Through the past decades, measures taken toward mitigating human impact on the environment have often failed, despite local and global successes. The need for developing the current and new policy measures, sustainable businesses, and grassroots movements stay urgent, and as there are plenty of different environmental hazards, not only one solution can solve the interlinked global urgencies the concept of planetary boundaries aim to depict.

Since research shows that negative environmental impacts, especially carbon emissions causing climate change, are in great measures generated by the consumption of households (Ivanova, Stadler, Steen-Olsen, & Wood, 2015) many campaigns and projects are drawing their attention to accelerating change within the households (in Finland e.g. Vähähiilinen huhtikuu, Sustainable lifestyles Accelerator, Energise). A number of projects have utilized footprinting tools in order to raise environmental awareness and allowing individuals and households to relate the impact of their own lifestyle on the environment. Footprinting tools, more commonly known as footprint calculators, are considered as soft policy measures (Salo, Mattinen-Yuryev, & Nissinen, 2019), Green Information Systems (Buhl, Liedtke, Teubler, Schuster, & Bienge, 2019) and eco-feedback technologies (Andersson, 2020), all contextualizing FPT's as communicational measures which can be used for sharing knowledge and supporting a sustainable lifestyle change.

Footprinting tools are also a common communicational strategy amongst sustainability marketing of compensation services and different types of products and services, which is possible due to the flexibility of the structure of FPT's. Despite the similar overall goal of FPT's provided by different types of organizations (Salo et al., 2019), there are as many ways to construct a footprinting tool as there are footprinting tools. Firstly, tools can focus on communicating different environmental issues from global climate change, as personal carbon footprint, to raising awareness of the contamination of the local environment, for example as Baltic Sea footprint. Secondly, tools can be targeted to different audiences, varying from the entire population of a nation to specific groups such as people interested in cars, or people who are about to purchase a car. Thirdly, along with the personalized calculation of individuals environmental impact, for instance, FPT's provide other sustainability-related information and variety of methods for engaging users, such as tips and pledges (Salo et al., 2019) and carbon trading (Kuokkanen et al., 2020).

Despite the remarkable popularity of particular tools, such as Sitra's Elämäntapatesti, hesitation of FPT's actual impact on individuals' consumption habits has been expressed (Biørn-Hansen, Barendregt, & Andersson, 2020). Impact of FPT's have been condemned, since gaining information does not necessarily result as voluntary lifestyle changes (Buhl, Liedtke, Teubler, & Bienge, 2019), while FPT's might fail at providing enough or the right type of information to help people to initiate change in their everyday lives (Salo et al., 2019). In general, footprinting tools have been criticized for focusing on individuals responsibility to solve environmental issues (Manninen, 2017), a critique arguing against the approach of considering households and individuals as key agents of sustainability transition. Other criticism considers, for instance, the reliability of the calculation results (Biørn-Hansen et al., 2020; Manninen, 2017; Nuotiomäki, 2019), and ability to reach those user segments whose consumption mitigation would have the most significant impact – individuals and households with highest footprints (Biørn-Hansen et al., 2020; Buhl, Liedtke, Teubler,

& Bienge, 2019; Buhl, Liedtke, Teubler, Schuster, et al., 2019).

In Finland, footprinting tools targeted to individuals have existed already for two decades. The key observation of literature considering Finnish FPT's is, that a broad overview of Finnish FPT's has not been made and that there is a request for such review (Lounasheimo, Nissinen, Hämäläinen, & Seppälä, 2019). Finnish tools have been reviewed mostly in theses or reports, while specific tools or selections of Finnish FPT's have been studied only in a small number of articles (Kuokkanen et al., 2020; Lyytimäki, Vikström, & Furman, 2019; Salo et al., 2019). In this thesis, the aim is to respond to this gap in the literature, by examining what Finnish footprinting tools are currently available for individuals. In order to examine how footprinting tools could better meet their goals, this thesis also aims at creating an overview of the characteristics of the current Finnish FPT's. Results of the analysis are then used for providing suggestions for further FPT design and development. The research questions are:

1. What Finnish FPT's there are?
2. What characteristics Finnish FPT's have?
3. How Finnish FPT's could be better designed to meet their goals?

The search of the tools provided a list of 37 currently available tools. All 37 tools were analysed by an adaptation of the visual and textual grounded theory method. Adaptation of Konecki's (2011) multislice imagining process was combined with grounded theory guidelines presented by Charmaz (2006), in order to be able to analyse the entanglement of visual and textual information which footprinting tools consist of. The study is based on analysing screenshots taken from the footprinting tools and downloaded pdf documents included in the tools. After the creation of tentative core categories, tools were examined directly from websites and applications. The scope of the analysis is framed to studying FPT's on websites and mobile applications, excluding their broader environment considering for example social media, and use in education or other events in the physical world. The approach of the analysis was to examine the tools as the user experiences them.

In the following chapters, I will present a compact literature review, focusing on a short review of the existing literature on Finnish footprinting tool and exploring key findings which formed the setting for the grounded theory study and guided the development of the design implications. Then, I present in detail the methodology, data-gathering and analysis conducted in this thesis. These chapters consider specifically the analysis of the current Finnish FPT's. Results of the analysis are then presented in chapter 6. In chapter 7, I present the type of design implications I decided to formulate based on the results, and how I combined results with notions from existing literature. Lastly, in chapter 8 I summarise the key findings of this study and present perspectives for future research.

2. Literature review

This chapter summarizes how literature was used in this thesis and presents a selection of relevant studies concerning the three research questions. In the first section (2.1.) I explore the existing literature relating to the Finnish footprinting tools, and in the latter two parts, I present findings also a few relevant texts consider tools in general or used in other countries. The two latter parts also present how the literature affected and directed the GT analysis, data-gathering process, and development of design implications (see chapter 7).

As will be presented in more detail in Chapters 3, 4 and 5, the method used in this thesis is grounded theory. In GT, depending on the branch of the method, the literature review can be done only after the analysis, or before the analysis to avoid reinventing existing theories. According to Charmaz (2006), the purpose of delaying the literature review is to "*avoid importing preconceived ideas and imposing them on your work*", and focusing on ideas which emerge from the data. Charmaz also describes that the role of literature review in GT studies can be to evaluate earlier studies and reveal knowledge gaps, or for instance, frame the results of the analysis and position a study.

In this thesis, literature was reviewed before the analysis to gain an understanding of how the subject has been studied previously, and what research gaps previous studies present. Literature was also used as an inspiration for the ways of answering the second research questions (What characteristics Finnish FPT's have?), as presented later in this chapter (2.2.). After the analysis, I turned back to the literature to compare my results to the previous findings.

2.1. Reflections on the literature review

Before the analysis, I conducted a literature search considering especially those Finnish footprinting tools that I had found by the date. The search was made in Scopus and Google Scholar from February 2nd to February 29th, 2020, including texts in Finnish and in English. As usual, not all findings were relevant. When beginning the search, I formulated three basic rules for the validation of the relevance of the texts, including 1) found text studies a Finnish FPT tool or a group Finnish FPT's, 2) text does not study a Finnish FPT but offers relevant information of a tool, and 3) a Finnish FPT has been used as a reference in a way which provides insight of the tool. These boundaries were considered when selecting literature for the review.

The findings of the search include for example journal articles, reports, book chapters, and theses from different subject fields. The majority of the found literature is thesis works, made mostly in Finnish universities, while only few reports, journal articles, or book sections (available online) have referred to Finnish FPT's or studied them specifically. The role of the tools varies a lot in the texts. For example, tools can be the main subject of a study, or they might be only referred to as a source when the tool has been used as a source of emission related data. During this initial literature review, I found only 9 journal articles, which refer to or study Finnish FPT's. At this point, I wanted to focus on Finnish tools, since they are the topic of this study, and excluded other studies on footprinting tools in general.

Most relevant articles for this thesis are those, which study one or many Finnish footprinting tools. Studies by Kuokkanen et al. (2020) on *CitiCAP* and (Lyytimäki et al., 2019) on *Sitoumus2050* study one FPT and its development. Similarly, Andersson (2020) examines a Swedish FPT *Svalna* and refers shortly to a couple of Finnish FPT's (*My Carbon Action* and Nordea's mobile

bank application). As this thesis aims to create an overview, also studies which examine multiple tools are highly relevant, such as analysis on 10 different Nordic lifestyle FPT's by (Salo et al., 2019). Less relevant studies are those, which merely describe one tool (Lyytimäki, 2014; Salo et al., 2016), or which use FPT's as a source of information (S. Baumeister, 2017; Salonen, Siirilä, & Valtonen, 2018; Valkila & Saari, 2012). Similarly, those thesis works and a few reports which consider one tool, or a group of tools, were examined. After the analysis, and to examine the findings from a broader perspective, I also reviewed a few articles which consider footprinting concepts and footprinting tools.

The key observations from the literature review include the notion that a broad overview of Finnish FPT's has not been made, and that there is a request for such review (Lounasheimo et al., 2019). Reviews on Finnish FPT's can be found for example on a thesis by Nuotiomäki (2019) and a report by Lounasheimo, Nissinen, Hämäläinen, & Seppälä (2019). In their thesis, Nuotiomäki interviewed five FPT hosts and five projects from which a few also contained an FPT. Nuotimäki's thesis though focuses more on tool hosts perceptions of their users and how footprinting tools could be used for accelerating sustainable lifestyles, than on providing an overview of Finnish FPT's. Lounasheimo, Nissinen, Hämäläinen, & Seppälä (2019) on the other hand list tools targeted to individuals along other meters in a report suggesting tools for assessing cities and municipalities climate projects.

The reviewed literature offered plenty of information on Finnish footprinting tools, though not in the form of academic literature. Information of Finnish FPT also seemed to be scattered, and a paper describing what FPT's in Finland especially are was not found. In the following chapters, I review the types of information which directed the analysis or guided the development of the Discussions chapter (see chapter 7).

2.2. Existing FPT templates

When conducting the initial literature review, it became clear that I could not find an answer for the first research questions from previous studies. Current, or even past Finnish FPT's haven't been listed and studied comprehensively. What I though found interesting in existing literature, was the ways to categorize FPT's features and functionalities. Often FPT research, such as the study of features of ten Nordic FPTs by Salo et al. (2019) offers tables or lists which present the different FPT features examined during the study. Salo et al. provide a table presenting the examined ten tools according to the 1) Name of the calculator, 2) Host organisation, 3) Country and 4) Documentation, as well as whether the tool hosts took part in an 5) Interview, and presented in a 6) Peer-reviewed article. A wider spectrum of features they studied is offered in five categories (originally developed in Salo & Mattinen (2017)): 1) Descriptive information of the calculator, 2) Methods, data and scope, 3) Calculator features to engage users, 4) Marketing and interventions, and 5) Calculator use and impact. All in all Salo & Mattinen (2017) presents a broad and detailed template for FPT analysis.

In comparison to the previously presented templates, style in which Lounasheimo et al. (2019) present FPT's is rather simple, but the purpose of the presentation is also different. Lounasheimo et al. aim to present a few key components of the tools to city or municipality staff and policy-makers, while Salo & Mattinen (2017) focused on evaluating and studying a sample of tools. The features Lounasheimo et al. present are: 1) Output, 2) Type (e.g. tool or model), 3) Difficulty level, 4) Documentation, 5) Openness, 6) Price, 7) Technical implementation (e.g. website or python), 8) Updates (e.g. is the tool up to date), and 9) Suitability (e.g. is the tool suitable for cities and municipalities). The focus thus is on results, costs, and usability. Already in these three examples, there is

evidence that tool characteristics have been researched, reviewed and presented for different purposes and audiences, and that the purpose of the study, report or thesis affects what is being listed and in which form.

Since my goal was to make an overview of the Finnish FPT's and their characteristics, I took inspiration from the style of making a table – or a template – of the found characteristics. During the analysis, I used the table-format as a way of diagramming emergent codes (a way of organizing and developing codes with visuals aids, see in detail in chapter 5), and later when formulating the results, I polished the findings into tables (see chapter 6). What I didn't do, and which I think now could have been useful, was, that I did not use the existing templates as a base for the analysis but started the directly from coding the data. Nevertheless, the results are plenty, as can be seen in chapter 6, but I also repeated some previous findings and invented new titles for existing categories. The comparison of the results of this study and findings from the existing literature is presented in chapters 7 and 8.

After the analysis, I reviewed also a few examples from studies focused on other than Finnish FPT's. These include an FPT template which currently has been used to review 82 FPT's from different countries (offered in addition to a draft by Kinnaird et al. (2020)). Since the draft is new and also considers Finnish tools, I wanted to include it to the comparison. Another example I found relevant in connection to the comparison and the content of chapter 7 is two tables presented by Burgui-Burgui & Chuvieco (2020). Their article reviews one tool and presents its features from the perspective of tool development, including 1) Requirement, 2) Target, 3) Implemented and 4) Compliance. The Requirement here refers to the wished or aimed feature or functionality, Target to how tool host wishes to implement the Requirement, Implemented a short description of how Requirement and Target were reached, and lastly, regarding the technical compliance, Compliance refers to how well set technical Requirements are met. Since this template is a kind of a report of the development of one tool, I consider it as a good source for answering the third research question (see chapter 7).

2.3. Previously noted FPT pitfalls

The second type of information which I found interesting and useful especially considering the third research question, is information provided about the pitfalls of current or previous FPT's. Information of the drawbacks are provided in tiny bits here and there in different texts – understandably there is no research under the title "Overview of footprinting tool pitfalls". In this chapter, I aim to present how notions of FPT pitfalls relate to my thesis and summarize the findings from the literature, including journal articles, theses, and reports.

Firstly, about how the knowledge of FPT pitfalls informed the analysis. Knowledge of the pitfalls might have affected the analysis since I read about them before the data-gathering and coding process. I did not specifically aim to draw my attention to aspects which previous research and reports have pointed out, but since I had become aware of the most common obstacles of tool development and use – information which I have also accumulated through work – I must have had my sensors tuned to specific characteristics. Secondly, I chose to use the information on FPT pitfalls to find a solution on how to turn the results of this thesis into a design implication. The intention is, that existing and known drawbacks can help in emphasizing characteristics which cause issues, or which require special focus from the tool host. Also: what is considered an issue can also give hints of characteristics or design and operational processes which *should* exist in footprinting tools.

One obvious pitfall of FPT's can be low user rates, or competition of users in a situation

where supply is high and the number of potential users low, as in Finland (Lyytimäki et al., 2013). As Salo et al. (2019) put it: "*The potential of calculators to raise awareness and reconfigure practices can only be realised if they are used*". According to Salo et al., many of the interviewed tool hosts of Nordic FPT's had not set numerical targets to user rates, though expected to gain higher numbers than they did. The literature currently offers only a limited amount of information of user rates of Finnish FPT's, and tools only in rare occasions publish user numbers on their sites. Examples I found included for instance *Finnairin päästölaskuri*, which in 2013 had not gained large audiences despite its a novel calculation method, thus not becoming an important factor in purchase decisions among air travellers (A. Baumeister, 2013). *Finnairin päästölaskuri* was launched in 2008 according to Kasurinen (2012). *Ilmastodieetti*, on the other hand, had reached 102,000 individual users during the time of March 2010 to August 2016 (Salo & Mattinen, 2017), meaning approximately 1300 individual users a month, a number considered moderate. As a third example, *Elämäntapatesti* recently peaked one million individual users, according to the visitor information openly available on their website (according to online sources, the tool was launched in 2018). According to the scarce input, Finnish FPT's have reached different volumes of audience.

The issue potentially relating to the number of users is the overall critique of FPT's emphasizing individuals responsibility (Manninen, 2017), an issue which tool hosts might have difficulties to overcome since it is directly linked to values. Other more conceptual, habitual and value-based issues relate to everyday practices and footprinting results' role in it. According to Manninen (2017), the concept of carbon footprint has not formed an established position in individuals lives, meaning that considering carbon footprint in daily lives is a project, instead of a norm. Thus, it is easy to look into, but potentially more difficult to adapt to everyday practices. Similarly, though from a different perspective, Salo et al. (2019) note that FPT use is "*(dis)connected from the practices they aim to change*". For instance, a tool which only points out an issue (e.g. "your mobility footprint is over sustainable levels") but does not provide ideas for making lifestyle changes (e.g. "according to your results, driving 100 km less weekly would improve your situation significantly") can be disconnected from everyday life. People might thus reject FPT's based on their values or have difficulties in adopting them part of their lives.

Concerning the above-mentioned issue, comes a pitfall relating to possibilities and capabilities of the users, which especially tackle the ability which individuals have for changing their current lifestyles. Salo et al. (2019) point out, that FPT's impact can be limited by individuals' lack of skills which more sustainable lifestyles require, including for instance renovation, vegetarian cooking, or bicycling. A broader literature review would most likely provide more barriers, such as income-level and location. Results of this study show, that FPT hosts have attempted to address these issues by providing relevant information (see chapter 6.2.3.). That said, the content of the footprinting tools have an important role in achieving their goals, but textual content is just part of the deal. Järvelä (2017) argues in her thesis, that a poor visual identity will not be saved by otherwise good content, meaning that a potential obstacle of an FPT is to neglect the visual appearance of the tool, including also factors which provide good usability.

If tools can have trouble finding enough users or providing them enough practical information to change lifestyles, contradictory issue tools often come across is that they are used by already environmentally-minded people, which comes across from lower than average footprinting results (Buhl, Liedtke, Teubler, Schuster, et al., 2019) and during the studies from interview participants who

obtain sustainable values (Biørn-Hansen et al., 2020; Buhl, Liedtke, Teubler, & Bienge, 2019). The pitfall, relating to the impact of the FPT's aiming to change lifestyles, is that the highest mitigation potential does not lay amongst those who are already interested in sustainability – though interest in sustainability does not mean low footprints, at least not in Finland. The perception of what is a sustainable habit can be false, as was presented in Heikkilä et al. (2020), resulting that nearly 80 % of Finns consider living sustainably, while the average carbon footprint is way above the target levels. Meanwhile, Koide et al. (2019), according to a study conducted in Japan, argues, that since the difference between lowest and highest footprint segments can be five-fold, focusing on policy measures which affect the highest segments would be the most impactful way to lower the average footprints. FPT's should thus be able to find people whose actual consumption habit's environmental impact is high and provide information on sustainable lifestyles in a manner which breaks the false perception of sustainability.

It can also be a challenge to engage users to use an FPT more than once (Biørn-Hansen et al., 2020; Salo et al., 2019). Attracting returning users can be difficult, even if a tool has specifically designed engaging functionalities and if a user has access to previous results (Salo et al., 2019). The study by Biørn-Hansen et al. (2020) explains the potential disinterest to be a result of static content, which does not offer new insights. Thus, users might not see a reason to visit a tool again. Attracting returning and frequent users though is possible, which partly is proven by the popularity of *Elämäntapatesti*. Also, Haaranoja (2019) presents in their thesis that tools which offer information and different types of statistics based on users actual purchases, such as S-mobiili, can become a routine for its users. Haaranoja's study gives a different perspective to the results presented by Manninen (2019), who argued that footprints as a concept haven't become an integral part of everyday lives.

Coming to the reasons behind the user rates, trust seems to be a big obstacle. For instance, perception of the tool or a tool hosts' brand correlates with how trustworthy user considers the information provided by the tool. Results of a thesis by Järvelä (2017) show, that users value FTP's which are independent and reliable, which can be difficult to achieve from an existing company or organization. On the other hand, an established company already has the existing resources and audience for marketing a new tool. A very different kind of trust issue relates to the calculation results (Biørn-Hansen et al., 2020). Biørn-Hansen et al., according to *Svalna*'s user interviews, reported that distrust can be a result of lack of confidence in the correctness of the calculation, faulty categorization of their transactions (tracker type), or difficulties in understanding what the results, in this occasion tonnes CO_2 equivalents, mean. Reasons causing calculation inaccuracy can also occur if users have difficulties in understanding the questions, consumption units, or if users are not being able to find the right information to answer the questions (Buhl, Liedtke, Teubler, Schuster, et al., 2019; Burgui-Burgui & Chuvieco, 2020; Mattila, 2019; Salo et al., 2019).

There are also pitfalls relating to the development and maintenance of a footprinting tool. Järvelä (2017) points out, that application development is expensive and suggests that FPT's could first launch a website version of the tool. Expenses can be high and difficult to estimate if the tool requires the development of new technologies (Väisänen, 2018). In general, available resources are divided into simultaneous communication projects leaves fewer resources for individual tools (Lyytimäki et al., 2013). This considers especially public and third sector, which are often dependent on project funding with a set ending date. Resources need to be divided, not only the development of the tool and its technologies but also to suitable staff with fitting skills, which, for instance, have an

understanding of marketing and finances, capabilities to perform technical changes, time to update social media, interest on the subject (Järvelä, 2017), direct contact to users (Salo et al., 2019) and capacities to answers users questions on phone or face to face (Väisänen, 2018), to name a few. Features which rise the costs, according to Järvelä (2017), are also for instance features which collect personal data, since then data handling and data privacy needs attention, as well as adding the tool to external databases and creating an interface.

3. Methodology

In this thesis, data-gathering and analysis were conducted according to an adaptation of textual and visual grounded theory guidelines presented by Kathy Charmaz (2006) and Krzysztof Konecki (2011). I decided to use visual GT methodology along with Charmaz' guidelines since the choice of data for the study considers also visual aspects: footprinting tools, as they appear on websites and mobile applications, contain textual and visual content, and often the types of content are interlinked, forming the meanings and messages together. Without analyzing footprinting tools as a whole, it could be difficult to form a comprehensive analysis of them.

I found grounded theory a suitable methodology for this thesis since I wanted to focus on examining Finnish footprint tools as they appear for the users on websites and mobile applications and conduct the study without basing the analysis on a specific theory or analysis frameworks created in earlier studies. GT methodology offers guidelines for making an in-depth, data-led analysis, which I considered as a suitable approach, as the topic of the thesis has not been studied with similar scope earlier. As the most significant benefits of the methodology, I consider flexibility, variety of guidelines and approaches which help the process of focusing on the data, and how the guidelines help in being critical while making an extremely subjective analysis.

In this chapter, I will present those grounded theory guidelines, which were used for data gathering and analysis. The next two chapters focus on how the data gathering process was carried out, and what steps were taken during the analysis. In practice, according to the nature of GT, analysis and data-gathering happened simultaneously.

3.1. Grounded theory guidelines and practices for data-gathering

3.1.1. Purpose of data and the role of the researcher

According to Charmaz (2006), the starting point of a grounded theory study is the entering of the field where data will be gathered. In GT, data is sought and analyzed without a hypothesis. Instead, data is gathered and analyzed inspired by open-ended research questions which direct to explore what processes are taking place in the studied area. Through systematic coding and comparison, the researcher will develop theoretical categorizations to explain what happens in the data. I consider, that the aim of creating categorizations fits well to this study, whose aim is to describe what a certain selection of footprinting tools are like. All in all, the grounded theory approach offers the researcher increased flexibility in comparison to other qualitative research methods while simultaneously giving a lot of focus on the process.

The coding process of the data guides the study and data-gathering by offering insights of the subject: what processes the data presents, what is repetitious in the data, what is interesting but not appearing often? When data proposes questions, new data can be gathered at any point of the research process. The further the coding, comparison, memo writing, and the scale of data set proceeds, the more theoretical the resulting categories will become and need for new data ends. (Charmaz, 2006)

The aim of the grounded theory approach is to see the topic from inside and avoid projecting prior knowledge and theoretical frameworks to the data. Charmaz' approach recognizes the issue of prior knowledge by acknowledging and accepting it. Her symbolic interactionist perspective discusses the researcher as part of the world and the collected data they study. Charmaz describes, that grounded theories are constructed

through the past and present involvements and interactions with people, as well as perspectives and research practices. Despite the attempt of creating new knowledge and understanding, Charmaz sees that the result of grounded theory is an *"interpretive portrayal of the studied world, not an exact picture of it"*. (Charmaz, 2006) Charmaz' GT branch fits well to my own understanding of how knowledge is obtained and how perceptions of the world are created, and for this reason following her guidelines seemed suitable to carry out in this thesis. Since Krzysztof Konecki (2011) bases his visual grounded theory concepts to the symbolic interactionist branch of GT, I considered his guidelines integrable with Charmaz' concepts.

Researcher's background is not the only influence which the data and the results of the study are affected by. How data is collected has an effect on what phenomenon it brings up, how it is analyzed, and where and when the data can be viewed. Different data on the same subject can create a different depiction of the same situation. (Charmaz, 2006) Role of the researcher in GT study thus is very significant, since it is, in the end, the person conducting the study, who reacts to the impulses of the data, and who decides the entry point to the studied field. In the context of this thesis, for example, the result of the study would be different, if the overview of the footprinting tools would be based on interviews of users or footprinting tool hosts, in comparison to studying the subject as it appears in its natural habitat.

To avoid data-related issues, Charmaz suggests focusing on gathering data which is rich-detailed and full-data and placed in a relevant situational and social context. In her book, which considers grounded theory in sociology, the depiction of rich data entails the revelation of the participants' actions, intentions, feelings and views, and the structure and context of their lives. (Charmaz, 2006) In this thesis, the subject of study is not a process of human interaction but more of an online platform of human self-interaction. It is probably clear, that since I am creating the overview of the subject based on its appearance online, the focus is not on the user's actions or feelings, but rather on what kind of a process an imaginative user could expect to enter when using an online footprinting tool. This means, that the richness of the data needs to be determined with different parameters. For example, rich data could be soughed by using an extensive data set, continuing coding until new information is not found, and if necessary and fitting to the scope of a thesis, by applying new data-gathering approaches. Rich-detailed means, in this case, having enough data to notice and code all the different characteristics of these tools, which would also mean, that the analysis has reached saturation.

3.1.2. Extant visual and textual data as a primary data source

Qualitative research is often based on analysis of texts (Charmaz, 2006; Konecki, 2011), while visual data is not traditionally associated with grounded theory (Konecki, 2011). In her book, Charmaz reviews the usage of textual data in GT and suggest that fieldnotes, interviews, and information in records and reports are commonly used in grounded theory. She also refers to visual data as an opportunity to gain insights into perspectives, practices, and events which might not be otherwise easy to study, but she does not consider visual data as a primary source, according to my understanding. Konecki on the other hand presents GT guidelines for using visual data as either primary or auxiliary source of information. He argues that the rare – though growing use of visual data in grounded theory (Konecki, 2011; Mey & Dietrich, 2017) – might be linked to the method's heritage in social research, which has traditionally been based on analysis of textual data with statistical methods. The formation of grounded theory indeed originates to the 1960s when social research was dominated by quantitative

methods (Charmaz, 2006). Despite the method originating in social research, in its adaptability, it can be, and it is encouraged to be used in other subject fields as well.

In his article on visual research and grounded theory analysis, Konecki (2011) presents five ways of using visual data in GT (see table 1). His five different combinations suggest that visual data can be used either as auxiliary data, for example, used during an interview, as data accompanied with other types of data, or as a primary data. The fifth combination, which is the most relevant in the context of this study, considers the use of data such as imagery in books, blogs, videos, photo albums, or any kind of existing visual content. This combination suggests that visual data could be used primarily or auxiliary *"to track visual actions and interactions"*, which is linked to the aim of this study: to find out what kind of characteristics the tools have, and what kind of activity or interactions they contain. In comparison to the other approaches, the fifth concentrates on what happens *in the image*, and not on what kind of real-life interaction the image represents.

In the initial empirical inquiry of the platforms, I made a remark that footprinting tools are entanglements of both textual and visual elements, including different types of documents from sustainability reports to calculation documentation, which on their own also contain visual elements, such as colors, photos and charts. Following Konecki's (2011) 5th combination, the most suitable available primary data seemed to be tools themselves documented via screenshots and pdf exports and later analyzed directly from the websites and applications. Since the action of taking a screenshot of a footprinting tool contains only little if any interference between the subject and the researcher, visual and textual data in the screenshots and other documents can be categorized as extant data, which means that data is not generated by the researcher (Charmaz, 2006).

Extant data should not though be considered

Table 1. Five combinations of visual data research and grounded theory analysis according to Konecki (2011).

Combination	Visual data as	Aim of the analysis	Example
1st combination	auxiliary material	to generate theories of actions and interactions or other processes	Photographing the interviewee to complement other data, or using an image as a conversation starter in an interview
2nd combination	the main source of empirical materials (along with the other kinds of auxiliary textual data or video)	to generate categories describing actions and interactions	Analysis of visual clues, such as gestures exchanged between human and animals
3rd combination	visual data alone (without ethnographic and other auxiliary data)	the analysis of actions and interactions	*No examples of this type of analysis by the time of the article was published*
4th combination	either as an auxiliary or as the main source of empirical evidence	the analysis of the visual dimension of actions and interactions	*No examples of this type of analysis by the time of the article was published*
5th combination	either as an auxiliary or as the main source of empirical evidence	to track visual actions and interactions	Analysis of different extant visual materials such as photo albums, blogs, illustrations and images in books, drawings etc.

neutral. Charmaz points out, that all texts, both extant and elicited, are products of their makers and this feature should be taken into account in data-gathering and analysis. Each author or creator has motives which might be hidden but present at the same time, and each text and visual outcome *"discourses and provide accounts that record, explore, explain, justify, or foretell actions"*. (Charmaz, 2006) My personal and professional background can have an effect on what kind of descriptions I create from the footprinting tool images. Considering the screenshots, it can be, and most likely it is so, that these tools have been created for attracting new users, convincing investors or sponsors, or for selling products, for example. All these aims have been embedded in the content of the tools and affect the gathered data. In the context of this thesis, nevertheless, these underlying motives do not need to be considered in great detail, since the aim is to make an overview of what these tools are as is. If the aim would be to find out what the actual goal of the footprinting tool hosts are, for example, the output of the tool's appearance should be compared to elicited data such as footprinting tool host interviews. Rather than concentrating on the agendas included in the tools, it is almost more important what is left out.

3.2. Analysis in grounded theory

3.2.1. From coding to forming theoretical concepts

Purpose of the analysis in grounded theory is to form theoretical concepts based on data. In this thesis, I use some of the guidelines presented by Kathy Charmaz in her book from 2006 and combine her guidelines a selection of visual GT methods by Viktor Konecki (presented in the next chapter). Analysis in GT is often conducted simultaneously with data-gathering, and the analysis guides the data-gathering process. Unlike in many other research approaches, in GT, the analysis starts with opening questions, which tend to suggest the direction of initial data-gathering, rather than define what exact answer the study is looking answers for. Research questions are defined along the analysis process, during which the data is examined in high detail: ideas and concepts which emerge from the data, become the focus of the study. (Charmaz, 2006)

The first analytic stage of GT is coding the data with *initial codes* (Charmaz, 2006; referenced as *open codes* in Konecki, 2011). Initial coding means looking closely to the data and labelling it by giving names for words, lines, segments or incidents. This activity of tagging information in the data creates the basis for the upcoming analytical ideas which emerge from comparing and sorting the codes. Methods for initial coding can vary from writing notes on margins, using post-its, to using software such as Atlas.ti, a tool specifically designed for qualitative research. In this thesis, initial coding was done in Atlas.ti.

As mentioned above, GT analysis contains the practice of making comparisons, a method called the *constant comparative method*. This method aims at generating abstract concepts and theories by an inductive process of comparing *"data with data, data with category, category with category, and category with concept"*. Comparison is done in each step of the analysis, and *memo-writing* is used for materializing the thinking process into words. Memos help in thinking what matters in the data, what the codes mean, and what could come up from the codes. Memos are a type of extended notes, which also help in developing and exploring ideas, to compare data, and to direct the data-gathering further. (Charmaz, 2006)

When enough initial codes have been gathered, it is possible to form first, tentative categories with the help of comparison and memoing. At this point, it is possible to continue coding the same data, or the researcher can collect new data, and continue the coding process with *focused codes*. Focused coding means

a more selective coding practice, which requires that the researcher has selected the most prominent initial codes, and by doing so, narrowed down the focus of the research. While initial codes are used for revealing what is in the data, focused codes are used for testing emerging ideas against a larger set of data. (Charmaz, 2006; referred to as "selective coding" by Konecki, 2011).

The tentative categories can be developed to more advanced categories, which, after recognizing common themes, patterns or other emerging characteristics, can be developed into conceptual categories. Forming conceptual categories require analytical examination of the categories emerging from the codes and recognizing those which best describe what happens in the data. Methods which can help in analyzing, organizing, and analytically examining the categories are, along memoing, for example, diagramming and axial coding. Diagramming is a method in which the emerged categories are examined visually, for example by writing down the categories in the form of maps, charts or figures. Diagramming helps to formulate an overview of the categories and organize them to potential main and sub-categories. Diagramming can also make it easier to recognize how categories are related to each other – which can, again, help in creating the conceptual categories, which would the in best way depict the data. Axial coding, on the other hand, is a type of coding which aims at bringing the data into a coherent whole, after it has been fractured into small pieces by the process of initial coding. Its purpose is to link categories into sub-categories, and this practice can be done by diagramming. (Charmaz, 2006)

Since the data-gathering process in GT is defined by the analysis, the researcher cannot foresee where the study will lead. The question then is, when the study is done, or when enough data has been analyzed? This point, referred to as theoretical saturation, is a point at which the studied data does not reveal new information of the theoretical categories. At theoretical saturation, comparison of the categories to the data supports the idea of the categories and does not present new insights. Often, reaching theoretical saturation in GT requires shifting from the initial data to other sources of information. (Charmaz, 2006)

3.2.2. Analysis of visual data

As mentioned earlier, the use of visual data in GT studies has been rare. In this study, the data used is a combination of text and visual input, which naturally resulted as a need to find methods in which to conduct the analysis of visual data.

To make the analysis of visual content more detailed and comprehensive, Konecki (2011) suggests following the four stages of multislice imagining process, a methodological device created in order to reveal the different layers of meanings embedded to images. In this process, visual data is verbalized to a description of the image, and this new textual material becomes part of the set of primary data. As data, written descriptions resemble elicited texts, which are texts generated by the researcher (Charmaz, 2006), which are then coded with initial codes.

According to Konecki (2011), use of visual data consists of four stages: 1) the creation of the image, 2) how the target of the image was put to display, 3) how the content of the image is interpreted, and 4) how the observer's previous knowledge affects the reading of the image. When writing the descriptions of the images, each stage should be considered. The four stages help the researcher to gain information about the context of the image, instead of only looking into what is in the image. For example, writing a description of the creation of the image can point out the time or motivation of making the image, while examining and writing how the target of the image was put to display can open up how the processes taking place in the image can be interpreted. For instance, the

researcher can examine whether the image is a snap-shot of a "real-life situation" (the process in the image can be seen as a capture of a moment in life), or if the subject of the image is posing for the research purpose (the process can be seen as a capture of the moment of making the image). This effects on the analysis of the processes that can be recognized in the image. The third and fourth stages relate to the researcher and help in realizing and being honest with the subjectivity of the analysis. In the fourth stage, for instance, the description could contain mentions of previous knowledge which helps in naming the processes taking place in the image, and also what kind of aspects researches cannot refer to according to previous knowledge.

Konecki (2011) describes, the description writing can be used in the early stage of the analysis, when making initial coding, and when the study does not yet have a focus. When shifting from initial coding to forming of tentative categories and focused coding, Konecki suggests that coding can be done directly to images. His guidelines offer also other methodologies for analyzing images, but since the data selected for this study is only partially visual, I considered these guidelines enough for grasping information also from the visuals.

4. Data

The first part of this chapter describes the role of data in grounded theory study and what kind of data is recommended to be used. The second part of the chapter presents the data-gathering process according to the two first research questions. The third research question relating to design implications will be discussed in chapter 7.

4.1. Data-gathering process

4.1.1. What Finnish footprinting tools are out there?

To begin the study, it was first important to make an inquiry of existing footprinting tools since such listing is not available in the existing literature. The search of the Finnish footprinting tools was conducted as an online inquiry in two phases. A number of tools were also added to the study according to prior knowledge and informal discussions with footprinting tool experts. The purpose of the search and listing of the tools was to build an understanding of the scope of the subject and to guide the further data-gathering process.

The premise of the search was that a footprinting tool is an online tool which informs an individual about consumptions environmental impact. Footprinting tools can focus on current or future consumption. The current consumption can be calculated according to direct or estimated consumption data of individuals lifestyle, while future consumption considers the calculated impact of different lifestyle choices. The common characteristic of these tools is that they include calculation or tracking functionality, but they can also consist of other components. To keep the scope broad enough for making an overview, I searched for tools which calculate either whole lifestyle or specific domains such as housing, food, mobility, travelling, leisure, and other consumer goods, or even particular products.

The first online search was done in Google search between 27.12.2019–2.2.2020 (see keywords in appendix 1). Keywords were based on relevant footprint concepts and some keywords were found and added during the search. Tools in Google Play were searched separately with similar keywords, though most of the mobile apps were found via Google search. Later more tools were found through literature (project reports, thesis, etc.), and in discussions following the presentation of the thesis' first findings at the ORSI project's roundtable event on footprinting tools at Aalto University on 12th February 2020. The results of the first search offered data for empirical observation and further development of the research questions. After the focus of the thesis was decided, a second search was made in DuckDuckGo during 6.5.2020–13.5.2020. Keywords of the second search can be seen in appendix 2.

In the beginning, the boundaries of the search were more open, and while the research scope was sharpened, only footprinting tools that were targeted primarily to individuals were included to the list. For example, tools targeted to companies or public organizations were excluded, as well as tools that individuals could use, but which were not directly targeted to them. The search also brought up a significant amount of different kinds of informative tests, games, or educational materials, which were excluded since they did not contain a calculator or tracker of consumption. Also, tools which are no longer operating, or tools which currently under development, were excluded, since their analysis would have required a data set exceeding the scope of a thesis.

4.1.2. What kind of characteristics do these tools have?

The second research question of this thesis

considers the characteristics of the footprinting tools. This chapter presents both the types of data gathered and the data-gathering process itself. Since GT allows a flexible attitude toward data-gathering, the process was multi-faceted, and it evolved during the process.

The primary data which I selected to be examined in this study are screenshots captured, and documents downloaded and exported from the footprinting tools. The type of data is extant. In order to guide and narrow down the data-gathering process, I needed to find a solution to the following questions: 1) what the boundaries of footprinting tools are, and 2) to what extent their features will be included to this study. Since the aim of this study is to create an overview, I preferred a broad definition of the tools, which does not only focus on the actual calculator function but the entity in which it belongs to. At this point of the study, the boundaries of the tools were seen at the borders of the service, for example, in cases in which footprinting tool is the main content of an application, the whole application was documented. If the tool was situated inside another service, the part of the service which included the tool was documented. By doing so, I aimed at recording information and features the user when using a footprinting tool.

As said in the first paragraph, footprinting tools provide different kinds of downloadable documents (pdf, excel), which were included in the analysis. Pdfs were exported also from parts of the tools which consists of large amounts of text, such as calculation documentation and additional information. Exportations were made since it was faster than documenting long textual pieces screen by screen, though visually relevant information was always documented by taking a screenshot. Content of the documents was mostly gathered from the Finnish version of the tools, but some materials were provided only in English. Examples of a gathered footprinting tool

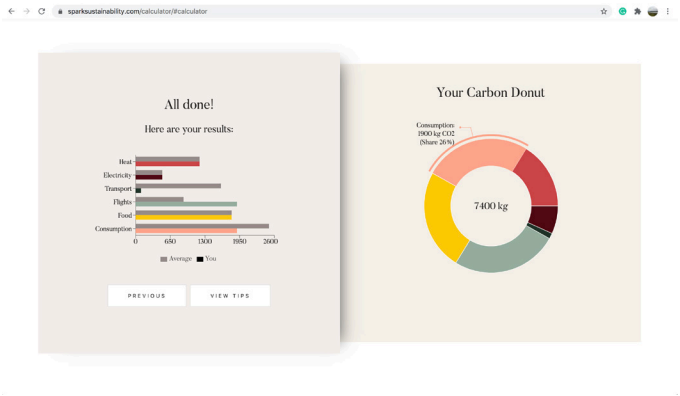


Image 1. An example of an FPT screenshot. Survey results in the Carbon Donut calculator (accessed July 7th, 2020).

Image 2. Example content of a downloaded pdf: Page from a User instruction of CitiCAP application (accessed July 12th, 2020).

screenshot can be viewed in image 1 and a downloaded pdf in image 2.

In order to randomize the beginning of the data-gathering and analysis, I began the data-gathering by following the list of found footprinting tools alphabetically. I systematically documented one footprinting at a time – by taking screenshots and if needed, by making pdf exports – and analyzed the collected data. If I noticed that I had skipped relevant characteristics during the data-gathering, I went back to the tool and captured more data. When analysis of one tool was done and the data did not reveal new insights, I started collecting data from the next tool and continued the same patterns until I reached a certain level in the analysis (see chapter 5). In total, I documented 14 (resulting as 815 separate documents) of the 37 footprinting tools, after

which I continued the analysis directly from online sources.

Following Konecki's (2011) multislice imaging process, descriptions of the content of the screenshots were written and analyzed during the data-gathering process. In these descriptions, I aimed to depict and express the processes taking place in the images, and the visual impressions I got. In the early stage of data-gathering, I produced a description of each screenshot and this data was used for creating initial codes. Later, as Konecki suggests, coding was done directly to the images. The quality of the descriptions varied. The very first descriptions of were usually rich and detailed, also, those which were written about characteristics which were noticed for the first time. When data became repetitious, the content of the descriptions shrank to short notes of specific characteristics. Table 2 presents two rich descriptions. Since taking screen captures is a rather objective event, I did not consider the context of taking the images or display of the target of the images in the descriptions.

In some cases, when I did not have access to a certain tool, I had to rely on the documentation of a tool to another person. Often this was due to not being a paying customer of a service who provided a footprinting tool. I acquired the materials through people who are customers of these services, and to whom I explained what kind of data I am looking for. Despite the process of taking a screenshot being the same for me and other people, it can be, that what and how was documented has been affected by the characteristics of these people. For instance, collaboration with one person was tricky, since this person did not consider the tool worthy, and expressed mistrust to its results and concept. According to personal experience, noticing all characteristics on a tool needs concentration, and a person might lack interest in paying attention when feeling irritated. Despite the potential inconsistency, this data was analyzed the same way as other footprinting tool screenshots.

Above mentioned boundaries relating to the definition of a footprinting tool exclude many aspects of the footprinting tools from the study. For example, footprinting tools often have a presence in social media, and part of the tool's content and activities might have been distributed between the tool itself and its social media channel. Similarly, when a tool is included to another service or a website of the footprinting tool host, looking only into the tool part can dismiss the connection between the services, products or information provided by the host. Footprinting tools might also be used in, for example, educational purposes, but information of this usage might not be included in the tool.

4.2. Evaluation of the data-gathering

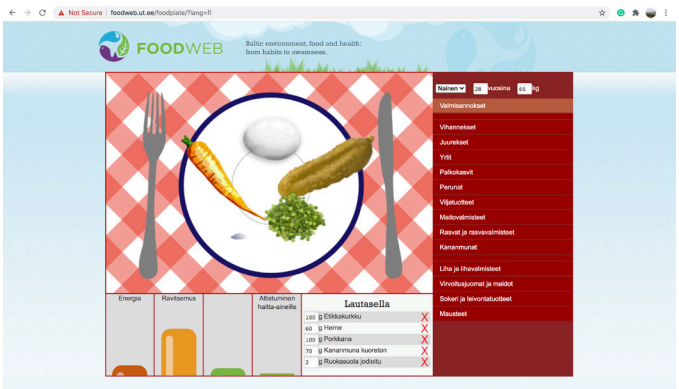
According to Charmaz, all data collected in the research setting can be considered data, but not all data is equally relevant for the study. Data may vary in quality, its relevance differs according to emerging interests, as well as the usefulness for making interpretations. (Charmaz, 2006) I could say with light-hearted confidence, that footprinting tool screenshots and document exports were a good source in order to find answers for the research questions. It was also easy to point out what kind of information could be collected to further analyze these tools from different angles. Sources of information are not scarce when considering footprinting tools, nevertheless, the amount of existing literature on Finnish tools specifically is limited.

Coming to the potential pitfalls in the GT method itself, Charmaz points out the balance between insightful use of data and act of producing mundane reports. If GT guidelines are used too mechanically, the result might be a routine report. When used well, grounded theory guidelines focus researcher's attention and enable looking at the data both broadly and in detail. In other words, the success of the data-gathering depends on the success of the analysis of the

data, which is presented in the following chapter. (Charmaz, 2006) The amount of data used in this study though should be broad enough for producing a thesis which does not resemble a mundane report, but as said above, the quantity of data does not guarantee a sharp analysis.

The online search conducted in order to find the tools was not totally inclusive – most likely there are footprinting tools which I was unable to find. It came across that not all of the tools appeared in both searches, and some tools which came up in discussions never appeared in either of the searches. This should not affect the analysis of the characters of the tools, since there are plenty, but the list of all Finnish footprinting tools can be inconsistent. Three potential reasons for not finding tools in searches are 1) inability to form strong keywords, 2) tool hosts do not communicate or market their calculator-like services despite offering them, or 3) footprinting tools are inaccessible due to requirement for customership.

Table 2. Examples of a descriptions written of a footprinting tool screenshot. The first picture presents Ateriasovellus (accessed July 2nd, 2020) and the second #nyhtiliike (accessed July 1st, 2020).

Screenshots	Description
	In this screenshot, visitor has chosen food products from the list of options and added them on the plate by dragging. The amounts of the products have been modified by typing in new amounts (g). Results are being showed in the darker light grey boxes as pillars. Pillars have different colors (red, orange, green). Style of the food products are realistic illustrations.
	“Challenge a fried” social media link directs the visitor to share the link of the calculator as a post, in this image in Facebook. Visitor can write the text themselves. The link is accompanied with an illustration of a sad looking cow.
	

5. Analysis

As in the data-gathering process, analysis of the data was directed by grounded theory guidelines presented by Charmaz (2006) and Konecki (2011). The study is carried out mostly relying on the practices suggested by Charmaz, while Konecki's methods were applied mainly in the beginning. For instance, practices of coding, memoing, constant comparison, and diagramming were inspired by Charmaz, while Konecki's multislice imagining process was applied in the early stage, during which descriptions of images were written and coded. I believe that initiating the analysis with multislice imagining helped in focusing on the tools in a more holistic manner throughout the analysis.

In this chapter, I present how the analysis of data was done. The first part presents the coding practice and how different methods were used. The second part provides examples of code development. The analysis was carried out in Atlas.ti, a tool optimized for qualitative research, and in Excel. Atlas.ti was used for coding footprinting tool screenshots and pdf documents and organizing and comparing the initial and focused codes. Excel was used for diagramming and axial coding.

5.1. Coding

5.1.1. Early stage of coding: From initial coding to creating categories

The process of data-gathering and analysis of the data was done simultaneously in this study. In the beginning, data was gathered according to the alphabetical order of the footprinting tools, and before the analysis started, data was first stored in a file on a computer and named according to the corresponding footprinting tools and main feature the screenshot presents. After that, data was transferred into Atlas.ti, where it was coded. New data was gathered whenever analysis suggested that the initial documentation missed important characteristics of the tools.

For the purpose of initial coding, descriptions were written of each document. Initial codes were made both to the descriptions, and when considering textual parts such as exported pdf's, directly to the documents. In the beginning, data were coded in high detail, following word-by-word and line-by-line coding styles. After a few tools had been coded, the coding process focused less on individual words and I began to compare the outcomes. At this turn, coding practice resembled more incident by incident coding.

After coding data gathered from 5-7 tools, there were enough initial codes to start forming tentative categories. This process resulted as first notions of emerging interests and also potential gaps which meant that more footprinting tools required an analysis. The first categories were created around codes referring to different ways in which information is presented and received in the tools, activities which users could participate in, ways in which users get information about their environmental impacts, basic information relating to the tool itself, and visual appearances, for example.

At this point, it was natural to move into *focused coding*, a more selective coding practice (Charmaz, 2006; referred as *selective coding* by Konecki, 2011). Data were analyzed through the lens of frequent initial codes, while at the same I aimed to pay attention to sporadic codes which suggested potential gaps in current data. This way the initial codes and tentative categories were tested against new data, and it was possible to gain answers to questions such as *"Are these characteristics similar in all tools, or do they have more variations?"* or "Is this single characteristic an alien in this data, or does it belong to a group of yet unnoticed characteristics?"? Often previous codes got affirmation from new data, but in some

cases, the coding practice returned to initial coding when entirely new characteristics were recognized in the data. During the shift to focused coding, I also had stopped writing descriptions of the images and began coding directly to the images.

Throughout the process of coding and categorizing, I followed Charmaz's (2006) and Konecki's (2011) advice of writing memos. On July 13th, for example, I began a memo called "GAPS!", in which I started to gather all notions of characteristics which either needed to be looked into in further tool documents (screenshots and pdf's) or potentially through other sources. On 17th of July, after analyzing seven footprinting tools, I was hesitant whether I still need to continue collecting data of new footprinting tools, or whether I could base my analysis on the currently gathered data. I looked at the codes I had gathered and started making a list of codes which could be redefined in case further coding would be performed from new tool data. The list grew long, containing nearly all categories I had initiated. Making the memo clarified to me that codes at that point were not ready for theoretical development, and further data-gathering could be justified.

One last notion of the first stage of the coding practice is the attempt to follow Charmaz (2006) advice on creating codes which resemble processes and action. The very first codes indeed were written according to what actions were taking place in the data (*activating, informing, recommending*). This method must have affected what I paid attention to in the analysis in the first place, but this practice was soon shifted to more depictive codes (*activation, information, tips*), especially when making focused coding. The idea of codes resembling action was though kept alive in the category creation, and further coding.

5.1.2. Making sense of the codes: Memos, diagramming, axial coding and generating theoretical categories

The process of trying to make sense of a large pool of codes required a lot of work – the same way looking into the data was a rather time and headspace consuming effort. In my attempt to sort out the findings, I trusted in the methods of diagramming and axial coding. I started to work on the tentative categories and both initial and focused codes in Excel, where they were easier to compare, sort, and rearrange. I organized my findings into different groups, highlighted potentially missing information, and raised questions. I tried different kinds of titles for categories, and rearranged subcategories, and shifted their place form category to category. Through this practice of working on the findings in a more visual way (than as a list in Atlas.ti), and by looking into the correlations between codes and categories, I was able to start formulating theoretical categories.

During this process, I kept memos especially about topics which seemed confusing. I did not aim to write a note about each and every change I made in the categorizations or while choosing initial codes which I should look into more, but rather used this method to solve issues and raise questions which I was not able to solve at the given moment. I noticed that the number of codes I was dealing with was too vast for memoing in detail, and better way to make sense of them was indeed diagramming and axial coding, which helped to find and illustrate correlations between the codes. Memos which I wrote though always helped me to arrange and further thinking and reflecting on the findings.

The first signals that gave me a hint that I had reached an "arrangement" which made sense, came when I was able to organize my findings into five segments, or theoretical categories. These five groups each began to relate to something similar but from a different perspective, and they all described

what a user gains or experiences when visiting a footprinting tool. The process of looking into what happens in the data – in the end – resulted as theoretical categories, which could be developed in further research.

5.1.3. An example of the coding process

As an example of the coding process, I present here the development of a characteristics Extent in subcategory Tool, which belongs to the first category Foundation (see in detail in chapter 62.1.). This category is linked to characteristics defining whether the footprinting tool is a website or a mobile application. The final form of the category Extent aims at describing in which role the footprinting tool appears on the platform.

The initial idea for such codes appeared early on in the coding process when I paid attention to those tools which are solely built for the purpose of offering individuals footprinting tool services and compared them to tools which are provided along with other services. The very first tool which I analyzed was #Nyhtiliike's calculator (*Laskuri*), which is offered in Gold & Green's website as part of the #Nyhtiike campaign. I noticed that the tool is, as said, a separate part of the site and not exactly the main content offered for the visitors, and in fact, is not provided in all language versions of the site. The main purpose of the site appears to be presenting the products of Gold & Greens for both individuals and companies. #Nyhtiliike campaign on the other hand, appears to be a social media campaign for raising awareness of meat-free diets and marketing Gold & Green's product, pulled oats.

Other similar tools which I coded were *Finnairin päätölaskuri*, a calculator offered in Finnair's website, and which presents the user carbon footprint of their flights with Finnair, and Compensate's website, where users can calculate their lifestyle carbon footprint and later decide most suitable carbon compensation subscription. Each of these tools seemed to be an additional feature on the site and not the core service or product of the tool host. This led me to think of dividing the tools to two different types: those, which are the *core* service of the tools, and to those, which are offered as an *additional* service along with the core services of the platforms. Tools which I coded in the early stage of the analysis and which represent the Core type are, for example, Susla, which is a service which specifically offers a footprinting tool and other functions which support the shift to more sustainable lifestyles, and *CitiCAP*, an application which tracks the mobility of the user with the mobile phone sensors and calculates user's mobility footprint based on the collected data. In other words, these are footprinting tool brands.

Looking closer to those tools which I had categorized as Additional, I noticed, that there are differences in ways in which tools are not the base of the platform. For instance, FOODWEB research project offers two different calculators on their project website. This website presents the project, it's background, and its results, such as the calculators. *Autokalkulaattori* offered by the Finnish Climate Change Panel is part of the main website of the panel but offered as a result of a project, and *Elämäntapatesti* by Sitra is offered as a separate function on their website, which otherwise presents a broad range of the organizations operations. If any of these tools would have had a unique domain and a website, they would have resembled a "Core" type of a footprinting tool, whose aim is to inform an individual about their consumption habit's environmental impacts and guide them to more sustainable – or healthy – lifestyles.

In contrast, #Nyhtiliike, Finnair's calculator, and Compensate's compensation service have a role in a process, which aims at leading the user to use a product or service provided by the tool host. Their underlying aim is the same since the used methods are the same, but these tools could be seen as a step toward

consumption of the tool hosts products or services, instead of being simply informed on sustainable lifestyles in general. Here, in these cases, the process of footprinting is a bridge, for which I gave a title: Intermediary. With the third type of tools I aim to specify those tools, which are used for marketing, or in other way leading the user to either being more informed about tool host's products or services or taking part in causes brought up by the tool host.

When comparing the found types, Core (later named as Base), Additional and "Intermediary" to the larger pool of data, I also found tools which were part of their parent page, but which functioned like a Base type of a footprinting tool. I formulated a fourth type called Separate. The final version of these codes can be viewed in chapter 6.

5.2. Evaluation of the analysis

In general, I would say that the analysis was successful since it provided answers to the research questions (What Finnish footprinting tools there are? and What kind of characteristics Finnish footprinting tools have?). By using GT methods, I was able to look very closely into what Finnish FPT's are, and then formulate an understanding of how frequent different characteristics are among the found 37 tools. In my opinion, this method suited well for making an overview which is not a literature review.

The downfall of the method is, ironically, that there are very many results. A single FPT can be a complex system and in general Finnish FPT's show lots of variations. For this reason, the scope of the study became quite broad, which to some extent can be explained with the choice of method and how it was used. The analysis though gave me good learning of GT methods, and I happened to enjoy it. Last, but maybe most crucial point to make is that the analysis did not reach saturation. If the analysis would have reached saturation, the number of results could be either higher, or actually smaller, since the analysis could have led into clarified results.

6. Results

In the following chapters, I present the results of the analysis of 37 Finnish footprinting tools. First, I go shortly through the findings of the online search of the currently operating Finnish footprinting tools, and then present in detail the different characteristics of the tools which I was able to identify within the scope of this study. With "characteristics" I am here referring to the different features and functionalities footprinting tools have, both those that are used as building blocks of the basic structure of a tool, and those that are selected in order to allow the user to perform a given task. Along the way, I present examples of Finnish FPT's relating to the found characteristics.

The results could be summarized as follows: 1) Finnish citizens are offered a broad range of footprinting tools which they can test and use, 2) the studied footprinting tools have a broad range of different characteristics, 3) the key differences can be found between calculators and trackers (see chapter 6.2.1), and 4) the amount of variations and characteristics shows, that each footprinting tool host is able to tailor footprinting tools to fit their own purposes and needs. Footprinting tool as a product or service is thus not set in stone, but an adaptable multipurpose tool, which according to the numbers of newly launched tools, is constantly developed.

6.1. Finnish footprinting tools

6.1.1. Currently operating footprinting tools

The search of Finnish footprinting tools resulted as a list on 37 currently active tools (see table 3). Most of the tools were found through an online search, but a significant share of the tools came to my knowledge also through conversations and via social media. During the search I also found remarks of footprinting tools which have been closed, and a few tools became inoperative during the study. Inoperative tools are not included to the study, expect *Ilmastopeli* offered by city of Lahti, since it became inoperative at the end of the analysis was, and Helen oy's *Sävel + service*, which will soon be taken down and replaced by a mobile application, but which is still currently working by the time of writing this thesis.

The list of tools and their hosts offer an opportunity to make a few remarks, and for this reason I included tool hosts to the above-mentioned table 3. A finding which arouses curiosity is that five of the tool hosts offer two different tools. For instance, city of Lahti, FOODWEB and SYKE offer two very different kind of tools and according to my understanding different people are responsible of the different tools in these organizations. On contrary, Compensate Operations Oy and Spark Sustainability Ab seem to offer a version of similar tool both online and as a mobile application. Both Compensate and Spark Sustainability first provided their tools on a website, and only recently launched their mobile applications. According to online sources, Spark's website footprinting tool was launched on 2018 and application on 2020, and Compensate's website tool was launched on 2019, and the application on 2020.

The empirical examination during the search revealed as well, that a handful of tools have significant similarities. For instance, Baltic Sea footprint calculators offered by Helsingin Sanomat, John Nurminen Foundation, and SYKE are based on similar survey model, the two first mentioned also sharing same visual identity. Similarly, carbon footprint calculators offered by The Martha Organisation and Guarantee Foundation are based on same survey type, but both organizations have modified the tool to fit their existing website's look. The biggest differences can be found between Sitra's *Elämäntapatesti* and how it has been implemented to *Sitoumus2050* website. Assumedly the Finnish National Commission

on Sustainable Development has used Sitra's license to implement the tool to their website, in which it is part of a bigger entity of different functionalities users can operate with, while on Sitra's site *Elämäntapatesti* is a relatively quick test which offers less further functionalities.

To conclude, it seems that there are plenty of footprinting tools that users can find and use. The selection of available footprinting tools is constantly changing, when new tools are launched and developed further, and when other tools are being closed. Lastly, not all Finnish footprinting tools are unique even if they are provided in different websites or applications by different tool hosts, since tool hosts have variety of ways to share the existing tools.

Table 3. List of currently available footprinting tools and their tool hosts.

Number	Footprinting tool host	Footprinting tool
1	City of Lahti	CitiCAP
2	City of Lahti	Ilmastopeli
3	Clonet Oy	CO2-muunnin
4	Compensate Operations Oy	Compensate
5	Compensate Operations Oy	No name (as part of Compensate's website)
6	Ekokumppanit Oy	Lentolaskuri
7	Finnair Oyj	Finnairin päästölaskuri
8	FOODWEB	Ateriasovellus
9	FOODWEB	Kalastetun kalan LCA-laskuri
10	Gold & Green Foods Ltd	Laskuri
11	Helen oy	Sävel + service
12	Helsingin Sanomat	Itämeri-kone
13	Innotakomo	Lentomatkaajan hiilijalanjälkilaskuri
14	John Nurmisen säätiö (John Nurminen Foundation)	Itämerilaskuri
15	Kesko Oyj	K-Ostokset
16	Kestävän kehityksen toimikunta Finnish National Commission on Sustainable Development)	Sitoumus2050
17	Maan ystävät ry (Friend of the Earth Finland)	No name (as part of Lentomaksu website)
18	Marttaliitto (The Martha Organization)	Hiilijalanjälkilaskuri
19	Neste Oyj	No name (as part of NesteMY website)
20	Nordea Bank Abp	Hiilimittari
21	Pääkaupunkiseudun Kierrätyskeskus Oy (Helsinki Metropolitan Area Reuse Centre Ltd)	Uudelleenkäytön vaikutuslaskuri
22	ResQ Club Oy	Saavutukseni (as part of ResQ app)
23	S Group	Hiilijalanjälkilaskuri
24	Sitra	Elämäntapatesti
25	Spark Sustainability Ab	The Donut
26	Spark Sustainability Ab	The Carbon Donut Calculator
27	Suomen ilmastopaneeli (The Finnish Climate Change Panel)	Autokalkulaattori
28	Suomen ympäristökeskus SYKE (Finnish Environment Institute)	Ilmastodieetti
29	Suomen ympäristökeskus SYKE (Finnish Environment Institute)	Itämerilaskuri
30	Takuusäätiö (Guarantee Foundation)	Elämisen hiilijalanjälki
31	The Sustainable Lifestyles Accelerator	Susla
32	UseLess	Ruokavalion hiilijalanjälkilaskuri
33	Visit Tampere Oy	Hiilijalanjälkilaskuri
34	VR-yhtymä Oy (VR-Group Ltd)	Hiilijalanjälkitesti
35	Väre Oy	Hiilijalanjälkilaskuri
36	Yleisradio Oy	Ilmastolaskuri
37	Ålandsbanken (Bank of Åland Plc)	Itämerikortti

6.2. Characteristics of Finnish footprinting tools

In this chapter I present the results of the analysis of the Finnish footprinting tool characteristics. The results emerged from analyzing the tools first by coding smaller selection of tools with GT methods, and later comparing the created categories to findings of the whole sample. As a result, I present a template of the characteristics of Finnish footprinting tools (see tables 4, 5, 6 and 9). and information of the frequency of specific characteristics

I grouped the findings into four categories: 1) Foundation, 2) Data, 3) Information and 4) Incentives. These categories include subcategories presenting what kind of foundation footprinting tools' functionalities are built on, what kind of data they collect of their users, what kind of information they offer for the users, and what kind of measures these tools take in order to provoke users to participate and take action.

The data analyzed brought up even more potentially relevant characteristics, but I was not able to take the study that far and build categories of all the findings. Speaking with the GT language, saturation was not reached. Characteristics which are not presented in this study in detail relate mostly to the visual appearance of the tools, their usability, and details considering specific characteristics in categories Information and Incentives. Partially some characteristics relating to usability are included into other categories, but this aspect was not studied here as a separate category or subcategory. This missing information is to some extent included to the design implication according to existing FPT templates (see chapter 7).

6.2.1. Foundation

The Foundation category consists of the characteristics which form the base of a footprinting tool. It is divided into four subcategories: 1) Founder, 2) Tool, 3) User engagement and 4) Instructions and background information (see table 4). Foundation as a whole refers to characteristics which could be seen as the basic building blocks of a footprinting tool, and to tool hosts' motivations which guide to the development of a tool. This category also contains the type of characteristics which define the optimal target group of the tool, what is the designated usage type of the tool, and what information users are offered about the tool itself and its use.

Founder

The Founder subcategory answers to the question of by whom the tools have been made, with what intention, and what kind of expertise and third-party services their development requires. It also explores to whom the tools are made for, which as well speaks a lot about tool hosts intentions. I divided the Founder subcategory into of four groups: 1) Tool host, 2) Project, 3) Roles in tool development, and 4) Primary target group (see table 4).

Tool host

Tool host characteristics offer information about the tool host, such as tool hosts 1) Name, 2) Sector, 3) Type, 4) Field of operation and 5) Mission statement. I find this information relevant since often tool host's motivation to offer a footprinting tool is rooted in their core operations. Regarding the names of the tool hosts, as presented in the previous chapter, 37 analyzed footprinting tools are provided by 32 hosts in total. The full list of tool host names can be found from table 3.

I divided tool host Sectors into Private (22 tools, 59 %), Public (7, 19 %) and Third sector (8, 22 %), and the statistics show that most tools in Finland are provided by private sector organizations (figure 1). Tools can also be analyzed in more detail according to organization Types, but I found it challenging to define the level of detail when it comes to these characteristics: should the focus be on

Table 4. The Foundation category.

Subcategory	Characteristic	Variables (including a.-m.)
Founder	Tool host	Name* Sector (a.^) Type (b.^) Field of operation* Mission statement*
	Project	Durational project^ Project partners* Funder*
	Roles in tool development (c.^)	
	Primary target group	Type (d.^) Specification* License^
Tool	Name and description	Name of program, service, campaign or application* Tool name* Description of the program, service, campaign or application* Description of the tool*
	Platform	Link* Type (e.^) Extent (f.^)
	Language (g.^)	
	Access (h.^)	
User engagement	Types of use (i.^) User profile and settings (j.^)	
Instructions and background information	Creation and updates (k.^) Instructions and background information (l.^) Terms, privacy and permissions (m.^)	

a.
Private
Public
Third

b.
Association
City or municipality
Commission
Company
Conglomerate
Cooperative
Daily newspaper
Foundation
Fund
Government-owned company
Institute
Non-profit organisation
Non-profit company
Organisation
Public company
Research project
Thinktank

c.
Management and/or coordination
Concept and/or idea development
Content creation
Calculations and/or tracking methods
Design
Development and programming
Platform provider
Data storing
Analytics
Interface source and/or provider
Communications
Business and/or organization collaboration
Supporting company and/or organization

d.
Individuals
Companies
Organisations

e.
Website
Mobile application

f.
Base
Additional
Intermediary
Separate

g.
Finnish
Swedish
English
Other

h.
Age limit
Registration
Customership

i.
One-time task or info
Durational process or monitoring

j.
User profile
Settings

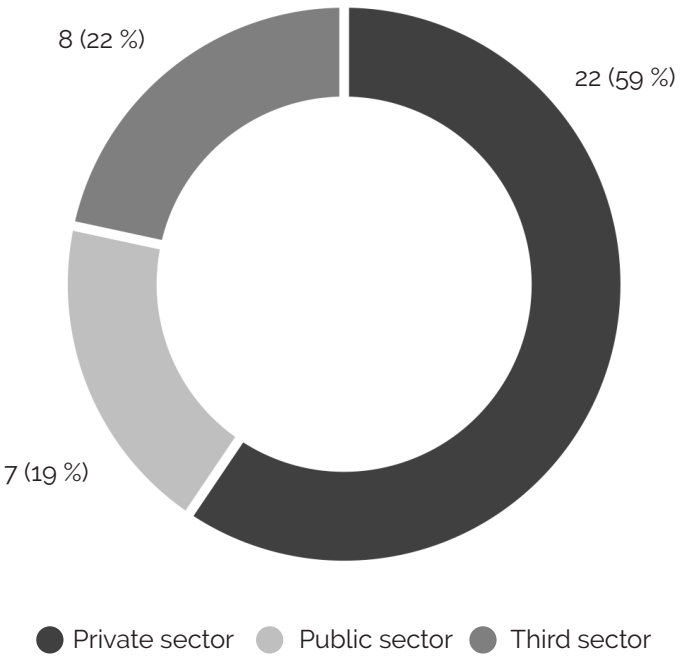
k.
Number of users
Date of launch
Update frequency
Update history

l.
User instructions
FAQ
Calculation documentation

m.
Terms of use or similar
Privacy statement or similar
Fundraising permission

** Free entry, ^ Varying options, such as Yes and No.*

Figure 1. Host sector types.



legal company form or type of operations run by the company? In my non-finalized listing, which currently contains both legal company forms as more descriptive product based Types such as Daily newspaper, I was able to identify 16 different organization types. The emerged ideas of tool host Types can be seen in table 4.

Level of detail grows, when looking into the Field of operations Finnish footprinting tool hosts represents. Types of Field of operation which occurred more than once in the data are: Energy services and energy production, Environment (including Environment and health, and Environmental protection), Financial services, Retail (including also Retail network), and Sustainability (including Sustainable business development, Sustainable development, Sustainable lifestyles). Other Fields of operation of Finnish tools are Aviation, Broadcasting, Carbon footprint calculation, Climate change, Compensation, Expertise and foresight, Food production, Gas stations and oil products, Governance, Home economics, IT-services, Railway services, Recycling, Subscription newspaper, and Tourist information. FTP's are thus offered by a range of organizations representing a variety of fields. The Field of operation though does not indicate by whom the end product is intended to be used or used without tool hosts' intention.

I created the subcategory Mission statement in order to see if there is a correlation between the core operations of an organization and the decision to offer a footprinting tool. According to the Mission statements, I could say that there are at least two ways in which Missions statements relate to becoming a tool host. The first group is tool hosts whose mission relates directly to the environment, sustainability or climate change, and the second group represents hosts offering products and services in consumption areas which have a critical role in cutting emissions. The first group is represented, for example, by The Finnish Climate Change Panel (*Autokalkulaattori*), whose mission is to provide scientific advice for policy-making and reinforce interdisciplinary insight in the operation of different sectors, and Clonet Oy (*CO2-muunnin*), whose mission is to offer services for calculating carbon footprints and develop of sustainable business. The second group is represented by Finnair Oyj (*Finnairin päästölaskuri*), whose mission is to provide national and international flights, and Helen oy (*Sävel + service*), whose mission is to provide energy services and energy production.

Project

FPT's are often created in a project, by which I mean projects with a specific timeframe, such as funded research projects. According to the information available in the data, I decided to analyze project-related characteristics of FPT's by 1) searching if they are created in a project, 2) what Project partner tool host has or has had, and 3) who was the Funder of the project.

In total seven of the Finnish tools had been initiated in a project (four of the tools did not offer enough information to answer yes or no). This 19 % are hosted by private (by tool host Types such as City or municipality,

Institute, or Thinktank) or third sector (e.g. Research project). The total number of project partners which I was able to detect from the used data ranges from one to seven. This number should not be mixed with the number of subcontractors or other partners who helped in the tool development. Some of the project partners themselves are tool hosts, such as SYKE, Yle, and Ålandsbanken. FOODWEB's tools and *Susla* are the only FPT's which have international Project partners.

Familiar names can also be found in the list of Funders. For instance, Sitra has supported SYKE's *Ilmastodieetti* tool. Other Funders found are the European Union, European Regional Development Fund (ERDF), KR Foundation, Ministry of Education and Culture, and Ministry of the Environment.

Roles in tool development

The information which footprinting tools offer limited information is organizations or companies the tools were made with. Often this information is found from privacy statements, though some tools provide information about their partners and subcontractors openly. Nevertheless, during the analysis I paid attention to the different Roles in tool development, and even if this is not a characteristic of an FPT tool itself, the development process of a footprinting tool could be considered a unique feature of FPT's: creating a footprinting tool requires a certain set of resources and skills.

Since the level of openness is not same in all tools, I did not analyze the frequency of different Roles in tool development. Instead, I was able to form a tentative list the different roles which partners, subcontractors, service providers or such can have in tool development. The roles are (loosely in order of the development process):

- Management and/or coordination
- Concept and/or idea development
- Content creation
- Calculations and/or tracking methods
- Design
- Development and programming
- Platform provider
- Data storing
- Analytics
- Interface source and/or provider
- Communications
- Business and/or organization collaboration
- Supporting company and/or organization

The list presents also the different kinds of resources and expertise building an FPT requires, though depending on the magnitude of the tool. For instance, if a tool is acquired through a license, FPT host might only need to work with Coordination (coordinating the use of the license, communication with the license owner, etc.), Design (decisions of how and to what part of existing website tool is places), and Development and programming (coding the licenses tool to be part of the existing website). Tool host might also want to do Communications in order to gain users. A very different kind of a scenario would be to create a tool, which obtains data for generating footprinting calculations through mobile phone sensors, and which connects the generated results into a market place, where user can purchase different types of products and services. In a scenario like this (more or less as is done in *CitiCAP* application), nearly all Roles could be checked from list.

Primary target group

The three main Types of Primary target groups I identified are 1) Individuals, 2) Companies and 3) Organizations. Since this thesis focuses on tools targeted to individuals, all 37 tools fulfil the first Type. Four of the tools are also targeted to Companies, and one to Organizations. An example of a tool provided to all three is *Sitoumus2050*, which offers different functionalities and information for each group. Especially its Incentives (see Chapter 6.2.4.) are specified to each target group. Only two tools offered a Specification of their target group. These

tools were Tampere.Finland application targeted to citizens of Tampere, visitors and travellers, and Helen's *Sävel + service*, offered for property owners.

Another way tool host can gain visibility and users to their tool is by licensing the tool or offering it to other organizations by commission. Licensing a tool means, in this context, that footprinting tool host allows other organizations to use and embed their tool to other websites. Licensing or offering a tool by commission is a rare characteristic, and according to my findings it is provided only by Sitra (*Elämäntapatesti*), Spark Sustainability (*The Carbon Donut Calculator*), and SYKE (*Itämerilaskuri).*

Tool

The Tool subcategory examines the basic information about the tools such as: 1) Name and description, 2) Platform, 3) Language and 4) Access. These characteristics offer information about how users identify different tools, how their purpose is explained for the users, and what different factors determine how users access the tools.

Name and description

During the analysis, I noticed that footprinting tools do not always have a specific name, or that their name might be a title of a specific feature belonging to a website or an application. Examples of tools which have a specific name are *Susla*, *Autokalkulaattori*, *Hiilijalanjälkilaskuri*, or *Hiilimittari*. Their name is either the brand of the tool or a title of the tool on a website or application. Tools which do not have a specific name can be found from websites such as NesteMY, Compensate, and Lentomaksu. These tools appear as part of the website and they might have their url, but they do not have a title to refer to. In these cases, I would assume that the user refers to the tools for example as "NesteMy's calculator". In general, I found it sometimes difficult to find the names for both the tool itself and the programs or such they belong to.

Depending on if the tool is connected to a program or such, or if it is clearly its brand, tools often provide a description of either or, or both. A description of a tool usually explains what the user can do with the tool, and what is the outcome of the use. For example, Tampere.Finland application's *Hiilijalanjälkilaskuri* is described the following way: Calculator enables collecting CO_2 savings estimated according to the use of bus, bike or walking, and viewing ranking among other users. Similarly, Väre Oy's *Hiilijalanjälkilaskuri* is described as "Calculator for examining everyday life carbon footprint and viewing tips on how to lower the footprint". Tool descriptions can usually be found either when entering the tool, or from the background materials.

Platform

The Platform characteristics consists of the group of following characteristics: 1) Link, 2) Type and 3) Extent. These characteristics relate to how users find the tools, where they can use them, and in what role the FPT's are on the platforms. Link to a site is more important with tools that are on website's, since mobile applications are usually searched from an app store with the name of the tool, or application it belongs to. During this study, links were found through an online search with related search words, from posts in social media, or searching tools online and app store after learning their name from other sources. This is most likely how users also will first encounter the tools.

As mentioned earlier in this study and the above paragraph, there are two types of Platform Types FPT are built on: 1) Websites and 2) Mobile applications (figure 2). Currently, nine (24 %) of Finnish footprinting tools are offered on a mobile application, from which most have been launched during the past three years. Here, technical development and preferences between

Figure 2. Platforms types.

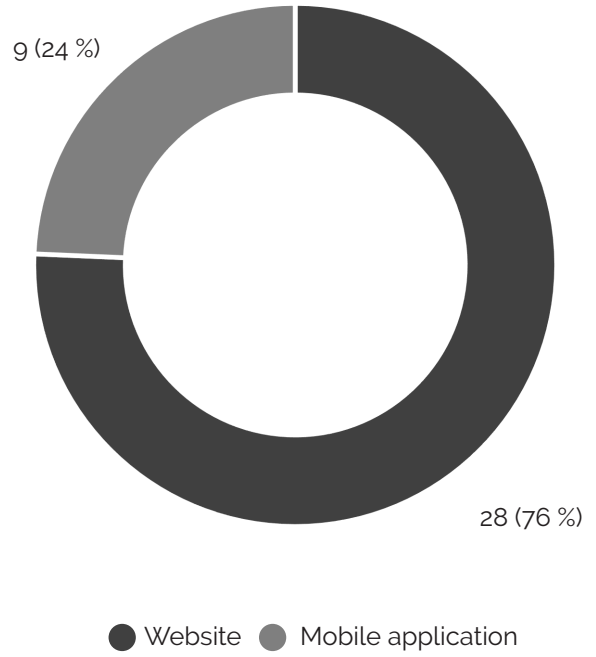
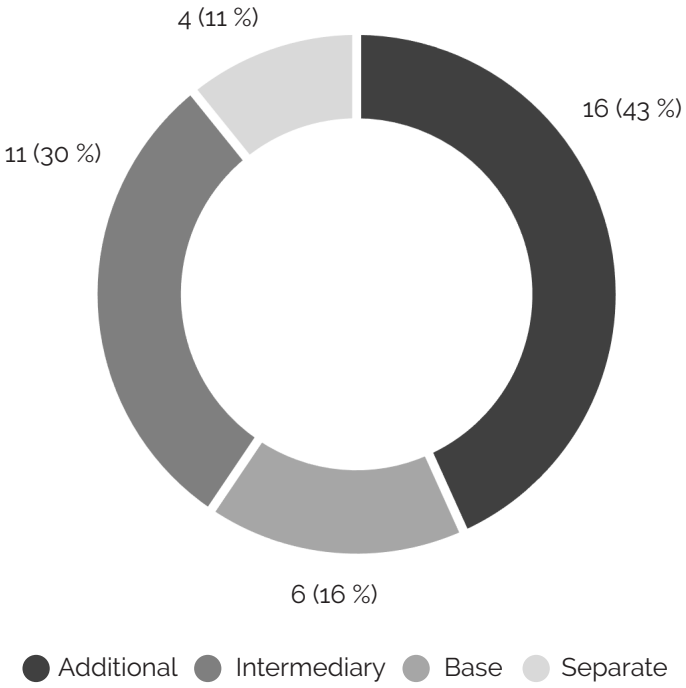


Figure 3. Extents.



websites and applications will most likely lead the future direction of footprinting tools as well, but that is a topic of another study.

The third characteristic of this group gets most of my attention, the Extent. With Extent, I aim to describe how the footprinting tool occupies the site or application it belongs to. Extent can be divided into four variables: 1) Base, 2) Additional, 3) Intermediary and 4) Separate. Base type means, that FPT functionalities, such as footprint calculation, are the main function or one of the main functions of a website or an app, and the purpose of the site is achieved through using the calculator. If FPT is offered as an Additional feature, FPT is offered to the user aside from the core purpose of a website or an application. Additional FPT's can appear to be similar as Base FPT, but Additional tools are not significant for fulfilling tool hosts' goals. Intermediary tools on the other hand use FPT functions order to direct the user to fulfil the core purpose of the website or application. For example, footprinting calculation can be used to examine their environmental impact before purchasing tool hosts products. Separate FPT's, lastly, are tools are part of tool hosts website, which has a specific domain, but do not have links back the main website. By character, they can resemble any of the first three Extents.

According to the analysis, six (16 %) of the tools represent the Base Extent type (figure 3). Examples of such tools are *The Donut*, *Susla* and *Ilmastodieetti*, an application and two websites whose core purpose is to offer an FPT for the individual user. The largest group is Additional tools (16, 43 %), which include tools such as *Saatuvukseni* as part of ResQ app, *Hiilimittari* as part of Nordea mobile, and *Elämäntapatesti* as part of Sitra's website. 11 of the tools (30 %), are Intermediary, represented by tools such as Gold & Green Foods Ltd's Laskuri and Friend of the Earth Finland's Lentomaksu. Only four tools (11 %) are separate, such as *Ilmastopeli*, *Itämeri-kone*, and *Itämerilaskuri*.

Dividing tools into the four Extents is not non-problematic, and as in all categorizations, exceptions can be pointed out. For instance, I categorized *Itämerikortti* as Additional, since the application its results are viewed from serves as a mobile banking app. But since it offers carbon calculation as a service along with banking services, and the idea

of the "Baltic Sea Credit Card" is to direct consumption based on environmental impact, the tool could be seen as a Base FPT whose other main purpose is to offer personalized information of consumptions environmental impacts.

Language

Choice of a language defines how well a tool will reach the overall population. According to the analysis, the main languages in Finnish FPT's are Finnish, Swedish, and English. The majority, 89 % of the tools are offered in Finnish, 51 % in English, only 14 % in Swedish, and 14 % were offered also in other languages (calculation in based on 35 tools, due to customership barrier). Some tools are offered only in English, such as *The Donut* and *Susla*. Susla has been created as an international collaboration, whereas *The Donu*t is provided by a Finnish company.

Access

Access refers to other characteristics which can limit the possibility to use an FPT. It includes factors such as 1) Age limit, 2) Registration, and 3) Customership. Age limit is often related to customership and might consider the whole tool, or only parts of it which require a subscription of services or donating. All in all, 22 (59 %) of the 37 tools do not have any above-mentioned restrictions. From the rest, at least two have age limit restricting the use of part of the functionalities (three other tools potentially have, but this information is unavailable). Ten of the tools require registration, and five offer registration as optionally or it is required for part of the functionalities. Seven of the tools require customership, and three tools require customership for part of the tool's functionalities.

Tools which require registration are often mobile applications, or tools which are connected to services offered by a company along with other products or services. Optional registration is often related to the possibility to save footprinting results, or usage of all FPT functionalities tool host offers. The Requirement for customership characteristic concerns a narrower group of tools, which use transaction or direct consumption data as the base of the footprinting calculation, such as apps provided by banks and retail conglomerates.

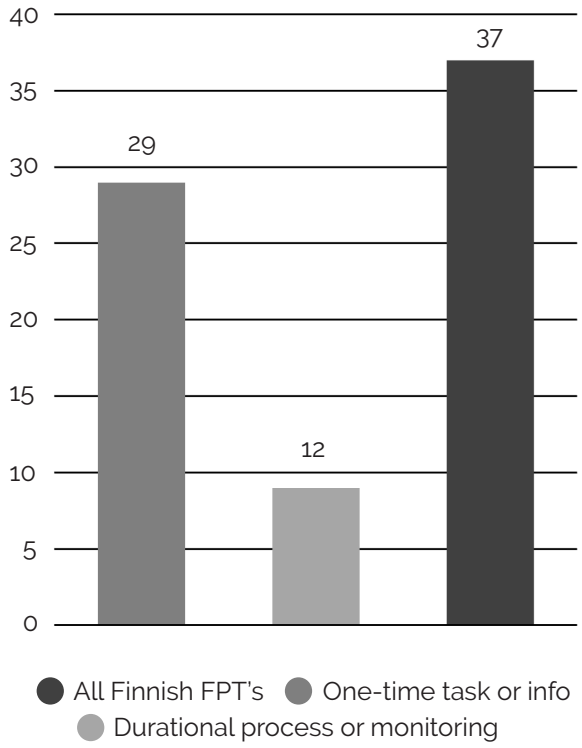
User engagement

Moving on from accessing a tool to characteristics which are created in order to achieve desired frequency and time the user spends on a footprinting tool. These characteristics form a group which I named User engagement, and it includes 1) Types of use and 2) User profile and settings. Types of use refer to the designated duration of the use, while User profile and setting can, in some cases, refer to allowing the user to form an attachment to the tool and personalize its functions. In a way, all these characteristics are connected to what a returning user will come back to when choosing to use the tool more than once.

Types of use

By inspecting the footprinting tools, I was able to categorize the tools according to how the duration of the user journey is designed and categorize tools to those which are a 1) One-time task or info, and to those which aim to offer a 2) Durational process or monitoring (figure 4). Unlike other characteristics, this group of characteristics is defined especially in connection to the use of footprint calculation. One-time task or info refers to tools which appear to have designed for "single-use". They often have a beginning and an end, such as *Elämäntapatesti* and *Lentolaskuri* (see image 3), but tools of this kind can also have a more open form which can begin from any part of the tool, such as *Ateriasovellus*. Tools which offer Durational process or monitoring are usually apps which use transaction, consumption or sensor data (for example, ResQ Club, S-group (see image 4), Helen) or tools which connect

Figure 4. User engagement: Types of use.



users footprinting survey to Incentives such as Planning and Experimenting (see chapter 6.2.4), such as in *Susla* and *The Donut*.

It seems, that majority of the tools offer an option to use the tool as a One-time task or info (29, 78 %), and 12 (32 %) of the tools offer Durational process or monitoring in a way or another. According to footprinting calculator perspective, eight (22 %) of the tools offer only Durational process or monitoring, meaning that their calculations are always connected to monitoring, and each time user comes back to the tool, they will see new results, even if the actual use of the tool would not have been active. Durational tools might also require active use in order to show new results, such as in *CitiCAP*, which requires that user keeps the tool active to make track their movement.

User profile and settings

Concerning durational processes, users often need to create a profile. Profiles include different sections, such as the ability to view results and follow individual progress, change the settings, and so on. Here details relating to user profiles are not examined, since they in most cases reflect the overall functionalities of the tools and would result as repetition. Often profiles include settings, but settings can also appear without a profile, or as a replacement of a profile. Profiles and settings can have a significant role in a tool, or they can be a characteristic which does not matter much for the user – in these cases, the user might not even use the profile.

From the 35 tools which I was able to gain information for this section, seven (20 %) provide a user profile and ten (29 %) settings. Tools which offer these options are mostly mobile applications, but they include also websites such as *Susla*, Compensate's website tool, *Sitoumus2050*, and *Ilmastodieetti*.

Instructions and background information

Instructions and background information group present different types of information users are offered about the tool and its use. This information can, for instance, help the user to estimate the tool's credibility, get information of how it is used, and with what kinds of terms. The provided information can also help the user to understand what the tools calculations and other functionalities are based on. Since tools offer a broad range of information and in multiple forms, I simplified this section to consider three main categories of information: 1) Creation and updates, 2) Instructions and background information and 3) Terms, privacy and permissions.

Creation and updates

Characteristics group Creation and updates include information such as 1) Number of users, 2) Date of launch, 3) Update frequency and 4) Update history. All four types of information related to the age of the tool, and how frequently it is being updated. It seems, that presenting any of this information is uncommon, since 70 % (26) of all the tools

Image 3. An example of a One-time task or info type of a tool. Lentolaskuri (accessed November 2nd, 2020) offers the user information on the climate impact of flying as a carbon footprint. The survey, presented in the picture, contains questions relating to the number of passengers, departure and arrival locations, stop-overs, and if the journey is made to one direction or back and forth.

Image 4. An example of a Durational process or monitoring type of tool. S-Group's S-mobiili application (accessed July 14th, 2020). The graph presents users monthly carbon footprint based on food purchases. User can select to view the results according to the previous 12 months or the past month. The footprint is calculated according to users purchases in S-Group's stores.

do not offer information of the number of users, and 24 % (9) tools from which this information is available, has it available in the mobile app store, and not in the application. Similarly, 72 % (26 of 36 tools) do not provide information of when the tool has been launched, 94 % (34 of 36 tools) does not refer to how often the tool is being updated, and 67 % (24 of 36 tools) does not offer an update history.

As the numbers show, tools which provide this information are in minority, but users could potentially find this information from other sources, such as looking for the launch date from tool hosts blog posts or news on social media, but update frequency and history are not the types of information tool hosts would publics in their communications, if tool creation is not their core subject area and they would aim to address expert audience.

Instructions and background information

As the title states, Instructions and background information consist of information such as 1) User instructions, 2) FAQ and 3) Calculation documentation, from which the latter is an FPT specific document type which often includes information of the calculation formulas and data factors used in the footprinting calculation. Each information type is often provided to guide the use of a tool, explain what the tool means, or justify the provided information.

User instructions can be offered in a separate section of a tool, as in 6 of 35 tools (17 %), or embedded along the process in small bits, as in 20 of 35 tools (57 %). Nine of 35 tools (26 %) did not offer information of the tool's usage, which in comparison to other tools could have been categorized as User instructions. FAQ, which often provides information both of the use of the tool, and the subjects the tools is related to where offered only in 7 of 35 tools (20 %).

Calculation documentation instead was offered in total 23 of 35 tools, which I divided into Detailed (15 of 35, 43 %) and Simple (8 of 35, 23 %). Difference between Detailed and Simple documentation is, for instance, that Detailed documentation might present all calculation formulas and emission data factors which have been used, including also estimations utilized in the calculation, whereas Simple documentation might only present the source of information, or explain the calculations in a general manner.

Terms, privacy and permissions

The last group of characteristics dealing with information provided about the tool deals with 1) Terms of use or similar, 2) Privacy statement or similar and 3) Fundraising permission. These documents or information sections allow the user to gain information of their legal stand and also what legal obligations the tool deals with. Term of use and Privacy statements contained, in some occasions, similar content, and tools used a variety of titles for these sections.

Terms of use can be found from 9 of 35 (26 %) tools, and 5 (14 %) offer this information as part of the tool hosts website or application the tool belongs to. The majority, 60 % (21), do not offer Terms of use. Privacy statement is more common, as 12 of 35 (34 %) offer it in connection to the tool, and 13 (37 %) as part of the tool hosts website or application containing the tool. Only 29 % does not offer a privacy statement at all. Fundraising permission is rare, as only 2 of 35 (6 %) tools are offering it on their tool, and it is related to gathering of donations for environmental protection by John Nurminen Foundation and Friends of the Earth Finland.

6.2.2. Data

The Data category considers data which FPT's gather from their users, and it is divided into four subcategories: 1) Gathering and use of personal data, 2) Data source, 3) User data and 4) Analytics data (see table 5). The topic is first examined from the purpose point of view, and then moving closer to the details of types of data tools gather. I chose to examine data, since, not always, but often FPT hosts are required to collect personal data from the users or customers to provide a functioning footprinting tool. Information relating to what data tools collect, when and how it is collected, can be found from privacy statements, which most tools provide (see section Terms, privacy and permissions in chapter 6.2.1.).

Privacy statements also declare with whom data is shared with, how long it is stored, and so on, but here I concentrate on examining only those parts, which consider the collection, use, and types of data. I focused to examine privacy statements which are provided along with a website or application and excluded privacy statements which considered the tool host's entire website or application, not only the FPT. This way I drew the focus on

Table 5. The Data category.

Subcategory	Characteristic	Variables (including a.-h.)
Gathering and use of personal data	Personal data^ Types of use (a.^)	
Data source	Use of the tool (b.^) Other sources (c.^)	
User data	Data provided by the user (d.^) Data relating to the use of the service (e.^) Data generated by the service (f.^)	
Analytics data	Device information (g.^) Use (h.^)	

a.
Claims handling and legal processes
Fulfilling contractual obligations
Identification of the users
Legal obligations
Providing services
Research
Sales and/or marketing
Service development, quality improvements and/or trend analysis
User and/or customer communications and relations management

b.
Information collected from registration or creation of an account
Information collected during the use of tool hosts' products or services
Device
Information shared to tool host by third party service providers
Cookies
Downloading and/or using a mobile application

c.
Customer service and communications
Event participation
Job application
Newsletter subscription or other membership
Publicly available sources
User or customer survey

d.
Age
Car register information and/or other car-specific information
Current or previous employer and/or current title
Customer identity number or similar
Credit or bank information, or other billing information
E-mail address
Gender
Consumption habits
Language selection
Marketing opt-ins or opt-outs
Name and/or surname
Name of the organization
Nickname or user name
Occupation
Place of residence
Password or encrypted password
Phone number
Social security number
System of measurement
Third -party account information and/or profile picture
User or organization picture or logo
Other information given to the host while using the service

e.
Amount of earned virtual currency
Payments, invoicing, order history, and/or follow-up information
Records of customer service
Redemption and usage information of coupons

f.
Carbon footprint based on calculated or tracked consumption habits

g.
Application version
Browser type
Browser version
Device advertising identifier
Device identification number
Device IMEI
Device model and/or type
IP-address
Location
Name of the internet service provider
Operating system
Operating system version

h.
Acceleration information (Acceleration sensor)
Altitude and/or air pressure
Time and date of visits to the service
Interaction with the service
Length and duration of journeys
Location information (GPS) and/or accuracy of location information
Magnetometer information
Mobility information
Position information (Gyroscope)
Time spent on the service
Types of mobility and/or reliability of mobility information

** Free entry, ^ Varying options, such as Yes and No.*

data which footprinting tools collect and use and opted out for example more general privacy statements considering tool host's other services. In this thesis, compensation services are considered FPT features.

Gathering and use of personal data

Characteristics group Gathering and use of personal data explore which tools gather personal data from their users and what the collected data is used for. This group is divided into two sections: 1) Personal data and 2) Types of use.

Personal data

The first and obvious questions to ask is, does a tool gather personal data, to begin with. From the 11 tools that were available to examination, 9 (82 %) collect personal data, and two (18 %) does not. The two tools which offer a privacy statement, and which offer an FPT without the collection of personal data are the same tool offered by two different tool hosts, John Nurminen Foundation (*Itämerilaskuri*) and Helsingin Sanomat (*Itämeri-kone*). The list of tools which will be further examined in this chapter are:

1. *CitiCAP*
2. *Sitoumus2050*
3. Compensate
4. Compensate's web tool
5. *Ilmastodieetti*
6. *K-Ostokset* feature in K-ruoka application
7. *CO2-muunnin* tool in OpenCO2.net carbon footprinting platform
8. *Susla*
9. *The Donut*

When a privacy statement considers only the tool itself is quite clear in all except one occasion, which is *CO2-muunnin*. OpenCO2. net by Clonet oy offers a variety of tools, but *CO2-muunnin* is the only one primarily targeted to individuals. Since the site offers similar tools, only for different audiences, I considered it suitable for this group of tools. If the tool was embedded on Clonet's website, it would be left out.

Types of use

The analysis of how tools use the gathered personal data revealed at least nine different Types of uses. In some cases, privacy statements offered only examples of the Types of uses and not a comprehensive list, which makes the analysis inaccurate. The information gathered here can though help in starting to build a better understanding of the use of personal data in FPT's.

The most commonly mentioned Types of use are 1) Providing services, 2) Service development, quality improvements and/or trend analysis, and 3) User and/or customer communications and relations management (see figure 5). In order of prevalence, the next Type of use would be 4) Legal obligations, which is mostly mentioned by Kesko, Compensate and *CitiCAP*, all tools which handle transactions of real money or virtual currencies. Less common Types of uses are 5) Claims handling and legal processes, 6) Fulfilling contractual obligations, 7) Research, 8) Sales and/or marketing, and 9) Identification of the users. My interest is drawn to the Type 7) Research, which is mentioned by *CitiCAP*, *Susla*, and *Ilmastodieetti*, all tools which originate to funded projects and which have strong relations to the public sector.

To summarize, tool hosts' data gathering concentrates on fulfilling the basic needs of providing the tools, improving them, and offering a channel for communication. Less common Types of uses can be related to specific functionalities FPT's offer, such as features including transactions, or tool hosts aim to learn from the users, for example by using the accumulating information for research purposes.

Data source

In FPT privacy statements, sources of data are divided into two categories: 1) Use of the tool, and 2) Other sources. Use of the tool refers to the collection of data which happens during the use, and while other sources are connected more to the overall environment where tools are being used, such as events.

Use of the tool

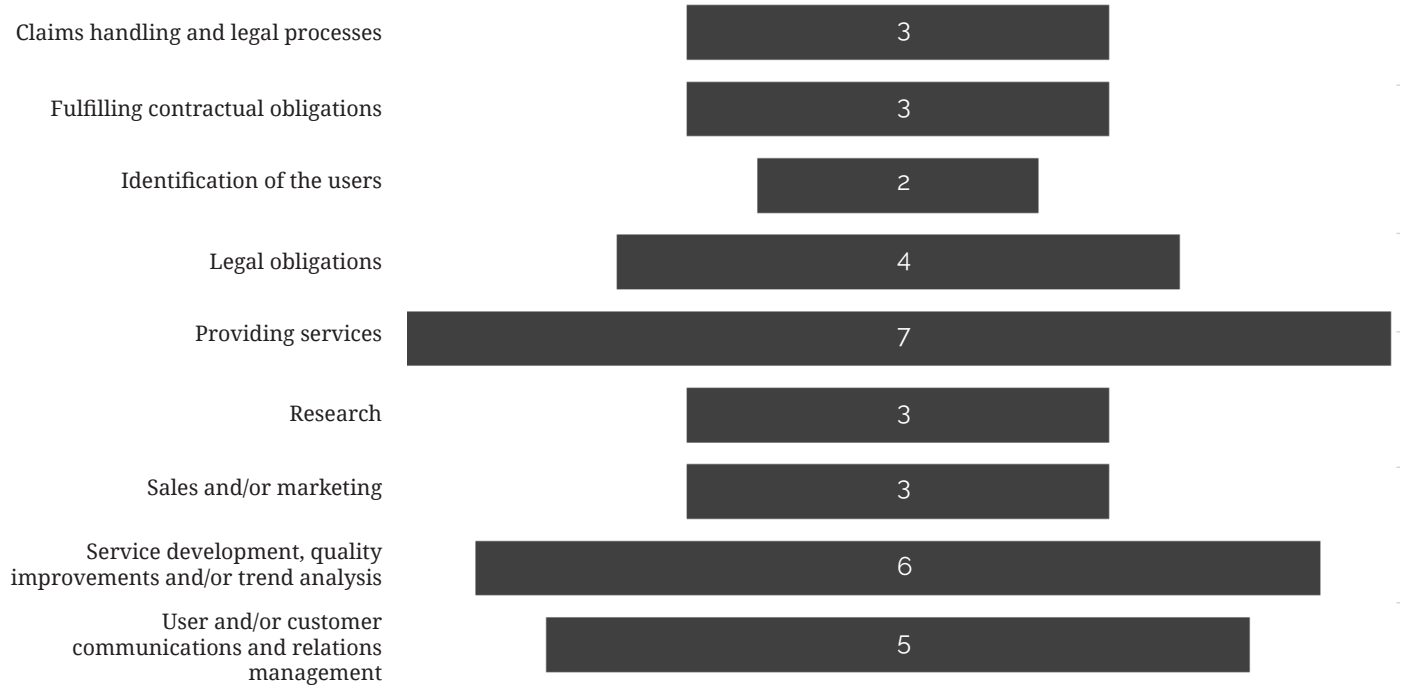
The main source of data in FPT's is the Use of the tool. According to the analysis, Use of the tool includes 1) Information collected from registration or creation of an account (8 of 9, 89 %), 2) Information collected during the use of tool hosts' products or services (7, 78 %), 3) Device (6, 67 %), 4) Information shared to tool host by third-party service providers (4, 44 %), 5) Cookies (3, 33 %), and 6) Downloading and/or using a mobile application (2, 22 %).

When considering the unique characteristics of footprinting tools, information gathered from footprint calculations and other functionalities relating to sustainable lifestyle choices are included into data source Information collected during the use of tool hosts' products or services. This information can contain, for instance, personal data related to Incentives to make sustainable actions (see chapter 6.2.4), or footprint calculations and tracking (see chapter 6.2.3). FPT's can though offer footprint calculation and other functionalities and without collecting personal data. For instance, according to the analysis, *Sitoumus2050* does not gather information from the use of the tool.

Other sources

Other sources of personal information include 1) Customer service and communications, 2) Event participation, 3) Job application, 4) Newsletter subscription or other membership, 5) Publicly available sources and 6) User or customer survey. Each source was mentioned by only 1-3 tools. Sources such as Job applications and Publicly available sources are more related to the organizational information gathering than information gathered for the footprinting tool purposes.

Figure 5. Personal data: Types of use. (Based on nine tools.)



User data

The main types of data FPT's collect are User data and Analytics data, which are presented here and in the next section. User data is a type of Personal data which is collected directly from the user or which is generated by the services provided by the tool. According to the analysis, FPT's collect three types of User data: 1) Data provided by the user, 2) Data relating to the use of the service and 3) Data generated by the service. The analysis considering User data types in inaccurate due small data set and quality of the data, and thus the focus here is on the types of data and not on the prevalence.

Data provided by the user

The first group of characteristics contains information which user computes to the service, including for example different kinds of personal information relating to the identification of the user (e.g. name, address), information required for transactions (e.g. credit card number), or personal preferences relating to settings (e.g. choice of language, marketing opt-ins or opt-outs). The full list of Data provided by the users can be viewed from table 5 (variables d.).

Most commonly tools ask the user to provide their Email and Name and/or surname. Other types of data in this group are less common. A good example of a very non-typical type of data is Car register information and/or other car-specific information, which is only requested in *CitiCAP* application according to its privacy statement.

Data relating to the use of services

The second group of User data consists of user data which accumulates during the use of the service. Full list of Data relating to the use of services can be seen in table 5 (variables e.).

Amount of earned virtual currency and Redemption and usage information of coupons, again, are special characteristics of CitiCAP, and they are related to the application's carbon trading scheme. Payments, invoicing, order history, and/or follow-up information, on the other hand, are connected to Compensate's website's and application's compensation services, which user can use if they wish. Kesko's application does not offer functionalities including transactions (according to the knowledge gathered during the analysis), so it does not itself collect this type of data – even if its functions are based on it.

Data generated by the service

The last group of User data contains only one type of data, but it is very crucial for FPT's: Data generated by the service. This type of data contains Carbon footprint based on calculated or tracked consumption habits – the result of the footprint calculation. According to their Privacy statements, not all of the nine examined tool hosts collect this information to their databases. Here again, the different approaches in writing the statements and level of detail can affect the results.

Analytics data

Analytics data is Personal data which is gathered automatically by different technologies when a tool is being used. Analytics data can also be anonymous if the user is not identifiable from the data. Tool host can thus either handle Analytics data by as Personal data, or anonymous data.

Analytics data is divided into two groups: 1) Device information and 2) Use. Device information refers to data about gathered through applications, browsers, devices, and operating systems, while Use refers to data accumulating automatically from the use of the technologies, such as different types of sensors of GPS data.

Device information

During the analysis, I was able to find 12 different types of Device information FPT's collect (see table 5, variables g.).

There is not, according to my findings, a single tool which would gather all this information. Most common types are Device model and/ or type and IP-address, both mentioned by four tools. Other types were less common.

Use

This particular section mostly considers *CitiCAP* application (image 5), which is a unique FPT among other Finnish footprinting tools. It is the only tool which generates footprint calculations from data which is gathered by mobile phone sensors, and it contains all types of Use Analytics data except Interaction with the service (at least according to the analysis). A small number of other analyzed tools mentioned using Analytics data such as Time and date of visits to the service, Interaction with the service, Location information (GPS) and/ or accuracy of location information, and Time spent on the service. The full list of Use type of Analytics data can be seen in table 5 (variables h.).

6.2.3. Information

One of the main purposes of footprinting tools is to promote sustainable lifestyles, especially by providing information on the environmental impact of individual consumption habits. This chapter considers the different ways tools provide information, and what kind of differences tools have when it comes to the ways of generating the information and communicating it to the public. As a result of the key findings, I have divided Information category into three subcategories: 1) Personalized information, 2) Information of sustainable choices, and 3) Information on sustainability (see table 6).. Within the scope of this thesis, I concentrated mostly on the first two subcategories and

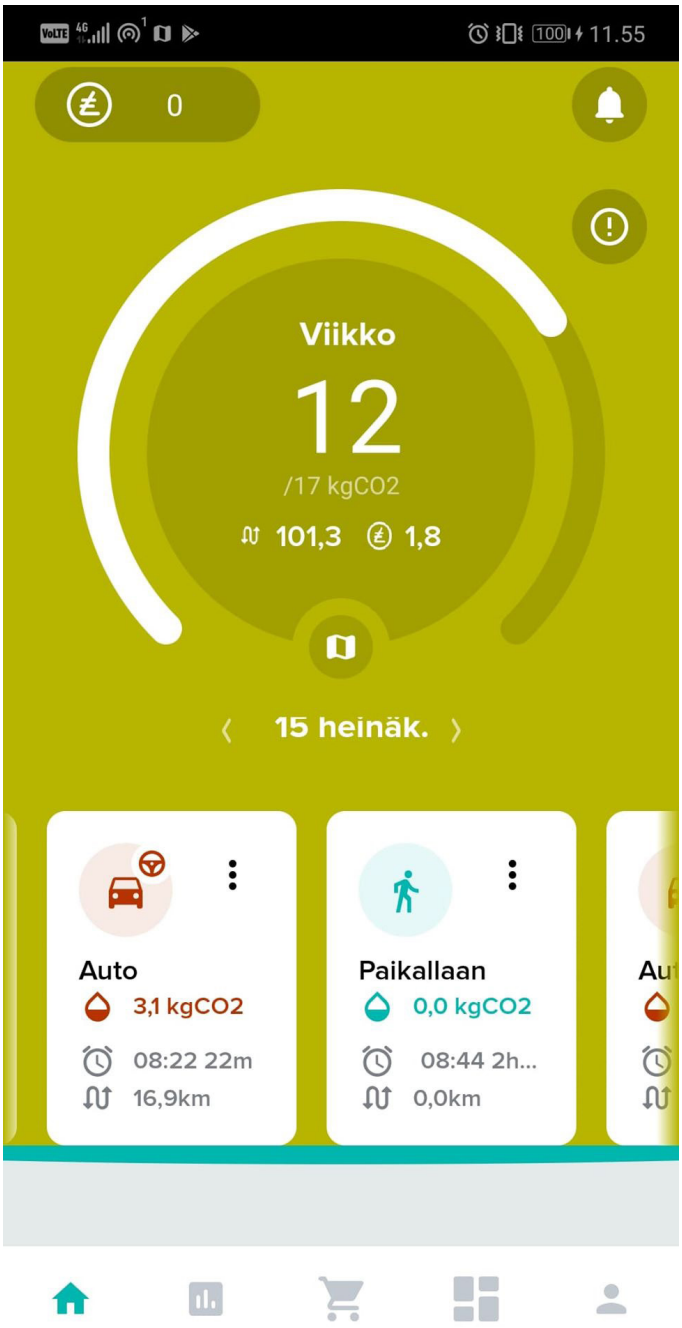


Image 5. The CitiCAP application presenting the user's weekly mobility (accessed July 16th, 2020). The view presents, for example, information of earned virtual currencies (top left corner), how much carbon emissions week 12's mobility has caused, how many kilometres the user has travelled, and which mobility types CitiCAP has detected (auto means car, paikallaan means being still).

selected only a few examples of the third.

Personalized information

Most often footprinting tools are discussed from the perspective of the content of this subcategory. Personalized information examines characteristics relating to footprinting, the production of user-specific

Table 6. The Information category.

Subcategory	Characteristic	Variables (including a.-j.)
Personalized information	Calculation method and data factors	Footprinting method (a.^) Input of consumption data (b.^) Data factors (c.^)
	Calculators	Survey version (d.^) Supplementary questions^ Prefilled or empty survey (e.^) Consumption category types (f.^) Categories, as presented in the tool (Total number of survey questions per category)* Total number of survey questions*
	Trackers	Sensors* Source of purchase or consumption data* Types of tracked consumption categories (g.^)
	Results	Type (h.^) Other*
	Results presentation	At what point user sees their results? (i.^) What user can compare their results to?* Is user offered a breakdown of the result in different consumption categories?^ Can user view their results in different time frames?^
	Follow-up	Results storing^ Adaptation of results (j.^)

a.
Calculator
Tracker

b.
Survey
Mobile phone sensor data
Purchase or consumption data
Other

c.
Adaptable
Fixed

d.
One version
Quick and detailed versions separately

e.
Empty
Partially prefilled
Prefilled

f.
Multiple consumption categories
Specific consumption category
Specific product or service

g.
Multiple consumption subject areas
Specific consumption category
Specific product or service

h.
Baltic Sea footprint
Carbon absorbtion
Carbon footprint
Carbon handprint
Ecological footprint
Eutrophicational impact
Environmental impact of production
Material footprint
Natural resource savings
Water footprint

i.
After active use of the tool
After answering survey questions
After answering to questions while the progress is shown while filling in answers
Directly
Results and questions are available simultaneously

j.
Adopting saved answers or creating a new account
Adopting answers before leaving the site, or starting over
Adopting saved answers, using the tool, or creating a new account
Adopting answers before leaving the site, adopting saved answers, or starting over
Adopting answers before leaving the site, adopting saved answers, creating a new account, or starting over
Continuing consuming and/or changing consumption habits
Continuing using the tool and/or changing consumption habits
Continuing using the tool and/or creating a new account
Starting over

** Free entry, ^ Varying options, such as Yes and No.*

Table 6. The Information category.

Subcategory	Characteristic	Variables (including k.-l.)
Information on sustainable choices	Lifestyle and consumption tips	Does the tool offer lifestyle tips? Type (k.^)
	Presentation of the tips	Is the user being offered a selection of tips based on their results?^ Can user compare the impact of the tips?^ What are the benefits of following the tips or recommendations according to the host?* In which form the tips are offered to the user?*
Information on sustainability	Types (a tentative list) (l.^)	

k.	l.
Lifestyle or consumption tips	Environmental issues
Product and/or service recommendations	Footprinting concepts
Both	Target levels of environmental impact mitigation
	Examples of sustainable living
	Other

** Free entry, ^ Varying options, such as Yes and No.*

information on the environmental impacts of consumption habits. I begin by exploring 1) Calculation method and data factors, after which I moved on to examine the different types of footprinting tool types 2) Calculators and 3) Trackers. Next, this chapter opens up what 4) Results Finnish FPT's offer, while 5) Results presentation explores how results are shown. Lastly, 6) Follow-up presents what different ways users are offered to monitor their progress.

Calculation method and data factors

The Calculation method and data factors group consists of 1) Footprinting method, 2) Input of consumption data and 3) Data factors. The key characteristic of this group is the method of footprinting, which in many ways determine the structure and usage of a tool. According to the analysis of the Finnish footprinting tools, I found that footprinting tools can be grouped into two categories:1) Calculators and 2) Trackers (see figure 6). Calculators are the type of tools which require data input from the user, while Trackers utilize existing or accumulating databases. In some cases, also Trackers require data input from the user, but mostly in connection to registration and not to the calculation of the footprint. From the 34 tools available for analysis of Footprinting method, 30 (88 %) are Calculators and 4 (12 %) Trackers. The three tools which I did not have at my use since they require customership, *Itämerikortti* in connection to Ålandsbanken Finland app, *Hiilijalanjälkilaskuri* in S-mobiili app, and *Hiilimittari* in Nordea Mobile app, are most likely Trackers. Tools which according to the analysis are the Trackers, are *CitiCAP*, K-Ostokset in K-Ruoka app, *Saavutukseni* in ResQ app, and Helen's *Sävel + service*.

Footprinting method can be then analyzed further by looking into the Input of consumption data, of which I recognized four different ways: 1) Survey, 2) Mobile phone sensor data, 3) Purchase or consumption data and 4) Other (see figure 7). 29 of 30 Calculators are surveys. The one remaining Calculator, *Ateriasovellus*, I categorized as Other, since its use differs significantly from the other tools. Typically Surveys

Figure 6. Calculation methods. (34 tools included.)

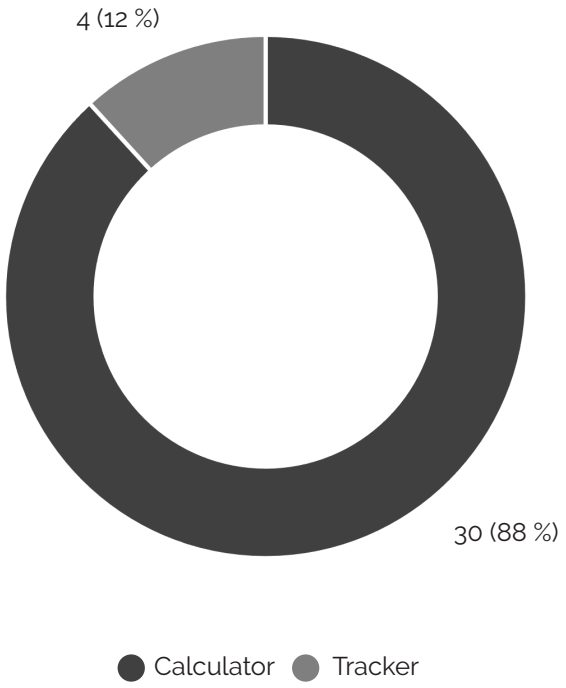
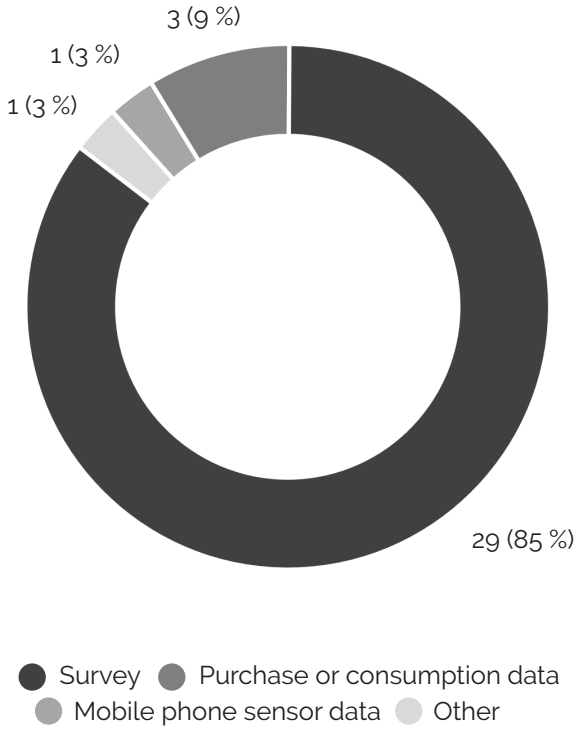


Figure 7. Consumption data input types. (34 tools included.)



have a set of question to which user gives or selects an answer to, but in *Ateriasovellus* user (after answering to a few questions) is supposed to select different food items to a plate, and while collecting a meal option of choice, the user is offered a selection of results communicating the environmental and health effects of the portion. When considering Trackers, only one uses Mobile phone sensor data (*CitiCAP*), while the other three utilize Purchase or consumption data to generate footprints.

Data factors are in a key role in footprint calculation, but since this thesis focuses mostly on the functionalities and characteristics which affect user experience and content, I do not consider the "background" work which is required to offer users a Calculator or a Tracker. I only want to highlight one minor characteristic, which relates to whether the Data factors are 1) Adaptable or 2) Fixed. 33 of the tools analyzed in this section have Fixed Data factors, meaning that they are static and only tool host can adapt them. An interesting opportunity to adapt data factors is offered by *Autokalkulaattori*, a detailed tool for estimating environmental effects and costs of different car option. It does not only offer multiple questions and options in its survey but also presents a list of the data factors with an opportunity to change them. My guess is, that since the tool has a specific purpose and it focuses on one consumable, it can reach users with high enough expertise and interest in detail, which use of Adaptable Data factors require.

Calculators

The Calculators characteristics provider information of tools whose Input of consumption data type is Survey. The groups in this section are 1) Survey version, 2) Supplementary questions, 3) Prefilled or empty survey, 4) Consumption category types, 5) Categories, as presented in the tool (Total number of survey questions per category) and 6) Total number of survey questions. This section considers Calculation type of FPT's, 30 tools in total.

Before the analysis, I was aware that some tools might have a short and quick version and a detailed version of the same

footprinting tool. This also came up in the data, and I formed two characteristics accordingly: 1) One version and 2) Quick and detailed versions separately. I was surprised that in the end only one tool, Spark Sustainability's web tool *The Carbon Donut Calculator*, offered two versions. Its quick version is based on 5 questions, and longer version has in total 23 questions. The more common way in which users can affect to the level of detail of their response is Supplementary questions: optional questions defining users consumption habits, or questions which offer tool hosts socio-demographic data of the users, for instance. Six (20 %) of the studied 30 Calculator type of tools provide Supplementary questions, being *Autokalkulaattori*, calculator offered on NesteMY's website, *Ilmastodieetti*, *Itämerilaskuri*, Itämeri-kone, and *Susla*.

Third aspect considering characteristics which affect the way user's fill-in Calculation Surveys is Prefilled or empty survey, divided into three option: 1) Empty, 2) Partially prefilled, and 3) Prefilled. If a tool has Prefilled answers, the user begins to answer a survey which has preset values of consumption in all questions, while Partially prefilled has both Prefilled and Empty questions. Partially prefilled also includes tools which offer two options (such as Yes or no) to one or more questions and has opted one of the options. Empty means, that the survey is blank. Empty type is the most common (16 of 30 tools, 53 %), while ten (33 %) of the tools are Partially prefilled, and four (13 %) Prefilled. An example of an Empty tool is presented below in image 6. Prefilled tools include *Kalastetun kalan LCA-laskuri*, *Lentomatkaajan hiilijalanjälkilaskuri*, *The Carbon Donut Calculator*, and *Itämerilaskuri*. The purpose of Prefilled or Partially prefilled answers seems to be to make the filling of the survey easier by, for example, offering an example answer (in which form answer should be given), or by offering the most common option first and that way making the process

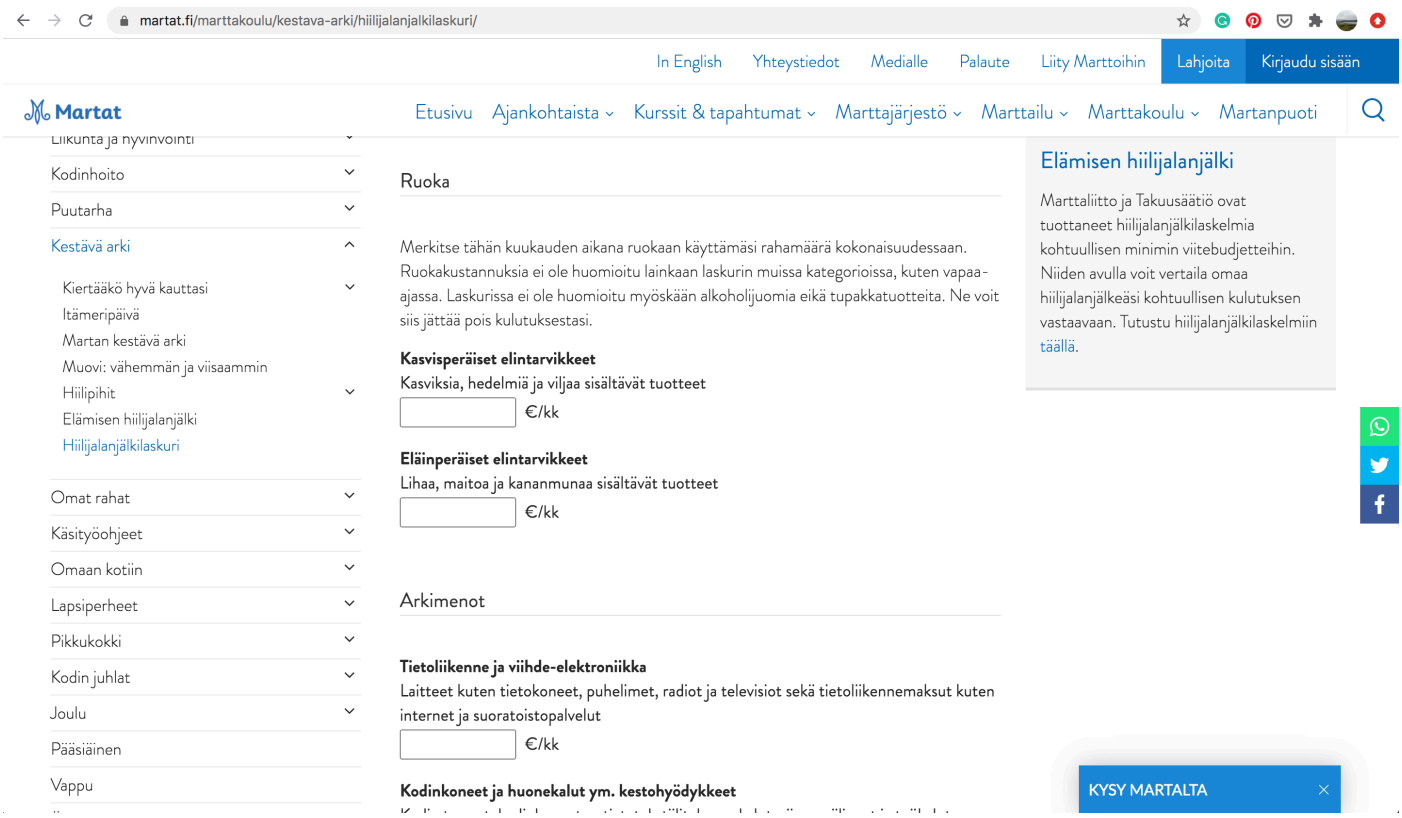


Image 6. An example of a Calculator type of FPT Hiilijalanjälkilaskuri (accessed November 3rd, 2020). In this section of the survey, the user is asked to fill in consumption data relating to their food and everyday expenses. The survey asks the user to offer the estimation as euros spent in a month for specific consumption categories such as plant-based or animal-based groceries.

faster for most users. Prefilled answers can also relate the process of answering the survey to an average footprint, such as in *The Carbon Donut Calculator*, which allows the user to see how their consumption habits change the preset carbon footprint level (see more in Results presentation).

The rest of this section examines the consumption categories. Surveys are often divided into different sections, which each represent a specific area of consumption. Instead of forming "archetype" consumption domain according to the domains and questions of all 30 Calculators, I chose to examine consumption categories in more general level as Consumption category types: 1) Multiple consumption categories, 2) Specific consumption category and 3) Specific product or service. To conclude, Calculators can base their Survey on a selection of different consumption categories, often leading to a lifestyle footprint (see Results later in this section). Difference between the other two types are, that Specific consumption category relates to one domain in general level (e.g. environmental impact of cars, as in *Autokalkulaattori*), while Specific product or service means that the calculation is done to communicate tool hosts products footprint (e.g. carbon emissions of biodiesel by NesteMy', calculated in their web calculator) – or handprint (e.g. emission saving by travelling by train in Finland, as in VR's Ilmasto raiteilleen website's *Hiilijalanjälkitesti*).

Most Finnish FPT's represent the first type, Multiple consumption categories (18 of 30, 60 %). Seven (23 %) of the tools consider a Specific consumption category, and five (17 %) Specific product or service. Consumption category types will be later compared to types of Results (see Results section).

The specific domains (Categories, as presented in the tool) different tools use can be viewed in table 7, containing also the Total number of survey questions and number of questions in each domain. Domains were analyzed according to titles which tool hosts have used for the different sections in their Surveys and which often suit the purpose of communicating the subject of a group of questions and dividing a survey into smaller fractions. If tools were available in English, Categories are listed according to the English title, otherwise, Categories are my translations from Finnish to English. Some tools (8 in total) did not name their domains. These tools consider Calculators in all Consumption category types, but mostly in type Specific product or service. I assume that naming the categories is not that relevant if the tool considers the same subject as the website or application in general. In other cases not giving titles to questions relating to different consumption domains seems to be a stylistic choice. For instance, Väre oy's *Hiilijalanjälkilaskuri* is a Partially prefilled Survey, containing Multiple consumption categories and ten questions, but no separation between the different domains. Similarly, it also presents the results as one number, and not separated according to the different domains (further information in Result presentation). Other similar tools, such as *Elämäntapatesti* and *The Carbon Donut Calculator* have divided their survey and Result presentation to different domains.

To summarize the findings relating to the different Categories, it seems currently there are no common ways of naming the domains or guidelines which would determine which questions belong to each domain. Neither there is a consensus of the level of detail, meaning that the number of questions can vary significantly between similar domains and different Calculators. There are, of course, repeating themes especially among tools which consider the whole lifestyle, but ways of naming and dividing the survey into different sections have significant differences. For example, during the analysis I noticed that questions relating to flying can be found from Mobility (*Ilmastopeli*), Transport and tourism (*Elämäntapatesti*), Flights (*The Donut*), or Leisure (*Susla*),

Table 7. Categories, as presented in the tools, the number of survey questions per category and the total number of questions.

Number	Footprinting tool	Categories (Number of questions)	Total number of questions
2	Ilmastopeli	Housing (2), Mobility (8), Nutrition (1), Consumption (1)	12
3	CO2-muunnin	No category (18)	18
4	Compensate	Living (9), Travel (7), Food (7), Shopping (4)	27
5	No name (as part of Compensate's website)	No category (1), Living (3), Travel (4), Food (1), Shopping (1)	9
6	Lentolaskuri	Travel information (6)	6
7	Finnairin päästölaskuri	No category (2)	2
8	Ateriasovellus	No category (8)	8
9	Kalastetun kalan LCA-laskuri	No category (3), No category*	3*
10	Laskuri	No category (3)	3
12	Itämeri-kone	Basic information (2), Housing 10), Holiday home (11), Hobbies (15), Diet (16), Mobility (21)	75
13	Lentomatkaajan hiilijalanjälkilaskuri	No category (1)	1
14	Itämerilaskuri	Basic information (2), Housing 10), Holiday home (11), Hobbies (15), Diet (16), Mobility (21)	75
16	Sitoumus2050	Housing (9), Mobility and travelling (7), Food (7), Things and purchases (4)	27
17	No name (as part of Lentomaksu website)	Flying (3)	3
18	Hiilijalanjälkilaskuri	Food (2), Everyday ex-penses (7), Mobility (3), Housing (3)	15
19	No name (as part of NesteMY website)	No category (5)	5
21	Uudelleenkäytön vaikutuslaskuri	Clothing (3), Furniture (3), Other goods (3), Electronics (3)	12
24	Elämäntapatesti	Living (9), Transport and tourism (7), Food (7), Things and purchases (4)	27
25	The Donut	No category (2), Housing (3), Electricity (3), Driving (3), Other transport (3), Flights (2), Food (2), Consumption (3), Second-hand consumption (3)	23
26	The Carbon Donut Calculator	Quick: Housing (1), Driving (1), Flying (1), Food (1), Consumption (1) Detailed: Heat (3), Electricity (3), Transport (8), Flights (1), Food (1), Consumption (7)	5 (Quick) 23 (Detailed)
27	Autokalkulaattori	Driving kilometres per year (1), Vehicle specific information (15), Fuels (5), Fuel consumption (4)	25
28	Ilmastodieetti	Personal information (7), Housing and energy (44), Food (11), Travel (26), Goods and services (9), Waste 9)	106
29	Itämerilaskuri	Basic information (2), Housing (10), Holiday home (11), Hobbies (15), Diet (16), Mobility (21)	75
30	Elämisen hiilijalanjälki	Food (2), Everyday expenses (7), Mobility (3), Housing (3)	15
31	Susla	Background questions (10), Housing (11), Mobility (11), Leisure (20), Food (13), Goods (15), Other (1)	81
32	Ruokavalion hiilijalanjälkilaskuri	Red meat (1), Chicken (1), Salmon (1), Cheese (1)	4
33	Hiilijalanjälkilaskuri	Buss (3), Bicycle (2), Walk (2)	3**
34	Hiilijalanjälkitesti	No category (3)	3
35	Hiilijalanjälkilaskuri	No category (10)	10
36	Ilmastolaskuri	Food (1), Mobility (1), Housing (1), Other consumption (1)	4

* Unlimited drag-and-drop options ** Two of the questions are same in each category.

while for example Martha Organisation's and Guarantee Foundation's calculator's Mobility section does not include flights at all, since it only considers daily mobility. Tools which consider Specific consumption category, on the other hand, might have very specific Categories, such as in *Ruokavalion hiilijalanjälkilaskuri* or *Autokalkulaattori*.

The total number of questions is counted by calculating each question of the survey which requires an individual answer. For example, a multi-choice question of different mobility options is one question, but if the tool asks to specify hours spent monthly in each mobility type, each presented mobility type is considered a separate question. It should be noted, that the total number of questions is the actual total number: a regular user might not need to fill in every single question. In some cases, selecting a specific answer opens a set of questions which would otherwise be hidden (such as type of a car, and consumption of a car). The total number also contains Supplementary questions. Questions which I did not include to the total number were, again relating to cars, questions for the second, third, or fourth car option, since the questions were the same as for the first car.

Since time became limited, I excluded some parts of my original findings from the results. For instance, I do not examine in detail the survey questions or answer types, since the number of questions in a single FPT can be up to 100 questions, meaning that the number of answers types is even larger. Also, since the differences between the content of the domains varied significantly, I excluded the tentative categorizations of the domains which emerged during the analysis.

Trackers

In this section, I will present a few key characteristics of Tracker type of FPT's: 1) Sensors, 2) Source of purchase or consumption data and 3) Types of tracked consumption categories. Further

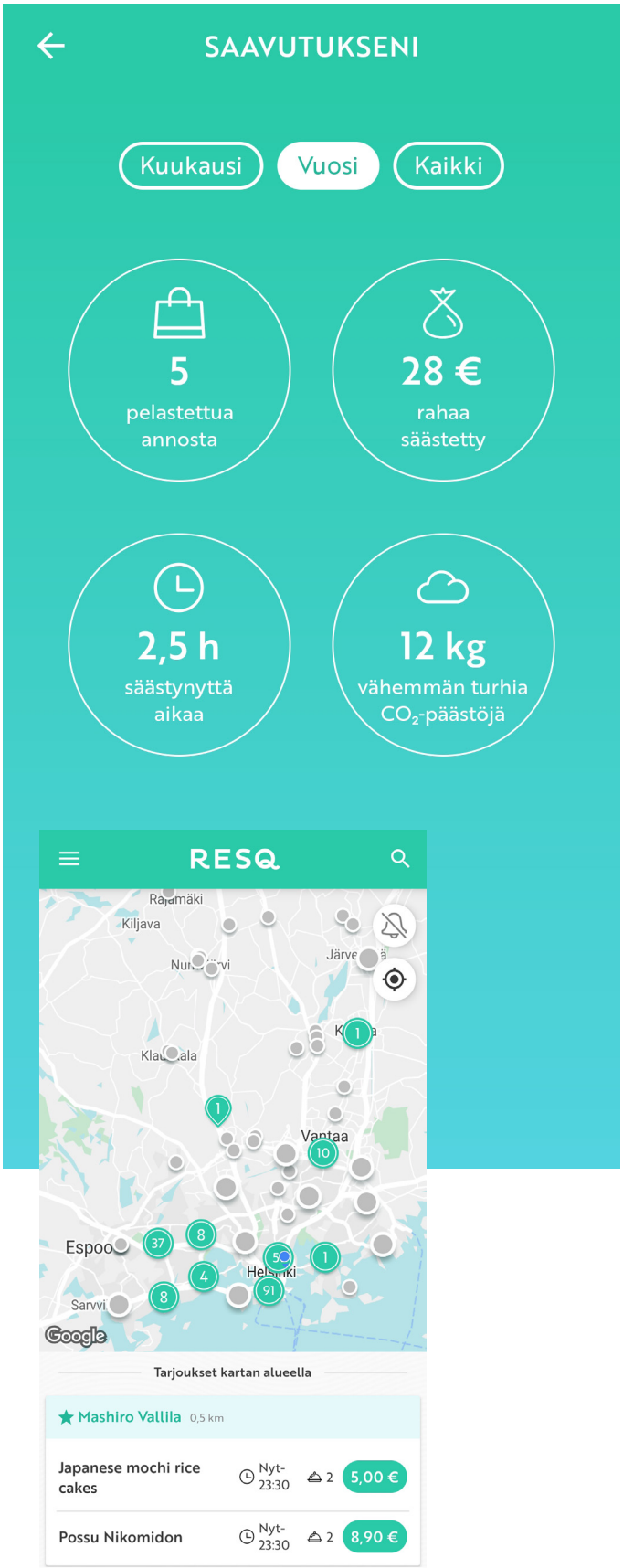


Image 7. An example of a Tracker type of FPT by ResQ Club (accessed November 3rd, 2020). "Saavutukseni" presents how many portions of food user has saved by purchasing surplus food through the app, as well as money and time saved, and carbon emissions which the user prevented. The picture below offers an overview of available surplus lunch portions (green circles) in the Helsinki area, offered by restaurants and cafés.

information about Trackers will also be presented in the following sections (Results, Result presentation).

As I have already earlier mentioned, the only currently operating Finnish FPT which uses sensors to gain consumption data is *CitiCAP*. The types of data it gathers have been presented in chapter 6.2.2. According to the analysis, the full list of sensors it utilizes is following: Accelerator sensor, gyroscope, magnetometer, air pressure sensor, and altitude sensor. Data gathered by these sensors are then used to gain information about users' mobility types, lengths of journeys, and so on. Sources of purchase or consumption data in the other three apps which I was able to analyze consider statistics of electricity consumption (*Sävel + service*), purchase statistics of using FPT hosts customer card in their shops (K-Ruoka), and purchases made through the services of the application (ResQ Club, see image 7).

Types of tracked consumption categories are the same as Consumption category types of Calculators: 1) Multiple consumption categories, 2) Specific consumption category, and 3) Specific product or service. Two of the four analyzed Trackers concentrate on Specific product or service (*Sävel + service*, ResQ Club). *CitiCAP* focuses on Specific consumption category, while *K-Ostokset* presents Multiple consumption categories type, as it forms it calculations from different purchases, from food to hardware. Since Trackers do not require Survey type of Consumption data input from the users, consumption categories are relevant mostly in the presentation of the results, not at the tracking itself. This is why I decided this time to leave out consumption categories from this section.

Results

One key characteristic of footprinting tools is what type of Results they present for the users. My finding is, that Finnish FPT's offer 10 different types of Results of environmental impacts, and few Results types which do not relate to environmental sustainability. The list of ten Result types which communicate users' consumption habit's environmental impact can be seen in table 6.

The most common type is Carbon footprint, including both lifestyle carbon footprints, used in 25 of 34 tools (e.g. *Elämäntapatesti*, *Susla*, *Hiilijalanjälkilaskuri* by Martha Organisation), and footprints calculated to a certain consumption category or product or service (e.g. *Ruokavalion hiilijalanjälkilaskuri*, *Laskuri* by Gold & Green Foods Ltd, *Lentolaskuri*). Interesting pair for Carbon footprint is Carbon handprint (used in 5 tools), which communicates the measure of positive climate impact. Such tools are, for example, *Uudelleenkäytön vaikutuslaskuri*, which calculates how much carbon emissions and natural resources user would save by purchasing a selection of products second hand instead of new. Similar carbon handprinting – calculated according to different consumables or lifestyles – are offered by *Ruokavalion hiilijalanjälkilaskuri*, *Hiilijalanjälkilaskuri* in Tampere.Finland app, *Hiilijalanjälkitesti* by VR, and *Ilmastolaskuri* by Yle. Other result types are in use in 1 to 3 tools.

Interesting combinations of Results are provided for example in FOODWEB's *Ateriasovellus*, which calculates food portions Environmental impact of food production (includes carbon footprint, eutrophication, pesticide use), Energy intake, Nutritional quality, and Toxic exposure. Combinations of environmental impacts and other benefits can be found also from *K-Ostokset*, which offers plenty of different types of information derived from users purchase habits: Purchase statistics, the domesticity of grocery shoppings (also, Domesticity level), Statistics based on the nutritional value of food purchases, and Climate level, which points out if users carbon footprint is on a good or bad level. While combinations of both environmental impact Results and for example health information are rare, I see

that this is a characteristic worth paying attention to.

Result presentation

Just as important as the result itself is the way it is presented. During the analysis, I paid attention to four characteristics, which I ended up formulating in a form of questions: 1) At what point user sees their results, 2) What user can compare their results to, 3) Is user offered a breakdown of the result in different consumption categories, and 4) Can user view their results in different time frames? Many other minor and also significant aspects came across during the analysis (for instance attributes used to describe different footprints, and visual representations such as different types of infographics), but I had to leave them out due to limited resources and attempt to keep the thesis within a suitable scope.

The first question considers the timing of the results: At what point the user sees their results? I found that there are five different timing or combinations of timings: 1) After active use of the tool, 2) After answering survey questions, 3) After answering to questions while the progress is shown while filling in answers, 4) Directly, and 5) Results and questions are available simultaneously. After active use of the tool refers to tools which offer results only after the user has used the tool, e.g. tracked mobility habits in *CitiCAP*, or purchased surplus lunches via ResQ application. User will only get new information about their emissions and in case of *CitiCAP* obtain virtual currency for carbon trading, if they continue the use. The most common type is After answering survey questions, which refers to tools, which offer the user results after pushing a "Results" button or similar (NesteMY's calculator, *Itämeri-kone* and similar). This type is on the base of 2) After answering to questions while the progress is shown while filling in answers, and 5) Results and questions are available simultaneously, where the difference is, that in 2) user can see the development of the results after each question or category (*Elämäntapatesti*, *The Carbon Donut Calculator*), while 5) represents tools whose layout is done in a way that questions are presented side by side with the results (e.g. *Ateriasovellus*, *Autokalkulaattori*). Tools which present results Directly are Trackers which use purchase or consumption data, such as *Sävel + service* and *K-Ostokset*. To summarise, the timing of result presentation is generally linked to the tool type (Calculator or Tracker), but it is also a stylistic choice which affects user experience.

Since FPT's are still mainly considered and offered as a source of information – and specifically personalized information as examined in this part of the thesis – What user can compare their results to, is an important question. 8 of 34 tools (24 %) did not offer a comparison for the main results types. Comparison of different main Result types is not counted in this characteristic. The full list of comparisons can be viewed in table 8. It seems that common comparisons are different types of averages, such as national average footprints or averages of other users. It seems that the purpose of the different types of comparisons can be, for example, to offer the user an example result according to which they can know better if their results are "good or bad", to make the results more understandable (e.g. Kilometers of private driving in *Sävel +*), or to even entertain the user with something unexpected (e.g. Weight of an elephant, in *Uudelleenkäytön vaikutuslaskuri*).

Next two questions consider how the results itself can be viewed. Usually, if the Calculator's survey is divided into different domains, the tool also presents its results according to the same domains. Similarly, Trackers might, and usually do, break down the results into smaller fractions (16 of 34 tools, 47 %). A smaller amount of Finnish FPT's offer a possibility to view results according to a different timeframe (7, 21 %). I included to this characteristics tools which

Table 8. Comparisons of footprint calculation results of 34 tools.

Number	Footprinting tool	Results are compared to
1	CitiCAP	Results of the community of users
2	Ilmastopeli	The ecological footprint of typical Lahti citizen
4	Compensate	Average carbon footprints of people in different countries (selection changes)
5	No name (as part of Compensate's website)	Amount of oil barrels equal to the result; Global average carbon footprint
7	Finnairin päästölaskuri	Results of different aeroplane types operating on the selected route; Comparison of different route distances
10	Laskuri	Amount of beef, pork and chicken required for the same protein intake as in answers; Amount of water saved in comparison to the water footprint of beef, pork and chicken
11	Sävel + Service	Kilometres of private driving
12	Itämeri-kone	Buckets of seaweed nutrients released in the sea will grow; Average of a citizen of the same municipality; Finnish average
13	Lentomatkaajan hiilijalanjälkilaskuri	Finnish average; Carbon emissions of different mobility types (train, ship, bus, motorcycle, car, sports car); Lifestyle choices (laundry of two-person household per year, sauna heating twice a week, use of electronics and cooling devices in one-person-household, water heating for one person in a detached house, heating of detached house of size 120m2, vegan diet, average diet); Global average; Average global carbon footprint target, EU citizen average
14	Itämerilaskuri	Buckets of seaweed nutrients released in the sea will grow; Average of a citizen of the same municipality; Finnish average
15	K-Ostokset	Ranking of the most emitting consumption category; Levels of domesticity in different consumption categories; Impact of food purchases as kilometres driven by car; Average Finnish consumption of domestic products
16	Sitoumus2050	The average result of footprinting tool user
17	No name (as part of Lentomaksu website)	Years of having toilet lighting on
18	Hiilijalanjälkilaskuri	Finnish average
19	No name (as part of NesteMY website)	Carbon saving as number of flights; Carbon saving as times of heating sauna
21	Uudelleenkäytön vaikutuslaskuri	Weight of an elephant; Back-and-forth flight to New York
24	Elämäntapatesti	Average results of all users of the tool
26	The Carbon Donut Calculator	Average footprint
28	Ilmastodieetti	Finnish average; User's average (according to postal code, family size, income, diet)
29	Itämerilaskuri	Average of a citizen of the same municipality; Finnish average; Fictional "friend of Baltic Sea" profile
30	Elämisen hiilijalanjälki	Finnish average
31	Susla	Carbon and material footprint of an average Finn, Indian, German, Dane person, Spaniard and Mexican
33	Hiilijalanjälkilaskuri	User's raking among other users
34	Hiilijalanjälkitesti	Emissions of Helsinki–Rovaniemi and Helsinki–Oulu journeys by plain, private car, bus, and train; Emissions of the selected journey if travelled by plane, private car, bus, or train; Number of hamburgers which could be produced with the mobility choice; Size of polar ice which could be saved from melting with the mobility choice
35	Hiilijalanjälkilaskuri	Finnish average
36	Ilmastolaskuri	Finnish average

have a historical time perspective on users' consumption, such as *K-Ostokset*, in which user can view their consumption statistics from maximum 12 months period, and tools which offer scenarios of consumption in for different durations, such as Gold & Green Foods *Laskuri*.

Follow-up

In the last group of characteristics considering Personalized information, I show results relating to ways in which users can Follow-up their Results. I divided my findings into two groups: 1) Result storing and 2) Adaptation of results. I found evidence that nearly a third (10, 29 %) of 34 tools offer a way to store their results, or it comes as given, such as in Trackers. Results can for example be viewed in a profile, or they can be downloaded. Other two-thirds of the tools do not offer in-built ways to save the results for further examination, and results are gone when the webpage is refreshed. Ways of Follow-up thus vary from following purchase statistics in real-time to taking a screenshot of the results, for instance.

Concerning Results storing, I found interesting the variety of ways in which the user can change their previous results or specific answers (see the full list in table 6, variables j.). Most tools (20, 59 %) allow the user to adapt their answers before leaving the site or when starting over the footprinting survey. These tools do not save the results, but the user can revisit their answers before leaving the site. Four of the tools do not allow the user to go back to their results, and the only way to make the calculation again is by starting over. Tools which save the results offer a variety of ways in which results can be changed, such as changing previous survey results or mitigating the footprint by using tools functionalities (such as Experimenting, see chapter 6.2.4.), for instance. Trackers on the other hand offer an opportunity to see how the results evolve by simply continuing business as usual or making changes in consumption habits.

Information on sustainable choices

The second type of information which is characteristic of footprinting tools is Information of sustainable choices. Here, I show results relating to 1) Lifestyle and consumption tips and 2) Presentation of the tips. In the first section I will briefly explore the frequency of tips and the different types of tips, and in the second section focus more on how tools which offer tips present them to the users. Here, I consider that tips and recommendations are a specific characteristic of FPT's if they are offered in a separate section, list or topic. Tips are also partially included to footprinting Results – especially to handprints – or Information on sustainability (see next topic), but these types of tips are not included to the here. Tips and recommendations are a separate type of information, which has its purpose in footprinting tools. Often tips are presented after the user has first learned their environmental impact.

Lifestyle and consumption tips

In this section, I will first present the frequency of the tips, and then the Types of tips. According to the analysis and framing of tips and recommendations, 17 of 34 (50 %) tools offer tips for recommendations. The Types of tips and recommendations can be categorized as follows: 1) Lifestyle or consumption tips, 2) Product and/or service recommendations and 3) Both. Most of the 17 tools offer Lifestyle or consumption tips (13, 76 %). Examples of such tools are, for instance, *Ilmastolaskuri* by Yle, *Finnairin päästölaskuri* and *Elämäntapatesti*. *Finnairin päästölaskuri* is connected to the company's business, but the tool itself does not offer flights as a solution or tip, but instead, it offers tips on how to reduce emissions when air travelling. In comparison, the two companies, Neste Oy and VR which offer Product and/or service recommendations, actually recommend their own product or services as an environmentally-friendly choice. Väre Oy and Kesko Oyj offer Both types

of tips in their tools. For instance, the user of Väre's *Hiilijalanjälkilaskuri* will be offered to change into a green energy contract offered by Väre, if they have responded that they use normal electricity mix.

In some occasions, tips are also meant to activate the user, meaning that they are not only offered as information, but the tips include activating features. Further information on Incentives can be found in chapter 6.2.4. Other topics which emerged during the analysis concerning Tips and recommendations are for instance the subjects of the Tips (e.g. mitigating electricity consumption, travelling by public transport), types of action the Tips suggest (e.g. reducing, recycling, shifting, mitigating) and categorizations of the Tips (e.g. similar domains as in Survey's, see table 7). Further analysis of Tips is this time left for the future.

Presentation of the tips

Presentation of the tips can be examined with four questions: 1) Is the user being offered a selection of tips based on their results, 2) Can user compare the impact of the tips, 3) What are the benefits of following the tips or recommendations according to the host, and 4) In which form the tips are offered to the user? Results are based on the 17 tools which offer tips and recommendations.

The question "Is the user being offered a selection of tips based on their results?" refers to tips, which are offered based on users results. For instance, if users housing footprint is the largest of the calculated domains, the selection of tips offered focus on tips which would mitigate the environmental impact of housing. 7 of 17 tools (21 %) offer tips or recommendations matching the results. Example of this type is Väre's *Hiilijalanjälkilaskuri*, which was described in the previous section, and *Sitoumus2050*.

Some FPT hosts communicate the Tips' or recommendations' impact for the users, and the impact is in some tools paired with a comparison (10, 29 %). This comparison can be presented, for example, with an impact scale (e.g. *Susla*, *Elämäntapatesti*), or by giving the impact in numbers which can be compared (*Ilmastolaskuri* by Yle, *Susla*). Another way to communicate the impact or gains is to present the benefits which can occur when acting according to a Tip or a recommendation. Most often tools communicate environmental benefits, but tools can also present other types of benefits. For instance, Friend of the Earth Finland suggests in their website that flying less equals less rush, more experiences (while travelling by land), no inconvenient security checks, and arrival directly to the centre of the travel destination. *Uudelleenkäytön vaikutuslaskuri* on the other hand suggests that buying second-hand leads to a reduction in emissions, better maintenance of home and the mind, less shopping anxiety, and reduction of textile waste.

Lastly, I will only shortly review the results considering the Forms of the tips. If very simply put, Tips and recommendations can be presented in a form of a link to further resources or a list of sustainable actions. Tips can also be a broader separate section, such as in Sitra's *Elämäntapatesti*, which offer a selection of 100 sustainable actions categorized by different domains and impact. By clicking one, the user gets more information on a single tip. A similar system has been taken further in The Donut and Susla, where actions can be saved and selected for an Experiment (see chapter 6.2.4.).

Information on sustainability

Here I shortly refer to what other types of information FPT's offer. The tentative results are, that some FPT's include information on different environmental issues, often to those relating to the tools theme, footprinting concepts, mitigation target levels, and such (see table 6, variables l.). The amount of information varies, as some

tools might not provide any Information on sustainability, while others have dedicated sections specifically for different themes. An example of a tool with specific sections for Information on sustainability is *Susla*.

6.2.4 Incentives

Incentives category consist of characteristics, which are used to provoke the users to take action or enhance their engagement with the tool and the tool host. These characteristics might, for example, support the designated way of using the tool, presented in Foundation chapter (see Types of use, chapter 6.2.1.). Some of the characteristics presented in this chapter aim at turning the learnings of Personalized information (see chapter 6.2.3.) into action. Communication with the tool host, on the other hand, relates to gathering information for tool development (see Gathering and use of personal data, chapter 6.2.2.) or to offering a channel for questions about the use of the tool (see also Instructions and background information, chapter 6.2.1.). All in all, this chapters deals with characteristics which direct users to activities which support tool hosts aims, whether the goal is to gain feedback or transform the societies.

As a result of the analysis, I was able to form four subcategories to better describe the purposes these different characteristics: 1) Incentives to mitigate the personal environmental impact, 2) Incentives to compensate the personal environmental impact, 3) Enhancing engagement with the tool and 4) Enhancing participation and communication (see table 9.). The findings of this chapter are, as in the study in general, based on studying the tools in their platform, which means that participatory methods, such as social media campaigns and different ways of activating the users, are left out from the study.

Table 9. The Incentives category.

Subcategory	Characteristic	Variables
Incentives to mitigate the personal environmental impact	Actions	Actions including calculation^^ Planning or roadmapping^ Setting a mitigation or other target^ Public commitment to take action^^ Experimenting^ Note making^ Public reporting of experiments^
	Rewards	Discounts and/or bonuses^ Carbon trading^ Market place^ Lottery^
Incentives to compensate the personal environmental impact	Compensation^ Donation^	
Enhancing engagement with the tool	Newsletter^ Notifications^	
Enhancing participation and communication	Communication with tool host	Feedback form and/or opportunity to contact tool host^
	Community and sharing	Community^ Sharing in social media^ Sharing for friends^

** Free entry, ^ Varying options, such as Yes and No.*

Incentives to mitigate the personal environmental impact

Characteristics of this subcategory refer to different types of activities which are used to incentivize the users to mitigate their environmental impact. Many of these characteristics are closely related to information provided on sustainable lifestyles, presented in the previous chapter. Never the less, here users are not only expected to read and act upon the knowledge, but tool host aims at guiding the users to take action. These features, presented in the following section, could be described as gamified functionalities. Since I do not study gamification specifically in this thesis, I suggest to look into a thesis by Roope Mattila (2019) for further information of gamification, and use of gamified functionalities in footprinting tools.

The key topics of this subcategory are 1) Actions and 2) Rewards. Significant differences amongst Actions are between those which are done privately or publicly, while the key separation between Actions and Rewards comes from the Incentive: Actions incentivize, according to my reading, by providing information and appealing to users values, in which case the prize and the Incentive is related to personal or community growth, achievements and ability to live according to values. Rewards on the other hand can incentivize without value base if the user is interested in the prize itself.

Actions

Actions, in this thesis, refer to methods which allow the users to select and experiment sustainable lifestyles with the guidance of an FPT and also follow how actions affect their footprint result. Content-wise Actions are related to Tips and recommendations (see chapter 6.2.3.), as they offer information on sustainable lifestyles. Additionally, Actions are coupled with different characteristics which aim to guide the user to take action, such as 1) Actions including calculation, 2) Planning or roadmapping, 3) Setting a mitigation or other target, 4) Public commitment to take action, 5) Experimenting, 6) Note making and 7) Public reporting of experiments. Some of the Incentives contain public features, while others are designed to be done privately.

The first and most significant characteristics which differ Actions from Tips and recommendations are, that Actions can be connected to the footprint calculation, or incentivizing characteristics such as Planning or roadmapping. Actions including calculation offer information about the impact of the sustainable habit, and when selecting and trying the actions, the user might be able to see how they affect their footprinting results. Currently, according to the analysis, only 3 of 33 tools have connected Actions to the calculation of the footprinting, being *The Donut*, *Susla*, and *Sitoumus2050* (see images 8-11). A similar method is also preset in Yle's *Ilmastolaskuri*, where user can select different sustainable deeds and view the handprint of the actions. But since *Ilmastolaskuri*'s tool does not take the handprint calculation any further, I do not consider it a characteristic including Incentives to mitigate personal environmental impact but the offering of information.

The next step after viewing Actions including calculation is usually Planning or roadmapping. This functionality refers to the ability to select and save Actions, which allows the user to come back to Actions they have selected, and potentially plan what they could do as an Experiment, as in *The Donut* and *Susla*. Planning or roadmapping can also be the first step before the user makes a Public commitment to take action, as in Sitoumus2050. There, after calculating their footprint with Sitra's *Elämäntapalaskuri*, user can select Actions, see how much their carbon footprint is mitigated if they would do the actions in real life. Selections are automatically paired to their Public commitment when the user goes to that step,

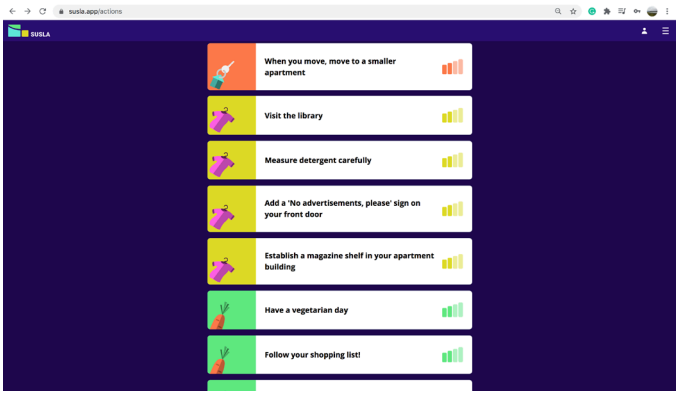


Image 8. List of Actions in Susla (accessed July 29th, 2020).

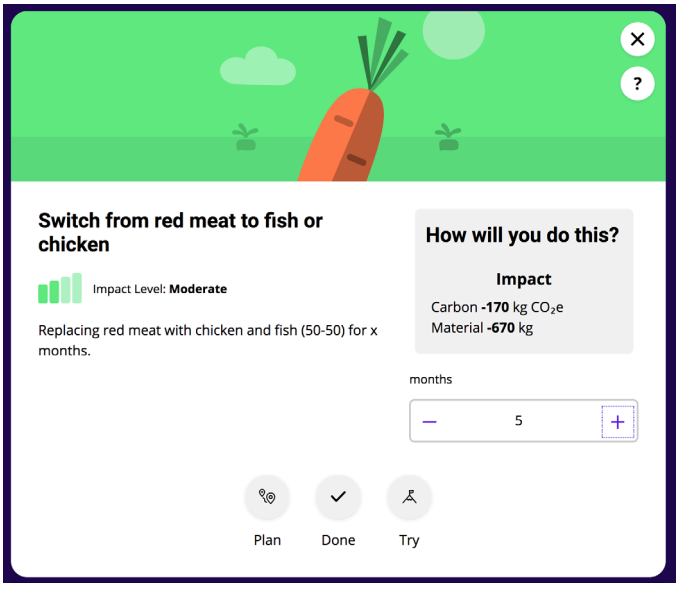


Image 9. An example Action in Susla (accessed July 29th, 2020).

and the mitigation of the footprint serves as a Mitigation target (explained later in this section).

The Public commitment, a characteristic only appearing in *Sitoumus2050*, is a functionality in which the user can commit to make a lifestyle change of their wish and publish this commitment on a specific platform. In *Sitoumus2050*, user can select the topic of the commitment from a list or create their own. Additionally, user can choose how to monitor the goal, by defining a meter for the commitment, for instance by selecting their starting level (e.g. the number of remote working days) and setting up their personal goal (e.g. the number of remote working days user aims to). After the commitment is ready, it will be publicly presented on the site.

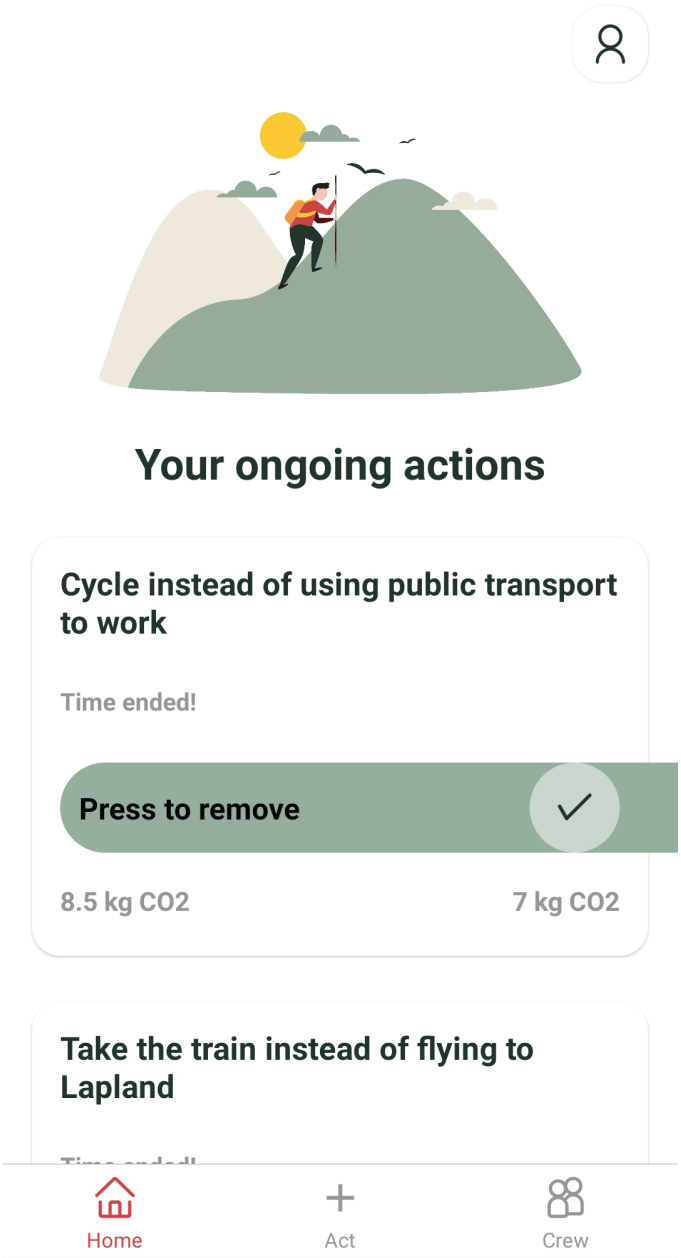


Image 10. An example of an Action in Experimenting phase in The Donut (accessed November 4th, 2020).

A kind of a private commitment can be made in tools, which offer a possibility to do Experimentation, as in *The Donut* and *Susla*. Here, user can also choose an Action, select what size or kind of a change they want to try with the selected habit, and choose a timeline for the Experiment. The user thus makes a personal challenge to change their habits, and after the experiment is successfully done, user can mark the deeds done and see follow how much their footprint ha shrank.

Setting a Mitigation target can be part of making a Public commitment (see image

11) or a start to Experiment (e.g. defining the meter of the commitment or selecting the scale of the Experiment). Mitigation target can also an inbuilt part of the tool, as in *Susla*, where all users have a common goal to mitigate their carbon footprint to 2,5 tonnes of CO_2e, and material footprints to 10 tonnes. Mitigation targets can also be found in *K-Ostokset*, where user can set, or is offered a suitable target level for their climate impact or domesticity level of their purchases. *K-Ostokset* does not include other Action characteristics, but since it is a tracker, users can follow their own "Experiments" from the purchase statistics. To summarize, tools offer users an opportunity to the set personal Mitigation targets, while common Mitigation targets can be a goal set for all users.

Users are also offered different ways to follow their progress. In *Sitoumus2050*, the user is asked to report their achievement, and they can determine the frequency of reporting. Reports are then published along with Public commitment. *Sävel + service*, which also contains a possibility to plan Actions, offers a Notes functionality for users' private notes. *Susla* and *The Donut*, on the other hand, only requires the user to mark Actions either done or undone, after which the Action either mitigates the footprint or is returned to the list of Actions. Follow-up of the process is thus often left for the user.

All in all, Actions are relatively rare among Finnish footprinting tools. 6 of 33 tools (18 %) have at least one of the above-mentioned characteristics.

Rewards

If Actions provide incentives to mitigate the personal environmental impact by allowing the user to plan, report, and view their results, for instance, Rewards consider the type of Incentives which provide the user monetary benefits. The type of Rewards found from

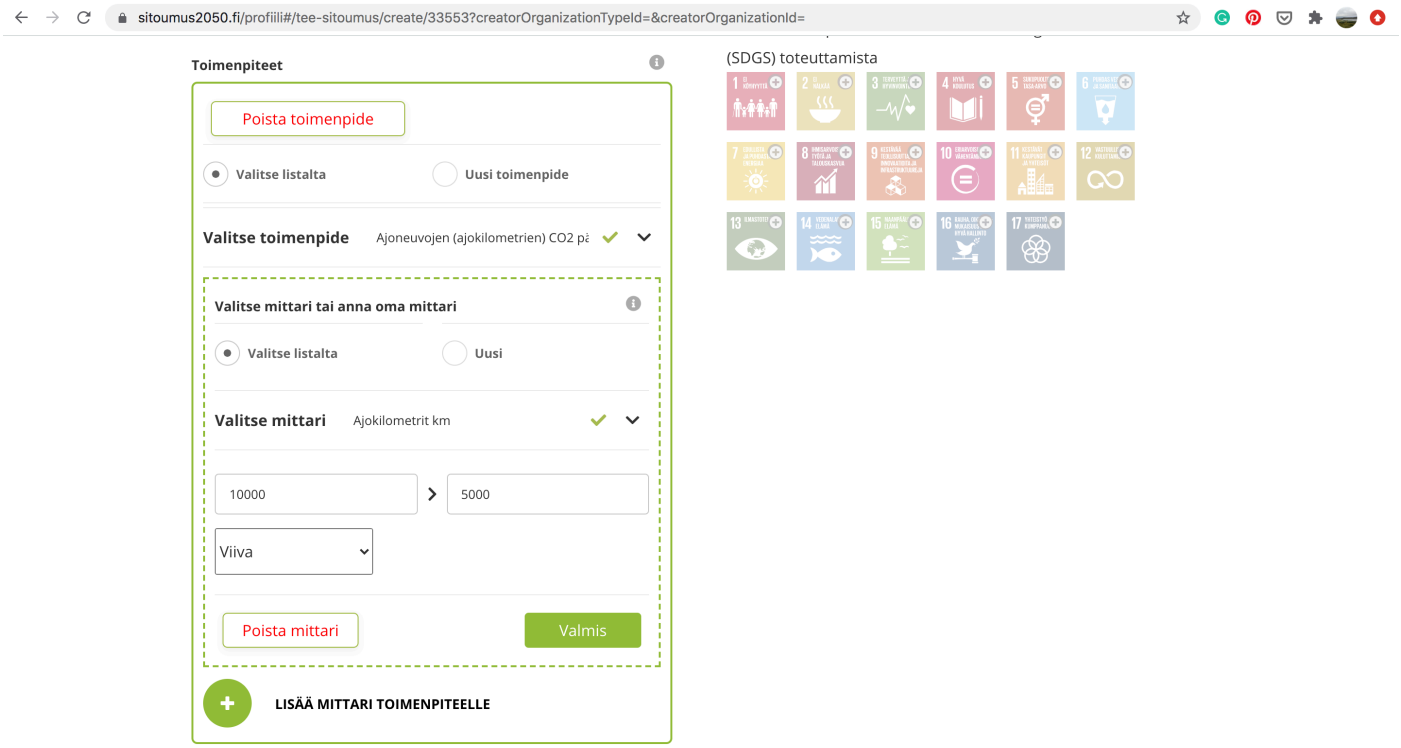


Image 11. An example of drafting a public commitment and choosing the mitigation target in Sitoumus2050 (accessed November 4th, 2020). The view presents how the public commitment is drafted in the website, and here I selected an Action from the existing list (Mitigating CO_2 emissions of private driving) and then selected to monitor the commitment by filling in the starting level (10 000 km) and choosing a target (5000 km). "Viiva" (line) refers to a type of graph I chose to depict the progress. On the right one can see that commitments are linked to SDG targets.

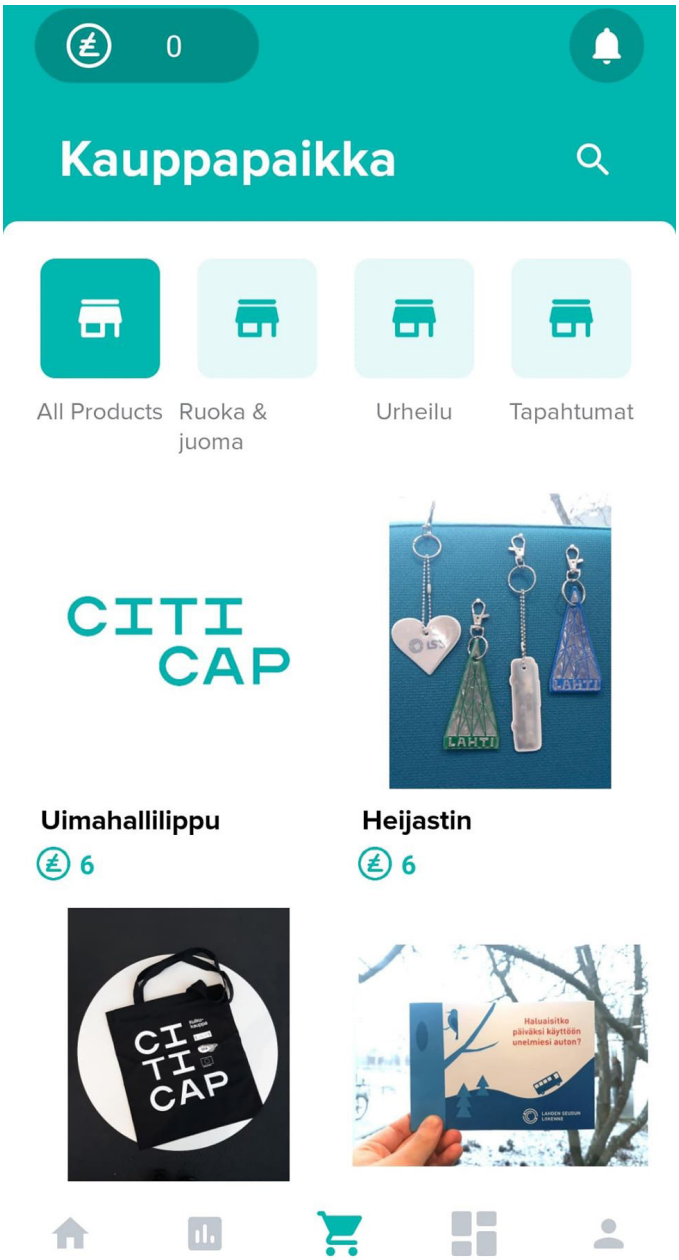


Image 12. The market place in CitiCAP (accessed November 4th, 2020). Here user can use their virtual currency earned in carbon trading for purchasing different items or services, such as reflectors or swimming hall tickets.

Finnish footprinting tools are: 1) Discounts and/or bonuses, 2) Carbon trading, 3) Market place and 4) Lottery. Here, I consider only the kid of the monetary benefits whose prize, product or service, supports sustainable lifestyles.

ResQ Club is currently the only tool which, according to the analysis, offer discounts. For instance, the user can buy specific ResQ Credits, which user can use for buying surplus lunches or other types of surplus food portions through the app. The more user buys credits at a time, the bigger discount they are offered (up to 5 %). Since ResQ Credits can only be used in ResQ app, buying credits mean returning customers or benefits made through unused credits. Also, when a ResQ user invites a friend, their friend gains a 50 % discount from their first purchase (see also subcategory Enhancing participation and communication). Discounts might be offered also by other Finnish FPT's.

The next two characteristics, Carbon trading and Market place, are currently interlinked and offered only in *CitiCAP* (see image 12). By favoring sustainable modes of transport, the user can gain virtual currency, which then can be used in the app's market place. Currently, user can change their virtual money to bike lights, coffee and a bun, swimming hall ticket, reflector, a *CitiCAP* tote bag, ticket to local public transport, and few other relatively inexpensive products. Some of the products and services support sustainable lifestyles, while others promote the app or city of Lahti and its services.

The last monetary Reward found during the analysis is Lottery, which is a characteristic found only in Gold & Green's *Laskuri* as part of #Nyhtiliike campaign. As part of the campaign, the site also offers an opportunity to participate in a Lottery. It is though unclear, what the benefit would be.

Rewards and Benefits (presented in chapter 6.2.3.) are connected, though while Benefits communicate the potential savings or other gains, Rewards offer the user direct gains. The difference between Rewards and Benefits can be seen as a good example of the difference between offering information and giving Incentives.

Incentives to compensate the personal environmental impacts

Footprinting tools can include an opportunity to compensate one's lifestyle emissions. Or to be sincere, often an organization which offers compensation has implemented

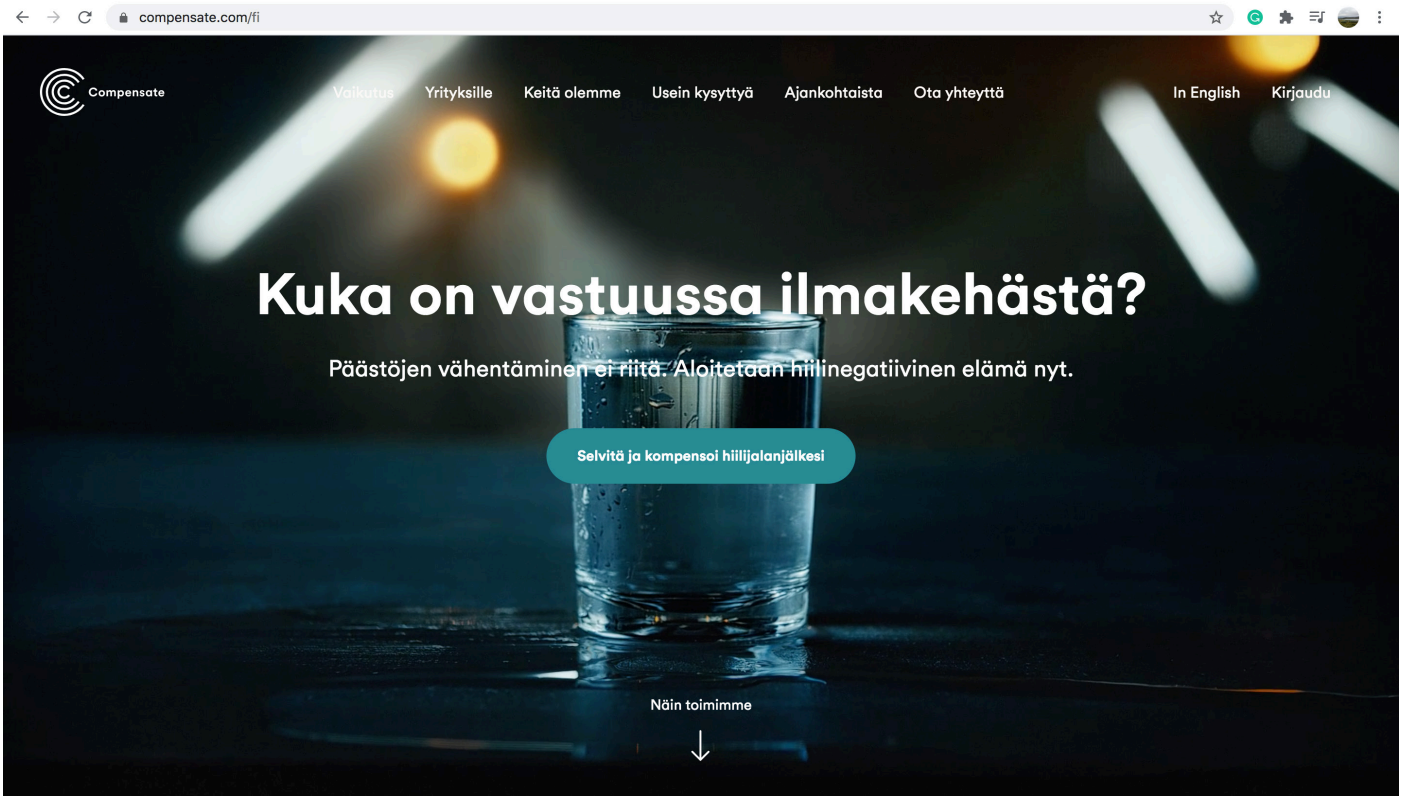


Image 13. Compensate invites users to calculate their carbon footprint and compensate (accessed July 17th, 2020). On their home page, presented in the picture, Compensate asks "Who is responsible for the atmosphere?" and states "Mitigating emissions is not enough. Let's begin carbon-neutral life today." Below, on the button, Compensate then suggests the visitor of the page to "Find out and compensate your carbon footprint". Button leads the user to a footprinting survey, which then leads to offerings of different compensation packages.

footprint calculation as part of the service (Intermediary type of tools, see chapter 6.2.1.). In compensation services, users can pay a fee or make a subscription to projects, which use the given money in to grow or protect carbon sinks, such as planting or preserving forests, or invest in carbon mitigation projects, such as implementing renewable energy. Along with compensation, users can also be encouraged to give donations for environmental associations or purchase low emission fuel for their flights.

Opportunity to compensate is offered in three tools (Compensate's website, see image 13, and application, and on Friend of the Earth Finland's Lentomaksu website), while Finnair promises to provide compensation in future. In all tools, the user is first offered to calculate their carbon footprint and then led to the different compensation packages. Friend of the Earth Finland's Lentomaksu's payment seems to be divided for different purposes, from which a part goes to compensation projects, and part to a more traditional environmental protection. Lentomaksu thus offers both Compensation and Donation. Other tools which are related to donations are all flying related. In *Finnairin päästölaskuri* user can choose to change their flying bonuses to third party Donations, while in *Lentolaskuri* user is offered a link directly to third party Donations. Also, John Nurminen Foundation collects donations, but here I considered that the website's FPT features were not directly linked to donating.

Enhancing engagement with the tool

All aspects of the tools could be designed in a way, that they aim at bringing the users back to using the tool. The better the content, the more engaging the functionalities, the more likely the user will return and recommend using the tool for others. There are though also few characteristics which I assume are specially designed to remind the users of the tool, such as Newsletters

and Notifications. Both functionalities offer the user information outside the tool (e.g. email, a screen of a mobile phone), giving either general information of the tool and its related projects or Personalized information related to user's targets and progress.

It seems that Newsletters are a rare type of engagement method among Finnish FPT's. Users can subscribe to a Newsletter on Compensate's website and application, and a few other tools offer Newsletters as part of tool host's other content. It seems thus that newsletters are not a popular way to inform users about footprinting tools – at least specifically about the tools.

Notifications are slightly more common. For instance, *CitiCAP* uses notifications to tell the user that the tool is currently actively tracking their mobility. In ResQ Club's application, the user can set a notification on to see lunch options nearby. *Susla* sends users email notifications about currently ongoing Experiments.

Enhancing participation and communication

In the very last section of the results, I shortly present findings relating to participation and communication, divided into two groups: 1) Communication with tool host and 2) Community and sharing. Enhancing participation and communication type of characteristics aim at building a channel of communication between the user and the tool host, and among the users or potential users.

Communication with tool host

14 of 33 tools (42 %) offers a Feedback form and/or opportunity to contact tool host and 12 tools offer similar features but not directly as part of the FPT. Opportunities to contact the tool host or give feedback varies from offering an email address, to different types of ready forms. Forms can be open, allowing the user to dictate whether to message is a question, suggestion, or a comment, or form can be for example user feedback surveys, including specific feature-related questions.

Community and sharing

The way I consider a Community functionality, is that it allows the users to communicate and exchange with each other. Some tools, such as *The Donut*, have a feature called "Tribe", but currently, on the application itself, it does not contain a possibility to interact with other users. Way to relate to other users is offered through information: user can see how much their community has mitigated their carbon emissions, and what has been the week's top Action. (While writing this on October 26th, week's Action is "Have a vegan treat!") That said, it seems that currently Finnish footprinting tools do not offer an inbuilt Community functionality – but this does not prevent tools from having real-world or social-media-based communities.

When considering sharing, 10 of 33 tools (30 %) offer Share to social media buttons – some of them include ready texts for the post – and only two have a specific feature for Sharing for friends (as presented earlier, ResQ Club has connected this characteristic to a Discount). Sharing characteristics are thus relatively common but do not seem to be the top priority of Finnish FTP's.

7. Implications to FPT design and development

After conducting the analysis, and after providing answers to the first two research questions (What Finnish FPT's there are, and What characteristics Finnish FPT's have), I still had the third questions at hand: How Finnish FPT's could be better designed to meet their goals? This question naturally raises further questions:

1. What are the key learnings of the analysis of the Finnish FPT's that could be helpful for tool development?
2. What kind of advice or suggestions tool hosts – existing or upcoming – need?

The key learning is, that there is no one answer. Finnish footprinting tools, not to mention their international counterparts, are provided by a variety of different organizations, and with a variety of goals and resources. Even if all FPT's aim to promote sustainability, the starting point and the end goal can be very different: for some, raising awareness about the condition of the Baltic Sea is the main topic, while for some, giving means to choose a climate and finance friendly car is the main objective. When goals and target groups are so different, methods to reach the goals can't be the same. How then could all these different actors with different revenue streams be advised?

In my opinion, knowledge of the opportunities and existing solutions could be beneficial for tool hosts. Knowing what is around can help in designing and developing tools for new audiences, or to improve existing solutions. Since existing literature already offers suggestions for the development of current tools, I decided to focus on something more general, and something where I could use the results presented in chapter 6. As a result, my suggestion then follows the form of an FPT template but takes the template a step further by formulating it to a canvas which tool hosts can use for tool development.

The outcome is a design implementation, which I named "FPT design canvas – Checklist for designing a footprinting tool for individuals" (see appendix 3). It is a tentative model, including different tool characteristics and questions which aim to support the development process. FPT design canvas can be used for FPT concept development or clarifying an existing FPT concept by generating ideas of the tool's goal, content and required resources. The purpose is to show the tool hosts what different features and functionalities existing FPT's have and what kind of skills tool development might require. This can help tool hosts to consider, what their tool could be like and what kind of an FPT the hosts can make with their existing resources. The benefit of using the canvas is, that tool hosts can gain an overview of the different steps FPT development include and that way prevent reinventing the wheel and be able to form better project plans.

The basis of the design canvas is on the characteristics found from the Finnish footprinting tools during the analysis, combined with the characteristics of other FPT templates (see chapter 2.2.). The questions, which I applied to guide the tool hosts in their concept development, have been inspired especially by the pitfalls presented in chapter 2.3. As the first step of the development of the canvas, I listed all characteristics found in this study and went through a thinking process. During this process, I decided to leave out some characteristics, for example, if they are very rare (such as the ability to adapt consumption data factors), and also added characteristics which I did not have resources to study in detail in this thesis, but which are important in FPT design, such as the visuals and usability. While making the

list, I drafted the guiding questions, based on my experience, empirical observations, and the earlier literature review. Adding the questions seemed very important since these questions help the user of the canvas to understand what each characteristic means, but also to consider the characteristics from an "FPT perspective".

After creating this list and drafting the guiding questions I compared the list to earlier FPT templates and common FPT drawbacks found in the literature. For example, the categorization of the consumption domains is borrowed from an FPT template by Kinnaird et al. (2020) and template by Lounasheimo et al. (2019) inspired to ask if the access the tool is limited by fees. Even if the domain categorizations have their inaccuracies (as presented in chapter 6.2.3., each tool can add varying types of questions under same domains), I thought it is good to give some guidance about the domains, and the categorization of Kinnaird et al. seemed to represent a typical set of domains. Template by Salo et al. (2019) inspired to formulate especially the sections relating to setting targets for the numbers of users, and at the end of the canvas include parts concerning the assessment of the impact of the tool and how tool host has managed to reach their goals. Template by Burgui-Burgui & Chuvieco (2020) was highly inspirational. Since their template is more of a report of an FPT development, it suited well to develop the FPT canvas. For instance, their template had mentions of usability and "Attractive design", and these notions helped in growing this particular section of the canvas, which in the original draft simply had titles of the characteristics. According to Burgui-Burgui & Chuvieco, I also further developed the sections considering the dissemination of the tool, user feedback, and sources of the information used to create the content of the tool. Existing templates all in all helped in evaluating the characteristics I included to the draft of the canvas, but especially to reframe and reconsider the questions.

FPT pitfalls, on the other hand, gave valuable insights from developing the guiding questions. While I intended to not bring up the pitfalls in the canvas, I wanted to propose questions which offer the user of the canvas an opportunity to consider those aspects which often lead to issues. For instance, relating to the criticism of focusing too much on individual's responsibility, I added questions which offer the tool host a place to consider how the role of the individual is being framed in the tool, and how individuals' impact is communicated. Considering the issue of too environmentally friendly users, I added questions which can help the tool host to pay attention to the selection of the target group from the perspective of impact, and also added notions relating to developing the content in a way that it speaks a language which has the opportunity to influence the selected target group. Each pitfall presented in chapter 2.3. was compared to the draft of the canvas, and most of the pitfalls are in some way considered in the final version, presented in appendix 3. The canvas thus is, a result of this thesis and its results compared to previous literature. It has also been flavored with the experiences I have gathered while working in FPT projects in D-mat ltd., a company specialized, amongst else, footprint calculations. This experience has given me insights on developing FPT's such as Susla.

All in all, the content of the FPT canvas (and some additional thoughts) could be summarized to a short and general list of FPT design suggestions:

1. Build a comprehensive overall picture of your project
   a. What is it for?
   b. Who is it for?
   c. How do you reach your audience?
   d. When do you want to launch it?
   e. What is its lifespan?
   f. Who are you making it with?
   g. What resources do you have for making it?

2. Match your goals with your resources
   a. What do you want to provide during the launch?
   b. What ideas you could implement to the tool later?
3. Be humble with your goals
   a. Consider what kind of an impact you can make with the methods you choose
4. Make it nice
   a. Pay special attention to the visuals
   b. Make the tool easy to use
   c. Avoid overloading the user with heavy textual content
5. Good content only
   a. Think what your audience needs to know
   b. Edit the content well – information is most likely your main content
   c. Choose a tone
6. Constant development
   a. Provide new content regularly (or don't, if it's not meant to last)
   b. Plan a suitable frequency of updates
7. Keep up with your goals
   a. What you aim for is what you should measure

The success of an FPT, in the end, depends on the goals set by an individual tool host, despite the common goal to raise environmental awareness. For instance, considering success from the perspective of the number of users, a tool created in a project might have to report numbers of users to the funders, while a company providing an FPT might need to consider if the launch of a tool is profitable, especially when providing an FPT might affect their sales. On the other hand, FPT's which function as a company might as well have their revenue stream linked to the tool and its users, and that way finding users and paying customers becomes more important than for FPT's whose hosts do not need to consider the number of users at all. The targets thus can vary from having informed a certain amount of people about sustainable lifestyles to having reached enough users to attract other companies to collaborate with the tool. Success can thus be difficult to measure in the same way for all the tools, which is one of the reasons why I wanted to avoid providing specific advice for tool development, and rather focus on offering guidance for developing FPT's to fit specific contexts and needs. FPT is never just a tool on a website, since it is affected heavily by who launches it, where and by whom it is used, and for example how willing the target group is to listen.

I consider though, that setting up some kind of measures for the tools can be useful, starting from setting a target level for the numbers of users. Goals such as "raising awareness" or "changing lifestyles" can be impossible to measure reliably, even if tools have a system which allows users to follow their footprint mitigation – people might simply play around with the tools without actually changing their lifestyles. To give some ideas, one way to follow if the aimed target group, for instance, the segment of people with higher footprints, has been reached, would be to try systematically try different marketing strategies and follow how the profile of the calculated footprints develop. Here, the requirement for the gathering of data becomes evident.

The aspects which I find the most intriguing in Finnish FPT's currently are different applications which offer footprinting as part of other services and consumption statistics. In my opinion, information which is provided to users automatically – without the need to visit a specific website or download a new app – along services which users already find useful and use regularly have the biggest opportunity to become a natural part of everyday lives and how individuals evaluate their consumption. The downfall of such tools often though is, that their applications to, for instance, policy planning, can be limited since the data is owned by private companies. But when it comes to reaching the audiences which do not find their ways to tools which require a personal interest to find them in the first place, FPT's which

come along the package can work the best in building broader awareness of the impact of consumption decisions, even if this is not their main goal. This to happen, though requires that the provided information is considered reliable.

To conclude, my suggestion for the future development of FPT's is to consider each tool as a unique project with their specific aims, target groups, and resources. I would suggest learning from the existing tools and to find the right methods for achieving the new goals. Also, before starting to plan a concept for a new tool, I would first look around, if there is an available license or another ready tool which could be used as it is, or whose tool host could become a collaborator.

8. Conclusions

In this thesis, I created an overview of 37 Finnish footprinting tools offered for individuals. Tools were found through an online search and other sources such as social media and discussions. These 37 tools were then analysed with GT methods to gain knowledge of their characteristics. Characteristics in this thesis refer to the different functionalities and features tools have, and also to the basis of the tools including information about who has made them, why and for whom. Based on the findings and the literature review, this thesis then provides design implications for FPT design and development.

Considering the first research question (What Finnish FPT's there are?) the results show that Finnish people are offered a broad range of footprinting tools, both as specific FPT websites and apps, and as additional features along with other services. The portfolio of available FPT's is constantly changing, as new tools are being launched and developed further, and as other tools are being closed. Already during this study, I witnessed new tools being launched, and similarly, several tools became inoperative. Examination of the tools also shows, that there are a few key organizations which both provide their tools and collaborate in other tool hosts' projects.

The analysis of the characteristics of the found tools – results relating to the second research question (What characteristics Finnish FPT's have?) – offer an insight into the multiplicity of the tools. Finnish FPT's have many key commonalities, such as the aim to provide personalized information of users' consumption habits' environmental impact, and tips or product and service recommendations relating to sustainable lifestyles. A minority of the tools also provide functionalities which aim to incentivize users to change their lifestyles, and these methods can be divided to two groups: those that appeal to users' values and help them to set personal goals, and those which offer monetary benefits before or after performing sustainable acts. Thus, it seems that Finnish FPT's are currently focusing on raising environmental awareness and attempting to have an impact on individuals' lives through knowledge, while the methods to encourage voluntary sustainability activity are in minority.

Relating to providing knowledge, an important feature of FPT's is, that tools do not only focus on providing information, but also collect data from the users to provide and develop the tool. At the moment, Finnish tools mostly gather information for the above-mentioned purposes, but data generated by the tools such as footprinting results and information gathered from the use of the incentives are also being used for research purposes. While many of the found characteristics confirm the findings of the previous studies, according to the literature review conducted in this thesis, previous studies have not focused similarly into bringing the data gathering to a central position in FPT's. Data gathering for different purposes though has been discussed in previous literature, these aspects have not been included in templates used to study or represent footprinting tools.

Despite the similarities, the methods and method combinations vary in each tool, making the FPT as a service flexible and easily adaptable for different purposes. When considering the key differences, footprinting tools can be roughly divided into calculators, tools which require consumption data input from the users, and trackers, tools which utilize databases of users' existing consumption data or data which is tracked through the use of the tool. Calculators characteristically have the biggest differences in ways which the data input method, usually a survey, has been designed. Trackers also have differences in the data collection, but their key differences

mainly consider the breakdown and presentation of the results, and if the results are connected to incentivizing features or not. Interestingly, despite the high supply of different tools and a broad variety of characteristics, Finnish footprinting tools do not represent all existing FPT characteristics. For instance, novel approaches such as communities where users can interact were not found in Finnish FPT's. To review the characteristics of Finnish FPT's in detail I suggest revisiting chapter 6.

The broad range of different characteristics raise also critical questions. For instance, if all FPT's are grouped under one concept and presented as one product or service type, is it possible for the users to understand their differences and have avoided creating false expectations of the outcomes of these tools? Especially, when similar communicational methods of the importance of individuals role to solve environmental issues are advocated by organizations whose actions support the transition toward sustainable lifestyles, and those who have a role in enabling unsustainable practices. The question of the problematics of the messenger is easily being brought up especially in social media. The different variations can also be looked at from a positive side: the more different tools try different methods, the more likely it is that the most effective methods are founds – but only if knowledge and key learnings are being shared, and resources allocated not only for launching a new tool but also studying the target groups, performance of current and potential functionalities, and so on.

As a response to the last research questions (How Finnish FPT's could be better designed to meet their goals?), I presented design implication which aims to support the concept creation of an FPT. Since existing literature offers different design and development suggestions, and as footprinting tools can be tailored to fit each need, I decided to focus on providing a canvas, which can help the future tool hosts to design a footprinting tool based on their targets. FPT design canvas helps to create an overview of the tools host goals and resources and provides is a checklist of different FPT characteristics. Each characteristic is paired with questions, whose purpose is to support the concept development and to avoid the most common pitfalls in FPT design and management. FPT canvas is a tentative suggestion which could later be further developed.

8.1 Implications for research and practice

The potential implications to research are, for instance, a possibility for compiling a more detailed template for FPT research, or ways in which to present key information of the tools. Characteristics found in this study confirm previous results, but the extent of the different features included in the study are broader than in the studies reviewed in this thesis. The results presented in chapter 6 also provide some new viewpoints to FPT's, and thus provide information relevant considering FPT development. Hopefully, this enables studying FPT's as an entity of different methods, content, visuals and usability, instead of focusing only on the footprint calculation.

Another potential for further research could be the possibility to better identify which characteristics could be examined to gain result for different research goals. For instance, a different selection of characteristics, especially if further developed, could be formed into a template for studying the development potential of the different incentives, the potential which tools have for providing societally significant information, or the impact which trackers included to everyday shopping experience can have to shift consumption habits. Also, the extensive set of characters could be used for generating a more comprehensive analysis of the tools, which accompanied with information of marketing and user rates could give clues of the impact and success of the tools.

In practice, the results of this thesis can be used as a toolbox of footprinting tool design and development. The results (chapter 6) can also be used when searching suitable benchmarks and ideas to be implemented in footprinting tools, while the provided design implication (appendix 3) can be utilized for FPT concept development.

8.2. Limitations and future research

Limitations of this thesis consider, for instance, the potential inaccuracy of the online search. It might be, that I did not find all currently operating Finnish footprinting tools. The analysis was also limited by time and resources, and it did not reach saturation, which means that part of the results is only tentative. Also, the accuracy of the results differ, since all tools were not available (due to customership barrier), and since there was no possibility within the time limit to confirm the results from the tool hosts. The selection of data limited the study in another way. During the study I noted, that often tools use for example social media to communicate and activate users, but this activity is not visible in the tools. Finnish FPT might thus have more social and active appearance than the tools itself present. Lastly, the literature review is rather limited, and thus the results of this thesis could confirm previous results more than is in the previous chapters presented.

Currently, I see potential future research in multiple directions. As mentioned in the previous paragraph, this same study could be continued until the analysis reaches saturation. This would result as more theoretically sound characteristics categories, and when the characteristics template would have reached saturation, the results could be used for analysing and comparing findings of Finnish tools to international tools. Before going this far, the overview of Finnish footprinting tools could be coupled with a historical review of past and current Finnish footprinting tools, which could be done as a literature review based on articles, reports and online sources. During this study, I found, that some Finnish footprinting tools might not have been documented, which means that interviews of key actors could be a good starting point for a historical review. I find that studying the historical perspective could provide important information relating to footprinting tools' impact and ability to provoke change, as well as an overview of the trends among footprinting tool topics. Also, such a study could help in putting things in perspective.

If considering the tools from a more sociological and societal perspective, I would draw attention to the representations of current, suggested, and future lifestyles which tools provide for their users. I consider this important since the information which is provided for the users narrate both today and the desired sustainable future – and stories matter. If possible, these representations and suggestions could be studied from a fairness perspective, linking the stories to a fair and just transition to sustainability. Also, further studies on what data FPT's could provide for decision-making in Finland, and which footprinting tools could be used as a data source, could be interesting and beneficial.

All the aspects of the tools are slightly different when it comes to trackers, and issues relating to trackers are very different from those with calculator type of footprinting tools. A study featuring all current trackers could help in developing similar tools in future, and give access for potentially developing further the idea of a platform, which could operate as a "lifestyle footprinting tracker", calculating all aspects of consumption based on actual consumption data in one website, or preferably application.

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Appendices

Appendix 1: Keywords of the first search (27.12.2019–2.2.2020)

Original keyword	Translation of the keyword
ekologinen jalanjälki laskuri	ecological footprint calculator
hiilijalanjälki laskuri	carbon footprint calculator
Itämeri-jalanjälki laskuri	Baltic Sea footprint calculator
jalanjälki	footprint
jalanjälkilaskuri	footprint calculator
jalanjälki laskenta	footprint calculating
materiaalijalanjälki laskuri	material footprint calculator
vesijalanjälki laskuri	water footprint calculator
orjuusjalanjälki laskuri	slavery footprint calculator
ympäristöjalanjälki laskuri	environmental footprint calculator
Pohjoismaiset kulutuksen hiilijalanjälkilaskurit	Nordic consumption based carbon footprint calculators
kädenjälki laskuri	handprint calculator
ekologinen kädenjälki laskuri	ecological handprint calculator
ilmastonmuutos mobiiliappi	climate change mobile app
ruoan jalanjälki	food footprint
ruuan jalanjälki	food footprint
Finnish footprint calculator	–

Appendix 2: Keywords of the second search (6.5.2020–13.5.2020)

Original keyword	Translation of the keyword
arkiliikenteen jalanjälki laskuri	carbon footprint calculator of mobility
asumisen jalanjälki laskuri	footprint calculator of housing
ekolog jalanjäl laskur	ecological footprint calculator
ekolog jalanjälki laskuri	ecological footprint calculator
ekologinen jalanjälki laskuri	ecological footprint calculator
elämänta laskur	lifestyle calculator
elämäntavan laskuri	lifestyle calculator
elämäntavan jalanjälki laskuri	lifestyle footprint calculator
Finnish footprint	calculator
hiili jalanjäl laskur	carbon footprint calculator
hiili jalanjälki laskuri	carbon footprint calculator
Itämer jalanjälk laskur	Baltic sea footprint calculator
Itämeri jalanjälki laskuri	Baltic sea footprint calculator
jalanjäl laskur	footprint calculator
jalanjälki laskuri	footprint calculator
jalanjäl laskent	footprint calculation
jalanjälki laskenta	footprint calculation
jalanjälki mittari	footprint meter
jalanjälki palvelu	footprint service
jalanjälki sovellus	footprint application

jalanjälki testi	footprint test
jalanjälki työkalu	footprint tool
kulutuksen jalanjälki laskuri	footprint calculator of consumption
kädenjäl laskur	handprint calculator
kädenjälki laskuri	handprint calculator
materiaali jalanjälj laskuri	material footprint calculator
materiaali jalanjälki laskuri	material footprint calculator
matkustamisen jalanjälki laskuri	footprint calculator of traveling
pohjoismai kulutu jalanjäl laskur	Nordic consumption based carbon footprint calculators
pohjoismaiset kulutuksen jalanjälki laskurit	Nordic consumption based carbon footprint calculators
päästö jalanjälki laskuri	emission footprint calculator
päästö laskur	emissions calculator
päästö laskuri	emissions calculator
päästö mittari	emissions meter
päästö palvelu	emissions service
päästö sovellus	emissions application
päästö testi	emissions test
päästö työkalu	emissions tool
ruoan jalanjälki laskuri	footprint calculator of food
tavaroiden jalanjälki laskuri	footprint calculator of goods
ympäristö jalanjäl laskur	environmental footprint calculator
ympäristö jalanjälki laskuri	environmental footprint calculator
vapaa-ajan jalanjälki laskuri	footprint calculator of spare time
vesi jalanjäl laskurwater	footprint calculator
vesi jalanjälki laskuri	water footprint calculator

FPT design canvas – Checklist for designing a footprinting tool for individuals

Purpose

FPT canvas can help in clarifying the concept, goals and content of a footprinting tool. The purpose is to show what different features and functionalities existing FPT use, and help you to consider, what your tool could be like. Each tool does not need to do it all – after considering the goal and setting your own targets, think, how to reach those goals specifically. This canvas can also help you to acknowledge resources your own plan requires.

Background

The content of the checklist is based on a study of Finnish footprinting tools and several FPT templates presented in peer-reviewed articles. Additionally, the questions which are provided in order to help to consider the different features and functionalities from different sides, have got inspiration from common FPT pitfalls.

Tool host

Organization
Is the tool offered as part of existing organizations services? Which?
Will the tool be provided by a new organization? What kind?

Brand
Does the tool have its own brand? Or is the tool offered as part of tool hosts existing brand?

Resources

Budget
What kind of resources tool host has in order to launch a tool?

Revenues
What resources there are for maintenance, updates and continuity of the tool?

Skills and expertise
In relation to the development of the tool and planned features, which of the following roles the tool development requires

- ☐ *Management and/or coordination*
- ☐ *Finances*
- ☐ *Concept and/or idea development*
- ☐ *Content creation (e.g. editorial tasks, texts)*
- ☐ *Proofreading and/or facts checking*

- *Calculation and/or tracking methods (e.g. data factors, calculation formulas)*
- *Design (e.g. visual identity and usability)*
- *Development and programming (e.g. coding of the platform)*
- *Platform provider*
- *Data storing*
- *Analytics*
- *Interface source and/or provider (e.g. sources of interfaces utilized in the tool)*
- *Marketing*
- *Communications (e.g. social media, dissemination)*
- *Support (e.g. email, phone)*
- *Business and/or organization collaboration*
- *Supporting company and/or organization*
- *Research (e.g. studying the data provided by the users)*
- *Other*

Which resources the tool host already obtains and which it needs to find via collaborations or as third-party services?

Concept and goals of the tool

The goal during the launch
What is the goal of the tool when it is first launched?

Long-term goal
What is the long-term goal of the tool?
How the tool will develop? What the tool will offer for new and existing users?

Name of the tool
Does the tool have a specific name? Is the name more like a title or more like a brand?
To what existing or emerging ideas the name links the tool (e.g. carbon calculator refers to existing tools)?

Description of the tool
What user can do with the tool, and what is the result of the use?

Primary target group
Who is it for? Does the tool have an existing user base?
Who should use the tool, so that its impact would be the highest? (Inspired by Koide et al., 2019)
Who would benefit most of the tool?

The objective of a number of users
What is the objective for the number of users? In which time?

Countries
In which countries the tool will be available?

License
Is the tool offered to other organizations with a license?
Is the tool a product tool hosts provides to other organizations?

Structure of the tool

Platform
Is the tool provided as
□ *Website*
□ *Mobile application*
□ *Other*
Is the tool the main or additional content of the platform?

Language
In which language the tool is launched?
Will other languages be added later?

Access
Is the tool available publicly?
Are there restrictions (e.g. age, registration, customership, fees)?

Types of use
Is the tool built to provide
□ *One-time task or info (e.g. tool's content is the same each time the tool is used)*
□ *Durational process or monitoring (e.g. tool provides an opportunity to follow progress or examine new information)*

Data

Use of personal data
What personal data the tool host needs in order to provide the tool or to fulfil other needs?
What types of uses the tool has, for example
□ *Claims handling and legal processes*
□ *Fulfilling contractual obligations*
□ *Identification of the users*
□ *Legal obligations*
□ *Marketing*
□ *Providing services*
□ *Research*
□ *Sales*
□ *Service development, quality improvements and/or trend analysis*
□ *User and/or customer communications and relations management*
□ *Other*

Personal data
Does the tool collect personal data? What kind?
□ *User data*
□ *Analytics data*
From which sources?
□ *Data provided by the user (e.g. consumption data provided by the user)*
□ *Data relating to the use of the service (e.g. amount of earned virtual currency)*
□ *Data generated by the service (e.g. footprinting results)*
□ *Device information (e.g. device model)*

- *Use (e.g. time spent on the service)*

What types of data?

Data handling
How and by whom the data is stored?
Will tool host use the data anonymously?

Visual identity and usability

Tone of voice
What is the sound of the language? What kind of tone would work for the target audience?

Style
Should the tool have its own logo and icons?
What kind of colors and typefaces should be used in the tool?
What adjectives would describe the ideal style?

Usability
What kind of navigation would support a fluent use of the tool?
What kind of icons depicting different sections and functions are clear and easy to understand?
Should the tool be optimized to different devices and operating systems?
How to achieve good usability in general?

Information on the tool

Instructions and background information
What information on the tool and its use is provided for the user, for example
- *Number of users*
- *Date of launch*
- *Update frequency*
- *Update history*
- *User instructions*
- *FAQ*
- *Calculation documentation (e.g. information on used data factors, formulas)*
- *Terms of use or similar*
- *Privacy statement or similar*
- *Fundraising permission*
- *Other*

Information on the user's environmental impact

Footprinting method
What footprinting method the tool uses?
- *Calculator (e.g. user inputs the data)*
- *Tracker (e.g. data is provided by a database)*
- *Other*

The input of consumption data
How the user's consumption information is gathered?
- ☐ *Survey*
- ☐ *Mobile phone sensor data*
- ☐ *Purchase or consumption data (e.g. transactions, consumption statistics)*
- ☐ *External database (e.g. national population statistics)*
- ☐ *Other*

Calculation design
Does the tool aim to provide accuracy or estimates?
Will the calculation be designed from scratch, or will it be based on an existing formula or license (e.g. another tool, calculation method such as Åland index)?

Emission data factors
Does the tool host have access to data factors and skills to use them, or will this work be commissioned?
How to maintain up-to-date emissions factors?

Consumption domains
What areas of consumption does the tool consider?
- ☐ *Multiple consumption categories*
- ☐ *Specific consumption category*
- ☐ *Specific product or service*
- ☐ *Other*

Does the tool consider the following domains (choose one or more)?
- ☐ *Housing*
- ☐ *Food*
- ☐ *Mobility*
- ☐ *Consumer goods*
- ☐ *Leisure*
- ☐ *Other (e.g. socio-demographic questions)*

How accurately the survey presents the lifestyle of the target group?
If the tool offers results in different product or service categories, how they are defined?

If the tool is a calculator
How broad survey the calculator is based on (e.g. simple survey can contain 1-10 questions, medium 11-30, detailed 31-100 or more)?
Does the survey include supplementary questions (e.g. to improve details, to provide socio-demographic information)?
Is to survey empty or prefilled?

If the tool is a tracker
Which sensors to tool use for generating consumption data, or which databases the tool utilizes?
Are the required technologies for using sensors ready, or does the tool host need to develop them?
Does the tool host have access to consumption databases, or do these connections need to be formed?

Results presentation
At what point users can view their results (e.g. during or after a survey, right after opening the

tool)?
In which ways the result is visualized (e.g. infographics)?

Bringing the results to a context
What user can compare the results to (e.g. averages, other users)? What the set target group can relate to?
How the user can examine which areas of consumption create the biggest impact?
Can the user examine the timing of the biggest impact, or view the results according to different timeframes?

Follow-up
Can the user save their results? In which form or where?
Can the user return to earlier results or progress?
Can the user change their previous results? How?

Information on sustainability

Lifestyle and consumption tips
Does the tool offer the user tips on sustainable lifestyles?
How tips relate to target groups current lifestyles?
Do the tips consider lifestyles in general, or recommendations of specific product or services (e.g. by the tool host or third party)?

Content of the tips
What are the benefits of following the tips or recommendations?
Where the user can learn the skills required to follow the tip?
What information could help the user to understand the impact of the tip in individual, societal or global level?

Presentation of the tips
In which form the tips are offered to the user?

Bringing the tips to a context
Is the user being offered a selection of tips based on their results?
Can the user compare the impact of the tips (e.g. impact as numbers, scale)?

Other information
What other information user is offered about the topics of the tool (e.g. footprinting concepts, environmental issues)?
What information could help the user to understand the role of an individual in mitigating environmental issues?

Sources of information
What the content will be based on?
What sources will be used?

Incentives to adopt sustainable lifestyles

Actions
What features the tool uses to incentivize users to change their habits? How do they support making a lifestyle change?
Can the user, for example
- ☐ *Choose actions which are connected to the calculation results*
- ☐ *Plan (e.g. selecting actions, roadmapping)*
- ☐ *Set a mitigation target or goal*
- ☐ *Make a public commitment*
- ☐ *Experiment actions*
- ☐ *Report experiments publicly*
- ☐ *Accomplish an experiment*
- ☐ *Mitigate calculation result by accomplishing an experiment*
- ☐ *Other*

Rewards
Can the user gain rewards with monetary value when using the tool, especially when performing sustainable actions?
Do the rewards support sustainable lifestyles?
Does the rewards include, for example
- ☐ *Carbon trading (e.g. earning virtual currency)*
- ☐ *Discounts and/or bonuses*
- ☐ *Market place (e.g. place to use virtual currency or view discounts)*
- ☐ *Other*

Compensation or donations
Does the tool offer compensation services? In support of what kind of projects? What is being compensated?
Does to tool suggest making a donation? In support of what kind of projects or such?

Community

Community
Does the tool include a community where users can communicate with each other?
Is the community part of the tool, or provided elsewhere (e.g. social media, events)?

Aim of the community
What users can do in the community?
How does it support the users to reach the goal of the tool?

Feedback and support

Communication to users
What channels (e.g. newsletter, notifications) tool host uses to communicate its users?
What is the main message?

Contacting the tool host

What channels (e.g. contact form, email, feedback form) users can use to contact the tool host?
How users are answered (e.g. individually, automatically)?

Communications and marketing

Connections
Is the tool offered or developed as part of a campaign, project, existing service or such?

Dissemination
Which medias the tool should be presented in?
Which mediums should be used (e.g. images, text, videos)?

Sharing
Does the tool encourage users to share the tool? How?

Assessment

Impact assessment
How the impact of the tool could be measured?
What defines the impact?