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DIGITAL SERVICES FOR NEW TYPES OF FINNISH PRIVATE FOREST OWNERS – A REVIEW OF EMERGING DEMANDS IN DIGITAL SERVICE OFFERING

Master's Thesis
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Abstract of master's thesis

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Abstract

Forests and forest management have recently been topical issues both internationally and in Finland. The discourse among scholars and societal actors has especially focused on the forests' role in climate change mitigation and the various new ways of doing sustainable forest management. Another topical issue is the changes in forest ownership and in the forest owner demographic. At present, the profile of forest owners is gradually changing especially in Western societies. Aging and urbanization, as well as structural changes in society and the livelihoods of forest owners are the biggest driving factors behind this transformation. One of the objectives of this thesis is to study the rising needs and attitudes of new types of forest owners. In this research the focus is especially on urban forest owners who live away from their forest properties. The emerging needs of this demographic are studied in the context of their use of digital forestry services. Consequently, the second objective of this thesis is to further the understanding on how the needs of urban forest owners affect the digital forestry service offering, and to find ways in which the services should be developed to better cater to the needs of this new demographic.

The empirical part of this thesis dives deeper into these needs and demands through an explorative qualitative research. As a part of this research, twenty semi-structured interviews were conducted among urban forest owners. The data from the interviews was analyzed and categorized thematically according to different subject areas relating to forest ownership. The findings of the interview study were then compared with previous research and literature on forestry and forest ownership.

The findings of the study show that urban forest owners have a variety of novel needs and demands that the current digital forestry service offering has not been able to adequately meet. The focus in service development should thus be on understanding and acknowledging the specific characteristics of new types of forest owners. From the findings it is evident that urban forest owners especially demand services that take into consideration the new ways of forest management that are more focused on the intangible goals of owners. The services should also be able to balance these objectives with the owners' goals regarding financial returns. Forest owners also seem to need more versatile information about ownership than before. The development of forestry services that fit the needs of new types of owners should then be focused on co-creation with forest owners and enhanced communication between different stakeholders.

Keywords Forest ownership, forest management, forest owners, urban forest owners, digital services, forestry services

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Tiivistelmä

Metsät ja metsähoito ovat olleet jo pidemmän aikaan erittäin suurta keskustelua herättäviä aiheita sekä kansainvälisesti että Suomessa. Erityisesti metsien käytön mahdollisuudet ilmastonmuutoksen torjunnassa ja erilaisten uusien metsänhoitomuotojen käyttö ovat olleet tutkijoiden ja yhteiskunnan toimijoiden keskustelun kohteina. Ajankohtainen aihe on myös muutokset metsänomistamiseen ja metsänomistajien väestölliseen rakenteeseen. Tällä hetkellä metsänomistajien profiili on hiljalleen muuttumassa etenkin länsimaissa. Omistajien ikääntyminen ja kaupungistuminen, sekä rakenteelliset muutokset yhteiskunnassa ja metsänomistajien elinkeinojen muutokset ovat suurimpia tekijöitä tämän transformaation takana. Tämän pro gradu -tutkielman yhtenä tavoitteena on tutkia uudenlaisten metsänomistajien muuttuvia tarpeita ja asenteita. Tässä tutkimuksessa keskiössä ovat erityisesti kaupungissa asuvat metsänomistajat, jotka asuvat kaukana metsätiloiltaan. Tämän uuden omistajaryhmän nousevia tarpeita tutkitaan tässä työssä näiden digitaalisten metsäpalveluiden käytön kautta. Työn toisena tavoitteena onkin ymmärtää uuden tyypin metsänomistajien vaikutuksia digitaalisten metsäpalveluiden tarjontaan ja löytää kehityskohtia, joiden avulla digitaalisista palveluista voidaan luoda kokonaisuuksia, jotka palvelevat paremmin uudenlaisten metsänomistajien tarpeita.

Tämän tutkielman empiirinen osio avaa tarkemmin näitä tarpeita eksploratiivisen laadullisen tutkimuksen kautta. Tutkimuksessa toteutettiin yhteensä kaksikymmentä puolistrukturoitua haastattelua kaupungissa asuvien metsänomistajien kanssa. Haastatteluista saatu aineisto analysoitiin ja luokiteltiin metsänomistukseen liittyviin teemoihin. Haastattelututkimuksen tuloksia verrattiin tämän jälkeen aiempaan metsätaloutta ja metsänomistusta koskevaan tutkimukseen ja kirjallisuuteen.

Tutkimus osoitti, että kaupungissa asuvilla metsänomistajille on lukuisia uusia tarpeita ja asenteita, joihin nykyinen metsänomistajille suunnattu palvelutarjooma ei pysty kattavasti vastaamaan. Palveluiden kehittämisessä tuleekin aiempaa enemmän keskittyä tuntemaan ja tunnistamaan uudenlaisten metsänomistajien erityispiirteet. Tutkimuksen pohjalta voidaan todeta, että kaupungissa asuvat metsänomistajat toivovat erityisesti palveluita, jotka ottavat huomioon uudenlaiset aineettomiin tavoitteisiin liittyvät metsänhoitomenetelmät, sekä pystyvät yhdistämään nämä omistajien taloudellisten tavoitteiden kanssa. Omistajat tarvitsevat myös aiempaa monipuolisempaa tietoa metsänomistukseen liittyen. Tarpeenmukaisten palveluiden kehityksessä tulisikin keskittyä yhteiskehitykseen omistajien kanssa, sekä aiempaa kattavampaan kommunikaatioon sidosryhmien välillä.

Avainsanat Metsänomistus, metsänhoito, metsänomistajat, kaupunkilaismetsänomistajat, digitaaliset palvelut, metsänhoitopalvelut

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1 Introduction

Growing global concern on environmental issues caused by climate change has brought forests into the forefront of public discussions worldwide. Forests and their proper management are seen as an effective way to combat the negative impact of changing environments- the greatest benefit being forests' role as carbon sinks for pollution. Other benefits of forests include improving water and air quality, preventing erosion, as well as preserving biodiversity. For these reasons it is of utmost importance to conserve forests and develop sustainable forest management practices that can help in improving the use and governance of these valuable resources. These objectives have also been an important part of the European Union's (EU) policy in the past decade. (European Commission, 2013)

Forests are also important in the EU for their financial and socio-economic impacts. This is especially true in rural areas, where logging and other forestry-related livelihoods account for a substantial part of the economy. In addition to traditional logging activities, in these regions, forests provide income for locals through wood-based production, tourism and various types of field sports. In 2018 there were over half a million people in the EU directly employed by forestry and related industries. (Eurostat, 2020)

According to Eurostat (2020) there were approximately 180 million hectares of forests in the EU region in 2020, which covered 45.1% of EU's land area. Over a quarter of this was accounted for by Sweden (30.3 million hectares) and Finland (23.2 million hectares) that both have three quarters of their land covered by forests. Consequently, these two countries are the most densely forested countries in the EU. (Eurostat, 2020) In this thesis I will mostly focus my research on these two countries as their forest industries, forest management practices and forest ownership structures have traditionally been quite similar in nature.

For reasons stated above, it is not a surprise that forests have traditionally been an integral part of these countries' economy and society. Especially in Finland the forest industry played a key role in industrialization and economic development during the 20th century, providing a backbone to the Finnish economic system. However, after the financial turmoil of the global economy in 2007, the industry faced major obstacles as demand for wood-based products staggered (Poesche & Lilja, 2016). Additionally, in recent years Finnish companies have faced more international competition from developing forest industries in other countries, which has forced the traditional industry to overhaul its revenue generation logic and innovate beyond existing business models (Poesche & Lilja, 2016).

Despite Finland's position as a forerunner in digital transformation activities on a global scale, digital innovation has been comparatively sluggish in the forest industry. In a recent research on Swedish forestry value chain Holmström (2020) found that the major bottlenecks for digitalization in the forest industry have until recently been differences in digital maturity among actors, non-functional supply- and demand chain, and low levels of digital competency and service innovation. The authors state that these challenges stem from the industry's unique characteristics, for example from the fact that forests are more often than not remotely located and they cover vast areas of land (Holmström, 2020). In general it can be stated that the slow adaptation to digital transformation in the forest industry is a product of inadequate understanding of value creation through digitalization, low level of digital process implementation and lack of digital know-how within organizations (Nylén & Holmström, 2011).

Although the transition to a more comprehensive digital environment has been slow, companies and operators in the forest industry have started to adopt operations models that have required development of their digital competences. These include more service-oriented business models, reciprocal value creation logics, as well as information and knowledge sharing. (Pelli et al., 2017) The same obstacles have also been traditionally part of digital service offerings for non-industrial private forest owners (Berghäll, 2018; Mattila et al., 2013).

In addition to the digital transformation in the forest industry, forest ownership has been similarly going through a significant change on a global scale. The changes in forest ownership are a result of vast changes in demographic and social factors of the forest owner population that have also affected the values and demands forest owners have (Ziegenspeck et al., 2004). These changes and the possible effects have also been observed within the Finnish forest owner base already for decades. Finnish forest owners in the future will be younger people, who live more often in cities, and are not dependent on forest properties as a source of income or employment (Rämö et al., 2009). These owners will also have less emotional- and family connections to the properties that they own. (Rämö et al., 2009) The aforementioned changes will surely have an even greater impact in the future on the different attitudes and demands forest owners have for forestry and forest ownership.

These changes in forest owners needs and demands are also the focal point of this thesis. These changes will be examined within the growing demographic of remote owners who live in cities, who can also be defined as urban forest owners (Hogl et al., 2005; Ziegenspeck et al., 2004). The topic of urban forest ownership and its effects on owners' attitudes and needs is a particularly interesting topic that has not been recently studied extensively in the academia.

In this thesis, I will highlight the importance of the growing demographic of urban forest owners in the context of Finnish forest ownership. The topic of the effects of urban forest ownership will be explored in relation to the possibilities and demands for the development of digital forestry services. The changing needs and demands of forest owners, and the impacts these have on digital forestry services, will be consequently examined through a series of interviews with forest owners who live in Helsinki metropolitan area. As a result of the interviews, I decided to specifically focus on the demands and needs urban forest owners have for the state-funded Metsään.fi-service. The specific service was chosen as the focus because it was most well-known among urban owners, but also because of its accessibility and nature as a state administered service.

All in all, the interview study and the surrounding research highlighted many interesting aspects on the different characteristics of urban forest owners and their needs and demands for digital forestry services. It seems that urban forest owners have numerous different needs for digital forestry services that have not properly been met in the past. For this reason, digital forestry service providers should focus more in understanding the specific characteristics and needs of this growing demographic in the future.

This first chapter of the thesis will continue with the presentation of the context and the scope of the study. After this, I will go through the objectives and contributions of the study, as well as the methodology used for the empirical part of the research. The chapter will close with a presentation of the overall structure of the thesis.

1.1 Context and Scope of the study

The purpose of this thesis is to offer deeper insight into views and needs of new types of private forest owners in the context of what type of digital services should be offered for this demographic. The needs of these types of owners have not yet been thoroughly studied in the academia. Especially the implications that these changing needs have for digital service offerings has previously been left mostly unstudied. In addition, I will also provide information on digital transformation of forestry and the forest industry in general to create better understanding of the status quo of the digital services offering. In the empirical part of the study, I will survey forest owners' perceptions and illustrate these in connection with current digital offerings for forest owners.

The focus of the thesis is predominantly on Finnish forestry and Finnish non-industrial private forest owners, yet some of the previous research cited in this paper is concentrated on findings from Sweden and other EU countries, as well as studies from North America. For this study, I have selected younger urban forest owners as the demographic. In this context "younger" forest owner is someone who is under the age of 50, as private forest ownership is heavily skewed to owners who are 60 years and older (Karppinen et al., 2020). In this thesis, I will use "urban" as an overreaching definition for forest owners who live in cities far away from their forest holdings. These owner types will be defined more thoroughly in chapter 2.

1.2 Objectives and Contribution

The aim of the study is to gain current information on the changing needs and views of younger urban forest owners, and to give insight on how digital forestry service offerings should cater to these owners' requirements. The changing landscape of forest ownership and the emerging attitudes and needs of new types of private forest owners have been rather extensively studied in the academia. However, specific research on younger urban-dwelling owners has been lacking, especially in the context of Finnish forest owners. This research seeks to deepen the understanding of this specific demographic and their particular attitudes toward forest ownership and the needs for service provision.

Moreover, the objective of this research is to study the needs this demographic has for digital forestry services. Digital forestry services that are offered to non-industrial private forest owners have not been, up to recently, widely studied. Therefore, this study seeks to continue the research into this topic and to give insight into how these services could be developed to better cater to the needs of forest owners in the future.

These objectives are approached through a qualitative research study, as well as a literature review on previous research on the topic. The qualitative research is conducted as an interview study for younger urban-dwelling forest owners in Finland. During the interviews, the owners were inquired about forest ownership in general, their attitudes towards topical issues, and their use and experiences with digital forestry services. These interviews give novel insights into the attitudes and needs of the aforementioned demographic.

All in all, this research can be of use to both private forest owners and digital forestry service providers. The service providers may gain more insight on the different needs new and emerging types of forest owners have for services. This might also benefit the owners, if these aspects are taken into consideration when developing new forest management services. Additionally, this thesis may help in acknowledging the need for future research within different emerging forest owner demographics and the digital services that are provided for these owners.

The research problem of this study is stated as follows:

Research Problem

The main research problem this study aims to solve is what kind of demands do younger urban forest owners have for digital forestry services and how should digital forestry services be developed to better cater to the changing needs of this demographic

Research Questions

To answer the research problem presented above, inter alia, the following research questions are studied in this research:

1) Who are urban forest owners and how do these new types of private forest owners differ from conventional forest owners?
2) What are the attitudes and views urban forest owners have on forest ownership?
3) What type of needs do urban forest owners have for digital forestry services?
4) What are the possibilities for the development of future digital forestry services?

1.3 Methodology

The research conducted in this thesis is exploratory in nature and it consists of two parts. The first part is composed of a thorough literature review that seeks to shed light on the main themes of the research and provide relevant viewpoints from previous research. The second part of the thesis aims to give deeper insight into forest owners' needs in connection to digital services through an empirical study. The empirical part is conducted via semistandardized interviews of the target demographic. The interview data was analyzed and coded according to relevant themes and topics. The key findings from the interviews are categorized by themes and presented accordingly in chapter four.

The methodology used in this thesis was selected, for it is an effective way of collecting data on thoughts and experiences of interviewees through follow-up questions and informal conversation (Lune & Berg, 2017). This is especially helpful regarding topics that have not been comprehensively previously studied in the academia, as is the case with the topic at hand. The semistandardized structure can also often elicit responses that the interviewer has not hypothesized beforehand (Lune & Berg, 2017).

1.4 Structure of the thesis

The thesis is structured as follows: the first chapter presents a general overview of the themes and topics that are the subject of the thesis, as well as a brief account of the structure and methodology used in the study. In the second chapter I will offer a thorough literature review on the most relevant forest-related concepts, give definitions on these, and present examples on existing digital services in the industry. First, the literature review summarizes the status of the forest industry in Finland. After this I will go over relevant literature on forest owners, which will offer insight into the primary topic of this thesis. The chapter ends in an overview of development of digital services in forestry and currently available services for forest owners.

The third chapter is the beginning of the empirical part of the thesis. The chapter offers a depiction into the research method used, including description on the methodology and interview structure that were applied. Chapter four presents the main findings of the interview study in the context of the themes of this thesis. The emerging themes that are discussed further include new types of forest owners, changing needs of forest owners, causes for change in needs and implications for future development of digital services for forest owners.

The findings from chapter four are connected to prior research on the topic in chapter five that will also provide outlook on future development of digital services for forest owners. Chapter six concludes the thesis by presenting conclusions, limitations, and suggestions for future research. The chapter ends in a brief summary of the thesis.

2 Literature Review

This literature review is focused on concepts and themes most relevant to the topic at hand. The purpose of the literature review is to provide a comprehensive foundation for this study and to offer a basis for the discussion on the needs of new types of private forest owners and the implications these have on digital service offerings. The focus in this study is mainly on the research on the Finnish forest industry and private forest owners, yet some of the research exhibited in this literature review concentrates on other countries as well, mainly focusing on other European countries. First, the focus will be on giving general insights on the topical aspects of forest ownership internationally and in Finland. After this, the status quo of forest ownership will be discussed. Third, I will concentrate on the emergence of new forest owner types and the various new needs that they have. Then the focus will be on the ongoing digital transformation in the forest industry and the needs and possibilities for service development. The framework of service-dominant logic will be introduced as a possible application for the development of digital forestry services. The chapter will end in a presentation of the different digital forestry services that are available.

2.1 Insights on Forest Ownership

As already stated in the introduction to the research topic, forest ownership is going through a dramatic change both in Finland and on the general European scale. In this chapter, these changes are depicted first at the European level, before delving into how forest ownership is changing in Finland. The biggest current issues relating to forest ownership and -management on a European level are climate change impacts, changes in owner demographic and urbanization, as well as changes in legislation.

Climate change is definitely one of the biggest issues that is effecting today's discourse and attitudes on forest ownership. The impact of climate change affect both the financial- and sustainability side of forest ownership, and these effects will continue to grow more significant if necessary actions are not taken (Fouqueray et al., 2020). According to Fouqueray et al. (2020) forest owners all around the world are experiencing immense pressure to counteract the negative effects that climate change can have on their properties and livelihoods. Forest owners and legislators should already be adapting their management practices to future effects of climate change, because developments and changes to forest management practices take time to actually manifest as concrete results (Fouqueray et al., 2020).

This adaptation of forest owners to climate change impacts has been quite widely studied in recent years. On a European level forest owners and forestry professionals seem to generally agree that climate change has already had or it will have a major impact on the forest ownership landscape (K. Blennow et al., 2020; Saksa et al., 2020; Sousa-Silva et al., 2018). Sousa-Silva et al. (2018) found that even though 91 percent of European forest owners believe that climate change has a direct effect on forest properties and forest owners' lives, the actual adaptation of forest management practices to counteract impacts of climate change has to date been much less prevalent. The levels of adaption vary between European countries, but in general the levels are alarmingly low (Sousa-Silva et al., 2018). More active implementation of adaptation measures is vital in the future as forests and their management play a crucial role in combating the negative effects of climate change (Sousa-Silva et al., 2018).

Changes in forest owner demographic and the effects of urbanization on forest ownership are also significant topical issues that have major impacts on the forestry industry as a whole. The diversity of ownership has grown substantially following social and economic change throughout Europe (Weiss et al., 2019). Weiss et al. (2019) state that in many West-European countries owners are aging, which will eventually lead to an increased volume of younger forest owners. Forest owners are also becoming less invested in ownership in general, as urbanization effects livelihoods and relationships people have to rural areas, while less and less forest owners are deeply connected to agriculture and forestry in general, and the amount of small property owners and remote-owners is constantly increasing (Weiss et al., 2019).

Also changing are the ways how forestry policy and -legislation is pursuing to influence forest owners and ownership (Lawrence et al., 2020). The forest management practices of both private owners and industrial actors are becoming increasingly significant part of policy making and public discourse as the effects and the importance of forests to societies become more vital. Various different stakeholders from politicians to private citizens, and industrial giants to third sector organizations are trying to impact the ways in which forest management practices can be implemented and how owners are allowed to manage their properties. The outside influences and pressures will certainly have a major impact on forest ownership, and there is certainly need for increased co-operation between private forest owners and other stakeholders, so that mutual goals on climate change mitigation, adaptation, conservation and sustaining of biodiversity can be achieved. This calls for major mutual changes in the methods, communication and objectives between private owners and other affected stakeholders. (Lawrence et al., 2020)

2.2 The Landscape of Private Forest Ownership in Finland

Private forest owners are a significant group in the Finnish forest sector as 52% of the forestry land and 60% of forest land is privately owned. Most of these privately owned forests are controlled by individuals, couples, or families and fewer are owned by estates and associations. In 2016 there were more than 344 000 forest properties with the size of at least two hectares, and the number of private owners holding these properties was 620 000. The average size of a privately owned forest property was 30,3 hectares. (Peltola et al., 2019)

The ongoing changes in the Finnish forest ownership base have been widely studied in the past, as these changes have been in view already for decades. A recent study by Natural Resources Institute Finland (Karppinen et al., 2020) showcased the status-quo of forest ownership changes. At the moment, biggest changes that are affecting private forest ownership in Finland are migration to cities, changing economic structures, aging of the forest ownership base population, the growing volume of female owners, changing ownership types, and the increased income- and education levels of owners. (Karppinen et al., 2020) Next, I will go through the factors that are most closely related to the topic of this research.

Urbanization and migration to cities are one of the key changes that affect forest ownership. These factors are also a focal point of the research in this thesis. According to the Natural Research Institute study these changes have not, however, been as rapid as the developments in society would suggest. One third of all forest owners still live on the property where their forest is also located, and over half of the entire forest owner population lives in sparsely populated areas of the countryside. One third of owners were categorized as living in an urban area. Additionally, only a one third of owners lived in another municipality than where their forest property was located (Karppinen et al., 2020). Accordingly, it is significant to note that the group of urban dwelling remote-owners composes a relatively large portion of the entire forest owner population.

Another interesting factor to note from the Karppinen et al. (2020) study are the changes in ages between the population. The focus in the empirical study of this thesis was on the group of under 50-year-old owners. The study shows that the average age of a forest owner was 62-years-old and over half of owners were over 65-years-old. The amount of owners who are under 45-years-old was only 12 percent of the population (Karppinen et al., 2020). It is however evident that the ownership base will become younger in the future as properties are passed down to younger generations. For this reason, it is extremely important to study the attitudes and needs of younger owners more extensively in the future.

Other noteworthy changes in the population that the Karppinen et al. (2020) study showcases were the changes in owners' economic structures, as well as the changes in income- and education levels. Forest owners are increasingly less dependent on forest ownership is a livelihood and a source of income. These changes will also have significant effects on how owners see forest ownership in the future and what type of services they need. (Karppinen et al., 2020)

It is also significant to note the different characteristics relating to forest ownership in general. The structural changes in forest ownership are deeply engrained to the mechanisms of inheritance. Most of forest properties are inherited, bought from relatives or receives as gifts from relatives. Only few properties are currently acquired through purchases on the open market, and forests are more often than not sustained within families throughout generations. (Karppinen et al., 2020)

In general, the changes in forest ownership demographic can have significant effects on a large scale, because of the significant volume of non-industrial private owners. Major changes in the attitudes that owners have towards forest ownership and their demands for services can impact the entire forestry sector, as well as the Finnish economy to a substantial extent. The growth in numbers of urban owners has been relatively slow in recent years, but significant changes can possibly be seen in the future as migration to cities accelerates and the owner population ages. These changes should be closely monitored, and their effects on the attitudes towards forest ownership and the requirements of future owners should stay at the center of future research.

2.3 New Types of Private Forest Owners

As already stated earlier, the forest owner base is experiencing changes both in Finland and on a global scale. As a result of these changes, new forest owner types are formulated. The emergence of new forest owner types is a topic that has been widely studied in previous research. The biggest factors behind the emerging new forest owner types are the demographic and social changes that shape European societies (Ziegenspeck et al., 2004).

The new types of forest owners can be classified in many different ways depending on the type of changes to forest ownership that are analyzed. In their overview of forest ownership changes, Weiss et al. (2019) offer a variety of approaches that have been used in previous literature to define these new owner types, which include:

- Socio-demographic characteristics such as age, gender, occupation, or educational level
- Characteristics of forest holdings
- Method of acquisition for forest property
- Length of ownership tenure
- Fragmentation of forest ownership
- Distance of owners' primary residence to forest
- Urban residence
- Connectedness with agriculture and forestry
- Economic relevance of agriculture

These factors of new owner type emergence have been, inter alia, categorized as being a result of privatization, restitution, cooperation between stakeholders, innovations, entrepreneurship, community ownership, and changes in property rights and ownership. Consequently, owner types are often conceptualized as being a part of the various aspects of the legal form of ownership, or the institutional or socio-demographic characteristics of owners. According to the authors, another way to define owners are oftentimes based on the various motives, goals, objectives and behavior of owners that have differentiated them from traditional owner types. (Weiss et al., 2019)

In this thesis the focus will be on these differentiating factors that are a result of owners' objectives, views and behavior in forest management, rather than the socio-economic or institutional factors. The changes in social characteristics will, however, be examined within the context of owners' place of residence and connection to their forest property location. These categorizations have been generally linked to owner types that are defined as absentee-, remote, or non-resident-owners, as well as non-farm or non-agricultural owners (Weiss et al., 2019). Additionally, the definition of urban owners has been one of the most distinctive classifications (Weiss et al., 2019). In this thesis, the definition of urban forest owner is used as the focal classification for a new type of forest owners that are emerging. This definition will be more closely examined in the following sub-chapter.

2.3.1 Urban Forest Owners

In general, there are not a large variety of studies available that mention the specific group of urban forest owners. The definition of an urban forest owner was first introduced by Ziegenspeck et al. (2004) in a study that examined forest ownership changes in Germany. The authors define urban forest owners as a new type of private forest owners who are shaped by the general process of modernization and urbanization in society, and not defined by their locational attachment to a city or an urban setting. This definition is more related to the lifestyles and livelihoods of owners rather than their place of residence. In this thesis, however, the focus is specifically on owners who live in cities and are remote-owners in a sense that they live far away from their properties.

Hogl et al. (2005) introduced this definition of urban forest owners as describing owners who live in larger cities and often far away form their own forest properties. Additionally, these owners have other characteristics that add to this categorization of urban forest owner type. These owners are still a heterogenous group who have various different backgrounds. Some owners grew up in large or urban-like municipalities, whereas others have moved into cities from rural areas. These owners only seldom have professional or educational backgrounds in forestry or agriculture, even though many of the grew up in the countryside. In comparison to other owner types, these owners are more educated and have higher incomes (Hogl et al., 2005). This definition is quite representative of the forest owner population that was studied as a part of this research. It is, however, important to note that the researcher's focus in this thesis was merely on categorizing owners based on their place of residence and physical distance to forest property. Nevertheless, the attitudes, objectives and behaviors that define urban owners were also of great importance in the study.

According to Hogl et al. (2005), urban forest owners are also defined as owners who spend less time in their forests than other owners and are less inclined to do active forest management and forestry work. This group views forest management as more of a pastime activity and a hobby that can be handled besides their day jobs, and for many urban owners the appreciation for forests comes from its aspects of environment and nature, rather than the economic gains and possibilities (Hogl et al., 2005).

2.4 Needs of New Forest Owner Types

As mentioned previously, the new types of forest owners have needs and demands that differ from traditional owners. These new needs are tied to the changing attitudes, motives, objectives and behavior of forest owners in general. The major forces that are driving these changes in the forest ownership base are different socio-demographic and financial changes in Western societies. More specific changes relating to urban forest owners include increased physical distance to properties, economic independence from forest property and changing motivations for ownership (Keskitalo, 2017). For these reasons, it is clear that the new forest owner types require new types of forest management approaches that cover both the practical silvicultural aspects, as well as counselling and different social innovations (Weiss et al., 2019). In this section I will go through the most significant needs that the new types of forest owners have that relate to the offering of digital forestry services.

As stated previously, majority of forest owners perceive climate change as a major risk impacting forest management and forest ownership (Blennow et al., 2020), and for many new owner types, climate change is an issue that has brought along many new needs these owners have for forestry management practices and services. These needs are tightly connected to owners' climate change adaptation levels, which according to Blennow & Persson (2009) are dependent on the owners' attitudes towards climate change and the capabilities to follow through with adaptation actions. Additionally, Joa & Schraml (2020) found that the concrete impressions on the positive impacts of conservation are the biggest factor in shaping the adaptation levels of private forest owners.

The differences based on new forest owners' gender have also been widely studied as a significant factor in determining the needs of new types of forest owners. According to Umaerus et al. (2019) female forest owners oftentimes regard the ecological, recreational and social values of forestry more important than their male counterparts because of their outlook on forest management from both traditional and novel perspectives. These differences are important to take into consideration as the share of women among Finnish private forest owners is currently 41% (Karppinen et al., 2020), and the amount of women among new forest owners is considerably higher (Rämö et al., 2009).

Urbanization is another key factor that affects the objectives and attitudes of new forest owner types. As shown in the previous section that presented the definition for urban forest owners, these owners are less connected to the traditional forest owner lifestyles and are less interested in the financial side of ownership. Many urban owners consider forest ownership as more of a hobby than a source of income (Hogl et al., 2005). These characteristics of urban forest ownership also shape the needs that these owners have for forest management services, as new services that are less focused on the financial aspects of management are needed (Kvarda, 2004).

Consequently, new forest owner types have various other different needs that are connected to their changing lifestyles and livelihoods, which impact the demand for forest management services in general. These owners are more likely to generally seek and use outside forest management services, as they have less time to handle the management all by themselves, and owners are also more likely to have no knowledge on the practices of forest management or the equipment to do tasks on their own (Côté et al., 2017). New forest owner types are also increasingly interested in receiving more information on forest management and the impacts different management practices and activities have on a larger scale (Côté et al., 2017).

As already stated, these new types of forest owners require new forest management approaches that better cater to their needs (Weiss et al., 2019). Integrated forest management is one example of an approach that has originated from the changing needs of new owner types. This approach seeks to consolidate the multiple different objectives that different stakeholders have for management of forests (Kraus & Krum, 2013). The most notable conflicting objectives being conservation and timber production and integration of these two into functional management practices (Aggestam et al., 2020). These types of trade-offs and balancing acts will certainly be more prevalent in the future among new types of private forest owners and a key aspect of their emerging needs.

It is also worthwhile to note that new types of forest owners are not a homogenous group, but their attitudes and objectives can vary greatly. Deuffic et al. (2018) categorized five different types of private forest owners based on their attitudes and objectives: optimizers, satisfiers, passives, environmentalists and multifunctional public managers. According to the authors, forest owners often move between different categories throughout their forest ownership tenures. For this reason, it is important to note that the needs and attitudes of certain owner demographics can change significantly over time.

2.5 Digital Transformation in the Forest Industry and The Needs for Digital Forestry Service Development

Alongside with the changes in forest ownership, also the digital competences of the forest industry have evolved drastically. One of the more revolutionary drivers of digital forestry service development has been the increased access to open forest data and its utilization (Rantala et al., 2020). However, in general the forest industry can be classified as a slow adapter of different digital tools and approaches in the past (Nylén & Holmström, 2011), and it can be categorized as a mature industry with conventional and established ways of doing things (Laakkonen et al., 2019). Most of the previous research on the aspects of digital competence in the forest industry has focused on technical innovations and applications. Much of this research is conducted from the point of view of the pulp, paper and forest products industry process development, which is rarely focused on private forest owners. The various studies that relate to the private forest owner side of digital services have ,among other things, examined forestry information crowdsourcing (Hyyppä et al., 2017), virtual forests (Rossmann et al., 2009), virtual reality-enabled services (Holopainen et al., 2020), and the application of Industry 4.0 in wood supply (Müller et al., 2019). Consequently, research on the type of services discussed in this thesis and the use of these services has been fairly rare, with the exception of some more recent studies (Pynnönen et al., 2021).

In the context of digital transformation, the forest industry has significant unique challenges to tackle that relate to the nature of forest properties. The properties are very often remotely located and they cover large land areas that can be hard to reach and in a rough terrain. Additionally, forestry and forest management always require some level of physical presence on location (Holmström, 2020). The downsides of distance and remote areas are although something that digitalization can help to alleviate. According to Andersson et al. (2020) the digital transformation in the industry has been helpful in counteracting the negative effects of increased distance between different forestry stakeholders. The distance between owners and service providers is reduced through, for example, improved processes and the use of new technologies, such as websites and applications (Andersson et al., 2020).

These issues of increased distance between owners and stakeholders, and the changes in forest owners' objectives, are mainly a product of the changes in the forest owner population that are driven by aging and urbanization (Häyrinen et al., 2015; Mattila &

Roos, 2014). As traditionally service providers have reached forest owners directly on a local level, now they have to find ways to get to owners who are ever more urban-dwelling and have less and less knowledge on forest management in general (Keskitalo, 2017). The issues of distance and diminishing levels of knowledge are often cited as the most important challenges in the status quo of digital forestry service development, while the increased diversity among forest owners and their changing behavior and attitudes are also major obstacles to overcome (Andersson & Keskitalo, 2019).

It is consequently clear that the emerging new types of forest owners create a variety of new needs and requirements for the development of digital forestry services. One of the biggest demands for new forestry service development seems to be increased focus on other than financial aspects of forest management (Andersson & Keskitalo, 2019). Even though the financial gains from timber sales are still a significant aspect of ownership for a majority of owners (Häyrinen et al., 2015), a growing number of owners are interested in the recreational-, nature-, and conservational aspects of forest management (Weiss et al., 2019). However, recent studies on the Finnish forest owner population show that the amount of such owners has stagnated recently (Karppinen et al., 2020). These are although issues that will quite probably be an important factor in the development of future digital forestry service offerings. Many of the major Finnish forestry companies have already developed a multitude of digital solutions that have a focus on other than the timber wood sales aspect of forestry (Watanabe et al., 2018).

Another significant need in the future from the perspective of forest ownership will be the ability of forestry services to encourage forest owners to uphold and pursue active forest management practices (von Willert & Krott, 2019). These endeavors call for more innovative support systems and consultative services that engage new types of forest owners, while simultaneously diminishing the amount of passive owners that are not actively involved in managing their forests in an effective and sustainable way (Feliciano et al., 2017).

How should the digital services then be developed to better cater to the changing requirements in the industry? Holmström (2020) offers an action plan (Figure 1) for the digitization in the Swedish forest industry. Even though the plan is not specifically established for the purposes of development of digital forestry services for non-industrial private forest owners, the suggestions are well applicable also in this context. The plan suggests increasing digital maturity, moving from supply chains to ecosystems, utilizing programs for improving digital competence, and focusing on identifying opportunities for service innovation.

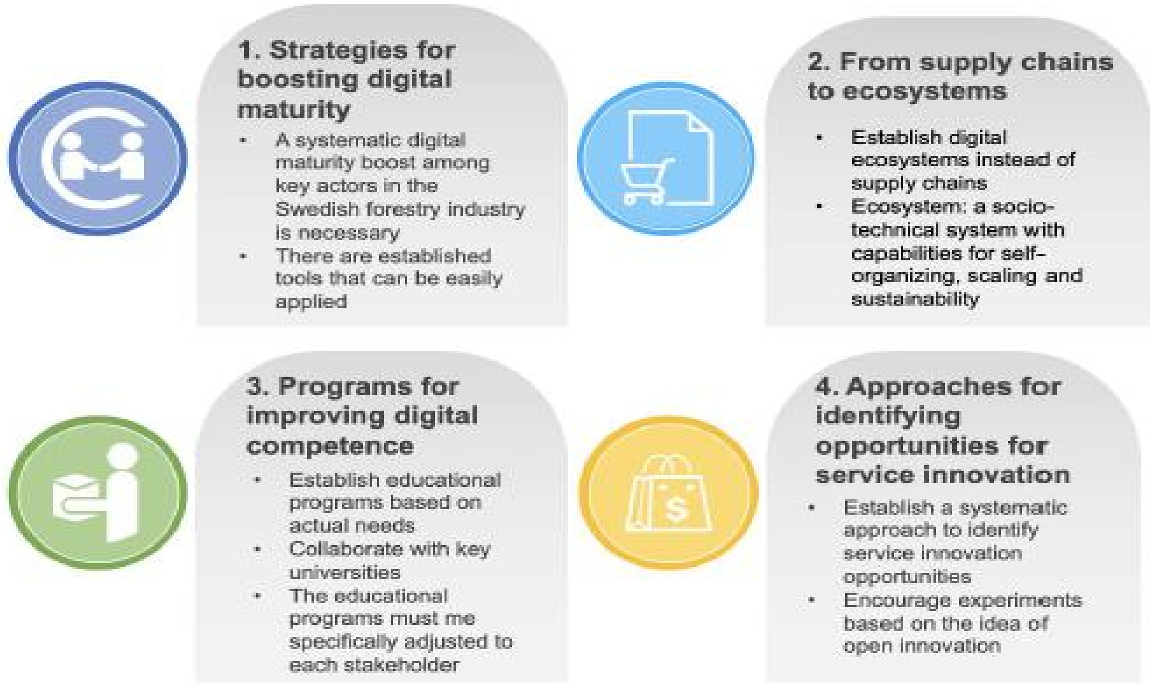

Figure 1. Action plan for digitization in the Swedish forestry industry

Resource: Holmström, J. (2020). Digital Transformation of the Swedish Forestry Value chain : Key Bottlenecks and Pathways Forward.

All of these aforementioned measures are equally as essential in the future development of digital forestry services that are targeted to private forest owners. As of now, the industry is still only starting to adopt these types of measures that are more geared towards customer-oriented thinking and are founded in digitization (Makkonen, 2018). However, as time goes on, the adoption of such procedures will generate new value creation possibilities in the digital information flow among the different stakeholders in the industry's value chain (Holmström, 2020), which will also help in answering the emerging needs new forest owner types have for digital services.

As the previous sections in this review have shown, the needs and demands of forest owners are changing. These changes also effect the requirements for digital forestry services and the needs these services can cater to. Additionally, the changes in forest owners' motives and objectives create requirements for the development of digital forestry services, but they can also bring about possibilities and opportunities to further the digital transformation in the industry through service innovation and co-creation. These possibilities for service development are more closely delved into in the following chapter through the framework of service-dominant logic.

2.6 Applying Service-Dominant Logic in the Development of Digital Forestry Services

One of the objectives of this research was to gain deeper understanding on the possibilities of the future development of digital forestry services. In order to offer implications and possibilities for the development of digital forestry services, a theoretical framework for this is established. For the purposes of this research, I have chosen to explore the possibilities, presented in previous literature, of applying service-dominant logic in the future development of digital forestry services that are offered to non-industrial private forest owners. The framework of service-dominant logic was chosen for the purposes of this research as there is a rather extensive amount of previous studies that have applied this perspective in the context of the forest industry. These studies have covered both the industrial services side of the sector, as well as the forest owner service aspect.

Before looking into how service-dominant logic has been connected to the forestry sector, it is meaningful to offer a definition for this approach. Service-dominant logic (SDL) was first introduced by Vargo & Lusch (2004) as a novel marketing framework that focuses on service provision and co-creation of value as the basis for economic activities, rather than the traditional goods-dominant perspectives. In their framework the authors noted the already ongoing transition from traditional tangible- to intangible assets, such as information, knowledge, interactivity, and co-creation. After its conception the SDL-framework has become one of the most cited pieces of academic literature, and has evolved into a foundation that has not changed operations models merely in marketing, but also in business, economics, and societal settings (Vargo & Lusch, 2017). Consequently, other authors have studied the SDL-framework extensively, and have taken it into new exceptional directions, such as the ecosystem service-dominant logic (Matthies et al., 2016).

This is also the case in the context of the forest industry. Traditionally forestry services have been predominantly driven by the timber sales market and the optimization of raw-material flows, which places the industry to be more centralized on goods-dominant logic in the past (Mattila et al., 2013). Mattila & Roos (2014) note that the traditional goods-dominant logic is undoubtedly still a valid approach for private forest owners who are active in timber sales and are financially dependent on the wood market, yet, as owners have increasingly different objectives in forest management and needs for different types of services, this approach is not entirely applicable to the larger population of current forest owners. This is especially the case for many urban forest owners, who are increasingly affluent and are not merely seeking to make a profit from their forest properties. It has thus been challenging for forestry companies to offer attractive and suitable services, for they have often still been more inclined to offer services with the goods-dominant logic approach (Mattila & Roos, 2014).

However, these more traditional approaches have slowly given way to the emergence of service-dominant logic in the industry. The forest sector has accepted the fact that services are becoming more integral part of the industry's business model as the tangible products (timber wood) are becoming inextricable with the intangible products (nature, recreation and conservation), which is a result of the increased importance of sustainability, climate change counteraction and the shift towards bioeconomy (Pelli et al., 2017). Still, most of the current services produced in forestry are focused on timber production and -sales (Andersson & Keskitalo, 2019).

Mattila & Roos (2014) found in their study that the application of SDL in these exchanges of timber sales is a quite straightforward example of reciprocal value creation between forest owners and other stakeholders. At the same time the other emerging intangible needs of new types of forest owners are not inherently understood by the forestry service providers, which has resulted in services that haven't been able to accurately respond to the needs of these owners (Mattila & Roos, 2014). Nonetheless, the SDL framework provides ample opportunities for service providers to create new value-creation models that are more in line with the needs of the new type of forest owner (Mattila & Roos, 2014).

Berghäll (2018) also found that the service provision to non-industrial private forest owners in the industry is still mostly product dominant, which is a result of rudimentary understanding of the new forest owner demographics. Novel service business models that are tied to the SDL view of service provision are needed to reach and engage the owners in the future (Berghäll, 2018). According to the author, the understanding of forest ownership in the broad context of each forest owner's process of value creation and the construction of their value networks is the most important factor in which the SDL framework can aid in the development of digital forestry services that are better suited for the needs of forest owners (Berghäll, 2018).

Moreover, the more prevalent application of the SDL framework in forestry services could produce new ideas and innovation for the service providers that are often still fairly traditional in their way of doing things (Häyrinen et al., 2017). Applying the SDL framework in service development can also improve the communication and co-operation between forest owners and other stakeholders, which is necessary for the more efficient and sustainable use of forests in the future (Häyrinen et al., 2017). In other words, the application of SDL framework in the context of forestry service offering can further expand the view from tangible resources to the settings of intangible values that extend to larger ecosystems of service provision (Matthies et al., 2016).

Even though the application of the SDL framework in service development can be argued to benefit both the service providers and forest owners, the use of SDL-based methods is still lacking within the larger forest industry. One reason could be the unwillingness of different operators to take part in open value co-creation between stakeholders (Laakkonen et al., 2019). Another one might be the lack of knowledge of the attitudes and needs of new types of forest owners (Mattila et al., 2013; Mattila & Roos, 2014). More open dialogue and collaboration is needed between different stakeholders in the industry to fulfill the demands of customers (Näyhä, 2020). In a market dominated by multiple traditional large-scale actors, the publicly financed operators could be trailblazers in developing new ideas and solutions that are more profoundly based on the SDL perspective (Mattila et al., 2013). This is also one of the objectives of this research in finding ways in which the Finnish Forest Centre service Metsään.fi could apply the SDL framework in an effort to better cater to the needs of emerging forest owner types.

Based on the previous literature in the context of the forest industry, the SDL framework seems to be well applicable to the development of forestry services according to many scholars. The research on actual applications of the framework in the development of services is yet quite rare as the industry has been slower than others to adopt new competences. It is however evident that the framework is well suited to be used in the examination of digital forestry service development. I will later go into more detail on how the SDL perspective could aid in the development of the Metsään.fi digital service to better respond to the requirements set by urban forest owners.

2.7 Digital Forestry Services for Finnish Forest Owners

As already stated, one of the key objectives of this research is to find insights into how digital forestry services could be developed in the future to better cater to the changing needs of new types of forest owners. The perceptions on the needs for services are gathered through the experiences of urban forest owners in the qualitative section of this thesis. For these reasons, it is important to look into the current digital forestry services offering that is available for Finnish forest owners. In this chapter, I will go through the most often cited services that forest owners had used according to the qualitative research, which is detailed in chapter 4 of the thesis. The services listed in this chapter are grouped according to their providers. All of the information provided on the services were gathered through service providers' websites.

The amount of different digital forestry services available has increased dramatically in recent years. In general, there are multiple actors in the forestry field that provide different kinds of digital forestry services for Finnish forest owners. The most notable ones are the state-run Finnish Forest Centre and the different Forest Management Associations, which operate under the Central Union of Agricultural Producers and Forest Owners. Additionally, there are various commercial operators that provide various digital forestry services for the use of their customers. In order to gain a better understanding on the different operators available for forest owners, Mattila et al. (2013) offer an outlook (Figure 2) on the main service organizations and their different roles on the Finnish forestry service market, which is still quite an accurate presentation of the different service provider dynamics to this day.

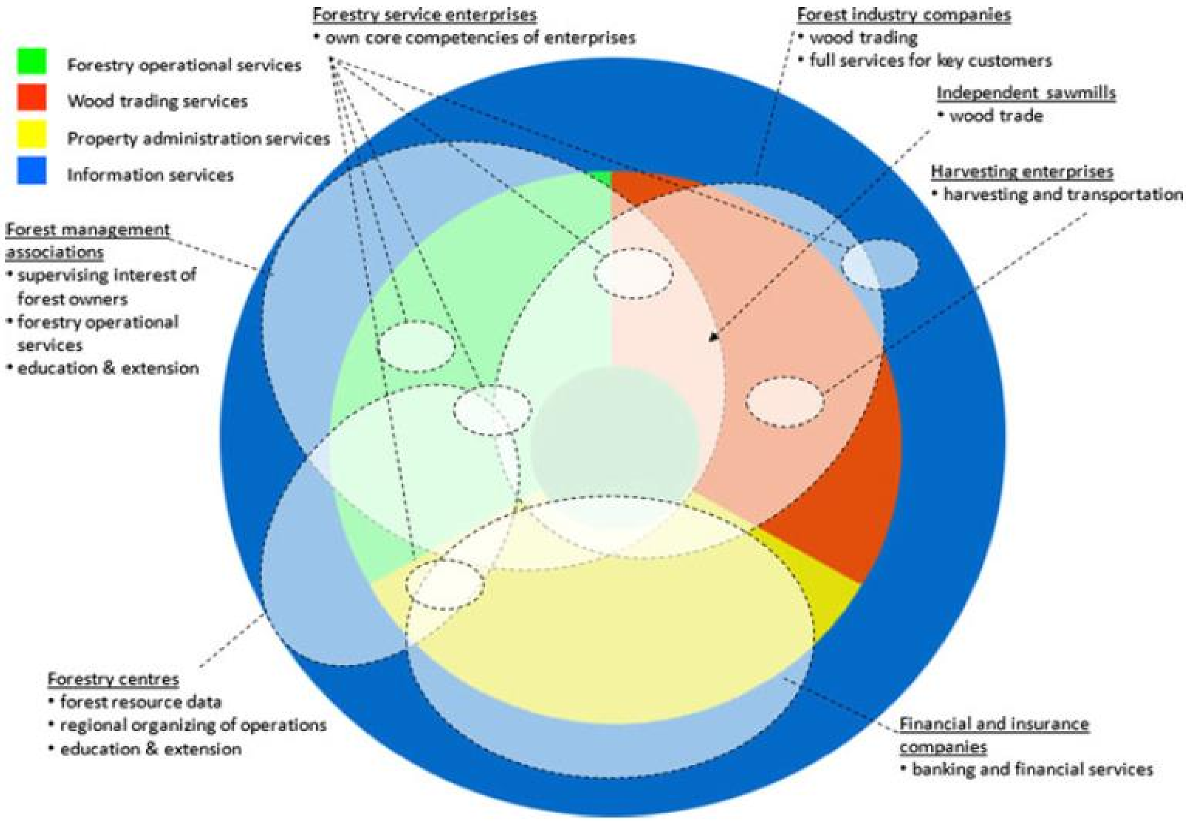

Figure 2. Operational focus of main service organisations in the Finnish forestry service markets

Resource: Mattila, O. et al.. (2013). Non-industrial Private Forestry Service Markets in a Flux: Results from a Qualitative Analysis on Finland

Finnish Forest Centre

The Finnish Forest Centre is a state-funded organization, which focuses on promoting forestry and related issues and advising forest owners in forest ownership. Additionally, the organization collects and shares data that is related to forests in Finland and enforces forestry legislations. The Forest Centre operates throughout the country. The main task of the organization could be captured as informing forest owners on how to care for and benefit from their forest properties and the ecosystems surrounding them.

The Forest Centre provides a free-to use digital forestry service for Finnish forest owners called Metsään.fi. The service is intended for all forest owners and other actors in the forestry industry. The main task of the service is to support forest owners' forest management decision making by offering forestry information and maps of properties.

Metsään.fi also serves as a platform to ease the management of forest properties through a digital channel and provide a setting for the offering of various forest management services. The service consists of an internet browser-based website, which includes the services of national open forestry data. In summary, the purpose of the service is to encourage forest owners to active management of forest properties, as well as information sharing through open forestry data.

Forest Management Associations

Forest Management Associations are local associations that are funded and governed by forest owners. The associations promote and supervise forestry within their local areas. There are 59 associations in Finland that cover the whole country. The membership of the association includes a fee for forest owners, but the membership is no longer mandatory for owners as of 2014. Approximately 75 percent of all forest owners are members of a forest management association.

The associations also provide different digital forestry services for their members. These services are included into the association membership fee. One of the digital services that the associations provide is Metsäselain. The purpose of the service is to enable the viewing and managing of forest management plans on an application for mobile devices or through a website. Additionally, the service offers information on properties broken down to forest compartments, as well as terrain maps and property lines.

A new service launched by the associations this year is named OmaMetsä. The service will continue its development until the end of year 2021. This service is developed to provide a digital channel for forest owners through which they can manage their forest assets with ease. Features include information of owners' own properties, planning for timber sales, and a platform for requesting management service offers from forest management companies. Additionally, the service promises to provide a channel for communication between forest owners and association experts with a low threshold for questions relating to forest management. In a later stage, the service will offer information on contracts, taxation-related issues, and carbon balances.

Other service providers

There are also multiple other service providers that offer digital forestry services for Finnish forest owners. These agents are predominantly commercial in nature. All of the major Finnish forestry companies offer their own digital services, and additionally there are other service providers with their own digital channels.

All of the large Finnish forest companies offer their own digital services for the use of their customers. The digital services that were most often mentioned during the empirical part of the study were Metsäverkko (MetsäGroup), UPM Metsä (UPM), and eMetsä (Stora Enso). These companies offer pay-to-use commercial services that include forest management plans, virtual forest interfaces, as well as tools for the management of taxation- and financial-related tasks. Another important feature for these commercial services is the provision of timber sales through digital channels. As another example, Kuutio, is a free-for-all timber sales platform that is provided by Suomen Puukauppa Oy, which is owned by both sellers and buyers of timber wood.

3 Research Methodology

This chapter will illustrate the research methodology used for the empirical part of this thesis. The research represented here was conducted in order to gain insight into private forest owners' attitudes towards forest ownership in general and how these attitudes may differ from previous research. In addition, the goal of the research was to find empirical knowledge on how forest owners use digital forestry services, and how these services have catered to the needs of forest owners. The analysis of the research data was carried out with the aim of finding possibilities for improving and developing digital forestry services that are developed for the use of non-industrial private forest owners.

On the topic of digital service use, the focus in the research was to especially find insights into how urban forest owners have used the state-funded Metsään.fi-service. Based on these experiences, the goal was to discover ways to develop this service to better cater to the changing need and demands of the urban forest owner demographic. The reasoning behind choosing the Metsään.fi-service as a focal point of the study was that this service is free-to-use and accessible to all non-industrial private forest owners in Finland. Additionally, the fact that the service is state-funded made it easier to approach from a research standpoint as an independent researcher. The Metsään.fi-service was also a digital service that the interviewed forest owners were most familiar with.

The research methodology used for the study will be presented accordingly. First, the methodology will be displayed in more detail. Second, I will go through the research site and participants of the study, as well as the interview structure used in the study. After this, I will end the chapter with an explanation of the analysis approach used for the research. The actual findings will be introduced in chapter four.

3.1 Methodology

When the research topic and questions were originally composed for the research, it was decided that a qualitative research method would be the best fit to uncover the phenomenon that I set out to research. Qualitative research is used as a tool to find meanings and qualities of different things that are not easily quantifiable or put into numbers and figures (Lune & Berg, 2017). Qualitative research methods aims to create images and interpretation from concepts, definitions, metaphors and descriptions that are encountered during the research process. This is often an effective way to approach themes and subjects that are not yet well known and defined, and when the researcher wants to elicit new information around certain issues (Lune & Berg, 2017). For these reasons, a qualitative method is best suited to explore the needs and attitudes of a demographic that is not yet well known in general. The qualitative method used in this research was consequently chosen to be extensive interviews with urban forest owners from different backgrounds.

The interviews in the study were conducted according to the semistandardized interview model and the general interview guide approach (Gall et al., 2003; Lune & Berg, 2017) The semistandardized interview is an interview structure that is somewhere between the entirely standardized and the entirely unstandardized approaches. Using this approach, the questions and topics are predetermined by the researcher, and these are gone through in a systematic and similar order. Even though the interview structure is in this way followed quite rigorously, the interviewees are allowed and encouraged to expand their answers beyond the limits of the prepared questions. (Lune & Berg, 2017)

This methodology to be used for the interviews was chosen as the interview participants were presumed to come from various different backgrounds and had differing levels of experience with digital forestry services. It was considered that allowing more flexibility in the questioning was something that could elicit more responses from owners that had different ideas and experiences, but also from a topic that had not previously been extensively studied. Additionally, it was important to have a somewhat rigid template for the questions and themes in order to receive concrete experiences on the owners needs and attitudes. The general interview guide approach largely seemed to be the best choice as it allowed the flexibility for interviewees to illustrate their responses, but it also kept the interviews within the limits of predetermined themes.

The planning for the interviews was initiated with the design of an interview agenda. The final version of this was used as an adaptable script during the interviews, and it was also sent to the interviewees before the interviews. The interview agenda can be found in appendix B of this thesis. The predetermined themes for the interview were use of forest management, urban forest ownership, climate change and other risks, COVID-19 pandemic, use of digital services and the needs urban owners could have for different services. Based on the responses from the interview, these themes were expanded on and weeded out for the purposes of interview content analysis.

3.2 Research Site

The interviews held for the purposes of this research were conducted for the most part in a remote setting. This approach was taken as at the time of interviews (April 2021) the COVID-19 pandemic was still imposing restrictions on meeting in person. It was also considered the most efficient approach as video conferencing tools have progressed to a level where they are reliable to use for interview purposes, and a majority of people are accustomed to using them. It was stated in the interview invitation that all of interviews would be held remotely via preferred video conferencing tool or by phone.

The interviewees were asked to specify their favored means of conducting the interview after they agreed to being interviewed, with the options of either a video conferencing tool or phone call. Two interviewees opted for interview by phone, whereas 17 interviews were held on Zoom. Only one interview was held in person at the interviewees request. This interview was held at the interviewees place of work in compliance with the safety recommendations set by authorities.

All of the interviews were recorded with the interviewee's permission. Meetings held on Zoom were recorded with the application's own recording feature. Phone interviews and the face-to-face interview were recorded with a computer by using Audacity software. Backup-recordings of all interviews held on Zoom were also made with Audacity.

In general, it can be stated that the empirical section of the research was carried out successfully and effortlessly as there were no major issues when conducting the interviews. There were no apparent connection issues during the interviews, and all of the interviews were held successfully from start-to-finish without interruption. In addition, the Zoom call recording feature worked seamlessly.

3.3 Participants

As stated earlier in this thesis, my focus in this research was on new types of forest owners. These new types were defined as younger owners, who live in urban areas, away from their own forest estates. For the interview study, I decided to narrow down these younger owners as owners who are under 50-years-old. The reasoning for this choice was that a majority of forest owners are 55-years or older, with the average age being 62-years-old, and over 50% of forest owners already 65-years or older (Karppinen et al., 2020). Additionally, according to Karppinen et al. (2020), the age group 45-54-year-old accounted for 14% of owners, and the group of under 45-year-old owners included only 12% of all owners.

The cut-off point of 50-years was thus chosen to enable a large enough population for the study, for I was not certain on the fact that I would be able to conduct enough interviews within a stricter age limitation. In addition, the fact that I was researching owners living in urban areas, made the entire population increasingly smaller.

With these restrictions in mind, I contacted Finnish Forest Centre with a formal request for provision of forest owners' personal information for research purposes. My request stated that I required the personal information of forest owners with the following criteria:

- Owner is 49 years old or younger
- Owner's principal abode is in Helsinki, Espoo, or Vantaa
- Owner's forest estate is located outside of the Uusimaa region

No further limitations were made in the request for the information. With this request, I was provided with a collection of personal information for 2 106 individual forest owners who met the criteria.

The forest owners were approached via email in a random order from the list provided. I set a goal of conducting 7 to 12 interviews for the research and chose to send out invitations until this goal was reached. In the end, I managed to conduct 20 interviews with forest owners, and sent a total of 277 invitations to participate. The invitation for the interview can be found from appendix A. The invitations were sent accompanied by the interview agenda that is shown in appendix B. The interview participants are listed in table 1, with the corresponding information on owner age, length of tenure and acquisition method of forest property. The interview participants were assigned an identifier (A-T) randomly to maintain confidentiality. These identifiers will also be used in the analysis of the data to identify the specific respondents.

Table 1: List of interviewees

Name (Identifier)	**Age**	**Years as an Owner**	**Acquisition of Forest Property**
FO A	41	30	Inheritance
FO B	32	2	Purchase - Relative
FO C	29	5	Purchase – Market
FO D	35	4	Inheritance
FO E	42	16	Inheritance
FO F	29	3	Purchase - Market
FO G	33	4	Inheritance
FO H	38	6	Purchase - Relative
FO I	41	10	Inheritance
FO J	34	3	Purchase - Relative
FO K	43	2	Inheritance
FO L	39	4	Inheritance
FO M	29	1	Purchase - Relative
FO N	33	30	Inheritance, Purchase - Relative
FO O	28	2	Purchase - Relative
FO P	33	15	Inheritance, Purchase – Relative, Purchase - Market
FO Q	43	25	Inheritance
FO R	44	17	Inheritance
FO S	44	5	Inheritance
FO T	34	18	Inheritance

3.4 Interview Structure

The interviews were conducted in accordance with the interview agenda (Appendix B) provided to the interviewees before the interviews. Participants were not urged to familiarize themselves with the agenda beforehand, but some of the interviewees stated to have gone through the questions in advance and had already briefly contemplated their answers. It was communicated in the invitation that the interviews were allocated a length of 45 to 60 minutes. The actual interview lengths varied from 35 minutes to over 60 minutes. The interviews were not stopped after the allocated time expired, but respondents were allowed to continue sharing their thoughts after the time limit if they wished to do so. All of the interviews were held in Finnish as all of the participants were native speakers.

Each interview started with a brief introduction to the research topic and the purpose of the study. The scope of the study and objectives were also introduced to the participants. After this, the interviewees were allowed to ask questions regarding the research and the interview in general. Before starting the interview, a consent for recording was requested from the participants.

The interviews were structured into seven different sections starting with background information of the interviewee as a forest owner and general information on their attitudes and activity as a forest owner. These two sections were constructed in a way that pursued building rapport between the researcher and the participants. Within these sections the interviewer made an effort to ask the participants to expand on their answers to build up conversation and make the interview setting more relaxed and comfortable. After this, the following sections considering urban forest owners, climate change and other risks, COVID-19-pandemic, and digital forestry services were gone through in this order.

As already stated, the interviews followed the semistandardized interview structure, which made the interviews more relaxed and conversational in nature. The interviews were conducted quite systematically in accordance with the interview agenda, meaning that the themes and questions on the agenda were introduced in the same order each time, and all of the questions were asked in similar order from each participant. Some flexibility was however employed in the fashion of posing the questions in order to keep the interview's conversational approach intact. In a few situations, questions were skipped, if the participant showed that they had nothing to answer on the matter or were reluctant to answer. However, participants were encouraged to elaborate on their answers and follow-up questions were often posed in order to learn more about the subject's sentiments.

3.5 Analysis

According to Creswell (2013) the data analysis of a qualitative research is composed of three different steps, which include preparation and organization of the data, reworking the data into themes through coding, and lastly representing the data. The analysis performed in this thesis follows the aforementioned steps. Objective of the analysis was to elicit different attitudes forest owners have and how these pertain to the use of digital forestry services and needs for new types of services.

The preparation and organizing of the interview data started with transcribing the interview recordings into text form. The transcriptions were first written word-for word in Finnish, omitting filler words, pauses and parts of interviewee contemplation. After this, these transcriptions were translated into English in a more concise form that excluded repetition within answers and answers that were deemed irrelevant for the purposes of the analysis. The written answers were then grouped into sections corresponding to the interview agenda, as some answers were given within questions of a category that did not fit that specific section.

The analysis of the interview data was carried out according to the interpretative approach of qualitative data analysis introduced by Miles and Huberman (1994) as one of three approaches to qualitative data analysis. This approach differs from the two other approaches, social anthropology and collaborative social research, in that it is most suitable for analyzing data given in text format. It is therefore fitting for the purposes of this research as all of the research data was in form of written interview transcriptions. The authors also state that this approach allows the researcher to uncover a practical understanding of meanings and actions of their subject, which supports the nature of this research.

Content analysis of data is a set of techniques that offer the foundation to most qualitative analysis. It is used to categorize and code the content gathered through research as data that is then used to answer the research questions of the study. Usually, content analysis starts with defining the categories to use in the analysis, which can be formulated either inductively or deductively. In this thesis, the analysis is done using the inductive approach, which allowed the defining of categories from the data without the focus on predefined accounts for categories. (Lune & Berg, 2017)

The actual content analysis of the interview data was carried out by using a conventional content analysis approach, which is one the three content analysis approaches conceptualized by Hsieh & Shannon (2005). According to the authors, this approach is used within studies that aim at describing a specific phenomenon when existing theories or previous research is limited. When using conventional content analysis approach, the researcher does not use predetermined or hypothesized categories in the analysis, but the interviewees themselves help shape these categories (Hsieh & Shannon, 2005).

This approach makes it possible to gain direct information from interview subjects without having to lean on premeditated categories or theoretical viewpoints.

The goal of the analysis was to find insight into the different attitudes and needs that the younger urban forest owner demographic has and how these factors should affect the development of future services for the urban forest owner population. Even though the interviews followed the interview guide quite faithfully, indicating some predetermination of analysis categories, the actual themes and findings for the research were elicited from the interview responses. The analysis categories were determined as:

- Background of urban forest owners
- General information on forest ownership
- Characteristics of urban forest ownership
- The effects of climate change and other risks
- The effects of the COVID-19 pandemic
- User Experiences of Digital Forestry Services Among Urban Forest Owners
- Demands for Future Digital Forestry Services and the Possibilities in Development of the Digital Service Offering

Subsequently, after the categories for the analysis were determined, the content was analyzed in order to find parallels and differences between the responses. In addition, interrelationships were drawn between forest owners and owners with similarities were grouped accordingly. In general, the interview population was quite heterogenous in their response to various topics, which made finding patterns and different groups within the data more straightforward.

4 Findings

In this chapter, I will go through the findings from the empirical portion of my research. As presented in the previous chapter, the empirical research consisted of 20 interviews with Finnish private non-industrial forest owners. The findings will be presented in accordance with the different sections of the interview agenda. First, the background of the interviewees will be presented, as well as general information relating to forest ownership. After this, the focus will be on questions regarding forest owners' attitudes towards urban forest ownership, climate change and other risks, and the COVID-19 pandemic. Lastly, findings on the use of digital forestry services and needs for new services will be presented. The answers are divided into sub-themes within each interview section presented.

4.1 Background of Urban Forest Owners

The approach for this research was to gain deeper understanding on the attitudes younger urban forest have on different aspects on forest ownership, how they use digital forestry services, and what types of needs do these owners have for digital services in the future. Because of the broad nature of the goals of this research, the target group of the study was not strictly limited. The forest owners approached for this study were only defined by age, place of residence, and the location of their forest property. For these reasons, the faction selected for the interviews is quite diverse on the attributes of their forest ownership background and activity. Ultimately, the goal of this analysis is to build a profile of a younger urban forest owner, which could be applied to the development of new digital forestry services for this target group.

When considering the age of the participants, the interview group was quite varied, ranging from 28- to 44-years of age. The average age of the respondents was 36.2, whereas the average age of forest owner in the data acquired from Finnish Forest Centre was 40. It can therefore be stated that the interview population presented the general population of under 50-year-old owners fairly accurately, however skewing somewhat towards younger owners. In general, within the constraints of this study, it seems that the age of the owner is a factor in some categories of this research, yet it is not possible to generalize attributes and attitudes as corresponding to specific age group. All in all, it seems that different types of forest owners can be found within all ages.

Even though gender of forest owners was not a determining factor in the selection of the participants, it is still relevant to highlight that both men and women were close to equally represented in the study (9 out of 20 interviewees were women). As already stated earlier in this thesis, recently there has been a large variety of studies on female forest owners and their specific characteristics. These studies have found that in general there are differences between attitudes and behavior of female forest owners and their male counterparts. It is also a fact that the amount of female forest owners has been gradually increasing each year, and it will continue to do so in the future. For these reasons it is significant to note that in order to be a representative study of Finnish forest owner population, both men and women should be taken into account in the research.

Another differentiating factor of the participating forest owners was the length of their tenure as a forest owner. Many of the owners had had their property since they were a child or a teenager. However, a majority of the interview population had been owners for six years or less, and several participants has been owners for only a few years. In general, the population is a good representation of owners with different lengths of tenure, as it appears that urban forest owners have remarkable variance when it comes to their history as owners.

The factor that accounts for these differences in tenure length is the method of forest property acquisition. In the Finnish context it is quite common that forest ownership is passed down from generation to generation. This was also evident within the population of this research, as 13 out of 20 participants had inherited all or parts of their forest property. In the case of inheritance, no distinction was made whether the ownership was acquired through a gift or an estate of a deceased relative. From the interviews it appeared that both of these acquisition methods had been equally common within the participants. The least common way of acquisition was purchase from the open market, which in this context corresponds to all purchases that were made from other than relatives. The interviews show quite clearly that the forest owners who have purchased their properties instead of inheriting them, have been more involved with their properties and claimed to have a better general knowledge on forestry and forest ownership. This was especially notable within the group of owners who have purchased property from the open market. However, the sample size of these type of owners (3 out of 20 participants) was so limited that no further generalization could be made about the particular characteristics of forest owners based on the method of property acquisition.

Participants of the study were also asked to provide the information of where their forest property is located. Specific information of the location of each owner's property has been omitted from the analysis of this study to hide the identities of the interview participants. Most of the owners live quite far from their forest properties, the distance being something between 200 to 500 kilometers form their place of residence. Only a few participants had their properties within a 100 km radius from the Uusimaa region, whereas some owners had their properties in Lapland or Kainuu region.

Most of the interviewees had their forest property located at or near a family estate or summer cottage. In many cases the owners had inherited their forest property as a part of an estate that also included other properties in addition to forest parcels. It was also apparent that the owners who had acquired their property through purchasing had their land near or at the location of their family estate or summer cottage. Only 2 out of 20 participants had no forest property that was closely related to a place of family estate or residence of relatives. From this interview data it is quite clear that urban forest owners have strong ties to their place of birth and family origins through forest ownership, and these factors are also key motives behind purchase decisions for forest properties.

When it comes to the sizes of forest property of the interview population, there were also quite a few differences. Most of the owners had a property size that was close to the national average of 30,3 hectares per estate (Peltola et al., 2019), however quite a few owners had properties of over 100 hectares. From the interview population it can be stated that there is a lot of differences in the property sizes of urban forest owners. For this research, this difference was not emphasized in the sampling stage of the study in order to gain a more generalized view of the specified forest owner population. However, it is quite conclusive from the interview data that forest owners who have larger estates are more active in their forest management practices and more often than not have different needs and expectations for forestry services. This distinction is something that should be taken into account more carefully in future research of forest owners.

4.2 General Information on Forest Ownership

After the interviewees described their general background and information on forest ownership, they were asked to share their thoughts on some common questions considering habits and attitudes on forest ownership. These questions were posed in order to gain insight into how actively urban forest owners are involved with their forest properties, as well as how much time do they allocate for forest management and forest-related activities monthly. The participants were also asked about their general level of experience and practice on forestry and forest management. After this, the interviewees were asked about their purpose of use of their properties and the benefits they get from forest ownership. Finally, the participants shared their thoughts on issues considering property productivity in contrast with other factors such as conservation and recreational use.

Involvement with forest property

Generally, it seems that urban forest owners differ greatly when considering the allocated time and effort for forest management activities. For many participants activities were performed only a few times a year or on a bi-monthly basis. These owners noted that occasionally there can be longer periods of time when forest property is not actively thought about at all, and forest management activities are done very rarely. Many owners also pointed out that maintaining forest properties is often highly seasonal. Most of activity is allocated to start of the year for taxation-related tasks, and to spring and summer for forestry-related tasks. There were only few forest owners who were active throughout the whole year, whereas for majority of owners the fall-winter season was an especially inactive time period. In contrast, the most active forest owners take up with forest management activities monthly or even weekly.

From the interview data, there seems to be a clear distinction between forest owners based on the time and effort they allocate for forest management activities. The other group of owners considers decisions and measures regarding their properties quite rarely. This group of owners consists of the vast majority of the population. More often than not, this group allocates time to such activities only when there is a clear task that needs to be done, and it is something that requires immediate action. This group does not actively follow or monitor their forest property through digital services, and they visit their properties infrequently. These owners also noted that the activity related to forest management practices is unquestionably more frequent at the start of one's forest owner tenure. When an owner receives their property, they use considerably more time and effort to familiarize themselves with the property and the necessary tasks for forest management. After this kick-off-period they are less inclined to use their time for forest management activities.

The second group of owners comprises a much smaller share of the population. These owners are highly active in forest management, and they allocate a considerable amount of time and effort monthly to forestry-related tasks. They carry out forest management tasks and plan the development of properties weekly. Usually, these owners also have a more hands-on approach to their forest management, and they like to visit their own properties quite often. Distinctive for these owners is oftentimes also the fact that they like to carry out silviculture activities by themselves. In general, this group consists of owners who have larger forest properties, which also implies that these owners have more financial stake in their forest properties.

Knowledge on forest management and -ownership

Urban forest owners can also be classified based on their self-proclaimed level of forestry or forest management knowledge and experience. Majority of the interviewed owners felt that they had above average general knowledge of forest ownership and forest management. This group included both newer owners and ones with more tenure. These owners often had already some knowledge on the matter before they acquired their forest properties. Additionally, some owners described to have a lot of knowledge on forestry-based matters from their own educational and vocational background. However, in many cases owners claimed to have little prior know on forest management before they became owners, but they have gradually become more informed. These owners found that active counsel from relatives and Forestry Management Associations had been most helpful in educating themselves in these matters. Most of the more knowledgeable owners stated however that forest ownership is such an extensive subject matter that there is always room to know more, and even a need to educate oneself to keep up with the constant changes in forestry.

There were also quite a few owners that declared that they had only little knowledge on forestry and forest management. This group also included participants with short and long tenures as an owner. These participants had the opinion that it is quite difficult to know what actions they should do on their forest properties, and what information is relevant to them. Some of the owners also shared the sentiment that gaining knowledge and finding information is troublesome, especially at the beginning of one's tenure.

> *"I don't feel that I know much … Especially didn't know in the beginning. It seems to be really difficult to find relevant information and dig up things you need to know. And even now I don't feel that I have much expertise on this matter"* – FO N

Quite a few participants also expressed the need for outside support in getting to know relevant issues considering their forest properties and their management. Improved facilitation and encouragement for self-learning was also brought up as something that could help forest owners, especially ones that have just started their ownership tenure. However, many participants expressed their desire for such support, but also stated that they don't have time to seek information and study the subject extensively. Also, the nature of forest management and ownership in general was highlighted in this context, as management cycles can be quite long, and there can be long periods of time when no major actions are needed to be taken. This also factors into the fact that forest owners with small properties do not have to have extensive knowledge on forestry, when the condition of their property warrants no significant management work to be done.

"It is shameful how little I know or understand the value of my property, or what should be done with it … From a financial perspective there is a lot to learn, like when should you do thinning or felling or regeneration felling … I would like to have some more support and self-learning, but I haven't had time for it yet because of studies and work … And as there is no emergency to do management right now … You can just let the forest grow, and I haven't had to do a lot of very active studying on the subject because of this situation" – FO G

In general, it seems that younger urban forest owners are quite well versed in forest management and forest ownership as a whole. It is evident from the data that the knowledge levels of owners increase as they are forced to seek information as necessary management tasks arise. In many cases, newer owners have not had the need to perform management tasks, and therefore their knowledge on these matters can be lacking. The information that forest owners most often need is usually related to the financial side of ownership, such as timber sales agreements, taxation, and collaterals. Especially new owners can often feel that finding information on these matters is difficult and time-consuming. Therefore, it would be unquestionably valuable to find ways to share this information with new owners and potential owners in the beginning of their tenure. Digital services for forest owners should therefore aim to reach these types of owners with relevant information and inform them in a compact way that is easy to comprehend.

Use of forest property

The use of forest property was in this study outlined as consisting either of financial- or recreational use. For the most part, it seems that urban forest owners mainly use their forests for wood production and timber sales purposes. This is in line with the forest usage of the general non-industrial private forest owner population. A great deal of forest owners however state that they have multiple purposes for the use of their forest properties, which was also evident in the interview population of this study.

All of the respondents stated that the financial aspect of their forest property is either the most important part of forest usage or at least a significant factor. For many forest owners, their forest property is one of their sources of income and are seen as an important investment tool. Many respondents pointed out that they use their property as a means to diversify their investment portfolio. Forest properties are also often used as a collateral for other property purchases or as a form of saving.

The financial aspects of forest ownership were also noted as major motivators for maintaining a regular cycle of forest management practices. Forest owners consider effective and active forest management as the biggest factor in sustaining a profitable property that yields income. This was especially important for owners who had bought their properties with borrowed money.

Versatile forest property usage seems to also be important for the majority of urban forest owners. Majority of the respondents stated that using their own forest for recreational use is important, at least theoretically. For many owners, recreational use of their own forest is very rare or non-existent because of the location of the property is too far away from their place of residence. However, when urban forest owners are able to do visit their own forests for recreational use, the activities are quite diverse. Among other things, the interviewees mentioned picking berries, trekking, biking, camping, hunting, and functional exercise through improvement work of the forest.

Benefits and disadvantages of forest ownership

The interview participants were also asked about their views on the benefits of owning forest and possible disadvantages forest ownership might retain. This question was posed in order to gain insight into whether urban forest owners consider their property more as a valuable asset or as a burden. This was especially aimed at owners who had inherited their properties, and not purchased them of their own free will.

The general consensus from the interview data seems to be that urban forest owners consider owning a forest property mainly as beneficial. All of the respondents seemed to have some benefits from their forest ownership. Most often cited benefits were financial ones that were already widely mentioned in the previous question, such as, income from timber sales, form of investment or using property as a collateral. A well-managed forest property was seen by many as a steady investment that brings financial stability, especially in more turbulent times such as recently. Owning forest property was also seen as a quite riskless form of investment with moderate rate of return, and an exciting opportunity to dive into the sphere of a new type of investment platform.

"The biggest benefit is that it is an asset ... It's also somewhat of a new hobby, as it's totally a new unknown field of business for me ... It requires dedication and studying, and it has become a bit of a new secondary occupation for me besides from my day job." – FO L

Most of the respondents also highlighted various other benefits that were both concrete and intangible. Forest management as a hobby was often cited as a benefit itself and also the possibilities for recreational activities in one's own forest property. One of the intangible benefits many respondents brought up was owning of forest property itself. This was seen as representing continuity and upholding traditions. It seems that for many urban owners it is very important to continue the work of previous generations in owning forests and maintaining the properties in good condition. Many owners also wanted to be able to pass their properties along to following generations, and it was important to keep the properties within the family after inheritance.

Some owners also saw the environmental aspects of forest ownership as a benefit, but these aspects were cited only by few individuals. It was said that owning a forest property can grow understanding of the environmental side of ownership and help understand the bigger picture of conservation and forest management. The owners who considered this as a benefit also noted that as an owner themselves, they can have a bigger impact on the environment through own forest management decisions.

There were also quite a few disadvantages or stumbling blocks related to forest ownership that were cited by the owners, but in general these were not seen as an aspect that outshined the benefits. The biggest disadvantage was that it can often be quite difficult to handle different tasks and manage the affairs, especially in the beginning of one's tenure. Some tasks were also seen as quite troublesome and time-consuming, which take a lot of familiarizing oneself with the different methods and regulations.

"Probably the stress as all things around this subject are in my opinion so difficult and I don't know a lot about them … Feels that it is something that I should be able to handle, but there are no clear steps on how you should handle things and how extensively … So, you easily have a guilty conscience about it and all the stuff creates a lot of tension and worry, like how you should do this and that" – FO I

As a whole, it is clear that for many owners the management of forest assets can be cumbersome and stressful. In most cases the owners had only a little knowledge on the particularities of forest asset management before their ownership tenure and gaining sufficient knowledge can be difficult without outside assistance. Aspects that were most often cited as especially complex were accounting- and taxation-related tasks.

"Taxation-side is in the beginning a thing that requires own will or outside help, as it is somewhat messy … If you have never done something like that before you can be quite puzzled about this stuff" – FO F

Some owners also stated that the physical distance to one's own property can be a big stumbling block in managing their property. Connections to forest management associations and good relationship with the local representatives was often cited as a key to counteract the restrictions that physical distance can carry. This is a disadvantage that most urban forest owners have to deal with, and the development of future digital forestry services should aim to find ways to reduce the difficulties that physical distance from one's place of residence to forest property entails. As already stated earlier, it is also extremely important to develop effective digital solutions for counteracting the troublesome nature of forest asset management and to make these services easily available and comprehensible.

Valuing productivity, conservation, and recreational use

To put together the aspects of the general forest ownership-section, the interviewees were asked to share their insight on how they value productivity of their property in contrast with the conservational standpoint of forest ownership. Additionally, the owners shared their point of view on the importance of developing their forest properties for the purposes of recreational use. The questions were posed as a juxtaposition of productivity and conservation in order to elicit more specific responses on the attitudes the owners have considering the more current topics surrounding forest ownership in general, in contrast with previous questions that gave insight into owners' actions. Overall, both the productivity and conservation of forest property was seen as important to owners. For majority of owners these two conducts work hand-in-hand, and they do not cancel each other out in the bigger picture of effective and sustainable forest management. The notion that effective management of forest properties can increase productivity as well as enable the efficient conservation of forests was shared by most urban owners interviewed.

> *"We lean more on the productivity side nevertheless … We try to take good care of the forest and in a timely fashion that yields good productivity … There are also a lot of individual columns of forest that don't have plans to rely on productivity … For example, we like to think about each column case-by-case, and leave some of them untouched and free of felling activities"* – FO H

> *"We have tremendous nature and great forests in Finland, which will be a great treasure in the future, for there are a lot of places in the world where there is no clean nature … So of course, conservation is important, so that future generations can also enjoy it … But I don't really see it that way that forestry and wood production are harmful or straining to nature … There are so many different compartments in different forests, so there is a lot of forest land still in its natural state and room for animals and plants to strive there"* – FO Q

Among owners who have larger forest properties, the importance for productivity was greater than for those with small-to-medium-sized properties. It is quite self-explanatory that the owners of larger properties have certain expectations for the yield on investment and are also possibly to some extent dependent on the profits financially. For most of the smaller property owners the monetary productivity of forest property was mostly seen as insignificant or fairly irrelevant as a source of income. These owners often mentioned the productivity as a pleasant side product of taking good care of their forest property. Consequently, even though owners would claim that productivity is important to them, they rarely have optimized their properties with these goals in mind or are solely focused on intensive timber stock raising.

“The productivity of forest property is a long-term strategy … My aim is to increase the value of the property … But it isn’t just the euros you get out of it that are considered … The fact that the forest is well and grows sustainably is important … We take into consideration also the diversity side of things … You don’t want to intentionally destroy or impair the forest in any way” FO P

Conservation and maintaining biodiversity were also largely seen as important by most urban owners. Few respondents were of the opinion that these acts of conservation were not a part of the responsibilities for non-industrial private forest owners. According to these owners, there is already a lot of forest land in Finland that is protected and conserved, and thus active conservation work is not required in smaller private owned forests.

However, most owners felt that conservation was also an important part of forest ownership and every forest owner’s responsibility. Many owners said that it is one of their goals to develop natural diversity in their forests and ensure habitats for animal- and plant populations. These owners also often noted that they take these aspects greatly into consideration when making forest management decisions. Few examples of measures mentioned were continuous-cover silviculture and avoidance of clear-felling practices.

“For me maintaining biodiversity and conservation is more important … Mere productivity comes second … Conservation is important for owners as it is a way to take responsibility in a global ecological crisis … It is also something that brings joy and a feeling of success when you know that the biodiversity is larger on your own property with the measures that you have chosen to take” – FO O

Few of the owners also noted that it was also important to maintain the scenery of their own property. This was seen as a pleasant side product of conservational-minded forest management. These owners said that commercial forests and properties that had implemented clear-felling practices often looked bleak or gloomy, and this is something that owners wanted to avoid on their own properties. On the other hand, some owners were of the opinion that planted forests were more scenic than forests in their natural state.

There were however no owners in the interview population that wanted to dedicate their whole property for conservation or as an object of protection. There were however some owners who had thought of leaving parts of their properties for these uses. Moreover, many owners already had objects of protection within their properties and had some parts of their forest land in conservational programs such as Natura 2000. Many owners had also already certified their forest land in the case of timber sales.

Many of the interviewed owners felt however that there are some obstacles in the more nature-oriented ways of handling forest management. Especially the method of continuous-cover silviculture was seen as retaining challenges for owners. These challenges were mostly caused by the lack of knowledge on how these methods could be implemented and what type of practices are suitable for different types of properties. These methods seem to however be of growing interest to forest owners and this is a factor that should also be considered in the development of digital forestry services.

"I think that these are very important [maintaining biodiversity and conservation] … I have two objects of protection on my property already, and I don't regret having those … I hadn't thought about this that much previously, because these things felt so natural to me … But I'm more and more interested in the debate of continuous-cover versus regeneration felling … I've become more aware of the different possibilities, as beforehand I just thought that clear felling was the only option … Like a century ago it wasn't the only option, but continuous-cover silviculture was quite prominent" – FO G

The participants were also asked about their perceived importance of developing and maintaining their own forest property from the recreational use perspective. The recreational aspects of the property were considered by nearly half of the owners as important or somewhat important. These owners were of the opinion that it is a significant aspect of forest management to maintain the ability do activities such as berry picking, fishing and hunting. Few of the owners also found that sustaining the public right of access to their properties was important, and forests should also be maintained with this in mind.

"The forest property is different from some other types of investment in that it actually exists and you can be there and do activities, which is great, and it entails a lot of stuff other than just the property itself … It's important to be able to walk in the forest and get to know your own property that way … This helps in seeing the needs and possibilities for what you should do to it … The recreational use is also very important as a person who does office work … It's a refreshing and a different world out there compared to the everyday life in the city" – FO P

For most of the owners however, the recreational use and its development was not deemed important. The most significant reason for this was the fact that the owners lived too far away from their properties to use them for recreational purposes on a regular basis. For many owners, their forest properties were also unfit for these purposes of use because of the rough terrain and insufficient road network. All in all, for most of urban owners the aspects of recreational use in their own forests are not significant motives in forest management. It was also evident from the interviews that only a small share of owners would actually be inclined to purchase forest with recreational use as a major intention.

The valuing of different forest management practices regarding productivity and sustainability are something that will continue to separate owners according to their different goals and attitudes. More frequent use of different management practices seems to be reality in the future, and more and more urban owners are going to contemplate implementing these practices. It can however already be stated that urban forest owners living in Helsinki metropolitan area, and especially those who are not financially-dependent on their properties, seem to value the sustainable practices more than other owners. The ongoing debate on how forests should be managed seems to divide forest owners into different camps that have their place of residence as one of the factors. The urban forest owner population is not however homogenous in this matter, which should also be considered when developing suitable digital services for this target group. Nonetheless, it is clear that the questions of values versus profits are something that all forest owners will ponder on in the future, and the purpose of digital services in this context should be helping these owners in this challenging decision-making process.

"We have a lot of differences in the objectives between the owners of our forest consortium … Some want to manage it with the financial aspect first, like cut and sell everything as efficiently as possible … Myself, I emphasize other aspects than the maximal profits … I don't want to do clear felling and such … But these questions relate also to my own incompetence regarding these things … In order to do things more sustainably, you would need to understand more about everything and gather a lot of information from different sources … As a new forest owner, who doesn't know anything about it, you often take the easy way out … From my experience the whole process of timber sales and such is built in a way to support clear felling practices and cutting down as much trees as possible … The other route is not easy to handle or justify to others as you don't have the expertise and know-how" – FO I

4.3 Characteristics of Urban Forest Ownership

Following this, the interviewed owners were asked about their own opinion on how living in an urban area could affect one's attitudes and views on forest ownership on a general level. In this instance it is once more significant to state the definition used in this research for urban forest owners. For the purposes of this research urban forest owners are defined as owners who live in an urban area and own a forest property that is located away from their place of residence. This definition predominantly used in this thesis is not to be confused with the definition used previously in the academia, which defines urban forest owners as owners who live in urban areas that also own forest in an urban area.

As already stated earlier, the phenomenon of remote owners' or urban owners' attitudes and viewpoints on forest ownership has not been previously widely studied. Previous studies on Finnish forest owner population has mostly focused on other demographic aspects instead of the impact of owners' place of residence. This inquiry into the attitudes of urban owners was therefore one of the more significant sections of the interview study.

Nearly all of the respondents stated that the urban aspect of their forest ownership background had at least some influence on their attitudes towards forest ownership as a whole. Some owners also notified that this had a major impact on the way they see forest ownership. Both more value-based and concrete examples were cited as having an effect on how urban forest ownership is viewed.

The most often cited crucial factor defining urban forest ownership was naturally the physical distance that urban forest owners have to their properties. Distance from forest property was seen as restricting physical presence on location, but also general activity on a significant level. For many owners, the physical distance had an impact on how often they put thought and effort into their own properties.

"It affects in a way that the property is located far away … If the forest were closer it would feel like I would think about it more often and would do more active management … Maybe you could also benefit more from it in that case … Because it's so far away, it is often out of my mind, and when something comes up, like a taxation-related thing, then it feels like only thing that you get out of the property are the unpleasant and bureaucratic stuff … Generally, I feel that it has an impact that I live far away, not necessarily the fact

that I live in a city … Urban living doesn't impact the appreciation for forests and nature" – FO D

"In a way [physical distance] can estrange you so that you don't think about the management tasks and responsibilities so actively … Management can easily become lacking, and you can get behind with the management work" – FO H

Many owners felt that if they lived closer to their properties, they would visit their forests more often and would have a more hands-on approach to managing the property. Closer proximity to the forest property would also provide better understanding of the forest and would make tasks easier and more natural to implement. The distance to property also impacts the possibilities to effectively manage assets if something unusual happens that would require immediate action or response.

"I don't know how much people think or understand that in forest management and ownership it is important to know the property … You need to really take care of the forest actively … It isn't really enough to just own something and sell a few logs here and there … Ownership requires active management and visiting the property, as well as planning" – FO L

"Of course, it has some effect … If something unexpected happens then, because of the distance, I can't react so quickly necessarily to things, but I can go there if it is necessary … Myself, I have been able to balance these really well [living far from the property and forest management] … I have never thought that living in a city, away from the property, would be a hindrance or that I couldn't manage things from here … It has been easy to balance weekdays in the city and vacation time near forest property" – FO Q

Most of respondents shared the sentiment presented above that the physical distance is not a significant barrier in maintaining active relationship with their property and being able to manage it efficiently. The strong relationship to property is also something that ties into the origins of many urban forest owners, for a large part of the interview population had lived in the countryside and close to their properties previously. These owners noted that moving to a city hadn't greatly changed their viewpoints on forest ownership or the connections they hold with their properties. In general, they had a strong relationship with nature, and as a part of that owning forest property was seen as a natural thing that holds a lot of sentimental value for the owners.

"I come from the countryside and from a farm originally … I feel that the values that I have about these issues are closely tied to my origins … My attitudes towards forest ownership are more closely affected by where I'm from rather than where I live … I feel that the people who are born in urban environment and lived there their whole lives have a lot of different views on things … These people probably have a high threshold of purchasing forest property … The people originating from countryside have more experience of what forest ownership means and are capable of acquiring services that they need through local contacts … People from cities don't really know anything about the big picture of ownership … I feel that these people will end up easily buying some "package deal" that is easier to manage, like a forest consortium or forest funds" – FO R

Of the more value-based impacts of urbanity to forest ownership, the respondents also shared a variety of other aspects that they had encountered. One of the more common themes was the fact that comprehension of forestry and theoretical knowledge on forests can be somewhat rudimentary for owners that have lived in cities for longer periods of time. This issue was raised as something that especially affects owners that have inherited their properties. Few owners also pointed out that living far away from forest property can obscure the perceived impacts forest management can have. This relates to the fact that urban owners can have different interpretations on forest management than other owners living locally to the properties, which can make it sometimes difficult for urban owners to relate to courses of action that are taken.

"I think that urban living shapes the attitudes and viewpoints in some way … It can increase the perceived dichotomy between forest usage and management … From afar some things can seem more impactful than the actual work or alterations that are done … You can't really see the local effects easily as these things are often not so black and white … If you look at things from only the urban perspective, these things can look simpler and more clear-cut than they actually are" – FO P

All in all, urban forest owners do not seem to perceive their place of residence having a major impact on the attitudes they have towards forest ownership. Attitudes are more tied to the origins of the owner. In this study, majority of the interviewees originated from the countryside, which had a significant impact on the responses to this issue. In the future, there will however be a growing number of owners who do not have these strong ties to the countryside or the areas their properties are located. These owners will probably have different views and attitudes about ownership and management, which is a significant factor to consider in the development of future forestry services for urban owners.

4.4 The Effects of Climate Change and Other Risks

In an effort to gain more insight into urban forest owners' attitudes towards issues that affect forest ownership, the interviewees were asked about their views on climate change and other risk-factors. Additionally, the aim of this section was to uncover underlying needs that could be met with digital forestry services. Generally, it appears that there is a fair amount of variation in the attitudes that urban forest owners have towards these issues. While many owners stated that these issues have a major impact on their views and actions on forest management, some owners felt that these factors play only a minor role in the overall picture of current forest ownership.

The owners who didn't feel that climate change impacts their forest management decision-making were a distinct minority of the respondents. Only a handful out of 20 owners stated that climate change has no effect currently in their decision-making. The reasoning behind this was for some owners that they had not profoundly thought about the effects climate change could have. Few owners were also of the opinion that these issues have no effect as climate change actions in general should not be the responsibility of non-industrial private forest owners.

Climate change and other risks affecting decision making

As already mentioned, most of the interviewed urban forest owners said that climate change has an effect on how they manage their forests and how they perceive the future of forestry in Finland. However, some owners stated that climate change has an impact, but they hadn't thought about the issue in-depth. Climate change was in many cases seen as a significant issue, but the owners felt that they were not familiar enough with the management actions that should be taken in counteracting the risks it entails. These owners mentioned that if they had more information on the matter and a possibility to consult someone who knew better about these issues, they would be inclined to let climate change have a bigger impact in their decision-making.

"Maybe [climate change] has no impact currently, but I would like it to affect my decisions … I don't have enough know-how on the matter and I haven't familiarized myself with how it should impact forest management … If there was someone available who knew more about this and some well-filtered information available … Then it would definitely have an impact on how I would do things" – FO N

The owners who hadn't yet thought about the issue in-depth, claimed however that they are aware of the possible impacts and are keeping an eye on the situation. This was especially evident among some owners who had smaller properties. Climate change was nonetheless seen as possibly having a major impact in the future also within this group of owners.

There were however a multitude of measures that the forest owners had already taken or thought of in counteracting the risk-factor of climate change. One of the most often cited measure was insurance relating to the harmful impact of changing climate. Some owners had already purchased insurance for these purposes, whereas some were uncertain of the usefulness of these. In this case, insurance was needed to compensate for the losses caused by more frequent storms and new types of pests. The fact that extreme weather conditions, and consequently pests, are becoming more frequent was in general cited as worrying many owners.

"There are a lot of risks that have an impact … The damages caused by moose are major factors as well as … In general deer damages will be an issue if the populations are not restricted … Big risk in the future is also root rot … Valuable timber wood will be rotten and unusable, and forest owners will be paid less for their timber … The lack of proper winters and frost, and increasing summertime cutting are also something that need to be taken into consideration" – FO C

The concerns about climate change had also caused owners to consider changes in their forest management practices. Avoiding clear cutting and effective reforestation of properties was mentioned often in the interviews. Many owners also stated that they had already focused on planting mixed tree species and had chosen species that can sustain in the changing conditions. Generally, diversity in species and the age of tree stand was seen as an effective way of counteracting the negative effects climate change can have.

The perceived risks relating to climate change were also seen partially as a result of uncertainty in future forestry policy making. Current discussions on carbon compensation and conservation practices have clearly been thought-provoking among urban forest owners. Some of the owners mentioned that some future policies can be beneficial for forest owners as allocating forests for carbon sink-purposes could be compensated in some way. The discussion and debate around carbon sink compensation was consequently something that many owners are following closely.

The uncertainties of future forestry policies were also brought up by many owners. These owners were concerned about the possible future restrictions that could be imposed on private forest owners and the effects these could have. The possibility of diminishing financial and intellectual value was a fact that was pointed out by few owners.

"The possible restrictions for forest use and ownership related to climate change are something that I've considered … Things like whether forest properties are less valuable in the future because of restrictions on management, and how are these things going to be regulated from a climate standpoint … Also, it feels like in general it's difficult to own forest in Finland … Forest owners are constantly "bad people" when you follow the news or social media … The attitude of the general population makes you think about the meaningfulness of forest ownership" – FO H

Examples on possible restrictions that were mentioned during the interviews included allocation of private properties for carbon sink-purposes or locations of power production. In general, some owners were concerned whether in the future forests are seen more and more as a collective asset for the whole society, which would also dictate how private owners can manage their own forests. Moreover, these owners were worried about the lack of financial insight in forestry policymaking.

All in all, urban forest owners seem to be well aware of the risks that climate change entails, but their actions and views on the subject are quite diversified. This is understandable, as there seems to be no clear consensus on what actions should be taken among forestry professionals and lawmakers. Many owners shared the view that there is a lot of climate change-related information available, but it is highly fragmented and partly conflicting. Actors in the forestry sphere can have divergent opinions on effective and sustainable management practices, which can make decision-making for private forest owners challenging at times.

> *"I have thought about the possibility to conserve parts of my property and leave them as they are, and try continuous-cover silviculture if possible … I however feel that it's quite difficult as it's not familiar to professionals or forest companies, or it's not something they want to do necessarily … I feel that the continuous-cover-thinking hasn't been popular in forestry circles for decades … Now that you should employ these practices, it is actually difficult … Forestry professionals might say that it is a good thing yes, but it won't be suitable for your property … In the past forests have been managed with the mindset that it always ends in a clear felling, so it might not be easy to change practices in the industry … It can of course be more just a lack of educating and the attitudes on that end of forestry operators … Suggested things are those that people are familiar with and what has worked in the past"* – FO S

> *"I noticed on Forest Centre courses that I attended that sometimes the suggestions and goals about carbon sequestration and biodiversity can be conflicting … If you want to support biodiversity then you have to do things this way, and with carbon sink-mentality you have to do things other way … For me for example, growing log wood is a goal that is attached to the climate change risks … It can provide wood products that are longer in the circulation than pulp wood for example … And nature conservation societies and others don't really talk about this … Conservation seems to always be more about protesting felling and cutting … So, it can be difficult to form a picture on how to balance conservation and other goals"* – FO M

As stated above, finding relevant information to support private owners' decision-making regarding counteracting climate change can be cumbersome. For this reason, one of the important aspects of future forestry digital services should be providing appropriate and multisectoral information on the effects of climate change and the possibilities to mitigate these. These would ease the path for forest owners in making choices about their forest property management, whether they emphasize the financial or conservational aspects more in their decision-making.

4.5 Effects of the COVID-19 Pandemic

Because of the fact that the COVID-19 pandemic was still ongoing during the qualitative interview study of this thesis, it seemed timely to ask the participants about the influence of the unprecedented situation that affected every aspect of society in one way or another. It was also safe to assume that forest owners could have had experienced some impact from the pandemic on the relationship to forest ownership or needs for new types of digital services. From the responses of forest owners, it seems that the pandemic had had no major impact on the relationships to forest ownership, but some owners had discovered new needs and opportunities for forestry service offerings.

Effects of COVID-19 pandemic on attitudes towards forest ownership

As already mentioned, for many owners the pandemic had no major impact on how they view forest ownership in general. However, some respondents felt that the pandemic had increased their own appreciation of forests and nature. This is also something that has been reported to have also happened among all urban inhabitants. The pandemic was also said to have reinforced the importance of having a piece of land or forest to which one can retreat in times that require isolation and social distancing.

> *"The pandemic has probably highlighted the understanding of the importance of forest property and what kind of opportunities it entails … Without the pandemic, active forest management would have most likely not been high on my priority list … It has affected the way how I see forests in general and its future … The effects of cramped urban living have also been something that has influenced this thinking"* – FO N

Relating to this, some owners also noted that they had been more active in forest management during the pandemic, as opportunities for activities and movement were greatly restricted. Many owners had visited their properties more often and had been staying outside of the city for longer periods of time. This was also seen as a spark to learn more about forest management, and many owners told that the increased activity had also added to better understanding about their property. The pandemic had also increased the interest of some owners to build a summer cottage near their forest property, in order to continue the more active streak of forest management.

Effects of COVID-19 pandemic on needs and opportunities for services

The pandemic had also some impact on the use of digital forestry services among few urban owners. The biggest negative impact mentioned was that all of the courses provided by forestry associations were moved to remote locations, which had also removed the opportunity to meet other forest owners and to run errands face-to-face. This impact was nevertheless very minor as a whole as only a handful of owners said to have had attended these courses in the first place. However, many owners brought up the fact that in forest management, all tasks and procedures cannot be done remotely, which was reinforced by the restrictions brought upon by the pandemic.

The circumstances forced by the pandemic were although seen as a positive factor in spurring on the adaptation of forestry services to increased use of ICT-tools in handling forest management-related tasks and informing. Most of the owners also noted that the pandemic had not impacted their ability to manage their forest properties, as they had already been handling their property remotely before the pandemic. All in all, this demographic of urban forest owners seems to be well versed in the use of ICT-tools for forest management, and the probable future increase in the use of these will not pose difficulties for them.

As well as the increase in general appreciation of owning forest property, the pandemic had added to the value of forest property as an asset for some owners. In uncertain times, forest land was touted as a secure form of investment that lacks the volatility of other investment types. Forest property was also seen as a great way of diversification of investment assets during the pandemic. Additionally, many owners stated that the pandemic had allowed them more time to evaluate the many aspects of forest asset management and to better familiarize themselves with the possibilities to financially benefit from it.

Some owners had also thought about new service possibilities that the post-pandemic forestry landscape could allow. This includes opportunities to better utilize the forest property for other activities besides timber sales. The increased popularity of outdoor activities could allow some owners to allow their properties to be used in such activities. Some owners had already thought about the development of some parts of their property for hiking trails and other activities. The few owners who had dwellings on their property had thoughts on renting and selling cottages in the wake of a budding cottage boom.

It is although clear from the interviews that the long-term effects of the pandemic on forest ownership are still quite unknown to owners. The opportunities that may emerge from the current situation are something that can benefit owners who want to utilize their properties more extensively. These possibilities should also be taken into consideration when developing future services that aim to help forest owners in effectively managing their assets and attaining versatile financial gains.

4.6 User Experiences of Digital Forestry Services Among Urban Forest Owners

This section of the interview covered the forest owners' familiarity of available digital forestry services and the use of services. Use and familiarity of the free state-funded service Metsään.fi was the main focus in this section. Most of the respondents told that they had use at least some digital services and were familiar with few services. There were however many owners who had not used digital forestry services at all. Overall, it seems that the average owner's knowledge of available services is quite limited, and the level of digital service use is low. There was yet quite a lot of variance in the familiarity and usage of services between the respondents. Nevertheless, nearly all of the respondents stated that there is a need for digital forestry services and that these services can be extremely helpful.

Do urban forest owners use digital forestry services?

In the interview population there were quite a few owners who had not used any digital forestry services. These owners had mainly outsourced the management of their property to a Forest Management Association that had taken care of most of the active management duties for the owners. In these cases, the owners had a trusted contact person in the association who was deemed more suitable in handling the management duties. The owners themselves had used some of the digital service features provided by the association to varying degree. These services included geographic information of their property, satellite pictures and financial plans. Some of the owners who had used Forest Management Association's services had also used their digital service platform Metsäselain.

> *"I have usually just managed things through Forest Management Association … I received a satellite picture from them, and it is what I've used a bit … I don't know what other types of services even are available … I trust the expertise of the association more*

than my own … You can get help from there as needed and I haven't really looked into other services" – FO T

These owners who had outsourced the management of their forests to a Forest Management Association were generally pleased with the functionality and dependability of the partnership. These owners did not have a lot of knowledge on services provided by other actors and they generally had not felt the need to look into other services as the current management arrangement had been deemed satisfactory. Some of these owners also stated that they have not heard of other services as these had not been advertised to them.

"I don't feel it's necessary for me right now to look into other providers or other types of digital services that are available … Things have been working really well with the Forest Management Association and the costs of their service are really moderate … Their service has been great compared to its costs" – FO E

There were also few owners that had used neither the Forest Management Association services nor any other services. The reasons behind the non-use of services were cited mostly being owner's own laziness, inefficiency and lack of time to do proper research on the available services. Many owners also shared the notion that they have not used any services as they do not know what services there are and what purposes do these services fulfill.

"As I don't really know what services are there, I haven't used them … In general, it is not clear to me what types of digital services do forest owners use and for what purposes … I don't know about the services, who provides them, who they are aimed at and what can they be used for, so I can't say I'm familiar with the whole thing … I would need a reason or benefit for the use, then I would probably use them" – FO I

One reason behind the non-use of different services was also the fact that the owners had not yet felt the need to use these types of services as a part of their management practices. These owners had either just recently started to actively manage their properties or were still in the process of starting more active management. For many such owners there were also other owners or advisors who had previously done the management decisions on their properties. This can often be the case in situations where an owner has recently inherited their forest themselves or in a group of multiple heirs. Yet, in many cases, the owners who had not used any services at this point, considered that they will probably use them more actively in the future as they take more control of the management duties.

Most of the owners who had used some type of digital services had only some experience of different services and were of the opinion that they don't know a lot about the overall offering of digital forestry services. These owners cited to have used free services such as Karttapaikka that is provided by National Land Survey of Finland, as well as the Metsään.fi-service maintained by Finnish Forestry Centre. Another free service that had been used was Kuutio provided Suomen Puukauppa Oy. The Forest Management Association's services Metsäselain and OmaMetsä were also familiar to most respondents. The owners had also used other paid services such as ArvoMetsä and the services of different forestry companies. All in all, owners seem to have used only few paid services other than the ones provided by Forest Management Associations, which is covered by the membership fee of the association. It seems that for many owners there are currently no paid services that they deem beneficial and worth the investment.

"Personally, I haven't used any paid services … I don't see that there are services available right now that would benefit me significantly, either financially or any other way … Maybe in the future, but not at this point" – FO C

There were only few respondents who said to have vast knowledge on different services and had also used a variety of services. These owners were also very active in their forest management on a general level and showed a general interest towards all the possible services that were available. The interest for these owners was inherently tied to their desire to know especially about the different technical solutions that different digital forestry services could provide.

It is consequently evident that urban forest owners differ greatly in the levels they are familiar with different services and how they use digital services. Some owners are well-versed in the service offering and use different services often and fluently. Another group of owners does not actually use any of the services themselves all that much as they have outsourced most of the management duties to a Forest Management Association. The third group of owners are then those who use some services, but quite rarely, and don't have a lot of knowledge on different services that are available. Lastly, there are the owners who are not familiar with the services and have not really used these services at all. The development of future digital forestry services should clearly aim to activate and inform the owners who belong to the last two groups. It is also extremely important that the services are properly promoted and advertised to these owners who lack prior experience and knowledge of services.

Use of Metsään.fi-service

As already stated, the focus on this research is to find possibilities for development of the free state-funded Metsään.fi-service. In general, the service was quite well known among the interviewees, as 13 out of 20 respondents had used the service at least to some degree. However, there were only few owners who had used the service more extensively. Generally, it seems that Metsään.fi is a service that most of urban forest owners are familiar with, but they do not use it often as a part of their forest management activities.

The Metsään.fi-service was especially prevalent among owners who had used a variety of different services. These owners were also quite familiar with the different forestry actors, such as Finnish Forest Centre, which for one explains their familiarity with the service. They were also the most active users of this service and were aware of all the different service features and how the service can be helpful in the management process. Other group of owners who had used the service were the ones that had some knowledge of available services in general and had tried or used a few different services. These owners had not used the service extensively, but most of them had found some aspects of the service useful.

The owners who had not used the Metsään.fi-service were mostly those who had mainly used the Forest Management Association services to handle their forest management duties. Additionally, there were few owners who had not used any services and thus had not used the Metsään.fi-service either. The owners who had not used the service had, for the most part, not even heard about the service.

All in all, from the interview data it seems that the Metsään.fi-service is quite well known among urban forest owners and it is also used quite extensively. Most of the users who have used the service do not however use it very often. In Addition, they have used only some features of the service and are often unaware of all of the possibilities with which the service could be helpful. Largely, it seems that urban forest owners do not always know why they should use the service and how it differs from other available services. This was something that both the owners who had some experience with the services and those who had not used the service noted.

"I think I know too little about the different services, and I should know more … Metsään.fi is something I use predominantly … And of course, the ones that different stakeholders have … I wish there were one distinct service that would cover everything … A service that doesn't rule anyone out and doesn't benefit or impede any single stakeholder" – FO Q

Seemingly, it would be a good approach to develop the Metsään.fi-service in a way that the purpose of use would be clearer to forest owners. The service should also aim to serve as a tool that would inform owners of the available services on the market and on the differences between these. It would be also important to find ways to inform newer owners about the usefulness and existence of the service, and to activate those that haven't used any digital forestry services to begin with.

Is it easy to find suitable digital services or information about different services and service providers?

In general, there were a lot of dissenting views among the owners when asked about the ease of finding suitable digital forestry services and information about different services. Many owners were of the opinion that it had been easy to them to find relevant services and information on their own. Also, the owners who hadn't searched for services had the notion that it would be easy for them to find relevant services if they would look for them. Additionally, few owners share their experience about finding suitable services from when they started their ownership tenure. They were also of the opinion that finding suitable services and information on the service offering had not caused any trouble.

"I feel that all the services I've found and used have satisfied the needs I have had … When I started as an owner, I went through all of the available services and I think it was quite simple to just do on your own on the web … After that I haven't really felt the need to find any other services or do any research on these" – FO O

There were, however, few owners who stated that their experiences on finding suitable digital services had been vastly different. In their opinion, the search for services had been quite difficult and time-consuming as there are so many options available and a lot of information to filter from different sources. This was especially seen as a stumbling block for new owners who had only little prior knowledge on forestry services.

"I think that in principle it is quite confusing [finding suitable services and information on different services] … If I hadn't had any support from relatives then I wouldn't have had a clue from where to start … This is probably the case for many owners who just purchase properties as new owners … There's so much information on the web if you start searching for services, and every provider sells it to you from their own perspective … Information is really fragmented and everybody seems to have their own intentions that they aim to serve" – FO G

"Finding that information is not easy in my opinion … Even as a person with two master's degrees, I feel that I have to put loads of time and effort into finding the services I could use and information on what could be helpful" – FO N

Consequently, the opinions on the ease of finding suitable services and information was yet again something that divided the interviewed urban owner population. While many owners seem to have found services that suited them quite easily, other owners feel that the process of finding information on different services and choosing suitable services is far too disorienting and time-consuming. It is clear that some forest owners would like to have more outside guidance in this process and that a clearer overall picture of all of the existing services should be available. Therefore, there seems to be a need for a service that makes it easier and faster for this group of owners to find the information on the forestry service offering on the market. For example, the state-funded service Metsään.fi could be the medium from which forest owners could get this type of information from a more impartial source.

"I think it is quite easy to find information about different services and things you could need, but I don't know which the correct place is to look for this … Or which would be the best authority for this information … It's quite hard to know if the information is correct and how these different stakeholders and service providers are connected … So, there could be a place for this type of service"- FO D

Which digital services have urban forest owners found useful?

Even though the interviewees had a varying degree of experience and knowledge on different digital services, they had found many aspects and features of services to be helpful. The service features that many owners mentioned to have been useful included forest management plans and different ways of presenting forestry data on the owner's property. Different mobile services that can be used when going through the forest property on foot were also mentioned as being useful by few owners. Some owners also mentioned different tools that have helped in taxation-related accounting and doing tax returns.

The Metsään.fi-service was also generally cited as being useful by multiple owners. These owners stated that the forest information provided by the service through maps and different forms of data had been helpful. Most of the owners who had used the service also applauded its ease-of-use and regular updates on features.

> *"Metsään.fi-service has been useful and it is developing and has already improved a lot … There is great potential in the service with the new additions of features in more precise laser-scanning techniques and better forest cover information … I see it as a great benefit in the future that the sate supports forest owners with this type of services … This will be beneficial for both wood production and other measures of forest management"* – FO C

> *"Metsään.fi has been generally useful in my opinion … You can find the information about your own forest property easily and you can inspect different maps and flip through different view in them … The mobile app is also a good companion that shows you where you move on your property"* – FO D

Shortcomings in the digital forestry service offering

The owners were also asked about whether they had noticed whether there were major deficiencies in the general digital forestry service offering. The interviewees also shared their experiences on the shortcomings of different digital forestry services they had used. Overall, it can be stated that urban owners seem to have a lot of different needs for services that haven't been met in the past, and consequently the owners were able to name various different shortcomings that digital forestry services currently have.

One of the most often cited shortcoming owners had encountered had to do with the actual knowledge on how different services are connected and which services should the owners use. Many owners shared the notion that it is difficult to form a clear picture of the entire service space and know the differences between each service. This is something that these owners felt should be made clearer by the different service providers. Also, the fact that a lot of information found from different sources is oftentimes contradictory was once more cited as a drawback.

“The entirety of forest management is such a diverse subject that it would be great to have a sort of one-stop shop where you could find information and handle all this stuff … Right now, I feel that the challenge in forest management for me is that the affairs and things are so unfamiliar and all of the terminology is unknown … And all of the information is dispersed into different places and services … You find some information on Metsään.fi and other information from other sources … And the information is oftentimes contradictory … It makes it frustrating at times to get to know these things and become more comfortable with them” – FO D

The owners also had criticism towards the Metsään.fi-service. One of the main criticisms was that the forest property information given by the service had been contradicting with the information with other services, which undermined the credibility of the service among some owners. Few owners also stated that the simulated data and estimates of the size of the forest property had fluctuated significantly, which had affected the valuation of forest property. This has also complicated making management plans for the future.

“[On Metsään.fi] I don’t know how accurate the data and information is or how current it is … I think it’s often just simulated or automated and doesn’t always represent the actual situation, and could be based on old data … And I generally feel that my level of knowledge on how the system there works as a whole is not that high either … But as a novice, it is a great tool to see what kind of information is available on your property and how it could be used” – FO B

Concrete features that the forest owners had missed from digital forestry services included different reminders on necessary tasks, facilitation of managing financial tasks and taxation. Many owners stated that there is a need to generally have more services that are provided digitally. This would save owners time and would help in handling all of the different documents and data relating to forest management.

"Maybe there could be more help on the taxation of forest property … More active guidance and counselling would be something that is beneficial … This would especially help new owners in my opinion as the whole taxation-side of forest management can be quite hard to grasp for beginners" – FO J

4.7 Demands for Future Digital Forestry Services and the Possibilities in Development of the Digital Service Offering

The questions in this interview section were posed in order to uncover elements and features of future digital services that urban forest owners might find useful. Researcher's own views and presumptions of the possibilities for service design were used as a basis to form the questions. Additional background for the question design was gathered through an interview with a Finnish Forest Centre employee. The emphasis in this chapter was to especially find ways to improve and develop the service offering of the free state-funded service Metsään.fi.

General overview on the information to support decision making

First, the owners were asked about their thoughts on the general level of need for information to support decision making. The question was posed as whether the owners felt that they were receiving enough information from digital services to support their decision making. The general consensus among forest owners was that there is a lot of information available to support decision making, but the information is oftentimes scattered into different channels and it can be difficult to filter the information that is relevant to the owner's state of affairs and direction of forest management. Some owners also stated that they do not receive enough information that would support the practices they would like to employ.

"It is easy to lose yourself in the abundance of available information … It has been a long process of examining all the information I've encountered, and trying to build a bigger picture out of all of this, so that you learn and realize the things that you should know and what could be helpful … There's a lot of information available that you need to be able to filter through … There's a lot of data available on your own forest too from different sources that can differ greatly between each other … The differences can be quite radical even on the recommended actions that you should take in forest management … Omametsä, Metsään.fi and the management plans all differ with each other, so you need to find a suitable middle ground yourself – FO B

"I don't feel like that's the case [receiving enough information] … For example, the continuous-cover method is something that big forestry companies seem to loathe … There are so many contradicting arguments for and against on this topic and others too … It would be of great help if there were more comparative research data available that is easily understandable … This would make the decisions a lot easier" – FO H

As stated above, many owners found that the information to support their decision making had often been contradictory. This was often seen as a result from the fact that the information came from various different sources that have different agendas and intentions. Many owners were of the opinion that there is a need for a service that would provide more impartial information and an objective view of the different schools of thought on forest management practices. The Metsään.fi-service was seen as a possible provider of such information.

"Getting information is not the problem, it's more that from where you can get the information that is impartial … Forest Centre could maybe be this place that would compare and filter this information … I think that in the past it has already been the provider of the most impartial views on forest management" – FO L

Altogether, it is clear that urban owners feel that there is room for improvement on how they receive the information to support their decision making. The ability to be critical in information dissection is highly pronounced in the digital era when the amount of information has vastly increased. Many owners felt that the digital platforms can in this way be beneficial but also counterproductive. These platforms require a lot of work and surveying from the owners in their effort to find information that could help them in their forest management efforts. Many owners also noted that it is important for them to find accurate, reliable and timely information that can be used as a justification for different forest management practices. Therefore, the digital services aimed at forest owners should be developed to offer relevant and customized information for each owner depending on their situation as well as wants and needs. This would also help forest owners in freeing their limited time to other crucial tasks in- and outside of the forest ownership spectrum.

"Targeted and customized information is something that I feel is needed … Information that is filtered so that is relevant for me specifically … At the moment you get bombarded with information from different sources and all the data is so unstructured and disconnected … Owners are forced to filter this all by themselves, so it is something that is easily left undone I think" – FO N

Information on the risks affecting forest ownership

The perceived risks urban owners view as affecting forest ownership were already discussed previously in this chapter. In this section, I will piece together the most talked about risks that owners see as most influential. The aim, in this context, is to find ways that future digital forestry services could help owners in informing about these risks and responding to them. All in all, from the interview data it seems that the relaying of this information about risks is something that most forest owners see as a critical part of a comprehensive digital forestry service.

Most of the owners shared the notion that it would be greatly beneficial to get information about different risks in advance. Many owners stated that currently this is not something that is done, at least effectively. Owners also seem to require more information and data that affect them and their properties directly. At the moment, the information about risks is not something that owners get in such customized form. This was especially seen as important regarding the concrete risks that threaten the devastation of forest property.

"It would be nice to get the data of different diseases on trees and risks involving pests by area or region … The information is needed beforehand, so that you have time to prepare and plan the action in management … There could be more forethought regarding

what is happening abroad and what are the situations there … And then some information about how you can prepare for these risks before they come to the north” – FO B

On a general level these risks that cause forest damages were regarded as the most important issues to be informed about. Digital platforms were seen as a great tool to illustrate storm- and pest damages through different models. This is an aspect that many owners felt that is missing from the current service offering.

Risks attached to the financial side of forest ownership were also something that interested some owners. These owners were, for example, interested in receiving more information about the effects of factory closures to timber sales as well as other aspects that may affect the profitability of their assets. The risks involved with timber sales was also an aspect that some owners wanted to see better represented in digital forestry services.

“It would be beneficial to get the information about when is it best to log … And how to deal with losses and damages in the felling process … We need more information in advance about different scenarios and factors that can affect this, for the investment could be more profitable in other things where you know the risks and know how to deal with them” – FO K

“For example, in timber sales, I feel that these aspects [risks] are not properly advertised … Say if you don’t know that much about this stuff and can’t really interpret all the stuff that is involved … Which are the responsibilities if something happens during the sales if roads are ruined or something happens to the protected parts of the property, as an example” – FO G

All in all, the many different risks affecting forest ownership were seen as an integral part of future digital forestry services. This is also an aspect that is not currently a notable feature in digital forestry services, for example the Metsään.fi-service. Urban forest owners will need more tailored and targeted information about these issues in the future as they will become even more prevalent in the coming years. Some owners also perceive it as a risk that there are not enough perspectives currently available on these services that would support management practices that are not inherently targeting profitability. Few owners who saw this as an issue also stated however that as these practices are still quite a novel phenomenon, viewpoints supporting these methods can still be few and far between. This is although something that especially the state-funded services should take into consideration when developing their services.

"It would be extremely valuable to know more about the other ways you can do things … In particular, regarding the forest management and how you can manage without just thinking about the euros, but focusing on the well-being of the forest and the land … If you buy forest then I acknowledge that you have to think about it from the money-side … But when you are given the forest as an inheritance, you don't really care about the money, you just want the forest to be well-off and that it's sustainable for the climate too … But I haven't really seen this kind of thinking advertised that much … Haven't seen a model that fits me or any targeted information that works for me" – FO N

"I think there's real need for a tool to evaluate the effects of choices diversely … So that you would get a clear conception how your management choices affect the surrounding nature and the climate … Also, the species that live there can affect the choices, so it would be great to know comprehensively about these too … In general, the information on how different management methods affect, like the carbon sink method … In forestry it seems like every time you make a decision that is not maximizing financial profits then you need to explain yourself … So, information is also needed to rationalize this and show others what I can achieve with my decisions" – FO M

Information on the use of raw material and recreational use of forest property

The owners were also asked about their opinion on whether they would want more information on how the raw materials of their forests are used and how their properties are used for recreational purposes. The owners were additionally asked whether they would feel that these are important aspects of forest ownership that should be included as part of the future digital service offering. Generally, urban owners were of the opinion that they don't need additional information on how their properties are used for recreational purposes. Also, the information about the use of raw materials was something that only few owners were interested in, and it was mostly considered as a nice-to-know type of additional property information.

Consequently, most of the owners felt that they had no need for the information on the use of their forest raw material. The view was shared by many that the ethical decisions regarding forestry are already done before timber sales. Few owners thought although that if this were something that came up during timber sales process, maybe they would be interested in knowing the destination of the raw materials. However, some owners were interested in receiving more information about the use of raw material. These owners considered it meaningful to know the end use purpose for the timber that is sold and wanted to have it used for valuable and ethical products. Based on this information, there might also be some demand for a feature on digital services that would provide more concrete information on the end-use purposes of raw materials. It is quite possible that the demand for the ethical use destinations for timber will become higher in the future, which is something that could be reflected on the digital service features that are offered.

Information on the area where forest property is located

The next question was on whether urban owners felt that it would be beneficial for them to receive more localized information on the area their properties are located. There were few owners that were of the opinion that such information would not be helpful, but most of the interviewees noted that this is something that they would like to see more ingrained into forestry services. Additional information on the development of forests in an area and different local risk factors were something that were cited as interesting possibilities that future services could provide.

The owners were especially interested in receiving more targeted and customized information about the area in which their property is located. In general, local information was not deemed particularly interesting, unless it could have a direct effect on the owner's own property. More information on timber sales patterns and demand in the area was cited by some owners as interesting data. The sale of properties and planning and construction was also something that some owners would find useful to know about. Additionally, different pests and other risks could be reported about locally, which could help in the efforts of counteracting such detriments.

> *"I don't really need more information of my own property, but the information of surrounding properties and the area could be quite helpful … If you would have more information about what's happening in the area and on neighboring properties … This would help if you wanted to buy new properties from the market or invest there in some other way"* – FO C

Information on forest legislature and innovations

The need for more current and relevant information on forest legislature and innovations was also discussed. The owners were asked about how actively they themselves follow the changes in forest legislation and the development of the industry through innovations. Additionally, the interviewees were invited to share their opinion on the need to receive more information about these aspects affecting forest ownership through digital services. Generally, it seems that most urban owners do not follow the ongoing changes in legislation all that actively. Some owners stated to follow these issues very closely, whereas other claimed to not follow them at all. The same dichotomy was also observed regarding the monitoring of the development of forestry innovations.

As many owners stated that they do not follow these issues closely, they also felt that they would not need more information about these matters through digital services. Nevertheless, there were some owners who mentioned that such information would be a great feature of a digital service. These owners relayed for example that it would be beneficial to get notice on local statutes and legislation that affects their properties. Properly targeted and concrete information about legislation that could affect forest owners was generally something that these owners thought could be helpful. Additionally, this information should be something that should reach all owners that would be affected by changes in legislature. Especially major changes in affecting legislature was something that some owners felt should be more effectively communicated through digital service platforms.

"I follow these things [legislation] quite superficially ... I think that it would be great to get some kind of targeted information and notifications about the changes that could affect me ... Not just some kind of e-mail spam that is not relevant ... Again, it would be beneficial to get information that is customized, concrete and actually beneficial for me" – FO B

The development of innovation in the industry that could affect forest management were followed to an even lesser extent. Most of the owners noted that innovations in the industry were generally interesting to them, but they do not track their development closely. The information on innovations was largely regarded as nice-to-know knowledge in comparison with legislature, which the owners found more useful as a whole. If such information would be communicated through digital services, it would have to again be something that would impact the owner and their property specifically. There were however few owners that followed the development of innovations actively and were of the opinion that information on these could greatly improve the benefit they would get from a digital service that would provide it.

"I follow the development [of innovations] really closely … I think that getting more information about these would be beneficial … Especially, the fact that what kind of additional financial value these can bring" – FO P

"There's a lot of innovation happening right now in how timber and forests in general can be used and worked … That is an aspect that I find interesting, and I think forest owners in general could find really useful if they follow these developments … I think that the innovations will have major impacts in the near future, for example the demand of some tree species will rise significantly … So, you should stay on top of these developments" – FO H

Co-operation of stakeholders in digital service development

Regarding the topic of digital service development, urban owners were asked about their views on the status quo of stakeholder co-operation in the forest industry. In this case, stakeholder co-operation is understood as any form of co-operation in the construction or development of digital services and the platforms they are offered on. The stakeholders that were considered were the forest owners, Forest Management Associations, Finnish Forest Centre, and commercial entities. The owners had many views on this topic, and it seems that there is room for more co-operation in the industry regarding the development of the functionality of digital services, as well as service features. Many owners felt however that the industry itself is quite problematic in this sense as it consists of individuals, state officials, associations and forest companies.

"I guess there could be room for this [co-operation in development], but then again it's not that simple … Forest Centre is an official authority, the management associations are their own separate entity and so are the companies that do timber sales … On a local level it's maybe easier and more straightforward as you know all of the players really well … The distinction between different actors and their roles can be difficult, which can make

this tricky … But it's interesting to see what happens in the future as the Forest Management Associations are merged and also with other developments" – FO P

Some owners mentioned that they have felt the need for more active co-operation between forest owners and service providers in developing digital services. These owners stated that the current digital services are not developed to be user friendly and easy to use. Especially new owners can have difficulties in getting accustomed to the ways in which these services can be utilized to get the most out of them. Forest owners should be more actively listened in the development process, and their concerns should be taken into consideration in service design. Many owners felt that current services are full of features that are difficult to comprehend and to use.

"I don't think that the current digital services are very user-friendly … I think that the developers and providers of these services should listen to criticism more closely and take into consideration what the forest owners think about what could be useful … The service environments as a whole should be easier to use … There's something inherently wrong with the service if you need a two-hour course two learn the basics about it … Digital service platforms should be about making things easier for owners not the other way around … These services should be as simple as possible, as the users come from variety of different backgrounds … It should be something that is understandable and logical, without any difficult to comprehend text and such" – FO L

Increased co-operation was also seen as a possibility between forest owners themselves. Currently ownership is often considered fairly faceless by many owners, and neighboring owners are not well known or interacted with. The idea that forest owners could better connect and co-operate with neighboring owners through the help of digital services received a lot of support. If owners would opt-in a service and offer their plans on future management tasks and provide information on forest damages to others, it would help in facilitating better collective forest management. It could also help in preparing for different scenarios in management that can otherwise come as a surprise to owners.

"I guess there could be some kind of virtual platform to bring neighboring owners into more active discourse … I think this could be an opportunity for the future … As of now you have to look for the information about neighbors from land register and start

digging up things from there … The communication is not well facilitated at the moment" – FO E

"I think that this sort of information would be very beneficial … There needs to be more coordination among property owners … Logging should definitely be planned without the boundaries of property limits, for this would help get better prices for timber and would make it cheaper to order the forestry machines and professionals … Another thing that speaks for more coordination is that if your neighbor does some management work, it can also impact your forest … Or if your neighbor is lacking with the management duties … Everything should be drawn to active forest management and the management activities should be commonly coordinated through some kind of platform … Right now, everyone is kind of doing their own thing in a vacuum" – FO H

Useful digital services for urban forest owners

The interview participants were also asked to share their experiences on what they saw as the most beneficial services for urban forest owners. This question was especially posed to uncover the features that had been missing previously but would help urban forest owners in the future. Most of the owners saw that the increasing amount of urban owners was a factor that should be taken into consideration when developing future services. The growing phenomenon of property co-ownership was also something that needs to be taken into account.

"The scattering of ownership is generally something that will be a problem … Something could and should be done to help this on a digital platform … I see this as a great risk in the future as ownership becomes even more fragmented" – FO E

Urban owners also seem to have a high demand for more concentrated and centralized services that could be used as their main management tool. Many urban owners claimed that they have little time and effort to put into the management of their properties, hence solutions should aim at serving as many needs at once as possible. The services should, in general, offer solutions to the hindrances and difficulties that physical distance entails for urban forest owners.

"There should be an application or a website for owners that would have all of the relevant data from your own property in a concentrated form … It should also be something that isn't driven by the agenda of commercial agents on the market … Something that could help the owners be closer to their properties, even though they are physically far away … This should include everything involving management on a larger scale and not just something that is solely focused on timber sales and such" – FO G

Some owners brought up the guidance and consulting elements of digital services as being especially important for urban-dwellers. Quite a few owners expressed their inclination to have more digital forestry educational services that would offer features through different digital channels. The current state of service providers social media channels was for example not shown to have provided this type of information for users. Many owners seem to want approachable educational information on forest management that is easy to follow and assimilate. This is something that the service providers in the industry should unquestionably take into account as the forest ownership base continues to change towards new types of owners that require more information and are accustomed to getting it through various different channels.

"I would be interested to follow a channel on social media or some other platform that would have information for new owners like myself, or that would tell about the management work of someone who is the same profile as me … A sort-of forest management for dummies kind of thing … Some channel that would go through things with simple terms and would show graphs and data on how management affects things … Some video content would also be helpful … Something where you could see someone walking in the forest and telling about different needs and options … Then you could replicate this yourself in your own forest" – FO I

"I've noticed that sometimes when you are in the forest, then something comes up and you would like to as someone a small question or such … These are not really questions that I want to phone someone about … Just some kind of channels for small and quick questions that would have a low threshold to use … For instance, you could take a picture in your forest and send it to someone and get a quick response on what you should do … This would be sort of a channel to one-off learning about management … And you could maybe

read the questions others have had and find answers this way too … A sort of a forest management coaching service or something in that vein” – FO H

There were also many owners who believed that the digital services should also be able to provide more accurate information on different financial and conservational opportunities that are current in the field of forest management. As urban owners are often not that actively present with their properties and rarely have a hands-on approach to management, these types of services could help in planning for the future possibilities their forest properties can provide. Many of the owners stressed the importance of foresight as an integral part of management services.

“A service where one can outline and plan the future possibilities of your forest would be helpful … For example, form the perspective of business opportunities … For instance, different plants and mushrooms and other new product possibilities … Would be nice to know how you could increase the profitability of your own forest” – FO R

Some forest owners were although of the opinion that mere digital services are not always enough in the case of urban forest owners. Forests in general are a special type of property in the sense that it is not possible to effectively manage them without actual physical presence from time-to-time. The properties are often also so large that depicting and visualizing them in only digital form is currently not possible. It is definitely important for many remote forest owners that locally there are reliable contact people who are involved with the properties and are able to manage and monitor the properties on behalf of them.

“Quality and reliability are very important when you let someone in your forest to do management work … You can’t only choose based on a digital service, but you need also more specific information … A direct connection with the associate is a better guarantee for better level of service … All in all, forest property management requires a lot of surveillance on what actually happens on the property and what is the quality of work … For instance, last time there were damages that were uncovered after thinning work was done on my property, and that is something that you can’t see through a digital service … You can’t monitor the property and the quality of work without going there by yourself or letting someone you trust check it for you” – FO R

"You can't simply put the whole forest in a digital form … The most optimal way of managing the property is to go there by yourself and check what is going on … Right now, I feel that the most accurate information can be gathered from actually visiting the forest in person, either by yourself or by someone local who knows the properties really well out there … It would always rather go to the forest myself than check the situation remotely from a digital service or an application" – FO S

Service features to increase the use of digital forestry services among urban forest owners

As already stated in the previous section of the interview analysis, most of the owners had only little experience with using digital forestry services or had not used these services at all in the past. The owners were therefore asked to give their opinion on what could make them use these services more frequently and what type of service features could further the frequency of use for these services. If owner had knowledge on the Metsään.fi-service or they had used it to some extent, they were also asked about the specific features they felt that would encourage them or others to use the service more actively.

Some of the owners felt that in its current state, they don't see a reason to use the Metsään.fi-service. The service was seen as outdated, sluggish and its features were not user-friendly according to these owners. However, most of the users of the service did not share these sentiments.

"Right now, on there [Metsään.fi] I only have the non-updated information that I can get from elsewhere too, so I don't feel the need to use it … They should have some new information there that would engage me to use this platform … I don't think that it serves any purpose as a place to just store information … The whole thing should be more interactive and simpler … I think that they just add new features there that I don't really see any use for these … The new features should be clearly planned with a vision and the ease-of-use in the center of focus" – FO L

"Metsään.fi would be great if for example you could take a photo on your phone of damages or something and you could attached it to a map or a plan … Right now, you can't really do anything interactive like that on the service … This would be great in planning work and managing things … The service should have a more long-term

approach in how you can make a comprehensive plan that is easy to modify and add on to … At the moment, it is not a dynamic service that utilizes this kind of stuff" – FO P

Many owners also felt that the current services should provide more accurate and timely data on the economy-side of forest management. Owners were interested in log – and property prices as well as demand for both of these. Additionally, localized information on the prices and demand was something that many owners felt would be helpful. In general, a more comprehensive service that covers all the aspects of forest management was something that would benefit many respondents. The addition of these types of services was cited by many as something that would increase their interest towards the services.

"It would be really great to have a place that would have centralized information about the financial aspects of forest ownership, for example visualizations of price development of log and properties … It would also be great to see information about the current prices and demand for timber sales locally … All of this data is so scattered right now which is just annoying and counterproductive" – FO G

"There's need for a service that could handle the complete field of forest management and everything that belongs under this umbrella … It should support the financial interests of owners, as this is still the most important thing for most owners … Other than the financial side should also be supported and informed about the possibilities … As of now, this is however much more difficult" – FO C

Few interviewees shared the notion that new service features should be especially developed to activate younger forest owners and prepare for the new generation of forest owners that demand different things and are accustomed to different kinds of user-friendly platforms. These new owners will most likely be more estranged on forest-related issues and forest management practices and will need more guidance. Simple, yet effective, digital service platforms could be a great way of getting new and potential owners invested into forest ownership. This would help the condition of forest properties as a whole as more properties would be well-managed also in the future.

"I don't see forest ownership as being very trendy or popular among younger people right now … The whole forest discourse should be extended towards younger people, and think of things from a fresh standpoint … Say, on how forest ownership is perceived in general … The digital services should aim to solve the problem on how we can get the information about forest ownership before they become owners … Right now, ownership is alien to these people and it's seen as a big intimidating thing … The terminology is unfamiliar and it's hard to get a hold off things when you just receive the property out of the blue … It should be clear to these owners from where to get the relevant information and such … For me, the contact from Forest Centre was really helpful and reassuring, and this is something that is also needed in the future" – FO L

"It would be important to encourage young and new owners to take active roles in forest management … So that the first thought for owners who inherit properties would not be to sell them or that they just let them be without care … I think that this is something that services should focus on … Owners should be made feel that owning property is a good opportunity and not just a nuisance that requires a lot of work" – FO Q

5 Discussion

This chapter consists of a concise analysis of the findings from the qualitative part of this research. I will highlight the most relevant findings and connect them to prior research on the subject. Additionally, the findings discovered from the interviews will be reflected on the responses gathered from an interview with a Finnish Forest Centre employee. Consequently, in this chapter, my goal is to give insight on how the Metsään.fi-service could be developed to better cater to the needs of urban forest owners in the future. The findings are divided into separate chapters on the characteristics of new types of Finnish non-industrial private forest owners and the needs and possibilities for the development of the Metsään.fi-service. Each of these themes is then split into the scientific contributions of the study, along with the practical implications highlighted from the findings.

All in all, the results of the study show that there is a lot of room to improve in the ways digital forestry services are offered. The demographic of urban forest owners seems to be interested in using various digital forestry services and most of the owners are of the opinion that they need these services in the aid of their forest management practices. There are however many owners that are not familiar with the current offering of digital forestry services. These owners have no clear picture on what type of services are available, and how these services could be utilized in issues regarding forest management and-ownership. Digital forestry services have an important role in the future in encouraging and engaging forest owners in retaining active levels of forest management throughout the country. This is already a goal of the state-funded Metsään.fi-service, but according to urban forest owners, the service has a variety of opportunities to better uphold the successful follow-through on these goals.

5.1 Scientific Contributions on the Characteristics of New Types of Finnish Non-industrial Private Forest Owners

The results from the empirical study analysis show that new types of Finnish forest owners have a large variety of different views and attitudes relating to forest ownership. It is quite expected that this the case in a large population that is only limited by factors of residence and distance to property. Additionally, urban forest owners seem to have a variety of different objectives and motives for forest ownership, which affects the needs and demands they have for different forest management services. The recognition of these divergent needs and characteristics is an extremely important aspect of the future development of digital forestry services. In this chapter these findings are reflected to the previous literature on the topic.

The fact that forest owners are becoming more concerned about the sustainability of forest management practices has been shown to hold true in earlier studies (Blennow, 2012; Saksa et al., 2020; Sousa-Silva et al., 2018). However, some studies have shown that in the general population of Finnish forest owners, the interest towards more sustainable and conservational management practices has stagnated in recent years (Karppinen et al., 2020). It was also evident in this study that urban forest owners have different views on the subject of sustainable forest management practices. It can although be stated that younger urban forest owners seem to be more and more interested about the sustainability- and conversational-aspects of forest management. This sentiment was also shared by the Finnish Forest Centre representative. The changes in attitudes are a result of various societal impact that affect also other demographics than forest owners. More and more people are distressed about climate change and their views are affected by the discourse and sentiments of the environments they live in. The findings on climate change adaptation among private forest owners is also in line with Blennow & Persson (2009), who argued that the owners' own beliefs considering climate change and the capabilities to adapt were the biggest factors in composing the climate change adaptation levels. The results on climate change adoption in forest management are also in correlation with the results of Laakkonen et al. (2018), who found that forest owners' actions and attitudes are greatly affected by actual observations on own forest land, but are also deepened by owners' own beliefs, social influences, financial factors and knowledge on forest management in general. The findings are also relatively in line with Koskela & Karppinen (2021) in that forest owners' inclination to maintain biodiversity through management is driven partly by values, but also by possibilities for compensation or contractual conservation-schemes.

The fears of growing inactivity and uncertainty of forest owners in management has been a major part of the discourse on forest ownership changes for a while now (Ficko et al., 2019). Inactivity has also been observed as being especially a characteristic for urban owners (Rämö et al., 2009), even though the amount of totally passive or uncertain owners has been quite low in studies (Karppinen et al., 2020). It was also evident in this study that some urban forest owners are quite inactive in their forest management. It cannot, however, be generalized based on the findings of this research that the current group of urban forest owners would be highly inactive in their forest management efforts. The findings are more in line with Karppinen et al. (2020) in that actually passive or indifferent owners are only a small minority of the demographic. The finding that the inactivity of owners is mostly a result of lack of time and knowledge on forest management is also supported by previous studies (Côté et al., 2017; Deuffic et al., 2018; Hogl et al., 2005; Rämö et al., 2009).

The argument provided by, among others, Umaerus et al. (2019) and Häyrinen et al. (2015) that female forest owners would be more focused on the ecological, recreational and social aspects of forest management was not supported by the findings of this study. Both female and male owners had varying degrees of interest in the traditional financial aspects of forestry, as well as the more novel intangible approaches. In general, it is reasonable to disregard gender as an attribute that affects owner’s behavior in the context of this study. Further studies on larger populations would be needed to warrant the use of such attribute as an indicator.

These findings are also consistent with Deuffic et al. (2018), and many others, in that the current population of forest owners is highly heterogenous. Deuffic et al. (2018) identified five different profiles for forest owners that were presented previously in this thesis. Many owners change between these categorizations throughout their forest ownership tenure. This was also evident in the interview data that many owners who would fit in a certain owner category felt that they would change their behavior in the future, which would place them into a different profile. It is therefore important to acknowledge the constant changing nature of forest ownership and owner attitudes as an integral part of new owner type characteristic.

Additionally, one of the most important findings of this research was the fact in line with this heterogeneity in that urban forest owners differ greatly in the way they need forestry services and how they use them. Urban forest owners seem to be increasingly interested in using external digital services as a part of their forest management routine but are also more prepared to pay for services. This notion has also been proposed in earlier studies (Rämö et al., 2009; Hänninen et al., 2020). The owners who are more inclined to pay for services and outsource the management entirely seem to be ones that are more affluent and more experienced in forestry. These findings are also in line with the notion of Follo (2011) that urban forest owners will not distance themselves necessarily from their forests, but the forest management activities.

All in all, the findings from the qualitative study on urban owner characteristics are in unison with the previous literature on the subject. The results of this study also show some differences to previous findings and prognoses. Urban owners seem to not be as passive and inactive as some studies have predicted. Many owners seem to want to take a more active role in ownership and management in the future. Urban forest owners also seem to be more interested in the intangible objectives of forest management than what some recent studies on the general population of Finnish forest owners have shown. These findings cannot however be generalized to wider populations as the sample size of this study was rather limited.

5.2 Practical Implications on the Characteristics of New Types of Finnish Non-industrial Private Forest Owners

Based on the literature reviewed and the qualitative research conducted, practical implications on the characteristics of Finnish younger urban forest owners are offered. No generalization of the results can be made as the interview population was quite limited. However, the following aspects of owner characteristics can be used as a basis of forming a deeper understanding on the needs and attitudes this demographic holds. These notions can then further be taken into account when developing potential digital forestry services for this demographic in the future.

Significant characteristics of younger urban forest owners to consider in the development of digital forestry services:

- Urban owners are not a homogenous group, but they have differing motives, objectives and attitudes in forest ownership and -management. These attributes can change over time with each individual owner.
- Many owners seem to be inactive in forest management but have plans to take a more active role in the future.
- Many owners still have a strong connection to the area or location in which their forest property is located.
- Only few owners have purchased property from open market. Most of owners have inherited their properties.

- Financial aspects of forest ownership are still important, but other aspects (sustainability, conservation and maintaining biodiversity) are becoming increasingly important.
- Owners' tendency to emphasize intangible objectives is based on their values and beliefs. Some owners seek compensation in order to further these objectives.
- Forest management for recreational use was not deemed generally important.
- Many owners have only little knowledge on the different aspects forest management and -ownership.
- Inactivity in management is a result of lack of time and/or lack of knowledge on forest management in general.
- Vast majority of owners regard digital forestry services as an important support tool of their management activities and are of the opinion that they need these services.
- Many owners know only little about the digital forestry service offering and have only little experience in the use of these services.
- Many owners are willing to pay for management outsourcing, rather than actively managing various aspects themselves.
- Owners in general do not feel that the COVID-19 pandemic would have had an effect on their positions on forest ownership and -management.

5.3 Scientific Contributions on The Needs and Possibilities for Development of the Metsään.fi-service

The Metsään.fi-service provided by the Finnish Forest Centre was chosen as the focal point of examination on the development possibilities of Finnish digital forestry services. This choice was made on the basis that it is a state-funded service that is accessible to all forest owners, as well as free-to-use. It was also the digital service that forest owners that were interviewed for this study were most familiar with. The interviewed forest owners were asked about their personal experiences with the service, as well as the factors that have affected their use of the service in question. As a result, the interviewees shared a variety of factors that could be taken into account when developing the service to better cater to the changing needs of these new owner types. In this chapter the results of the interview study are compared with the previous literature on topic of digital forestry services.

Generally, many of the interviewed owners shared the notion of Häyrinen et al. (2015) that the current digital service offering does not reach urban owners and does not adequately take into account the changing objectives and needs of owners. Häyrinen et al. (2015) also found that the changing objectives of owners have resulted in less than favorable timber harvesting and communication methods, which was also outlined by many interviewees as a critical need for service development. Vainio et al. (2018) also suggest the establishment of new communication channels and innovative communication methods that could help owners in realizing their objectives on forest management. These development in the ways service providers communicate with owners and the methods that are used were often cited as targets for development in the interviews.

Many aspects on the needs for forestry service features were also shared by the findings of this research and the literature. Joa & Schraml (2020) found that forest owners are in need of more suitable advisory services provided by institutions, mentoring, and peer-learning. This is especially important in the context of education on sustainable forest management methods. Majority of the interview participants agreed with this sentiment that one of the greatest needs for digital forestry services is their educational aspect in the time of emerging new ways of conducting forest management. Many owners also seem to call for more innovative support models and consultative services that would help sustainable management, which was supported by findings of Feliciano et al. (2017). A large part of urban forest owners also seem to feel that the current digital advisory services do not take into account their more non-traditional objectives (sustainability, conservation), which was also noted by Lawrence et al. (2020) in their study. In the scheme of entire forest economies it has been found that focusing services merely on timber wood provision instead of more intangible objectives will almost certainly lead to dissipation of biodiversity and ecosystem services (Eyvindson et al., 2018). This was also something that many interviewees feared that could be the result if forestry services would not be better positioned to take in to account the non-traditional objectives of owners.

According to the interviews, another key aspect of the need for future forestry service development is the ability to combine owners' intangible (conservation and sustainability) and tangible (resources and financial gains) objectives. Aggestam et al. (2020) conclude that the utilization of integrated forest management methods could be a solution in counterbalancing these objectives. The growing amount of forest management knowledge and the differing views between various stakeholders are the biggest obstacles for successful implementation of integrated forest management practices (Aggestam et al., 2020). The authors suggest improved communication, outreach and education as a solution for these barriers. These were also cited by many interviewees as extremely important aspects. Urban forest owners in general seem to be more and more interested in how they can balance the sustainability- and financial aspects of forest management, and digital educational services are something that they see as a great tool for this. In their research Andersson & Keskitalo (2019) found that the new types of owners will also want more services that are focused on assisting the management of legal and economic aspects of property ownership, which was also a factor that many owners interviewed deemed extremely important.

Urban owners also seem to be very interested in learning about novel and alternative methods for forest management, which is a sentiment shared by Weiss et al. (2019) in their recent study. Digital forestry services should aid the owners in informing about these different methods to help their decision-making. Weiss et al. (2019) state that service providers need to think ways in which owners can maintain sustainable and profitable management through co-operation and task division between owners and service providers. This also something that many urban owners seem to demand from service providers. Service providers also need to build trust with owners through communication and informing about the different possibilities of management methods. This notion was also shared by Vainio et al. (2018) who found that forestry services need to make better use of forest owners' social networks and peer-learning in building this trust. This is an important notion as many interviewees of the study felt that it can be difficult to be certain of the accuracy and reliability of information coming from various digital service sources. A successful service would be then one that the owners feel provides up-to-date and trustworthy information about ownership and management.

The need for increased co-operation in the development of digital forestry services was indeed an important factor that was supported by many interviewees in this study. These demands have also been noted in recent academic studies. Weiss et al. (2019) call for more innovating, experimenting and co-creating between different actors in the industry, which would help in developing more suitable services. Many urban owners seem to be interested in building the prospects of co-operation with both other forest owners and the service providers.

As already stated, this enhancement in co-operation in service development could be facilitated with the use of the service-dominant logic perspective that was introduced in chapter 2 of this research. Although, the previous literature on SDL applications has not specifically focused on digital services that are provided for forest owners, the results are mostly appropriate based on the findings of this research. Many urban owners seem to feel that the current service offering does not meet their changing needs and demands and does not inherently understand these changes. Much of the previous literature examined for this study agrees that utilizing the SDL framework in the development of services could alleviate these problems (Andersson & Keskitalo, 2019; Berghäll, 2018; Häyrinen et al., 2017; Mattila & Roos, 2014). Andersson & Keskitalo (2019) found that through service-dominant positioning the adaptation to the changing needs of the forest owner demographic is easier. Ficko et al. (2019) also argued that this use of the SDL perspective can be harnessed to better serve different segments within the new forest owner types through rapport between service providers and different segments. These sentiments were to a large extent also shared by the urban forest owners interviewed for this study, as many owners felt that the digital services should include more tailored and customized offerings that help different kinds of owners without treating all owners as a homogenous group with similar aspirations and objectives.

The findings of the qualitative study are also largely in line with previous studies conducted on the Metsään.fi- digital service. Sajeva et al. (2019) found in their research that many owners use the service rarely as the need for constant management on smaller properties is occasional, which results in the fact that many owners are not accustomed to the service and are not up-to-date with new features and changes to the service. This was also evident among the owners that were interviewed for this study. Many urban owners use the service rarely and are not familiar with its features to a large extent. The findings are also similar with Sajeva et al. (2019) in that the owners' greatest demands for the service are provision of accurate and up-to-date information. Another similar finding was that owners' feel the need for increased information on the intangible objectives of forest ownership.

In their recent study on the users and utilization of the Metsään.fi-service, Pynnönen et al. (2021) found that it is the service features that affect a forest owners' decision to use the service, rather than the owner's characteristics or the different attributes of their forest property. This sentiment is also in line with the results of this study. However, it can be argued that owner characteristics, in some cases, have a major impact on the owner's inclination to use a digital forestry service. The most notable characteristics of urban owners affecting the use of service cited in the interviews were the lack of time and work that could be allocated for the use of these services, as well as their general knowledgeability of the service.

Pynnönen et al. (2021) also discovered that in its current state the service offers more benefit to owners whose objectives are uniform with the more traditional outlook of even-aged timber cultivation, while other objectives are not served equally well. The authors saw that the service has opportunity and potential to take into account these different objectives and further the sustainable and effective use of forests in the future. These were also sentiments that many interviewees shared as their wish for the future development of the service.

Even though a large part of the findings of this research were in line with previous academic literature, there were some new ideas and outlooks that emerged from the interviews. These are examined in more detail in the following chapter. In general, it is clear from the findings and literature examined that the new forest owner types create new needs for the provision of digital forestry services that the current service offering has not thus far been comprehensively able to respond to. Then again, these findings and previous studies offer great insight on the possibilities for future development of such services. There is evident need for deeper understanding and awareness of the non-traditional new forest owner type needs, as well as innovative ways in which these can be supported (Weiss et al., 2019). The increase of the share of urban forest owners, who are less familiar with the subject area of forest management, will certainly amount to a growing need for advisory services and counselling that can be facilitated through the use of digital services (Koskela & Karppinen, 2021). These services can then be developed within the perspective of the SDL framework that emphasizes cocreation of value between different stakeholders in the forest owner service value chain.

5.4 Practical Implications on The Needs and Possibilities for Development of the Metsään.fi-service

In this section I will go through the practical implications for the development of the Metsään.fi-service. These propositions are based on the interview study with forest owners and the Finnish Forest Centre representative, as well as the previous literature examined throughout the research. The suggestions for development can be used as a basis for improving the service to better cater to the needs of younger urban forest owners.

One of the biggest needs for the service would consequently be that all of the possible motives and objectives of owners would be reflected on the service and its features. Many of the owners interviewed shared the opinion that it is difficult to find information currently that would support decision-making that is not focused on financial gains or timber procurement. This has also been noticed in the past that owners' interests do not always line up with the management practices that are recommended to them (Hokajärvi et al., 2009). Even though the financial benefits are still the biggest motivator for many forest owners, there is a growing number of owners that are interested in other aspects of forest management and -ownership and require more information and justification for their decision-making. The Metsään.fi-service should in the future offer more of such information as owners' objectives are changing.

Additionally, most of the urban forest owners interviewed for the study were of the opinion that one of the biggest obstacles for owners in forest management is the fact that there is endless amounts of information available that is scattered to different channels and services, and it can be oftentimes conflicting. Based on this, it can be difficult to make premeditated decisions on the most effective ways to manage forest properties. Many owners felt that the Metsään.fi-service could be the provider of aggregated and filtered information that could be used as a basis for management decisions. Owners do also need a source that would compare different pieces of information and would provide scenarios and possibilities for management activities based on this.

It seems to be that these owners who lack the time to use digital forestry services, have often outsourced their forest management to a Forest Management Association. These owners can rarely find an additional use for the Metsään.fi-service that would not be handled by the associations. Subsequently, the service should not be inherently developed according to the needs of these owners who are extremely unlikely to use the service in the future regardless of the features offered.

On the other hand, the group of owners that haven't used the Metsään.fi-service because of a lack of time but are not actively using the Forest Management Association services should be considered when developing the services. These owners would require more informing and notifying of the purpose of the service and the benefits it can bring. All in all, these are owners that the service should encourage in taking a more active part in forest management duties.

The Forest Centre interview was also partly focused on the certain owner groups that should be focused on in the development of the service features in the future. The inactive owners seem to be the main target for the Forest Centre, which is in line with the implications of this research. It was also mentioned that the Forest Centre has in the past viewed new forest owners as a group that they do not want to specifically focus on. However, at the moment it seems that both the Forest Centre and many urban forest owners feel that the Metsään.fi-service should be especially targeted to new forest owners. Both the owners and the Forest Centre seem to also agree on the fact that the state-funded service would be the best actor in supporting and guiding new owners at the start of their forest ownership journeys. This was also regarded as an important role of the service.

According to many interviewees, digital forestry services should be developed to better respond to the specific needs of owners in different occasions and circumstances. One of the main aspects of forest ownership that was cited in the interviews was that during the tenure of a forest owner the state of affairs changes in many instances. New owners have different needs than experienced ones, and motives and objectives can change considerably over time.

A possible solution to remedy these needs would be to offer different paths or profiles that different owners would follow when using the service. The increased tailoring of the service features to respond to the specific needs of an owner at a specific time could increase activity and retention in forest management service use. This would also be a great way to help inform new owners about the different aspects of forest management and -ownership.

There are, however, specific factors that affect the possibilities for Metsään.fi-service development according to the interview with Forest Centre. One of the biggest factors affecting the possibilities for development is ultimately the service's position as a state-funded service. The service has always been developed with a limited budget, and the possibilities are not as vast as with other service providers. In the past, the service has been integral in the development of the digital forestry services offering in Finland, as other service providers have continued to build on the ideas of service in the development of their own products with the help of their extended resources. In the future, the service could have a more focused approach regarding the features it offers and who the service is targeted towards.

All in all, there were a lot of different ideas that emerged from the interviews that can be used as a guideline for the development possibilities and needs of the Metsään.fi-service. The most significant and applicable suggestions are listed as follows:

The aspects to develop for the Metsään.fi-service according to younger urban forest owners:

- Increased tailoring, customization and guidance through profiles and pathways for owners in different stages of forest ownership.
- Providing a comprehensive and up-to-date databank on all aspects pertaining to forest ownership and -management.
- Focusing on other service aspects than forest management plans.
- Developing services that do not extensively overlap with the service offering of other service providers.
- Impartial information channel for forest owners that provides and compares information on
    - Possibilities and justification for non-financial objectives of forest management.
    - Different non-traditional management approaches.
    - The effects of climate change and other different risks related to forest management.
    - Localized information pertaining to the area in which forest owner's property is located.
    - Possibilities for novel financial opportunities relating to forestry and forest ownership.
- Offering projections for different types of owners relating to their chosen management actions and objectives.
- Engaging owners to maintain active forest management practices and finding ways in which owners would use the platform more frequently.
- Educating and motivating new forest owners in taking possession of their forest properties and actively managing them. Informing prospective owners of the service even before their tenure.

- Offering consultation and education to owners with a low threshold of participation.
- Increasing the interactivity of the platform through the use of different communication channels and features.
- Building trust and networks with owners and other stakeholders and using these to find innovative ways to offer novel service features.
- Facilitating co-operation and communication between forest owners to improve collective forest management.
- Developing the services with the owners in order to find the features that are most useful and relevant in the future.

6 Conclusions

This final section of the thesis discusses limitations of the research, as well as the future possibilities for research on the topic. The ethical considerations of the research are also briefly touched upon. At the end of the chapter, a short summary of thesis will be offered.

All in all, the research conducted in this thesis has been able to broaden the understanding on the characteristics and needs of new types of Finnish private forest owners, and the implications these have for the future development of digital forestry services. Generally, the findings from the interview study are in line with much of previous research on the topic. However, some of the findings of this study were also quite novel and unprecedented as similar studies in the context of forest owners and their use of digital forestry services have been somewhat rare in the past, especially when considering the Finnish forestry sphere.

This research set out to further the knowledge on twofold objectives. First, on the characteristics of the new type of forest owners- namely urban forest owners. Second, the objective was to find ways in which digital forestry services should be developed to better cater to the needs of this growing demographic. The findings offer current insight into the properties of the younger urban forest owner demographic. The characteristics of this demographic have not been widely studied in the past, especially in Finland. Consequently, the results offer deeper insight into how these new types of owners see issues pertaining to forest ownership and -management. This information can be valuable to service providers in the industry as previous studies on forestry services have shown a lack of understanding on emerging forest owner needs and objectives to be an obstacle in suitable service development. These insights on changing forest owner characteristics will be even more valuable in the future as the share of urban forest owners continues to grow.

Additionally, the findings offered valuable outlook into how digital forestry services should be developed in the future to better respond to the demands of new types of forest owners. The interviewees shared a variety of opinions and experiences on the matter, which can serve as grounds for service development. User experiences and demands on service features have until now been less frequently studied in the context of digital forestry services. Therefore, the findings can open interesting avenues for future research on the topic.

6.1 Limitations and Future Research

Even though the interview population size of the research was fairly substantial when considering the nature of the research and the interviews conducted were relatively extensive, there are quite a few limitations pertaining to this study that can be highlighted. The generalization of the data to the wider population of urban forest owners is challenging as it can be argued that the interview population is not a representative sample because of the size of the interview populated compared to the amount of owners there are. It can also be contended that the reliability of the interview data is affected by these same issues. As the amount of urban forest owners interviewed was quite low, it is important to note that the views on which the implications of the research are built on might not be valid in other urban forest owner populations of the same size.

There are also many limitations that pertain to the specifications and restrictions of the chosen research population. The chosen demographic was quite varied in the attributes and characteristics of different forest owners. As the target population was limited rather loosely, the research could have benefitted from more specific limitations based on certain attributes. Additionally, the amount of questions in the interviews could have been more limited to concentrate more specifically on different fields of forest ownership, urban owners and digital forestry services. As of now, the interviews gave a rather broad outlook on the different sections included without more precise specialization.

A different approach could also have been taken in the application of the interview findings and how the implications to digital service offerings were formulated. For the basis of the implications for digital forestry service development, only one expert interview was conducted with the Finnish Forest Centre. Additional interviews with the service provider side could have helped in creating a more substantial view on the status quo of services and would offer more applicable results.

These observations open, however, many interesting avenues for future research in the field of forest ownership in Finland. The subject of urban forest owners and -ownership should be studied with different populations. Future research could focus on owners from different areas than the Helsinki metropolitan area, as well as on owners in a more specified age range. For example, a stricter limitations to under 30- or 40-year-old owners who live in other parts of the country would most likely yield different results.

Another factor that was not closely focused on in the study was the size of forest owners' properties. In this research, the owners were not generally grouped by property size, and it did not play a major role in how the data was perceived. Forest owners should be categorized more strictly based on the property size in future studies, as the needs and demands of an owner are clearly substantially shaped by this attribute.

Future research could also focus more closely on the origins of the owners and on the ways they have acquired their properties. In this study, the origins of the owners were quite varied and the interviewees had different connections to the locations of their properties, as well as differences in the time they had lived in an urban setting. There were also somewhat few participants who had purchased their properties from the open market. It would be interesting to see more studies on urban forest owners who have purchased forest properties and have no connection to the area from where their property is located. Furthermore, it would be interesting to study owners who have lived in a city for their whole lives and have decided to purchase a property from the open market. The effects of the ongoing COVID-19 pandemic will also be an interesting avenue to pursue in the future. The possible impacts on migration, service possibilities and forestry service offerings will be only experienced in the future. The ways in which urban forest owners and other new demographics use digital forestry services will also be interesting avenues for future studies. It would certainly be interesting to know more about the needs for specific service features different owner groups have in the future and how they use these services.

Overall, forest ownership changes and the development of digital services in the industry will offer a large set of possibilities for future research. The forest ownership base is rapidly changing and so are the needs and demands of this demographic. The eminent technological developments in the industry will also present apt opportunities for studies in the field. It will also be extremely interesting to see more studies on how the growing amount of urban forest owners changes the playing field and what type of opportunities and challenges this brings to the digital forestry service offerings.

6.2 Ethical Considerations

As the empirical section of this research involved an interview study, it is worthwhile to contemplate the ethics of the conducted research. In this case the most important principle to consider is the confidentiality of research participants, as well as the responsible use and management of private information that is acquired from public sources.

In the context of this study all of the personal information data acquired for research purposes was stored and accessed solely on the researchers personal computer using the network provided by the University. This data was not shared with anyone other than the researcher. Additionally, all of the data acquired was deleted after the completion of the interviews. Also, the interview recordings were deleted after transcriptions of the interviews were finished.

To ensure the confidentiality of the research participants, all data acquired was covered anonymously in this paper. Different participants were identified only by their age, length of tenure and method of property acquisition to ensure anonymity. Other identifiers that were acquired in the data gathering phase were left out of the analysis in order to ensure the confidentiality of respondents. The Finnish Forest Centre employee interviewed for the study was not identified in any other way to maintain anonymity.

6.3 Summary

In this thesis, I have researched the topic of urban forest ownership and the characteristics of urban forest owners, as well as the needs and demands these new types of owners have for future digital forestry services. Additionally, I have explored the ways in which digital forestry services could be developed in order to better cater to the needs of urban forest owners. The empirical part of the study was conducted as a qualitative research that included 20 semistandardized interviews with younger urban forest owners. From the data that was gathered through the research, it is evident that there is a lot that can be improved on the digital forestry service offerings, as well as on the features of digital forestry services. It is also clear that service providers need to build better understanding on the characteristics of new types of forest owners and their changing attitudes and needs.

The findings of the interview study show that younger urban forest owners are a heterogenous group with a variety of different objectives and needs. Financial gains regarding forest ownership are still an important aspect for many, but more and more owners are increasingly interested in the sustainability and conservational objectives of forest management. Many owners are of the opinion that they need more information and guidance on balancing the fulfillment of their tangible and intangible objectives. A large share of urban owners also feel that they require more know-how and knowledge on forest ownership- and management in general. Most urban owners seem to be more and more estranged from forest management skills and knowledge, while some owners are extremely knowledgeable of these issues. Yet, most urban owners still claim to have strong connections to the area in which their properties are located. The most important reasons why urban owners are less familiar with forest ownership and management practices at large were found to be the distance to property, lack of time, the difficult nature of the issues, the nature of acquiring properties through inheritance and general lack of support and consultation. Especially owners who have recently acquired their property by inheriting seem to have issues in "taking ownership" of their property and find the nature of ownership and management difficult and cumbersome to understand and learn. Only a small number of urban owners seem to be totally passive in their ownership as majority of owners want to be more involved in management and are eager to learn about the different issues pertaining to ownership. It is also worthwhile to note that some urban owners are willing to outsource the management of their properties and pay for these services.

A majority of urban owners feel that digital forestry services can be an extremely helpful tool in forest management and many are of the opinion that they need such services in the future. The findings of this research seem to indicate that the demand for such services will be even higher in the future among urban forest owners. This is especially the case with owners who have recently acquired their properties and are just starting their journey as a forest owner. It is although evident from the data that the majority of urban forest owners are not sufficiently familiar with the current digital forestry service offering.

The practical implications for development of digital forestry services were in this thesis observed through the interview population's experiences with the government-funded Metsään.fi-service. A majority of owners highlighted the fact that the service should be more tailored to the various needs and objectives of different owners in different stages of their ownership tenure. Digital forestry services should hence be developed to include different pathways for owners according to their objectives and motivations. In general, urban forest owners seem to be of the opinion that the Metsään.fi-service should be built more towards the purposes of owner education, consulting and activation. These objectives can be achieved through the increased facilitation of peer-learning and co-operation between owners and service providers. Additionally, communication towards owners should be developed via the use of innovative ways to interact and novel communication channels.

One of the most salient ways to improve the functionality and suitability of digital forestry services seems to consequently be the engagement of owners as innovators and experimenters for different service features. Forest owners seem to be increasingly interested in co-operation with other owners and service providers in making their forest management tasks easier to handle. The collective development of services to be better suitable for different management practices is something that many owners seem to be ready to actively partake in. Applying the service-dominant logic perspective in the future development of digital forestry services could be a valid way to facilitate this co-operation in making the services better cater to the emerging needs of urban forest owners.

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Appendix A: Interview Invitation

Kutsu haastatteluun: Aalto-yliopiston pro gradu -tutkielma kaupungissa asuvien metsänomistajien digitaalisten palveluiden kehittämiseksi

Hyvä metsänomistaja,

Tutkin tällä hetkellä Aalto-yliopiston lopputyötäni varten metsänomistajien digitaalisten palveluiden nykytilaa ja kehitystarpeita. Tutkimukseni erityiskohteena on kaupungissa asuvien alle 50-vuotiaiden metsänomistajien asenteet metsänomistukseen liittyen, sekä tarpeet digitaalisten palveluiden kehitykselle.

Metsänomistajien muuttuvat tarpeet on erittäin ajankohtainen tutkimuskohde, sillä yhä useampi omistaja on kaupungissa asuva alle 50-vuotias. Metsänomistajille suunnattujen palveluiden kehityksessä onkin jatkossa keskityttävä yhä enemmän tämän kasvavan ryhmän tarpeiden palvelemiseen. Tämän haastattelututkimuksen avulla pyrinkin löytämään lisää tietoa siitä, miten juuri tätä kohderyhmää voidaan tulevaisuudessa palvella paremmin.

Tutkimustani varten haluaisin haastatella juuri sinua! Haastattelun kesto on noin 45–60 minuuttia. Haastattelun rakenne löytyy tämän kutsun liitteenä. Kaikki haastatteluista saatu materiaali käsitellään nimettömänä ja se poistetaan tutkimuksen valmistuttua. Valmis tutkimustyö lähetetään haastatteluun osallistuneille.

Olen saanut yhteystietonne haastattelukutsuja varten Metsäkeskukselta virallisen tietojenluovutuspyynnön kautta. Yhteystietojanne käsitellään luottamuksellisesti ja ne poistetaan haastattelututkimuksen valmistuttua.

Toivon suuresti, että voisit osallistua tähän haastatteluun ja auttaa näin kehittämään metsänomistajille tarjottavia digitaalisia palveluja tulevaisuudessa. **Haastattelu toteutetaan etänä joko toivotun videoneuvotteluohjelmiston avulla tai puhelimitse.**

Mikäli olet halukas osallistumaan haastatteluun, otathan minuun yhteyttä mahdollisimman pian sähköpostitse tai puhelimitse.

Aurinkoista kevään jatkoa!

Ystävällisin terveisin,

Lauri Hartikainen

Translation of the original invitation in English

Interview Invitation: Aalto University thesis research on development of digital forestry services for urban forest owners

Dear forest owner,

I am currently researching the current state of digital services for forest owners and needs for development for my thesis in Aalto University. The focus of my research is on the attitudes towards forest ownership within the group of under 50-year-old forest owners, who live in cities. Additionally, my research is focused on the needs for development of digital forestry services.

The changing needs of forest owners is a very current research topic as more and more forest owners are under 50-years-old and live in cities. For this reason, the future development of forestry services should focus more on catering to the needs of this growing demographic. Through this interview research, I aim to deepen the understanding on how this group of forest owners can be better served in the future.

I would love to interview you for the purposes of my research! The interview will take approximately 45-60 minutes. The interview structure and questions can be found as an attachment to this invitation. All the data gathered through interviews will be analysed anonymously, and the data will be deleted after the research is completed. The thesis will be sent to all interviewees after it is published.

I have received your personal information for these invitations from Finnish Forest Centre through a formal request of provision for information. Your personal information will be managed as confidential, and the information will be deleted after the research is finished.

I sincerely hope that you could take part in this interview and help the development of digital forestry services in the future. **The interviews will be held remotely via suitable video conferencing tool or phone.**

In case you are willing to participate in an interview, please contact me as soon as possible by email or phone.

Have a pleasant spring!

Best regards,

Lauri Hartikainen

Appendix B: Interview Agenda

Aihe: Digitaaliset palvelut uudenlaisille suomalaisille metsänomistajille

Alateemat: Digitaaliset palvelut, metsänomistajat, kaupungissa asuvat metsänomistajat

Tutkimuksen laajuus ja aineiston käyttötarkoitus: Haastattelumateriaalia käytetään osana Aalto-yliopiston pro gradu- tutkielmaa. Valmis tutkielma julkaistaan oppilaitoksen toimesta sähköisesti. Tutkielman havaintoja ja löydöksiä saatetaan käyttää myöhemmässä tutkimuksessa. Kaikki haastattelussa kerätty tieto on luottamuksellista. Haastatteluaineistoa kuvataan tutkimuksessa nimettömänä.

Suostumus haastattelun nauhoitukseen: k/e

Haastattelun tarkoituksena on saada lisätietoa kaupungissa asuvien metsänomistajien tarpeista ja asenteista liittyen digitaalisten metsänhoidollisten palveluiden tarjoamaan. Tutkimuksen päätavoitteena on löytää tekijöitä, jotka vaikuttavat metsänomistajien palvelutarpeeseen.

Haastattelun rakenne (kesto noin 45–60 min.)

<u>Johdatus aiheeseen ja tutkimuksen taustat</u>

<u>Haastateltavan taustatiedot</u>

Kuinka monta vuotta olet ollut metsänomistajana?
Kuinka olet saanut omistuksesi?
Metsäomaisuuden sijainti?
Sijaitseeko metsäomistus lähellä kesämökkiä tai suvun tilaa?
Mikä on omistuksen koko?

<u>Metsäomistuksen perustietoja</u>

Kuinka usein olet tekemisissä metsäomaisuutesi kanssa tai siihen liittyvissä asioissa?
Kuinka paljon aikaa käytät metsänhoitoon ja siihen liittyvin asioihin kuukausittain?
Miten päätöksenteko jakautuu oman metsäomaisuutesi osalta?
Koetko tietäväsi paljon metsänomistukseen ja metsänhoitoon liittyvistä asioista yleisesti?

Kuinka käytät omaa metsäomaisuuttasi? (Talousmetsä, virkistyskäyttö jne.)
Mitkä ovat suurimmat hyödyt sinulle metsäomaisuudestasi?
Tuleeko mieleen joitakin haittoja tai negatiivisia puolia metsän omistamiseen liittyen?

Kuinka tärkeää sinulle on metsäomaisuutesi tuottavuus?
Kuinka tärkeää sinulle on metsäomaisuutesi biodiversiteetti ja metsän suojelu?
Kuinka tärkeitä sinulle ovat mahdollisuudet omassa metsässäsi liikkumiseen? (Esim. metsästys, kalastus, marjastus, patikointi jne.)

<u>Asenteet – Kaupungissa asuvat metsänomistajat</u>

Kuinka koet, että kaupungissa asuminen vaikuttaa asenteisiin metsän omistamista kohtaan ja suhteeseesi omaan metsäomaisuuteen? Miten kaupungissa asuminen on vaikuttanut aktiivisuuteesi metsän omistukseen liittyvissä asioissa?

Asenteet – Ilmastonmuutos ja muut riskit

Vaikuttavatko ilmastonmuutos tai muut riskit metsänhoitoon liittyviin päätöksiisi yleisesti?
Koetko, että ilmastonmuutoksella tai muilla riskeillä on merkittävä vaikutus omaan metsäomaisuuteesi tulevaisuudessa? Miten koet ilmastonmuutoksen ja muiden riskien vaikuttavan metsäomaisuuteesi nyt ja tulevaisuudessa?
Onko jokin uusi viimeaikainen ilmastonmuutokseen tai muuhun riskiin liittyvä tieto saanut sinut tekemään jo päätöksiä/muutoksia metsäomistukseesi?

Asenteet – COVID-19

Onko COVID-19-pandemia vaikuttanut jollain tavalla suhteeseesi omaa metsäomaisuutta kohtaan?
Oletko ollut enemmän tekemisissä oman metsäomaisuutesi kanssa pandemian johdosta?
Oletko pandemian johdosta miettinyt mahdollisuutta muuttaa vakituisesti tai osa-aikaisesti pois kaupungista, lähemmäs metsäomaisuuttasi?
Koetko, että COVID-19-pandemia on vaikuttanut jotenkin palveluiden käyttöön tai tarpeeseen?

Digitaalisten palveluiden käyttö

Kuinka tuttuja sinulle ovat metsänomistajille tarjottavat digitaaliset palvelut? Mistä palveluista olet kuullut?
Mitä palveluita olet käyttänyt?
Oletko käyttänyt digitaalisia palveluja metsänomistukseen liittyen? Jos et ole, niin miksi?
Oletko ostanut maksullisia palveluja? Oletko käyttänyt ilmaisia palveluita? (Esim. Metsään.fi)
Miten olet valinnut palveluntarjoajat?
Koetko, että sinulle on helppoa löytää juuri sinulle sopivia digitaalisia palveluja? Koetko, että on helppoa löytää tietoa eri palveluista ja palveluntarjoajista?
Mitkä palvelut olet kokenut hyödyllisiksi?
Koetko tarvitsevasi tällä hetkellä ulkopuolisia digitaalisia metsänhoitoon ja -omistukseen liittyviä palveluja?

Tarpeet uusille palveluille

Koetko saavasi tarpeeksi tietoa metsänhoitoon liittyvien päätösten tueksi?
Mistä kanavista saat tietoa päätöksenteon tueksi?
Mihin metsänhoidollisiin riskeihin liittyen koet tarvitsevasi enemmän tietoa?
Koetko haluavasi enemmän tietoa siitä, miten metsäsi raaka-aineita käytetään ja miten metsääsi käytetään virkistyskäytössä?
Koetko haluavasi enemmän tietoa paikkakunnasta/alueesta, jolla metsäomaisuutesi sijaitsee?
Seuraatko tarkasti metsänomistukseen liittyvän lainsäädännön ja innovaatioiden kehitystä?
Koetko tarvitsevasi lisää tietoa näistä?

Koetko, että metsänomistajien palveluiden tarjoamisessa tulisi keskittyä entistä enemmän sidosryhmien yhteiseen palvelukehitykseen? Olisitko itse kiinnostunut kehittämään sinulle sopivia palveluita yhdessä muiden sidosryhmien kanssa?

Mistä palvelusta kokisit olevan eniten sinulle hyötyä?
Millaista palvelua mielestäsi erityisesti kaupungissa asuvat metsänomistajat tarvitsevat?
Oletko huomannut merkittäviä puutteita metsänomistajien palveluiden tarjonnassa?
Puuttuuko jokin sinulle tärkeä palvelu kokonaan?
Mitkä palveluominaisuudet saisivat sinut käyttämään enemmän digitaalisia metsänomistajien palveluja?

Translation of the original interview agenda in English

Theme: Digital service offerings for new types of Finnish forest owners

Sub-themes: Digital services, forest owners, urban forest owners

Use and scope of the thesis: The interview material will be used as a part of master's degree thesis for Aalto University. The thesis will be published online by the university. The findings of this research might be used for further academic research. All information given in interviews is confidential.

Consent for recording: y/n

The purpose of the interview is to gain information on urban forest owners' attitudes and needs in the context of digital service offerings in forestry. The main objective is to find factors that affect the needs forest owners have for digital services.

The Interview Guide (approximately 45-60 minutes)

<u>Introduction and background of the study</u>

<u>Interviewee background</u>

Length of tenure for forest property?
Acquisition of forest property?
Location of forest property?
Is forest property located near summer cottage or family property?
Size of forest property?

<u>Forest ownership background</u>

How regularly are you involved with your forest property?
How much time do you use on forest management on a monthly basis?
Is decision-making on the property shared with other stakeholders?
Do you feel that you have vast general knowledge on forest ownership and -management?

How do you use your forest property? (Financial use, leisure etc.)
What are the biggest benefits for yourself from your forest property?
Can you think of any negative aspects relating to forest ownership?

How important is the profitability of your forest property?
How important is biological diversity and conservation of your forest property?
How important are possibilities for outdoor activities? (e.g., hunting, fishing, hiking etc.)

<u>Attitudes – Urban forest owners</u>

How do you feel that living in a city affects your attitudes towards forest ownership? Has living in a city affected your activity towards forest property?

<u>Attitudes – Climate change and other risks</u>

Does climate change or other risks affect your forest-related decisions in general?
Do you feel that climate change or other risks will affect your forest property substantially in the future?
How do you think it will affect your property?
Has any new knowledge on climate change or other risks affected your ownership?

Attitudes – COVID-19

Has COVID19-pandemic affected your relationship with your forest property?
Have you been more involved with your forest property during the pandemic?
Have you considered moving part- or full-time closer to your forest property because of the pandemic?
Has the pandemic affected your use or needs for services?

Use of Digital Services

How familiar are you with the current digital service offerings for forest owners? Have you heard about available digital services?
Which services have you used?
Have you used digital services related to your forest property? If you haven't used any services, why is that?
Have you bought any services? Have you used free services? (e.g., Metsään.fi)
How have you chosen the service providers?
Do you feel that it is easy to find digital services best suited for you? Do you feel that it is easy to find information on different services and service providers?
Which services have you considered useful?
Do you feel that you need external digital forestry services at the moment?

Needs for New Services

Do you feel that you are provided with enough information for forest management decisions?
From where do you get information and knowledge that guide your forest management decisions?
What types of risks regarding forest management do you need more information on?
Do you feel that you would want more information on how the raw materials in your forest are used and how your forests are used for recreational activities?
Do you feel that you would want more information about the area in which your forest property is located?
Do you follow the development of forest legislation and innovations closely? Do you feel that you need more information on these?

Do you feel that more social activities and service development is needed? Would you be interested in being involved in such activities?

Which services would you consider most useful for yourself?

What type of services do you feel especially urban forest owners need?
Have you noticed that there have been shortcomings in services you have used? Are some services entirely missing that you have considered valuable?
Are there any service features that would have you use more digital forestry services?