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Finland's model in utilising forest data

Metsään.fi-website's background, implementation
and future prospects



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Summary

The aim of this study is to depict the Finnish Forest Centre's Metsään.fi-website's background, objectives and implementation and to assess its needs for development and future prospects. The Metsään.fi-service included in the Metsään.fi-website is a free e-service for forest owners and corporate actors (companies, associations and service providers) in the forest sector, which aim is to support active decision-making among forest owners by offering forest resource data and maps on forest properties, by making contacts with the authorities easier through online services and to act as a platform for offering forest services, among other things. In addition to the Metsään.fi-service, the website includes open forest data services that offer the users national forest resource data that is not linked with personal information.

Private forests are in a key position as raw material sources for traditional and new forest-based bioeconomy. In addition to wood material, the forests produce non-timber forest products (for example berries and mushrooms), opportunities for recreation and other ecosystem services.

Private forests cover roughly 60 percent of forest land, but about 80 percent of the domestic wood used by forest industry. In 2017 the value of the forest industry production was 21 billion euros, which is a fifth of the entire industry production value in Finland. The forest industry export in 2017 was worth about 12 billion euros, which covers a fifth of the entire export of goods. Therefore, the forest sector is important for Finland's national economy.

The Metsään.fi-website is based on forest resources data that has been collected by remote sensing since 2011. Forest data can be utilised in, for example, the regional planning of forests and commercial forestry, to support the assessment of wood use possibilities and generally for

developing forest businesses. At present, the forest resource data covers almost 90 percent of the surface area of productive forest land in private forests.

The Metsään.fi-service was first opened in November 2012 as a version that was subject to charge, and was changed to a service free of charge for forest owners in 2015. By the end of 2018, about 110,000 forest owners had logged into the service. The forest owners that use the service own forest properties that are larger than average. The Metsään.fi-service's usage activity was increased in particular by forest owners experiencing that the presented recommendations for forest management matched their own objectives. Out of the respondents of the objective questions in the Metsään.fi-service, 87 percent considered wood production to be an important or very important purpose of forest owning. On the other hand, the majority of forest owners also appreciated nature and leisure values and scenery, and about a third appreciated hunting possibilities.

Out of the benefits brought to the forest sector by the Metsään.fi-service, open forest data that reduces costs and enables new kinds of business opportunities for both forest owners and actors stand out. Central benefits from the service for forest owners are the opportunity to run forest errands online, regardless of time and place and the service being free of charge. Actors emphasise the role of open forest data in cost effective activities. It speeds up the forest management and harvesting planning and forest property evaluations. Also, it enables a targeted contacting of potential customers.

A central challenge in developing the website is to integrate several different sources of information into one entity that offers forest owners and actors all forest and nature data simultaneously. From the perspective of both forest owners and actors, the up-to-datedness of forest resource data and improvement of quality rose as the most important development objects.

It is inherent for a service that is maintained with public funds that it's seen to be necessary and that it is being used. By the end of 2018, already over 100,000 forest owners had logged into the service. This is about a third of

forest properties measuring over two hectares. The service is seen useful in many ways by the forest owners and other industry actors, but there are also areas that need improvement. It is important for future use and usefulness of the service to improve it and its content continuously.

Recommendations:

- The service remains free of charge for forest owners and actors, which requires constant funding. However, when developing the website it is worth considering which supplementary services and levels of information accuracy could be subject to charge or provided by another operator.
- The number of users is increased by marketing the service especially to new forest owners, but a complete coverage is not worth pursuing since the costs rise for every achieved hectare.
- The usability of the service is in a key position for a large portion of forest owners, therefore the basic level's ease of use and clarity cannot decrease among the supplementary services. The easiness of the login is the first step towards using the service. The usability and convenience are supported by offering a mobile application to the users.
- Informing the users of the purpose, method and limits of the forest resource data offered by the Metsään.fi-website should be emphasised further than before, so that the expectations for the material become more realistic.
- The structure and aims of the forest owners are becoming more diverse. This is worth noting when planning the materials and management recommendations that the service offers: material related to nature and leisure values and more diverse forest treatment options will have their own user base in the future.
- In the future, the climate change mitigation and reinforcing biodiversity will likely receive more attention. The Metsään.fi-service acts as an important platform for relaying information and it makes it more effective to, for example, focus counselling towards those forest owners whose forestry activities have the largest impact on the desired goals.

- The service platform planned in connection to the Metsään.fi-website is a significant step in advancing information sharing. The needs of corporate users should be addressed through data services. Diverse data bases should be available on the same website, utilising interfaces.

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1 Introduction

Pellervo Economic Research PTT carried out this study of the Metsään.fi-online service in spring 2019 as commissioned by the Finnish Forest Centre. The study was implemented with funding from the DataBio project (see chapter 2.4). The purpose of this study is to depict the background of the Metsään.fi-website of the Finnish Forest Centre, as well as the development of the number of users, the steadied use of the service, the technical implementation and to assess its needs for development and future prospects.

The first chapter describes the background of forest ownership in Finland, the relevance of commercial forestry in the national economy, the actors in the forest sector and the objectives of this study.

1.1 Forest ownership in Finland

The state owns about a quarter of all forest land in Finland, private industries eight, commonhold forests three and municipalities two per cent. (Natural resources institute Finland 2019). The largest part (three fifths) of Finnish forests are privately owned. Privately owned forests consist of forest properties controlled by private individuals or families (74 %), undistributed estates (9 %) or jointly owned forests (17 %). There are about 344,000 forest properties in Finland that measure at least two hectares and are owned by private individuals. The average size of forest properties is about 30.5 hectares. However, the number of private forest owners is considerably higher, about 620,000 forest owners, since a forest property often has more than one owner. (Natural Resources Institute Finland 2019). Private forests cover roughly 60 per cent of forest land, but about 80 per cent of the domestic timber used by the forest industry (Hänninen et al. 2011).

Private forests are in a key position as a raw material source for traditional and new forest-based bioeconomy. In addition to raw material, the forests

produce non-timber forest products, opportunities for recreation and other ecosystem services. Ecosystem services refer to all things produced by nature that offer material (for example berries and mushrooms) or immaterial benefits for people.

Financial incentives, legislation and counselling (Mäki et al. 2011) have traditionally been used as methods to influence the behaviour of forest owners. Counselling consists of, for example, communication about forest management, education and training for forest owners, personal counselling and drawing up forest plans. Forest planning and counselling have a central role when it comes to forest data and decision-making among forest owners (Primmer and Wolf 2009). According to research, the existence of a forest plan has a clear impact on timber sales (Hänninen et al. 2011; Rämö et al. 2011) and on forest management activity (Ovaskainen et al. 2006, 2017). Forest planning in its current form is best suited for those forest owners who already have data on their forests and that are interested in commercial forestry (Kurttila et al. 2010). The forest resource data that is produced free of charge by the Metsään.fi-service is believed to stimulate the forest management activity of the forest owners (Kurttila et al. 2010).

1.2 The relevance of the forest sector in the national economy

Forest based bioeconomy has deep roots in Finland. The development of the forest industry began already in the 16th century when sawmills based on water power began their production. In 2017 the value of the forest industry production was 21 billion euros, which is a fifth of the value of industrial production. The manufacturing of paper and paper/cardboard products covers over two thirds of the value of the forest industry. (Official statistics...). Forest industry exports in 2017 were worth about 12 billion euros, which covers a fifth of the entire export of goods. (Natural Resources Institute Finland 2019). The share of commercial forestry and

the forest industry of the Finnish bioeconomy and its earnings was 38 per cent in 2016¹.

The forest sector provides jobs for 59,000 persons, which is over two per cent of the employed workforce. Commercial forestry, wood product industry and pulp/paper industry each provide employment for about a third of the workforce within the forest sector. Commercial forestry and forest industry form a significant part of Finland's national economy, and are very important areas for regional economies especially in Eastern and Central Finland.

1.3 Actors in the forest sector

The Ministry of Agriculture and Forestry is responsible for the administrative guidance of the forest sector. The ministry guides and supervises the Finnish Forest Centre, the Finnish wildlife agency, and – in matters included in their field of expertise – the Regional State Administrative Agencies and the Centres for Economic Development, Transport and the Environment². The mission of the Finnish Forest Centre is to strengthen the sustainability and competitive edge of the forest sector³. Its tasks include advancing livelihoods that are based on forests and wood, servicing forest owners and organisations within the forest sector, funding forest and nature management work, sharing information about Finland's forests and commercial forestry and supervising forest legislation. The Centres for Economic Development, Transport and the Environment, which are under the Regional State Administrative Agencies, are responsible for certain forest related matters, such as permissions and compensations as defined in the Water Act and the Environmental Protection Act⁴. Their tasks regarding the environment also cover the

¹ <https://www.luke.fi/en/news/forest-sector-continues-to-drive-the-bioeconomy-in-finland-fastest-growth-in-renewables-and-chemicals/>

² Further information: <https://mmm.fi/en/agencies-and-partners>

³ Further information: <https://www.metsakeskus.fi/tehtavat>

⁴ Further information: <https://www.avi.fi/en/web/avi-en/>

monitoring of the environmental status, environmental protection and nature protection.

Services within the forest sector can be divided into services relating to wood processing products, those relating to forestry, and other services relating to forests (Ministry of Agriculture and Forestry of Finland 2015b). Out of these, the services relating to wood-processing, such as administration, planning and education functions, are targeted in order to service the forest industry. However, according to the National Forest Strategy 2025 (Ministry of Agriculture and Forestry of Finland 2015b), services regarding commercial forestry are: *“various forest services targeted towards forest owners, which are linked with the planning of forest management or actual contracting services, including harvesting operations. Added to these are various advisory services and, for instance, inventory, regional planning, administration, research and training services for forestry”*.

The previously listed services directed towards forest owners are offered by private forest service and wood trade companies and forest management associations. Until the beginning of 2015, the supply of forest services was controlled by the forest management associations, which are funded and administered by forest owners. Until then, a statutory forest care payment (Law on changing the forest management association law 20.12.2013) obliged forest owners to pay a mandatory annual membership fee to a forest management association. The competition on the forest service market and the freedom of choice for forest owners increased along with the amendment of the Act (Pelkonen 2017). New forest services companies were born into the industry.

1.4 The objectives of this study

The purpose of the study is to depict the background, aims and implementation of the Metsään.fi-web services of the Finnish Forest Centre, as well as assess its needs for development and future prospects. Chapters 2–4 describe the background, objectives and users of the service.

The following chapters 5–6 present the implementation of the service. Chapters 7–8 analyse the user experience and future prospects. Finally, chapter 9 draws conclusions and makes recommendations.

2 The background and objectives of the service

This chapter describes the forest resource data collected and administered by the Finnish Forest Centre, its reliability and the development of the Metsään.fi-service.

2.1 Forest resource data collected and administered by the Finnish Forest Centre

Forest data or forest resource data refers to geographic data that describe forests, their management and utilisation. The Forest Centre collects forest data primarily from forests owned by private individuals or organisations.

The publishing of forest data is regulated by law (Law on changing the forest management association law 12.1.2018). Forest data is available for forest owners, and, with their permission, also for actors in the Metsään.fi-service. Since 2018, the service has also provided open forest data that does not include data connected to a particular forest owner.

Forest data can be utilised in, for example, the regional planning of forests and commercial forestry, to support the assessment of tree utilisation and generally for developing forest businesses. Regional aggregate data is open and does not include the kind of information that can be connected to a private individual, as that would require the consent and extradition decision according to the above mentioned forest data law. The data is published primarily by municipality.

The Forest Centre collects forest resource data by remote sensing. The gathering system is based on laser scanning, aerial photography and sample plot measurements. Earlier, the corresponding data was collected by visual approximation as area planning or on order by a forest owner as a forest plan.

Laser scanning effectively achieves accurate, three dimensional data concerning the structure of the land and tree stand. In addition, aerial photographs are utilised when, for example, recognising tree species. Laser scans are performed from an airplane at an altitude of roughly 2 kilometres and aerial photographs likewise from an altitude of 7–8 kilometres.

The areas that are inventoried by remote sensing are large, their forest area usually being between 150,000–200,000 hectares. In the 2010's the Forest Centre has inventoried 10–12 areas in different parts of the country each year, totalling 1.5 million hectares of private forests. Therefore, an inventorying cycle that covers all of Finland lasts for 10 years. The next cycle begins in 2020 and will be shortened to six years, which almost doubles the inventoried areas.

The inventory process based on remote sensing, with all of its steps from planning to publication, lasts for about 1.5 years. In addition, the forest resource data is being updated as a continuing process. Quality control assurance is done along the separate work phases in the office as well as in the field. During the spring and summer, laser scanning and aerial photography are performed in the areas and sample areas for tree stand interpretations are measured. During the autumn the materials required for the tree stand interpretation are prepared, and during the winter the statistical calculation models are created, of which the functionality and the quality of their results are confirmed by comparing them to data measured in the field.

Tree stand data is calculated for each raster square of the productive forest land. The raster squares are 16 m x 16 m sized areas that form the inventory area. Forest compartments are also formed based on laser scanning and aerial photography material. The tree stand data of

compartments are calculated as the sum and average data of the raster squares. In addition, the soil and growth place data is retrieved for the compartments from existing data, as they cannot be acquired from the present method for laser inventory. After this, the management recommendations are calculated according to the forest management recommendations. The forest resource data based on remote sensing is then published the following summer or autumn at the latest.

For part of the compartments, remote sensing or other existing data will not provide reliable enough data. These objects are primarily sapling stands that will receive data from the best available source. Previously the sapling stand data used to be complemented by a compartment specific field evaluation, but this is no longer possible due to a lack of resources. In today's work model the supervision of the forest laws, inspections and other possible field tasks have been combined. The aim is to time the field inventory of sapling stands to a point of time that is optimal for their development and the supervision of their renewal.

The reliability of forest resource data

The reliability of forest data and the factors that have an effect on the process for collecting and analysing data must be taken into consideration when utilising open forest data. These factors are described below.

The Finnish Forest Centre has moved from a compartment based field assessment to a remote sensing based inventory method in steps since 2010 (Finnish Forest Centre's...). The quality of the methods and materials and the accuracy of the forest resource data have since improved. This causes some regional variation in the quality of the data. Furthermore, the forest resource data will not cover the nation until 2020, which is also when the new national laser scanning and aerial photography program will start⁵.

Remote sensing usually defines the total tree stand of growth and regeneration-ready forests more accurately than compartment specific

⁵ Further information: <http://kmtk.paikkatietoalusta.fi/projektit-jatyopaketit/laser2020>

field evaluation. One factor is also the objectivity of remote sensing, that makes it more consistent in quality than a field assessment that's dependable on the person performing it. In remote sensing the accuracy goal for an individual compartment for the tree stands height is 2 m, the mean diameter 3 m, the bottom surface area $\pm 3 \text{ m}^2/\text{hectare}$ and the volume 20 per cent. The data for the total tree stand is the most accurate, and the main tree species is often correct. However, flaws may occur in the side tree species. Remote sensing does not provide usable in data for certain objects, such as smaller sapling stands. In this case the forest resource data is produced based on other sources (Finnish Forest Centre's...).

The collected forest resource data is updated annually with the help of growth models. According to Kangas et al. (2019) "The use of growth models added bias to the tree stand estimations, compared to up-to-date remote sensing inventory". In particular the longer roughly seven year inventory interval increased flaw and bias. Kangas et al (2019) sees that the inventory data based on laser scanning in five year intervals is the most accurate. Furthermore, the reliability of growth models in modelling different development classes varies: in particular the calculated updating, which is the calculation of annual growth based on growth models in sapling stands and young forests (Saari and Kangas 2005).

The Forest Centre also updates forest resource data with procedure data (including forest use declarations and notifications on implementation relating to forest management subsidy, Kemera, funded projects (Kemera is a Finnish forest management subsidy⁶), based on update requests from forest owners and the available forest planning data. The updates are not comprehensive, since information on every performed process does not reach the Finnish Forest Centre. The Forest Centre does not check the correctness of update data in the field. (Finnish Forest Centre's...) In the future the objective is to update the forest resource data with more

⁶ Further information: <https://www.metsakeskus.fi/kemera-tuet>

coverage than before with the help of harvester data from actors and in-house control data on forest management operations.

The felling recommendations for intermediate and regeneration fellings are calculated with stand characteristics, thinning models in forest management recommendations and limits that define regeneration-readiness. Therefore, the quality of the management recommendations depends on the accuracy of tree sample estimations. The quality criteria are that the estimations of the tree stand identifiers shall not cause wrong management recommendations or have a significant impact on the correct timing of a management operation. Correctly timed management is essential for sapling stands and, additionally, the quality aim is that the number of stems is within a 50 per cent accuracy. (Finnish Forest Centre's...)

2.2 The coverage of up-to-date forest resource data

The coverage of forest resource data on forestry land in privately owned forests in Finland was about eight per cent when the Metsään.fi-service was launched in November 2012. Up to the beginning of 2013, the coverage of forest resource data on forestry land in privately owned forests in Finland had risen to 20 per cent. The limited coverage at the time of the release is explained by the fact that the collection of laser scanning data had only just begun. In February 2014, the forest resource data in the service covered 55 per cent of forestry land in privately owned forests in Finland (see figure 1).

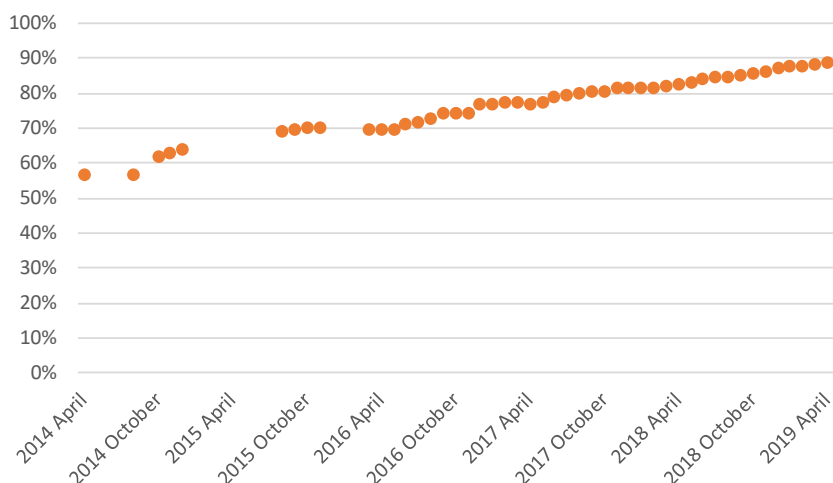


Figure 1 The coverage of forest resource data in the Metsään.fi-service, the percentage of forestry land in privately owned forests in Finland. April 2014–April 2019

In March 2015, the coverage of forest resource data on forestry land in privately owned forests in Finland was 65 per cent. The share then slowly increased so that in spring 2019 the data covered almost 90 per cent. On the other hand, in October 2015, those forest owners who had logged in to the service and who own land that is already included in the resource data represented 20 per cent of the privately owned forestry land in Finland. (See figure 2).

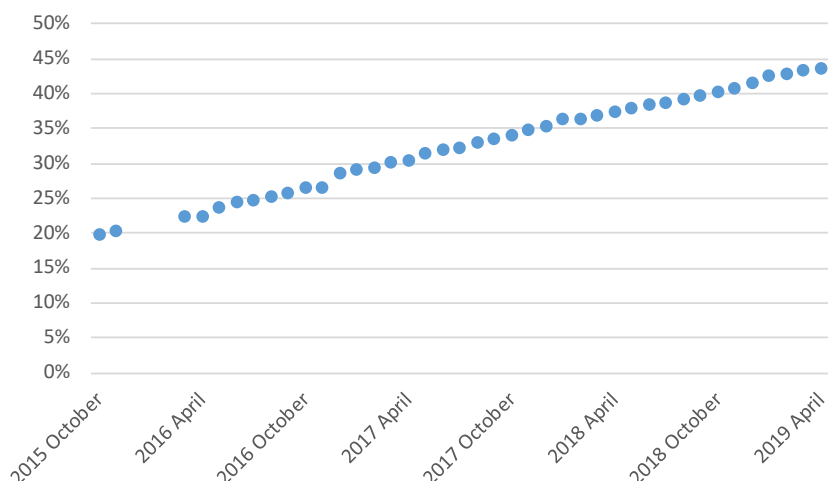


Figure 2 The share of forest area belonging to owners registered in the Metsään.fi-service, whose forest resource data is available, out of the forestry land in privately owned forests in Finland. October 2015–April 2019

The coverage of the forest resource data on forest areas belonging to owners that have logged in to the Metsään.fi had increased steadily to 43 per cent by April 2019. During the monitoring period the amount of forest resource data also decreased temporarily, which was due to the data expiring.

2.3 The background of developing the service and its objectives

This chapter describes the background and early development of the Metsään.fi-service and is mainly based on an interview with Veikko Iittainen, manager of forest ownership services at the Finnish Forest Centre, conducted in April 2019, and figures and notes on the development phases handed in by Kirsi Greis.

The decision to start developing the service was made as there was a clear need for a more efficient use of the forest resource data collected in connection with the Forest Centre's regional planning; back then, the

regional Forest Centres collected forest resource data from the forests of individual forest owners as part of the regional forest planning process, and it was seen that the data could be used more efficiently. It was discovered that the forest owners used the property specific forest plans produced from the data only to a very small extent. There was a need for a new kind of service or system for using and sharing forest resource data, so that forest owners could be activated more efficiently to take care of their forests. Furthermore, there was a need for a new service that would enable the forest resource data to be kept up-to-date, since the data did not update in any way in the old system.

In the beginning of the 21st century the property specific forest plans covered half of the privately owned forest's surface area (Ministry of Agriculture and Forestry of Finland 1999), which is just over seven million hectares (The Finnish Forest Research Institute 2000). The amount of state supported regional planning was reduced during the 1990's from 1.4 million hectares to 0.6 million per year (Ministry of Agriculture and Forestry of Finland 1999). The annual amount of planning and therefore the coverage of forest plans for privately owned forests has still declined in the 21st century (Ministry of Agriculture and Forestry of Finland 2008). The regional planning performed by the Forest Centre changed step by step from 2010 to forest resource data collection by remote sensing, and the property specific forest planning moved from the Forest Centre to completely commercial service providers (Finnish Forest Centre 2016). Forest planning has been considered to be an important tool for promoting forest politics; maintaining and increasing it has been regarded as important for a long time (Ministry of Agriculture and Forestry of Finland 1999, 2008).

The development of a new service began when the management at Pirkanmaa's Forest Centre asked Iittainen to plan how the collected forest resource data could be used better. The development of the service started off and progressed strongly as the Forest Centre's own development project during the first years, i.e. from the early conception of 2002 to roughly 2009, when the project moved on to the technical development of the system. During the early stages of planning there were

no similar services online, so there was no opportunity to gain experience from other actors. Between 2003–2005 the idea for a new system and services was worked in the Finnish Forest Centre's function groups, and in 2005 a decision was made to officially take the development work forward. Tapio (the Finnish forest industry development centre) defined the services content and outlines for implementation in co-operation with the Finnish Forest Centre. In the different phases of developing the service, the work was presented to interest groups central to the forest sector (around twenty organisations), and feedback was received from them from the perspective of future users. The development of the Metsään.fi-service is an example of bottom up development, where the solution for a practical problem grows to change the politics that guide the activities. Since then the development of the distribution of forest resource data and of the service has been included as a part of forest politic objectives and processes (Ministry of Agriculture and Forestry of Finland 2008).

Since the beginning, the main objective for the service has been to support active and conscious decision making among forest owners regarding the use of their forests. As other objectives the following were listed in 2010: to offer a platform for the data accessible for both forest owners and the actors in the forest sector, where you can leave contact requests regarding needs for forest management services and timber sales and to use online services, and to open the forest service market, and to improve the service as well as the profitability of forestry. The directors of the 13 Forest Centres approved of the objectives, as did the board of Tapio. The service has mainly been implemented in accordance with these objectives.

The Forest Centre's system for collecting forest resource data was changing around the same time as the planning of the service started, and, therefore, a decision was made to postpone the new service system so that it would go hand in hand with the new Aarni system for forest resource data. However, the implementation of Aarni was delayed by a few years, which also delayed the development of the Metsään.fi-service. In 2009, Affecto Oyj (today CGI Finland Ltd) was selected as the technical implementor through competitive tendering, and the actual technical

implementation started in 2010. However, this delay brought the advantage that different online services had developed quickly and they could be attached to the Metsään.fi-service. The department of consumer research at Helsinki University and Taloustutkimus conducted surveys on customer expectations. Feedback on the content and solutions was also collected from a panel consisting of 50 forest owners during the planning phase and technical implementation. Usability testing was also conducted in a laboratory before launching the service. The service was the first system of the Finnish Forest Centre to receive data from several different background systems, and the difficulty in building up the interfaces caused further delay.

2.4 The current state of developing the service

The service has been improved and extended continuously since the technical implementation began in 2010. During the early years, the development was implemented with a government grant allocated to the Finnish Forest Centre, i.e. with own development funding. In 2009, when it was officially decided that the service shall be developed, Tapio was granted separate financing by the Ministry of Agriculture and Forestry. During 2016–2019, the development has mainly been done in the Finnish Forest Centre’s project *“Metsätieto ja sähköiset palvelut”* (Forest data and digital services), that was a part of a key project of Prime Minister Sipilä’s government *“Puuta liikkeelle ja uusia tuotteita metsästä”* (“Wood on the move and new products from forests”), still funded by the Ministry of Agriculture and Forestry (Ministry of Agriculture and Forestry of Finland 2015a). The interest groups have been represented in the key project’s steering group and given feedback to support the development work. The funding used for developing the website has been specified by year in table 1.

Table 1. The annual funding used for developing the Metsään.fi-service from the beginning of development to April 2019

Year	Outsourcing services, million €	Own work, million €	Total, million €
2009–2014	4,7	3,6	8,3
2015	0,3	0,3	0,6
2016	1,2	0.4a	1,6
2017	1,0	0.5a	1,5
2018	0,7	0.3a	1,0
2019	0,3	0,2b	0,5
Total	8,2	5,3	13,5

^amainly key project funding

^bhalf from the key project, half as state aid

The Ministry of Agriculture and Forestry is following up the development of the service. Moreover, the work is continuously affected by results from new customer surveys and customer feedback. Areas that require improvement are prioritised based on this feedback. Several thesis and final projects in universities and polytechnics have been made about the service, and information for developing the service has been extracted from them.

The improvement in the interfaces has made it possible to share and use geographic information produced by other public organisations through Metsään.fi. After releasing the service, data describing nature values has been introduced alongside data regarding wood production. In addition, the electronic services, which the Forest Centre offers to forest owners as a part of its official duties, have taken environmental matters into account by, among other things, making it possible to initiate a protection review online. The Metsään.fi-website is being developed further towards a next generation system.

The Metsään.fi-website has also been developed through the DataBio project, which is implemented with the Horizon2020 funding by the EU. The aim of the DataBio project is to build a platform for utilising big data in the bioeconomy. The platform is intended to increase the volume,

productivity and competitiveness of the European bioeconomy. The ambition is to verify accomplished benefits in pilot tests in Finland, Belgium, the Czech Republic and Spain. In the project, Finland is represented by the Forest Centre, among others. As far as the Finnish Forest Centre is concerned, the objective for the DataBio project is to improve the use of forest resource data and of the Metsään.fi-service. New ideas for the development of the forest resource data are collected from other involved sectors. Out of these ideas, the most suitable have been picked for the forest pilot in the DataBio project. Ideas produced in the DataBio project can also be used in the development of the Metsään.fi-website in the future.

3 The release of the service and the development in the number of users

This chapter depicting the use, reception and development in the number of users of the Metsään.fi-service is based on an interview with Veikko Iittainen, manager of forest ownership services at the Finnish Forest Centre, conducted in April 2019, and email correspondence with Kirsi Greis, expert on data services for forest owners at the Finnish Forest Centre, in June–July 2019. The statistics presented in the chapters are based on statistics maintained by the Finnish Forest Centre.

The release of the Metsään.fi-service

The Forest Centre released the Metsään.fi-service for forest owners subject to charge at the November 2012 “Metsäpäivät” (Forest Days) event held at the Helsinki Exhibition Centre. The service for corporate users was released in autumn 2013. The service was presented to the

actors during the evening of the opening day and the forest owners could familiarise themselves with the service the following day at the Finnish Forest Centre's exhibition booth. Information about the service release and the presentation events was published through the Finnish Forest Centre's own channels. Moreover, a press release was sent. The forest owners were reached the best through announcements that the Finnish Forest Centre sent out by mail and email. After the release the service was featured in company magazines. Company magazines were also an effective communication channel, since, according to the Finnish Forest Centre, there were clear peaks in the number of visitors in the services when a magazine had been published.

The Metsään.fi-service also received attention internationally, even though the release was only communicated domestically. Introducing the service has been a part of the program for countless foreign visitor groups, and it has been presented in several different countries through the years.

The release and information of the Metsään.fi-service went as well as expected, although at the time of release the amount of forest resource data included in it was lower than expected. During release there was data available for only eight per cent of the forest land area. Beforehand the goal was 50 per cent at the time of release. Not reaching the goal is explained by the fact that the service had to be published earlier than planned, after information about the service had gone public. The Metsään.fi-service became completely free of charge in 2017.

Marketing the service

Data from those forest owner's whose forest resource data's percentual share of the entire surface area exceeded a set minimum threshold was used in the marketing of the service since the beginning. During the first years, a monthly mail or email was sent to those forest owners whose forest resource data had just been completed. Several forest owners heard about the service this way. Later on, the marketing was no longer targeted towards those who had new data available, but the Forest Centre continued to send Metsään.fi-announcements. The announcements first included a map on felling and forestry management recommendations. In

2017, the comprehensive remote sensing of sampling was dropped, after which the map was only sent about felling. The letter included a recommendation to search for further information from the Metsään.fi-service in addition to the map.

During the subject to charge period a forest owner could try the service for seven days during their first login, after which the service cost 60 euros a year (Haapoja 2014). Later there were three types of paid products: a one year product, a joint owners one year product and a three year product. The cost for the three year product was 120 euros (Pöllänen 2014). The free trial could only be used once. This was problematic for those users that would later have been willing to join the service but had already used their trial. This was the reason why the practise with trial periods stopped. Out of the reasons for choosing the trial period, the most popular were that the users wished to see the forest resource data on their own properties and to familiarise themselves with the service.

The development of the number of forest owners using the service

The Forest Centre has collected data on the number of Metsään.fi-service users by following the total amount of forest owners that have logged into their own data and monthly and annually inspecting the number of both users that log into the service for the first time and that have already logged into the service earlier. This monitoring is based on the data attached to the Finnish Forest Centre's custom data system. In addition, the number of individual logins to the service is monitored monthly through Google Analytics. This monitoring began regularly and comprehensively from the beginning of 2015.

During August 2015, the amount of forest owner users monitored from the customer data system were collected directly as database surveys, which meant a larger data content could be taken into the monthly monitoring and data from other databases could also be attached to it (for example, the woodland surface area and ready forest resource data of those who logged into the service).

A month after the release of the Metsään.fi-service, 500 forest owners had logged into the service and to their own forest property data, and three months later the amount of logged in users had tripled in number. Within a year of launching the service, 12,000 forest owners had logged in and two years later the number had risen to 24,000 (see figure 3).

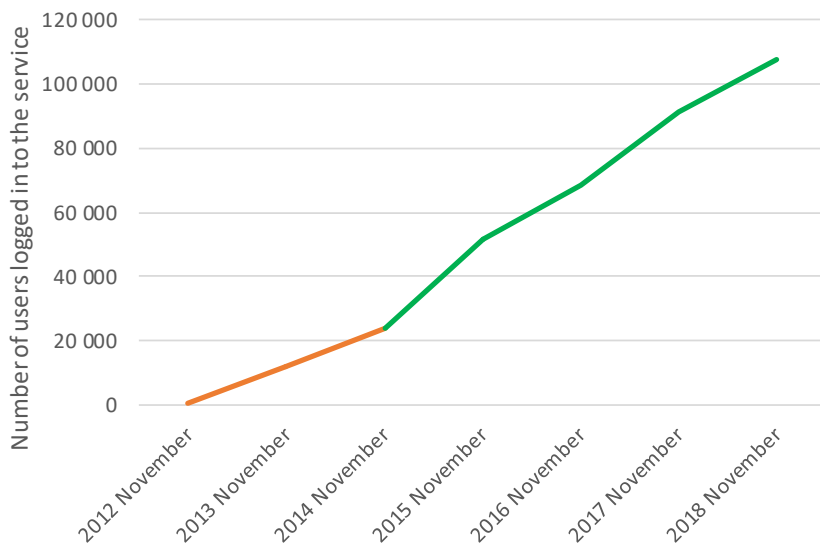


Figure 3 The number of users that logged into the Metsään.fi-service November 2012–November 2018. The orange line depicts the time subject to charge and the green line the time free of charge.

Once the service had become free of charge for forest owners in March 2015, there were 35,000 registered users. After this the number of users that logged into the service began to increase steeper than before. Over the following three years the number of users grew steadily, and in November 2018 there were 107,510 registered users.

The calculation of login events began in August 2015. Almost 153,000 login events were counted that year (see figure 4).

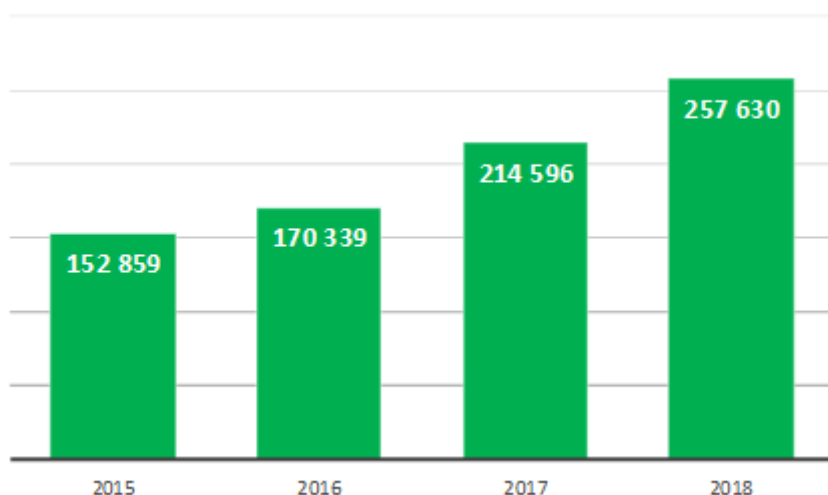


Figure 4 The number of forest owner logins. 2015—2018

There was some growth in 2016, but it accelerated especially in 2017 and 2018 when the number of logins grew by 45,000 both years. The quarter of a million login limit was breached in 2018.

The number of logins varies from season to season (see figure 5).

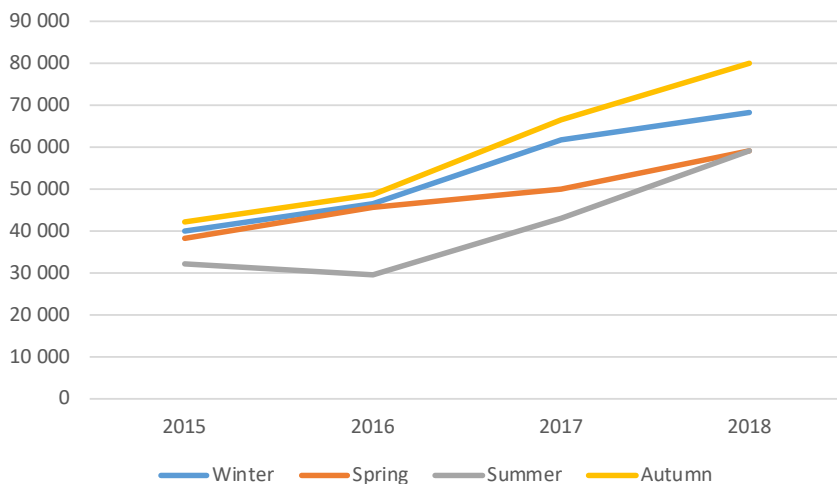


Figure 5 The change in the number of forest owner logins depending on the season. 2015—2018

The forest owners mostly logged into the service during the autumn and winter, and the least during spring and summer.

The development of the granted consents and access rights, based on membership for corporate users

Since November 2013, the forest owners could provide consent with a separate form for different forest sector corporate actors to browse data concerning their property (Haapoja 2014). This consent (see chapter 5.1) enabled the browsing of a forest owner's forest resource data and/or moving it to the corporate user's own forest resource data control system. After the change in the Act on the forest information system of the Finnish Forest Centre, from spring 2018 onwards, the corporate users have been able to deliver information about their customers and members to the Forest Centre. The Forest Centre has then processed the data request and reached a decision. After the decision, the Forest Centre has changed the settings for the corporate user in the customer relation management system, enabling the corporate user to use a forest owner's data in the Metsään.fi-service and transfer it into their own systems.

The Forest Centre began to compile statistics on the consents admitted by forest owners to corporate users in May 2016, when the consents were taken into the customer data system. The statistics covered both the number of consents and the forestry land area covered by them.

Every consent given for different corporate users are compiled into the statistics, even if the consent has been given to the same forest property. For example, when a forest owner gives 10 consents for their property to three different corporate users, the number of consents given is 30. The number of consents was almost 261,000 by May 2016 (see figure 6).

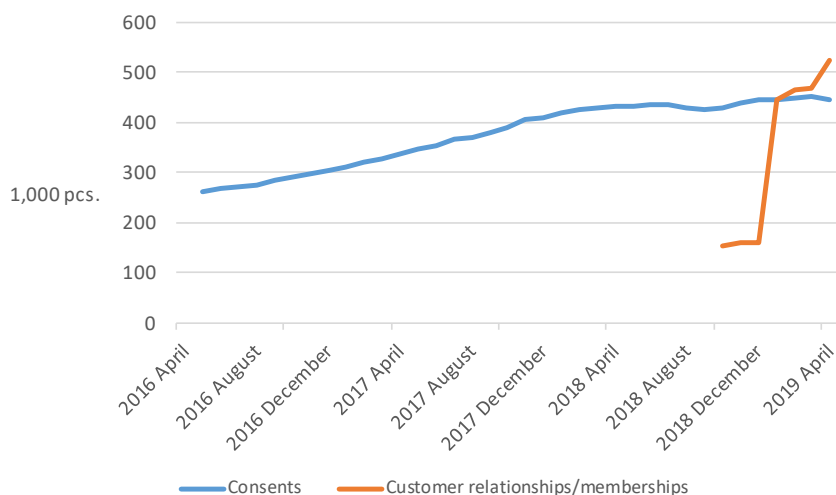


Figure 6 The number of consents given by forest owners and the access rights based on a customer relationship or membership. April 2016–April 2019

The number of consents grew steadily all the way to the summer of 2018, when a momentary decline occurred. After the momentary decline the number has varied between 430,000 and 450,000. The orange line in the figure shows the number of access rights to property specific forest data granted by the Forest Centre on the basis of a data request in connection with a customer relation or membership. This was compiled into statistics when the changes came into effect on 1.3.2018, after which the data delivered by corporate users with a slight delay was saved into the Finnish Forest Centre’s customer data system. During the months that followed, the number of access rights applied for by corporate users on the basis of a client relation or membership rose quickly and exceeded the number of consents granted by the forest owners themselves.

The extent of the data which is available for the corporate users is a better indicator of the area of the forest properties that are included in the data than the amount of access rights granted on the basis of a client relation or a membership. The surface area of the forestry land is based on the Finnish Forest Centre’s Metsämaski (“Metsämaski” is a map that shows

forestry land as geometrical data) data product⁷. The area of the forestry land in Metsämaski is based on property border data from the National Land Survey of Finland. Objects that are not considered to be forestry land have been removed from the material. For the purpose of this study, overlapping ownership in connection with co-owned forest properties, as well as overlapping consents that have been granted by corporate users based on a client relation or a membership, and consents given by the forest owners themselves have been removed from the total area in Metsämaski. At the time of the study, the area of the forestry land according to Metsämaski in private forests was 14.1 million hectares.

By May 2016 the combined forestry land of the forest properties under consent was almost 2.4 million hectares and corresponded to 17 per cent of the forestry land of Finland's privately owned forests (see figure 7)

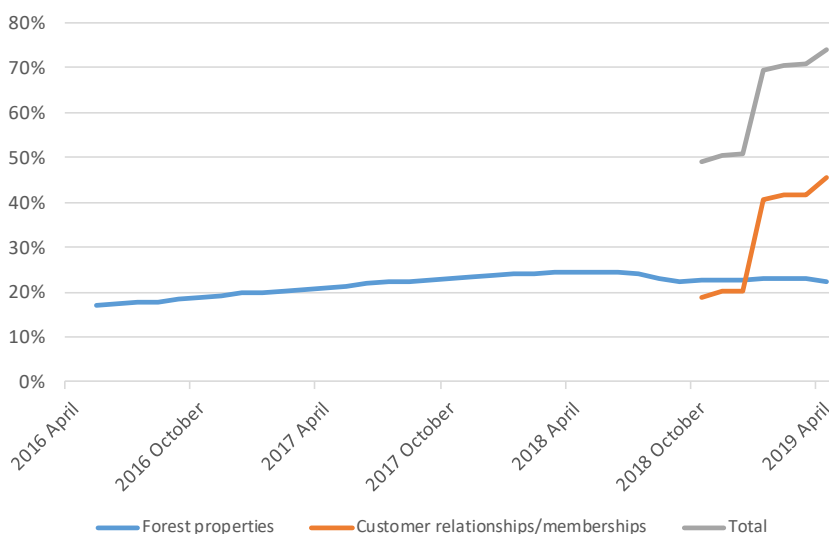


Figure 7 The share of forest properties, to which data the forest owners have granted their consent or the corporate users have access to based on a customer relationship or membership, out of the forestry land in privately owned forests in Finland. April 2016–April 2019

The combined forestry land area of the forest properties under consent reached a peak in March 2018, when it amounted to 3.5 million hectares,

⁷ Further information: <https://www.metsakeskus.fi/metsamaski>

which corresponded to 24 per cent of the area of forestry land in privately owned forests in Finland. During the summer of the same year, the forestry area shrunk a little, and has then varied between 22–23 per cent (3.1–3.2 million hectares) of the area of forestry land in Finland's private forests. The orange line in figure 6 shows how the total area of forestry land, the date of which the corporate users have access to based either on a customer relationship or by a membership, has developed over the years. This type of access has been granted by the Finnish Forest Centre. The combined forestry land area was at a peak 6.4 million hectares in March 2019, which corresponded to 45 per cent of the area of forestry land in privately owned forests in Finland. The grey line in figure 6 shows the total area of forestry land, the data of which the corporate users have access to based either on the forest owner's consent or on a customer relationship or membership. Overlapping areas have been removed.

The corporate users experiences of the service's implementation

At the beginning the corporate users experienced the Metsään.fi-service to be slow and clumsy, but use of the application became easier once the corporate users learned how to use it. In hindsight, the Finnish Forest Centre concluded that there was clearly more need for guidance. This would have made it faster to adopt the service. Furthermore, in the beginning the small quantity and low quality of forest resource data also impeded the corporate users service. Therefore, use of the service did not free the forest service providers and timber purchasers from field work, so the old methods were still in the main role for acquiring customers. However, the Metsään.fi-service provided added value, since the corporate users saw that even poor data is useful as it offers approximate information.

All in all, the implementation in companies required linking it to their own processes and from this it followed that the service's implementation was slower than expected. There was also some resistance within the Finnish Forest Centre, especially towards the marketing of the service that the white collar employees are required to carry out, since the service's marketing calls and presentations was not work that was gratefully

accepted by everyone. The equation of the Metsään.fi-service's forest resource data with the forest plan contributed to the background of the resistance. Metsään.fi was seen as a competitor and not as a platform that can be utilised in your own processes and build your own services on top of it.

4 The characteristics of forest owners that use the service

In this chapter the characteristics of forest owners that use the service, such as age, sex, surface-area, place of residence, education and occupation are presented. Moreover, their characteristics are compared to all Finnish forest owners. Finally, this chapter inspects the service's customer satisfaction in the light of NPS surveys, the usage activity of the service and factors that contribute to it and the objectives of forest owners that use the service.

4.1 The differences between the services users and all Finnish forest owners.

The differences between the services users and forest owners are inspected based on observations from the register data picked from the Finnish Forest Centre's customer registry and a survey conducted by Pellervo Economic Research PTT. Furthermore, the 2018 key figures of forest owner users based on figures from the Finnish Forest Centre are studied in this chapter.

The materials used in the comparison

The comparison between the background characteristics of the users of the Metsään.fi-service and, more commonly, Finnish forest owners are based primarily on material picked from the Finnish Forest Centre's customer registry. The register material was compiled out of the data of 385,269 forest owners, and it covered all Finnish forest owners that owned at least two hectares of forest land, either alone or together with another individual (for example, a spouse or sibling). Therefore, the material does not include individuals who own forests just in undistributed estates or jointly owned forests. There was data on the background of forest owners in the registry (age, sex, place of residence) and data on the forests they own (the surface area, number of forest properties and duration of ownership).

The survey material was collected in early autumn 2016 as an online survey. The research was carried out by Pellervo Economic Research PTT and was ordered by the Finnish Forest Centre. The observations presented from this material are based on the research of Pynnönen et al. (2019), where the Metsään.fi-service's users, their experiences of the service and reasons that contributed to the service's implementation were studied. A link to the survey was sent by email between 1.3.2015 and the beginning of August 2016, which is when the service was free of charge, to all Metsään.fi users that had logged into the service and provided their email address. It was also checked in the sampling that the individual still owns their forest and that the forest has not moved to a undistributed estate. The Finnish Forest Centre picked the email addresses from their customer registry. The survey was sent to 35,139 recipients, of which 5,742 service users responded. Therefore, the survey's response rate was 16 per cent. Some of the respondents had not used the service at all after their first login, and their answers (574 respondents) were removed from the material.

The survey consisted of multiple-choice questions, statements on the Likert scale and open ended questions. The questions concerned ways in which to use the service and views on the usefulness and usability of the

service's different functions. The respondents were also asked about their background characteristics (age, sex, place of residence, employment status and education) and about their forest ownership (the total surface area of the properties, the duration of ownership, the method of ownership). The respondents described in their own words in the open ended questions what they thought was particularly good in the service and what needed improvements. The responses to this survey are also the basis in chapter 7.2 the benefit experienced by the users and in chapter 8.1 the user's needs and development suggestions.

4.1 Comparing the users to all Finnish forest owners.

The Metsään.fi-service's users (that had provided their email address) differed from Finnish forest owners by age. Out of the 71–90 year olds, only 11 per cent had logged into the service, while their share in the registry data was 27 per cent (see table 2).

Table 2. The background characteristics of the respondents, survey sample and registry data

Variable	Respondents, %	Survey sample, %	Registry data, %
Age group			
71–90yr	18	11	27
61–70yr	35	29	27
51–60yr	26	29	22
41–50yr	15	18	14
23–40yr	7	13	11
N-number	4 064	23 780	356 882
Sex			
Woman	17	20	39
Man	83	81	61
N-number	4 607	28 387	385 269
The combined area of forest properties			
2–5 hectares	3	3	22
6–10 ha	6	5	14
11–20 ha	12	11	16
21–35 ha	17	15	14
36–50 ha	13	12	9
51–100 ha	23	24	14
101–200 ha	17	19	8
Over 200 hectares	10	11	3
N-number	4 582	2 822	350 366
Place of residence			
Over 150,000 inhabitants	11	10	10
50,000–150,000 inhabitants	23	22	20
15 000–50 000 inhabitants	23	22	24
5,000–15,000 inhabitants	28	29	28
Under 5,000 inhabitants	14	16	15
Abroad (includes The Åland Isles)	0	0	2
N-number	4 607	28 386	385 149
Location of forest properties			
In the municipality of residence	25	28	28
Not in the municipality of residence	45	39	37
In the municipality of residence and elsewhere	30	34	35
N-number	4 607	28 387	385 269
Education			
No vocational qualification	7		
Vocational qualification or similar	31		
Bachelor's degree or similar	36		
Master's degree or similar	24		
Doctorate	0		
Other	2		
N-number	4 980		
Occupation			
Employee	35		
Farmer or forestry entrepreneur	13		
Other independent entrepreneur	7		
Pensioner	40		
Student	2		
Unemployed	3		
Other	0		
N-number	5 079		

In the younger age group, there were more forest owners logged into the service than their relative share. In the survey's sampling the younger age groups were emphasised due to the required email address, that particularly cut off older users from the sampling. The most active respondents to the actual survey were those between 61–70 years of age, with their age group being overly represented in the survey responses. Those under the age of 40 replied the least to the survey. Their share of the respondents was seven per cent, while their share of the sampling was 13 per cent and in the registry data 11 per cent. The share of women out of those logged into the service (20 per cent) and especially those who responded to the survey (17 per cent) were clearly lower than the average share of women out of forest owners (39 per cent). A part of this difference is explained by the fact that the women's share is the highest in the oldest age group, whilst those that belong to it were not typically active users of the Metsään.fi-service.

When inspecting by place of residency, the sampling and respondents represented the forest owners rather well. The most common place of residency for those logged into the service and of forest owners was a municipality of between 5,000–15,000 inhabitants. The service was used a bit more often (32 per cent) by those living in larger cities (50–150,000 and over 150,000 inhabitants) than their share of forest owners was (30 per cent). A similar difference was also observable in the location of forest owner's properties: the service was used by 39 per cent of those forest owners whose forests were located in a different place than their place of residency. 45 per cent of them responded to the survey when their share of all forest owners was 37 per cent.

Clearly more owners of larger forest property entities had logged into the service and responded to the survey. Out of those who own 2–5 hectares only three per cent had logged into the service, while their share of forest owners was 22 per cent. The difference was also similar to those who own 6–10 hectares: in the service their share was five per cent while out of the forest owners they were 14 per cent. The share of those that own over a hundred hectares was in total 11 per cent of all forest owners and it was 30 per cent out of those logged into the service.

Compared to Hänninen et al. (2011) there were more salary earners that responded to the survey (35 per cent vs. 20 per cent) and fewer land or forest industry entrepreneurs (13 per cent vs. 16 per cent) and fewer pensioners (40 per cent vs. 45 per cent). This is coherent in the relation to the age group deviation of the respondents. More than half (60 per cent) of the survey respondents had at least a Bachelor's degree or similar.

The service's forest owner user's 2018 key figures

In 2018 the average age of the Metsään.fi-service's users was 56 years and half of them owned their forest property alone. 45 per cent of the service's users only owned forest in their municipality of residence, while on the other hand, 38 per cent only owned elsewhere than in their municipality of residence. The average surface area of forest properties owned by the service's users was 64 hectares. The forest owner users were distributed evenly across Finland. In the absolute number of users, the largest cities were those where most forest owners were living: Helsinki, Oulu, Kuopio, Rovaniemi and Espoo.

Based on the key figures of 2017, those under the age of 45 used the service more often than the other age groups. In 2017, their share out of all forest owners were 11 per cent and out of the Metsään.fi-service's users 20 per cent. Therefore, they had a higher than average chance of using the service. In the older age groups the differences were quite small, except for those over the age of 75. The share of those between 45—54 years of age out of all forest owners was 19 per cent and out of the Metsään.fi-service's users 22 per cent. For those between 55—64 years of age the corresponding numbers were 32 and 39 per cent, and similarly for those between 65—74 years of age 24 and 24 per cent. Whereas those over 75 years of age had a lower than average chance of using the service. Out of these five per cent had used the service while the age group's share of all forest owners was 14 per cent.

4.2 NPS surveys

The Forest Centre has followed the customer satisfaction of the Metsään.fi-service through repeating customer satisfaction surveys. The Net Promoter Score⁸, which is a question determining the NPS index, has also been a part of the surveys since 2016. NPS is internationally in use to measure customer experience by asking customers their willingness to recommend the service to others. The answer is given on a scale of one to ten. The score is calculated by subtracting the relative share of critics (grades 0–6) from the relative share of recommenders (grades 9 and 10). Hence the NPS can vary between -100 and 100. The NPS of the Metsään.fi-service has been surveyed separately by forest owners and corporate users.

The NPS of forest owners has risen by 10 units from 35 to 45 between 2016—2018 (see figure 8).

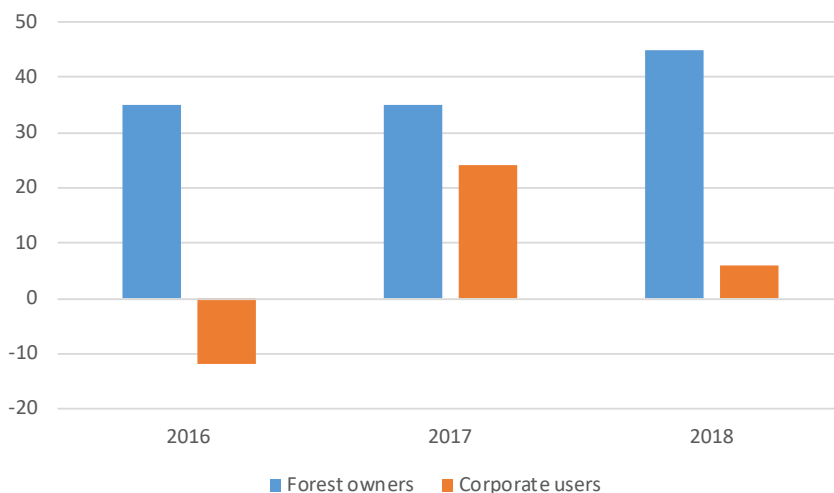


Figure 8 The development of the Metsään.fi-service's NPS 2016—2018

This indicates an increase in customer satisfaction among forest owners. The satisfaction of corporate users has been lower and more varying during the same time period. For example, in 2018 the score based on the corporate user's answers was six. When comparing the score between two

⁸ Further information: https://en.wikipedia.org/wiki/Net_Promoter

different user groups, the difference in group size must be noted: there were 1 590 forest owners that replied to the NPS question in 2018 and similarly 170 corporate users.

4.3 Active users

The factors that impact the activity of forest owners as users of the Metsään.fi-service have been inspected based on material presented earlier in chapter 4.1.

The forest owner's activity was defined by Pyynnönen's et al. (2019) research with six survey statements (see table 3).

Table 3. The questions and statements used in creating the activity meter

Question or statement	Value	Point of activity
How often do you use the Metsään.fi-service?	Weekly/ monthly	1
Have you utilised, for example, your electronic forest resource data available in the Metsään.fi in the planning of your forest management or timber sales?	Yes	1
Based on the management and felling recommendations, I plan when and how the proposed procedures for different compartments will be carried out	selected	1
I leave an electronic forest use notification	selected	1
I inspect the nature sites on my property	selected	1
I fill an electronic forest management subsidy application for early tending of seedling stands or management of young stands	selected	1
Total		6

The survey statements answers were turned into activity points that varied from zero to six. You gained the lowest activity points if you used the Metsään.fi-service less than monthly or had not used the service for acquiring information, for example, to do a forest use declaration. You gained the highest six points if you used the service at least on a monthly

basis and used the service for the forest related operations mentioned in chart 3.

The distribution of the activity points by activity level are presented in chart 4. The majority of respondents gained two activity points (1,580 respondents and 31 per cent) and three points (1,212 respondents and 24 per cent). 10 per cent of the respondents belong to the least active class with zero activity points. In models, where the respondent's activity was explained with background variables, the active forest owners were classified as those who have three activity points or more. There were 39 per cent of these respondents in the survey data (see table 4).

Table 4. The amount and portion of respondents by level of activity

Level of activity	Amount of respondents	Share of respondents, %
0	524	10
1	1 031	20
2	1 580	31
3	1 212	23
4	654	13
5	160	3
6	9	0
Total	5170	100

The forest owners' activity as users of the Metsään.fi-service was inspected through statistical models. Common background factors were attempted to be found with the models that explain belonging to the most active Metsään.fi-services user group. Such factors were selected as explaining variables that were assumed based on previous research to affect either the forest owner's forest management activity, or commonly the activity in using online services.

The forest owner's activity as users of the Metsään.fi-service was increased by a large forest area, that the owner was a man, that the forest owner's objectives were focused on timber production or on multiple objectives, experiencing the operation recommendations to align with their own objectives and a high level of education. Against expectations,

the model did not show that age affected a forest owner's activity in using the online service. Therefore, the factors affecting activity were inspected separately for different age groups.

There were clear differences observed in the analysis in the factors that affect the forest owner's activity in those over and under 60 years of age. The forest area, multiple objectives for the ownership and the process recommendations aligning with the forest owner's own objectives increased activity in both age groups. The objectives focusing on economy and timber production also increased activity in those under 60 years of age. The timber productional objectives did not increase activity in the use of the Metsään.fi-service in those over the age of 60. On the other hand, activity was increased by a high level of education and by the respondent being a farmer or a forestry entrepreneur.

The most significant factor in increasing activity was that the forest owner experienced the forest management and fellings recommendations to align with their own objectives. Remote forest owning had no impact on the activity of use, even though the online services are assumed to make it easier to run forest errands particularly for those forest owners who live far from their forest property.

4.4 The forest owner's objectives

The forest owners that use the Metsään.fi-service have, since the end of 2017, received a survey inquiring their objectives in forest ownership when they log into the service for the first time. The forest owners are asked in the service to inform on a scale of 0–5 how important objectives are timber production, nature's diversity, gathering non-timber products (for example berries and mushrooms), hunting, scenery, and recreation.

In spring 2019, Pellervo Economic Research PTT analysed the objective survey's responses commissioned by the Finnish Forest Centre⁹. A

⁹ More about the research: <https://www.metsakeskus.fi/tiedotteet/tutkimus-metsanomistajien-arvot-ovat-moninaisia>

statistical method was used in the research, which was used to divide the respondents into objective groups that depict their forest ownership.

Almost 21,900 forest owners responded to the survey, which is 49 per cent of the recipients. Based on the results the respondents could be classified into four groups: forest owners with multiple objectives (33 per cent of respondents), with multiple objectives that emphasise hunting (33 per cent), those that emphasise timber production (23 per cent) and those that are unaware of or have other objectives (11 per cent).

According to the results, timber production was an important or very important objective for 87 per cent of the forest owners that replied to the Metsään.fi-service's objective survey. A large part of forest owners regard nature values, recreation and scenery to be important. These values were particularly important for multi-objective forest owners, which were 66 per cent of the respondents in total (33 per cent of owners with multiple objects that did not value hunting and 33 per cent of the same owners regarded hunting to be important). All in all, a third of the respondents valued the hunting made possible by forest ownership and just under a quarter set only timber productional objectives for their forest ownership. About a tenth of the respondents were unsure of their own objectives or set other objectives to their forest ownership than offered in the survey.

Based on the results of the research, it is possible to identify the most important objectives that the users of the Metsään.fi-service set for their forest ownership and to develop the functions included in the service with these in mind. Additionally, the results can be utilised in targeting the Finnish Forest Centre's customer work.

5 The Metsään.fi-website

This chapter is about the contents of Metsään.fi and what kind of services it offers for logged in forest owner users and actors.

The Metsään.fi-website is a service portal for forest owners and actors within the forest sector, which includes the Metsään.fi-service for forest owners, the Metsään.fi-service for forest industry actors and the services for open forest resource data (see figure 9).

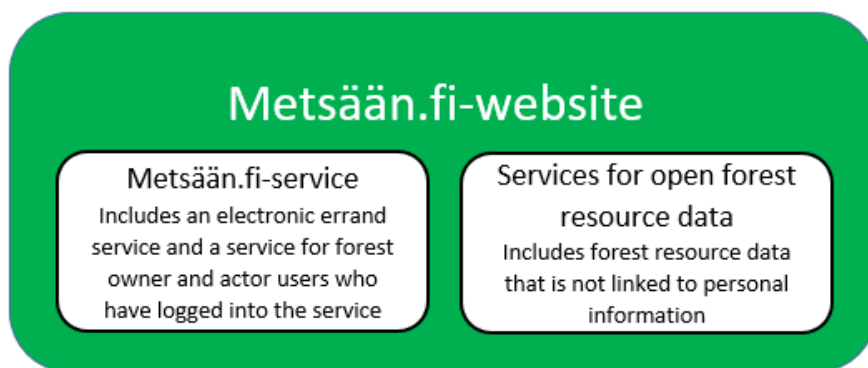


Figure 9 The structure of the Metsään.fi-website

Forest resource data collected from Finland's private forests are utilised for forest owners and actors in the Metsään.fi-service. The service is produced by the Finnish Forest Centre. The website's Metsään.fi-service is produced as similar versions in both Finnish and Swedish. The service's name is MinSkog.fi in Swedish.

The starting point of the Metsään.fi-service has been to offer an online service that advances the utilisation of forest resource data forest owners and forest sector actors. The Metsään.fi-service also includes a Forest Centre interface for Forest Centre employees. The employees can read a forest owners data through the same view with the Metsään.fi-service.

The strategic objectives in the background of the Metsään.fi-service were the following according to the online service concept created in the Finnish Forest Centre 2010:

- to improve the possibility to run errands with the authorities online
- to make the utilisation of forest resource data that has been collected with public funds more efficient
- to advance the implementation of forest political objectives

- to implement the Forest Centre's role as a bridge builder between forest owners and forest sector actors.

5.1 The service for registered forest owners

The control of my data

The use of the forest owner service of the Metsään.fi-service requires strong identification by the forest owner with either online bank codes, a mobile certificate or a chipped identification card. A forest owner can view and administer their own data once they have logged into the Metsään.fi service. All the property information is in the forest owners "personal data" section (the property's name, identification number and total surface area) and the forest owner's contact information. The property benefits come to the service from the property data system (KTJ) maintained by the National Land Survey of Finland. The data from there updates into the Metsään.fi-service once a day, during the night. You can inform about any mistake in the property data in the Metsään.fi-service. The forest properties can be seen in the service as a catalogue by owner, according to the land register.

The forest owner can view their contact information in the contact information section (name, address, phone number and email address). They are sent from the Population Register Centre's population data system (VJT) to the Metsään.fi-service once a week. Forest owners can update their phone number and email address in the Metsään.fi-service. They can also decide if their contact information can be handed over for direct marketing. The contact information saved in the Metsään.fi-service is also simultaneously updated to the Finnish Forest Centre's customer data system. The official ownership data is sent to the Metsään.fi-service at regular intervals from the property data system of the National land survey of Finland. A forest owner can log their own objectives, write notes for a tax declaration and log other personal notes in the personal data section.

Forest owners can give chosen actors in the forest sector their consent to browse or transfer data about their forest properties. The actors can then see the data in their own Metsään.fi-service, e.g. the property registry number, forest resource data and the environment/nature data. This way it is easy for them to discuss forestry matters and to plan work together with the actors anywhere. A forest owner can provide consent to browse or move their data to those properties that they own alone or together with others.

When a forest owner has granted an actor the permission to browse, the actor sees the data in the service and can perform searches particularly based on the forest resource data. An actor can run authoritative errands for the forest owner online (forest use declaration, Kemera-errands), if the forest owner has provided a letter of authorisation for errand running in addition to the permission to browse. With the moving permission the actor can also move data to their organisation's database.

Consents can also be modified or withdrawn. A forest sector actor can also see a forest owner's forest resource data, based on a customer relation or membership. A forest owner cannot modify the rights for using the data in a service like this. When a forest owner decides to end a customer or membership with an actor, the actor must automatically inform the Finnish Forest Centre who will then remove the access rights for the actor.

Data on own forests and management recommendations

A forest owner can see the data on their own forests, their need for management operations and the natural sites in the Metsään.fi-service. The service's data is based on the forest resource data collected and maintained by remote sensing by the Finnish Forest Centre (see chapter 2.1). A forest owner can see the management and felling recommendations (see chapter 2.1) for the next five years. The service displays compartment specific recommendations for management and felling work and recommendations on their implementation year for the next five years. However, a field inspection is always recommended for forest resource data and management recommendations before beginning work.

The Forest Centre adds the annually calculated growth to the tree stand data (see chapter 2.1). The management and felling recommendations also update at that time. A forest owner can also ensure that their data updates by notifying the performed management and felling work by filling a form in the service or by agreeing that the service provider notifies them. The Forest Centre also updates data based on forest use declaration and applications for funding. If a forest management plan has been made for the property, its data can be moved into the service if the forest owner wants to and by agreeing about moving it with the actor who made the forest plan. The Forest Centre collects new forest data from different areas every year. By logging into the service, a forest owner sees which year their property's forest resource data is from.

The forest owner sees different nature attractions in the service, that must be noted in decision making regarding the use of the forest. For example, statutory nature attractions can limit the use of your own forest. The service also shows the notable nature attractions that can cause obligations for the forest use. The service also shows natural sites that comply with the recommendations, such as other habitats of special importance and sites that are potential objects for the METSO-programme¹⁰.

Map materials

The Metsään.fi-service collects different forest, nature and environmental data from public administration organisations into a common map view. A forest owner that has logged into the service can see data on their forest property on different map levels. They can choose a field map, aerial photo or a false-colour aerial photo as a background. The recommended management and felling works are shown on the compartments of the property. The compartment also shows nature objects that comply with the forest law and recommendations and are known by the Finnish Forest Centre. In addition to these, they can see if the property is a part of a ground water, Natura 2000, environmental protection or environmental

¹⁰ Further information: <https://www.metsonpolku.fi/fi-FI>

protection project area or if there are known ground water points, relics, flying squirrel nesting sites, falcon nests or other endangered species.

A forest owner can inspect the public authoritative errand history of the area. The forest owner can see the created forest use declarations in the authoritative errand section, that is available in electronic format. The user can choose to separately see the funding applications and notifications of implementation associated with Kemera-errands or – out of the inspection objects – the Kemera-projects and inspections in connection with forest use declarations.

In addition to these a forest owner can inspect other map levels: the need for early treatment, the master plan situation, scenery areas, game forest data, harvestable objectives, recent storm or insect damaged objects, surface water flow models or availability data for forest resource data. On the other hand, the grid cell maps show the average volume and development class of the tree stand. The maps are produced to the service by the Forest Centre, excluding the master plan and scenery area maps that are produced by the Finnish environment institute (Syke).

Compartment lists

A forest owner can see their forest property's data in the compartment list, in addition to map materials. The compartment list includes data on all of the property's compartments. The compartment list can be inspected via a browser or be downloaded onto your own computer as a data package that opens as an Excel sheet. There are three kinds of compartment lists: Basic compartment list, extended compartment list and the list that has the forest resource data according to the forest data standard. The basic compartment list includes the most important soil and tree stand data, forest management recommendations and nature objects. The extended compartment list includes more detailed data on the compartments for professional use. The compartment list can be transferred as a XML file package from one forest resource data system to another and also to your own computer (more about the forest data standard in chapter 5.2).

Doing business online

A forest owner can use online services through one channel in the Metsään.fi-service. The forest owner can create and send a forest use declaration, perform a deer damage insurance claim and make both an application for Kemera-funding and a notification of implementation on the early tending of seedling stands and management of young stands. The forest owner can see their earlier applications and declarations in their history. You can also begin a protection review for protecting a forest in the service.

The forest owner can also send a wood trade call for tenders on felling sites to Kuutio (Kuutio.fi) that is an open wood trade location meant for forest owners, wood buyers, dealers and other service providers in the forest sector. The forest owner can ask a service provider to contact them with the service notification when they are interested in, for example, having a forest plan or property evaluation made. The forest owner can use a work site notification to find a professional to perform their management operations out of the service providers. In the Metsään.fi-service, the forest owner can also enter a contract to add their property to the organic control system. Moreover, all contracts can be viewed in the service.

5.2 The service for registered actors

The actor service is aimed towards companies and organisations that offer their services to forest owners and need forest data in their operation. The purpose of the actor service is to bring the actor up-to-date on forest management and felling opportunities that are based on the forest resource data. An actor can also update the forest data and run errands with the authorities on behalf of a forest owner.

The actor service has its own start page in the Metsään.fi-website where actors can find information about the actor service and a link to the authentication service.

An actor company can announce their willingness to join the actor service with a request to join. The request to join is done with a form for joining that is available with instructions on the Metsään.fi-website. The Forest Centre contacts the actor company and a separate contract on using the service is made.

The use of the Metsään.fi-service requires strong identification by the user. After the positive decision from the Finnish Forest Centre the actor can log into the actor service with personal online bank codes, a mobile certificate or a chipped identification card. The login is successful when the person has the authority to perform business for the organisation they represent. The information on the authorisation should be active in either the Suomi.fi e-Authorizations service or in the Katso-service. The use of the Metsään.fi-service is free of charge for actors.

In particular, the needs of the following user groups are taken into account in the actor service:

- those looking for work sites
- providers of forest management services
- providers of counselling services
- providers of forest planning services
- providers of nature treatment services
- providers of nature protection services
- those utilising forest resource data in forest improvement

The users of the actor service work in a company that purchases wood, in a forest management association, a forest service company or work as private entrepreneurs.

Administering own data

An actor can view and administer their own data in the Metsään.fi-service. The contact information provided by the actor, the data about the actor visible for forest owners in the service catalogue and the list of municipalities that the actor has informed as their area of operations can be seen in the actor's My data section. An actor can update their contact information, which is their email address, phone number and post address, through the Metsään.fi-service. When wishing for changes to the information or list of municipalities shown in the service catalogue, the actor must be in contact with the Finnish Forest Centre's customer support.

You can also inspect your own information on the Metsään.fi-services front page, that also shows the text that describes the company to forest owners. Furthermore, you can inspect the list of municipalities informed as the area of operations. You can find the forest properties in the area behind the name of the municipality, that the actor has received consent for the forest data from the forest owner.

Administering forest owner data

An actor can browse or search for consents granted by the forest owner in the Metsään.fi-service's Forest properties section. The forest properties can be presented as a list or they can be viewed in the map view. Furthermore, the forest properties can be searched based on the property number, property name, municipality of location, property owner, operation recommended for the property or the timing recommended for the recommended operation. Forest properties can also be searched with received handling permission or consent, which is based on a membership, customer relation or a permission to browse or transfer. The actor can exclude properties with no forest resource data available from the search, if they only want to inspect the kind of properties that have forest resource data available. The search criteria that is chosen and deemed to be good can be saved as a favourite for later use. The actor receives an email

notification with the notification service, when the customers have added consents for their forest properties or declared felling or management operations or the need for service.

An actor can use the so called shortcut link in customer communication when there is a need to get consents fast and easily. The forest owner is steered to the Metsään.fi-service through the shortcut link. After the personal identification, the website for granting consent opens for the forest owner, where the consent is directed to the actor that sent the shortcut link.

Data on the customers forests and management needs

The actor can inspect the data on the forest properties in the list at a glance in the forest properties tab. In addition to the property number and name, the list shows the location municipality, total surface areas, commercial forestry land areas, management operation's surface areas, the volume of felling potentials and the distribution of the timber assortment. There is also the possibility to inspect every listed forest property both in the map view and as compartment data. The forest property's map view and compartment lists tab has been implemented similarly as in the forest owner service's side. The compartment list tabs functions correspond to the functions visible for forest owners, which means that the actor also has the opportunity to download the forest resource data according to the forest data standards as an XML file to their own data system, if they have the required rights.

The operation recommendations produced by the Finnish Forest Centre for both management and felling procedures can be found in the basic compartment list. Similarly the operation recommendations can be inspected in the forest property's map view, where the operation recommendations are themed according to the felling and management operations and the nature objectives are presented either as areal or point specific objects.

Administering notifications

An actor can administer notifications on the Notifications tab. The actor can search for work objects notified by forest owners with the help of the search engine. They can see the notifications that the forest owner has published for the actor. The actor can search for service notifications on another tab.

The actor can also receive notifications from forest owners that have not granted consent for the specific actor to see their property data. However, in this case the actor does not see all of the forest property's data, such as the tree stand data for external forestry compartments. The actor can search for notifications according to different criteria with the search function, for example, according to the timber assortment. The notifications can be viewed as a list or on the map.

Map services for actors

An actor logged into the service can view information on the map in the forest properties section. For the background they can choose, similarly to a forest owner, either an aerial photo, a field map or a false-colour aerial photo. They get to see the management operations, fellings and natural sites in the map materials section, in the same way as a forest owner (see chapter 3.1). If the actor would like to know if their customer's property has already applied and received Kemera-funding earlier (management of young stands or early tending of seedling stand), they will see it on the forest property map from the authoritative errands menu (funding applications and notifications of declaration). They can also see the forest use declarations and inspection objects from the same section (Kemera-projects and forest use declarations).

The actor can choose to view the maps on the following subjects in the other materials menu: the need for early treatment, the master plan situation, scenery areas, game sites, harvest ableness, insect damages and storm damages. They can also choose to see the availability of forest resource data, whereupon they can choose a map according to the data collection method or a map that shows the publication year of the

estimated data. The actor sees the average volume and development class from the maps based on grid cells. In the section presenting the surface water flowcharts, the user can view maps that are formed based on runoff areas, speed, area and slope.

Digital errands

An actor can run forest errands for their forest owner customer when the forest owner has granted consent (see chapter 5.1) or when the actor has the right to use the data based on a customer relation or membership and has been authorised by the forest owner. The actor can create and send forest use declarations for the forest owner in the service. They can also see the forest use declaration that they have earlier created for their customer's forest properties. The actor can make applications for Kemera-funding applications and notifications of implementation on the early tending of seedling stands and management of young stands their customer. The actor can see information about the funding application, such as the handling's situation, the amount of calculated support (euros) and the information on when the implementation work associated to them should be done. The information of the notifications of implementation is shown to the actor, as is the information about the handling stage at the Finnish Forest Centre. The actor can send a deer damage insurance claim on behalf of their customer.

Part of the actors have the role of a supervisor when incorporating the forest property to an organic harvest site: When a forest owner has entered a contract in their Metsään.fi-service to add their property to the organic control system, the actor whom the forest owner has chosen as their supervisor will accept the contract in their Metsään.fi-service and add the contract to the regional supervision programme. The contract is then valid. The actor can see all of the organic production contracts in which they act as the investigator in the service.

5.3 Services for open forest data

Open forest data and applications

The materials and services for open forest data was released on the Metsään.fi-website in March 2018 when the renewed forest data law came into effect. Out of the materials collected by the Finnish Forest Centre, the majority is openly available in digital format based on the forest data law (Law on the Finnish Forest Centre forest data system). The Finnish Forest Centre's material contains data on the forest growing locations and tree stand, habitats of special importance and the use of forests, among other things.

No person or contact information of forest owners are handed out through the open forest data available through the Metsään.fi-website. If the data user connects open forest data to owner data, the user must comply with the personal data protection obligations.

Open forest data is available in three different formats: map services, file packages compiled out of spatial data materials and as interfaces. You can inspect the open forest directly through the map services in a browser window, which means you do not need any other software than an internet browser to utilise the data.

The spatial data materials are file packages formed from areas agreed on beforehand, that are possible to download onto your own computer by using suitable/appropriate software for the purpose. The interfaces enable the use of material through a technical link.

The objective of the open forest data is to advance the forest sector's digitalisation and to diversify the supply of services for forest owners. During the first year of use there were already more than three million downloads of forest data and the service has been used both plentifully and consistently. There are already applications based on open forest data available on the market, and the Forest Centre has also been a part of producing the first applications based on open forest data. Examples on the services produced by the Finnish Forest Centre are the Metsään tie ("Road to forest") and Laatumetsä ("Quality forest") mobile applications.

Mobile application Metsään Tie

The development work for the Metsään tie-application began from the open forest data hackathon competition, whereupon the RoadsML winning team gained the opportunity to develop their presented idea to a completed product as funded by the DataBio project and the ministry of agriculture and forestry of Finland's key project. The Metsään Tie-mobile application estimates the condition of a forest road with the help of a smart phone. At the same time the mobile devices GPS locator positions the device on the map on the screen along the road it is travelling and its sensors also measure the vehicle's vibration. The application estimates the condition of the road from the intensity of the vibration.

After driving, the car's driver can enter their own view on the road's condition into the application, and in the same way, for example, provide information on any rocks or holes on the road or the need for ploughing. The observations entered to the application and the drive data are collected to the online forest data map service maintained by the Finnish Forest Centre, where they are available for everyone.

The application is self-learning, which means that the more data inserted the better it will develop. The objective is that in the future the application will estimate the condition on the road based only on the vibration.

The forest sector can utilise the application when planning the route to felling sites and timber vehicles. The need for the service is reflected by the fact that at the moment, for example, the weight limits of a forest road cannot be seen anywhere openly. Therefore, the application is also suited to be used by road maintenance associations.

The Metsään Tie-application is free of charge and compatible with Android operating systems. The application was released in January 2019 and has since been downloaded more than 500 times.

Mobile application Laatumetsä

The Forest Centre launched the Laatumetsä-mobile application at the end of 2018 in collaboration with the DataBio project and the Ministry of Agriculture and Forestry's key project *Puu liikkeelle ja uusia tuotteita*

metsästä (Wood on the move and new products from forests). The application was developed for the Finnish Forest Centre by the Mikkeli based Wuudis Solutions Oy. The application makes the in-house control of forest management operations easier, and you can also inform observed forest damage with it.

The forest owners and forest sector actors can now inspect the quality of early tending of seedling stand and management of young stands with a mobile application. You can also save in-house controlled data for the forest management objectives on, for example, the tree stands' growing thickness, loss, diameter and age and send them for information to the Finnish Forest Centre. The in-house control improves the quality of forest management operations and creates favourable conditions for the forest's growth. In-house controlled data saved from the field can also be utilised, for example, when creating a Kemera-notification of implementation. The application also includes instructions for sample area measurements and the recommendations for forest management.

You can also inform forest damage observations to the Finnish Forest Centre with the application. You can make the notification anonymously with the application's form that does not require signing up. The data on the damage observations are collected into the Finnish Forest Centre's map service.

The Laatumetsä-application is free of charge and compatible with both Android and iOS operating systems. The application has been downloaded over 500 times since its launch.

5.4 The Metsään.fi-service's user support

The Finnish Forest Centre's customer support is responsible for the support of the Metsään.fi-service's users and it guides the forest owner and actor users by phone, email and, since the beginning of 2019, also through the chat in the Metsään.fi-service. The customer's calls regard, in addition to the Metsään.fi-service, the other services provided by the Finnish Forest Centre, forest management and ownership.

In 2018, the customer support received a total of 6,000 phone calls, 7,332 emails and 2,450 contacts through the Metsään.fi-service¹¹. The total amount of contacts was 15,780, which is 300 a week on average. Out of all the contacts to the customer support, 38 per cent (4953 pieces) was regarding to the Metsään.fi-service. Out of the contacts regarding the Metsään.fi-service, 3918 came from forest owner customers and 10335 from actor customers.

6 The technical implementation of the service

This chapter presents the technical implementation of the Metsään.fi-service and website. The chapter goes through both the forest resource data and other standards that the service is based on and the technical implementation of the website.

6.1 The forest resource data and other standards

The solutions based on standards and other open interfaces were proved to be a functional and cost effective way of implementing data systems. XML-schemes are defined in the standardisation of forest data that enable standardised data transfers, cost effective implementation of data systems and the building of functional data infrastructure for the forest sector.

The forest data standards are already used in several data systems and the preparation work groups perform active collaboration in the developing and maintenance of the standards together with the forest sector's software developers. The development of new standards and maintaining

¹¹ The numbers presented in the chapter are based on the Forest Centre's 2018 customer specific accounts.

old standards is implemented by a preparation work group with a varying composition. Participation in the standardisation work is voluntary and open. However, the actual software development is limited to the outside of this standardisation work for the public good.

The Ministry of Agriculture and Forestry of Finland leads the steering group for the forest data standardisation work and the responsible organisation for the implementation is the Finnish Forest Centre. Several other forest sector organisations and private companies have also participated in the development work of the forest data standards.

Standards regarding open and free spatial data maintained by the OGC organisation, such as interface solutions based on the WMS, WFS and WMTS services, are utilised in the Metsään.fi-service in addition to the XML standards. Furthermore, the data transfer protocol based on both the SOAP and REST standards are utilised in the transfer of messages based on the XML standard.

6.2 The technical implementation of the Metsään.fi-website

The Metsään.fi-service

The Metsään.fi-service is a service used with a www-browser, the map functions of which are optimised for use on a computer. The application is implemented with Java technology by using the Apache HTTP service and Java Enterprise Edition environment. The solution is implemented as a result of portlets installed to the Liferay service and the tailoring of the portal. Liferay's content management for maintaining dynamic content on a www-website has also been utilised in the solution. The map functions are implemented as a JavaScript, using the OpenLayers library in a browser. The server assembly consists of a web frontend server, Java Enterprise Edition application server and the Oracle database server.

The component model for the system architecture consists of the Metsään.fi-service's portal platform's user interface and services. The user

interface includes the tailored portlets and web-contents fed with the content management. This also includes the tailored themes and layout of the user interface. The services include the system's business logic's service components. The service components can be used from many different portlets. These supply the required services and data for the portlets so that the displayed data is achieved according to the business logic.

The Metsään.fi-service is connected to the Suomi.fi-identification service that is used in the forest owner's login. The actor users also log into the service through the Suomi.fi service. However, the actors' authorisations for representing the actor company is checked from the Suomi.fi-authorisations. The Finnish Forest Centre's users log into the Metsään.fi-service through the Finnish Forest Centre's own user administration. The user interface's visitor monitoring is implemented with Google Analytics.

WMS and WMTS materials, which are aerial photo and map services, are also directly attached to the Metsään.fi-user interface. They include both the Finnish Forest Centre's own materials and materials from external sources, such as the National Land Survey of Finland and the Finnish Environment Institute.

The Metsään.fi-service is based on the content produced by background systems and, therefore, no additional content is being produced and maintained. The Metsään.fi-website's services are built on the data model, database, integrated background systems and data transfer services. The data model means the system's data model that guarantees the system's internal operation logic even though the background system's data models would change. The data base is a relation database where all the system's data are stored. The integrations to the background systems are implemented as web service and database integrations.

Open forest resource data

Open forest resource data means data found in the Metsään.fi-website's open data section where spatial data in the Finnish Forest Centre are shared. The following are removed from the shared data: owner data,

property data, free texts that can include personal data and data regarding Kemera funding. This means that the shared data only includes so called environment data, which is data that describes the three stand operations implemented from the management recommendations, things regarding soil and living environment, which is data that somehow describes the environment and measures that have been or will be taken there.

The spatial data groups of the open forest data consist of forest resource compartments, grid cell materials, declaration of forest use materials, Kemera-materials and remote sensing sample areas. The habitats of special importance are also included in the forest resource compartment data.

Open forest data is shared publicly without a login and the information seekers are not identified. Data is distributed according to the commonly used data license Creative Commons 4.0 (CC BY 4.0). Materials under the license can be used freely in any way as long as the source of the material is mentioned.

It is possible to use the open forest data through three channels, which are spatial data materials, interfaces or map services. To download spatial data materials means that file packages has been formed from the open forest data based on the prepared regional division. The used regional divisions are region, municipality and 6x6 km map grid division. It is meant to receive large material entities with the spatial data material download service You can do this, for example, when you want to perform a municipality based analysis. Spatial data materials can be searched through the HTTPS and FTP protocols. At its most simple, a website is opened whereupon you can select and download the file. The file format is a .zip packaged OGC GeoPackage that version 1.2 with the RTree extension is used with. The forest resource compartments are available in XML format in addition to the GeoPackage by map grid as the forest resource data standard version 1.7.

Interface means the technical interface between two applications where the applications communicate while complying with the standards. The interfaces deviate from the local data materials in the way in which

dynamic data is transferred through them in different formats. The data that can be transferred are from a geographically smaller area, for example, than the interest area moving along the map window's cropping. The data is usually stored in the cache memory and is not necessarily meant to be stored for as long as data acquired through the spatial data materials. The interfaces formed from the open forest data comply to the OGC's WMS and WFS standards. These are common data locations standards in global use. Furthermore, it is possible to download forest data compartments in the national forest sector's XML standard through your own REST interface.

The map services the simplest and easiest to use option out of the open forest data utilisation possibilities. They are on the websites on the internet found under the Metsään.fi-website, whereupon anyone can also see data supplied through the interfaces.

7 The benefits from the Metsään.fi-website

This chapter describes the benefits produced by the Metsään.fi-website and the data included in it for the forest sector and the service's users.

7.1 The benefits for the forest sector

As in other fields, the role of data and digitalisation has stood out in the forest sector in the 20th century. For example, the up-to-datedness and usability of forest resource data and the significance of online services in utilising the harvesting potential was highlighted in the Finnish forest politics in 2008 (Ministry of Agriculture and Forestry of Finland 2008). Räsänen et al. (2017) estimated that better data on forests, terrain and roads and decision support systems that utilises them would enable at

least a 100 million euro benefit potential annually. The National Forest Strategy 2025 (Ministry of Agriculture and Forestry of Finland 2015b) updated in 2019 visibly highlights the significance of forest data and platform economy in the renewal of the forest sector: *“Accurate information on forest resources and the utilisation of this information will increase activity in the timber market and forest management, and improve conditions for the allocation of nature management. Timely open data on forest resources and their owners will improve the efficiency of forestry processes. The Metsään.fi-website maintained by the Finnish Forest Centre is an example of an open information portal that is financed with public funds and is widely used.”*

Out of the benefits brought to the sector by the Metsään.fi-website, the significance of open forest data, that has been more specifically presented in chapter 7.2, was highlighted in particular. Kangas and Packalen (2018) estimated the benefits of forest resource data¹² among forest sector actors through interviews. Private forest owners were excluded from this survey. Based on the results, the primary benefit producing mechanisms were divided into five classes:

1. **Screening.** Objects that fill specific criteria are searched for from a large amount of forest properties and forest owners (such as unannounced fellings, forest stands that have reached the age of regeneration felling or sites that are rich in biodiversity).
2. **Planning of operations.** The utilisation of forest resource data enables cost savings in the planning of operations (such as more effective planning of harvesting operations).
3. **Transactions** The forest resource data can reduce transaction costs that occur, for example, in the trading of unwanted timber assortments between actors.
4. **Improving the quality of products.** The more accurate tree stand data can increase the production of higher quality and more

¹² The forest resource data covered by the study referred either to the data collected by laser scanning included in the Metsään.fi-website or to the data based on multi-source inventory produced by the National Forest Inventory (Valtakunnan Metsien Inventointi VMI).

valuable products, for example, if it would be possible to choose a stand and optimize bucking according to the needs of the sawmills' clients.

5. **Indirect effects.** The forest resource data can produce many indirect benefits, among other things by increasing the forest management activity of forest owners.

The benefits brought by the forest resource data produced by laser scanning to the Metsään-fi-website have been estimated by, among other things, comparing it to the cost required to gain similar data by field measurements. Assuming the traditional compartment specific estimation to cost around 20 euros/hectare, the price for laser scanning and aerial photography based inventorying is around 5 euros/hectare and assuming that the data received from the inventorying has the same utilisation possibilities as a traditional field measurement, the net benefit would be on the data producer's level about 22.5 million euros annually. A significant part of the calculated benefits is formed from the fact that laser scanning enables the inventorying of a much larger area than possible in a traditional compartment specific estimation. (Kangas et al. 2019)

In the same study it was estimated that the advantage that laser scanning provides to the forest owners amounts to up to 210 million euros every year compared with a situation where forest resource data is obtained from satellite pictures, and to about 60 million euros every year compared to data collected through traditional field measurements, providing that the advantage is studied solely on the basis of the reliability of the total volume. Since laser scanning is less accurate than field measurements regarding certain factors, the achieved benefit is likely to be smaller than this estimate. On the other hand, laser scanning enables data gathering from a larger area.

7.2 The benefits experienced by users

The users in general

The Metsään.fi-website generates cost savings and enables new kinds of business for both forest owners and actors. For forest owners, the Metsään.fi-service gathers data concerning their own forests, such as growing stock, recommended operations and natural sites, and provides a channel for online services, for instance, notifications of forest use. For actors, like organizations along the wood procurement chain and forestry service providers, the Metsään.fi-service and the open forest data services generate savings, for instance, by reducing the time spent in the forest, and create new business opportunities. The availability of an almost nationwide, laser scanning based forest resource data has increased the understanding of the quantity and quality of Finland's forest resources, and has potentially promoted the forest industry's readiness to invest. In addition, the Metsään.fi-website has also provided opportunities to make the Forest Centre's own activities more efficient, above all regarding the focus of client support and supervision tasks included in the Forest Act.

In customer surveys relating to Metsään.fi, in surveys assessing the advantages of the data provided by the service and in the interviews that were conducted for this study, certain benefits for the users stood out. Examples of the most important benefits are presented in table 5.

Table 5. The main benefits that Metsään.fi offers its users

Function	Who uses	What kind of benefit	Example on cost savings
Leaving an electronic forest management subsidy application, a forest use declaration or an elk damage notification	Forest owners, timber procurement organisations, forest service providing entrepreneurs, forest management associations, Forest Centre staff	Filling out applications and giving declaration and notifications has become faster, handling times have shortened	Usage of online services saves the authorities 0.5 million euros in legislation monitoring costs and 0.7 million in the costs of administration of subsidy applications
The availability of forest resource data, property specific management and felling recommendations	Forest owners, timber procurement organisations, forest service providing entrepreneurs, forest management associations, Forest Centre staff, research organisations, banks, insurance companies?	Data on the property's forest resources and the management and felling recommendations; more efficient forest planning and property evaluation; faster planning of forest management and marking stands for timber harvesting; more effective contacting of new customers and customer work	Open forest data saves every year forest service providers roughly 10 million euros and timber procurement organisations roughly 100 million euros. The intensification of the Finnish Forest Centre's customer work has reduced costs by 5 million euros each year. The use of forest resource data in ownership changes by inheritance saves the authorities about 2.7 million euros each year
The availability of data on nature sites	Forest owners, timber procurement organisations, forest service providing entrepreneurs, forest management associations, Forest Centre staff	Forest management and felling that take nature values better into account; more effective identification of nature sites that could be protected	The data on nature sites saves the Finnish Forest Centre roughly 0.55 million euros each year
Announcements regarding needs for forest management services and timber sales	Forest owners, timber procurement organisations, forest service providing entrepreneurs, forest management associations	Competitive tendering for forest management services and timber sales based on management recommendations, finding local service providers	

By request of the Ministry of Agriculture and Forestry, the Forest Centre calculated the cost savings included in table 5 with a benefit analysis method. The request was part of the investment calculations for the new forest resource data system.

Forest owners

During the autumn of 2016, Pellervo Economic Research PTT conducted a survey among forest owners commissioned by the Forest Centre (see chapter 4.1). Almost 90 per cent of the respondents considered the possibility to check the data concerning their own forests to be useful or important (see figure 10). Just under 80 per cent of the respondents looked for maps on their properties, and a little less than 60 per cent got familiarized with information about growing stock or planned upcoming work with the help of the forestry operation and felling recommendations. Approximately 20 per cent of the respondents took the opportunity to leave a digital notification of forest use or a forest management subsidy application or checked out the natural sites within their forests.

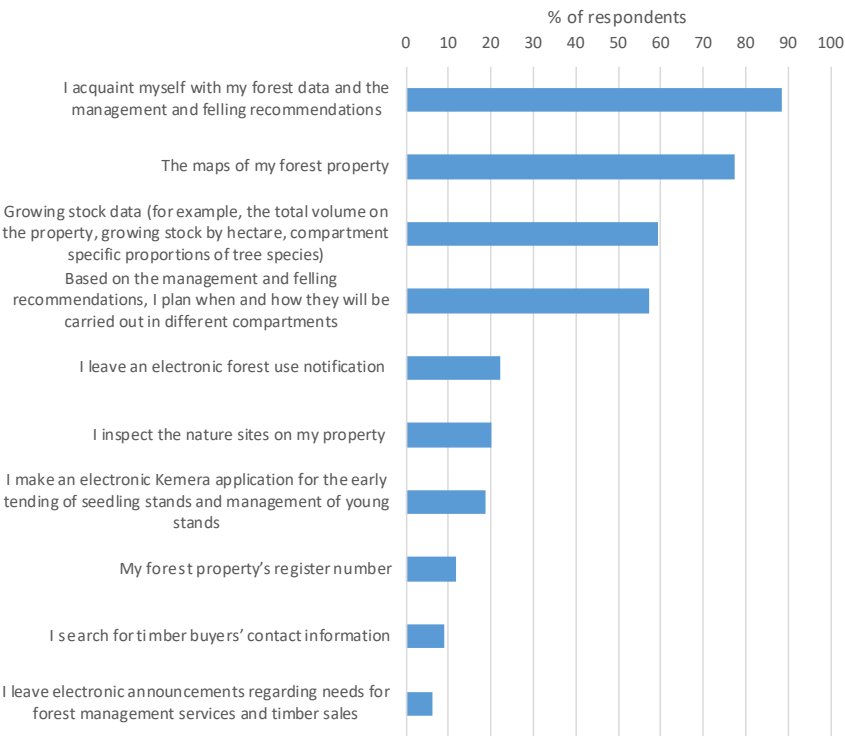


Figure 10 The importance or usefulness of different functions

In the research done by Pynnönen et al. (2019), the answers were classified into different themes based on their content. The classes were formed based on themes present in the materials (see table 6).

Table 6. Examples of forest owner's answers on the benefits of the service (based on Pynnönen et.al. 2019)

Classes of analysis	Examples on answers
Independence from time and place, online service	E-services can be used at home when there's time/need Free service any place and time
Existence	That there is such a service, and that it's so diverse That it exists
Free of charge	That it's free of charge Free service provided by the state
Independence, credibility and reliability	A public and free open forum, where the owner has a say in the publication of their data The service is free and I believe the authorities provide an impartial view on the state of my forests An actor that is free of charge and impartial to timber buyers
Versatile	The versatility and broad information on the forest property. Almost all information critical to forest management can now be found in one place All the information I need can be found
Easiness	Ease of use even when seldom used The service's functionality and ease of use
Technical implementation	Log in with online banking codes ¹ , no separate account or password needed A nicely developed and functioning system
The easiness of the service	You can easily check the data of your own forest An overall improvement (= nothing like this existed before). It's a very big step for forest owners and makes life easier

¹Online banking codes are used by Finnish banks in customer authentication

According to Pynnönen et al. (2019), the central benefits available from the service is the opportunity to use e-services regardless of time and place and that the service is free of charge (see table 6). The forest owners thought that it is useful that the maps, information about the growing stock and the management and felling recommendations for their forests are stored online into one place and easily accessible. The independence from the forestry and forest industry actors enabled by public service was also thought to be important. The service's functions and the data it offers on forests were generally seen as versatile and rather up-to-date. The service's technical implementation was thanked for its simplicity, clarity and good functionality, which helped use of the service.

Based on the Forest Centre's internal presentation dated 21.8.2018, the results of the customer survey conducted by the Forest Centre during spring 2018 highlighted the same themes. Out of the forest owners that responded, 51 per cent used the service less than monthly and about 40 per cent at least once a month. About 75 per cent of the respondents experienced that the service had functions that are useful for them (values 4–5 on a scale of 1–5). The Metsään.fi-service was experienced to be good and clear in general in the survey. The respondents appreciated the map functions and the opportunity to gain different information from the same place. The login was also experienced to be easy on average.

Corporate users

The corporate users' views on the Metsään.fi-service have been mapped in several surveys. The following sub-sections present the results of a survey that Pellervo Economic Research PTT conducted for forestry professionals in 2016 and the Forest Centre's results of a survey for corporate users in 2019. In addition, the results of interviews for users of the corporate service conducted for this project are presented.

Survey for forestry professionals conducted by Pellervo Economic Research PTT

Pellervo Economic Research PTT conducted a survey for forestry professionals as requested by the Forest Centre, the objective of which

was to investigate their experiences and views on the Metsään.fi-service. The majority of the respondents were workers. Just over 63 per cent of them worked in forest service companies, out of which the majority was either members of the Finnish Forest Industries or forest management associations. Almost 16 per cent of these were in the service of forestry machine entrepreneurs and just over 10 per cent were forest service providing entrepreneurs.

Almost half of the forestry professionals used the service on a monthly basis, close to a third weekly and a fifth less than that. Only a fraction did not use the service. Most of the professionals used the service for between 0–30 minutes as per each login. Searching for data was the most common reason to use the service. The professionals searched for forest owners' announcements regarding needs for forest management services and timber sales and calls for tenders, potential felling and forest management sites for customer acquisition and maps on forest properties. Clearly fewer forest professionals had used the service to search for the contact information of forest owners or property identifier and for inspecting nature sites.

The respondents were asked to respond to the statement "The metsään.fi-service is a good addition to the forest sector's supply of services". 42 per cent agreed completely and almost 30 per cent agreed somewhat. This means that a clear majority experienced the service as a good addition to the supply of services. This conclusion was strengthened by the fact that nearly a third thought that the service included useful functions. However, many wished that the functions would be diversified.

Nearly 70 per cent agreed or somewhat agreed with the statement that "the maps on the forest properties were illustrative". Use of the map was primarily experienced to be easy, since two thirds of the respondents had this opinion. On the contrary, there was no clear majority view on the amount of map layers.

The professionals thought that data about the forest owners' properties can be accessed easily, as a quarter of the respondents completely agreed and 40 per cent somewhat agreed with the statement. A majority thought

that the compartment-specific data was clear, although a good 20 per cent disagreed. When asked whether the service has sufficient data about the criteria for forming compartments, a majority agreed, whilst 20 per cent did not. The professionals felt that there is enough data about growing stock, and that that this data was easy to find in the service.

A quarter of the respondents had not utilised the nature values available in the service. Those professionals, who had browsed through data about natural sites, in most cases thought that the data was illustrative. Just under 10 per cent of the professionals were of the opposite opinion. A majority of the respondents had utilised the aerial photos (85.6 per cent). Overall, they felt that it was easy to use aerial photos.

Regarding management recommendations (forest management and felling), it was stated that “it is easy to respond to work requests on the basis of the recommendations”. The number of respondents who agreed completely or somewhat with the statement was almost the same as the number of respondents who disagreed completely or somewhat. When it comes to the statement on how easy it is to contact forest owners on the basis of management and felling recommendations, a little over 45 per cent of the respondents thought that the recommendations make it easy to contact the forest owners. Almost 15 per cent of the respondents had not contacted forest owners on the basis of management recommendations, and 11 per cent had not done so on the basis of felling recommendations.

The survey for the users of the Finnish Forest Centre's actor service

In 2019 the Forest Centre addressed a survey to the users of the corporate user service. 170 users representing organisations of different sizes replied. More than half had used the service to get information about their customers' forests and acquainted themselves with the management and felling recommendations. Furthermore, almost half had looked for and used the notification service to follow-up on announcements regarding needs for forest management services and timber sales through the corporate user portal. The respondents thought that the service had given them useful functions (average 3.7 on a scale from 1 to 5). Above all, the

users appreciated that it was easy to draw up forest management subsidy applications and notifications of implementation, the existence of forest resource data, the advantages of using the data when working with the customers, as well as the easiness in using the service on the whole. The average grade for the service was 3.5 (scale 1–5).

Interviews conducted by Pellervo Economic Research PTT

In connection with this study, two corporate users of Metsään.fi were interviewed: Arvometsä Oy and Stora Enso Metsä. According to them, too, the Metsään.fi-service and the services for open forest data were convenient and user friendly. The services helped to develop and make their businesses more effective. Both corporate users used forest resource data through an interface. Moreover, one of the corporate users used other materials provided by Metsään.fi, such as information about habitats of special importance, felling recommendations and forest management subsidy applications and -notifications, in their own data system.

The actors emphasised the role of open forest data in cost effective activities: it speeds up the activities done in the forests such as planning of forest management and compartments marked for harvesting. Besides, by using the data it was possible to focus customer contacts, concentrate activities and speed-up the processes for property evaluation. The material containing forest resource data and the compartment geometries formed on the basis of the data was, however, of varying quality, which sometimes made it more difficult to use the material. The forest resource data available today has not removed the need for field work, but reduced the time spent in the forest.

Both corporate users used the online services on a regular basis (notification of forest use, forest management subsidy applications and -notifications), and, in addition, one of the companies used the function for announcements regarding needs for forest management services and

timber sales. They both had a positive experience of the functionality of the service.

Both corporate users highlighted the role of the Forest Centre when it comes to producing, gathering and providing public data. Corporate users can use these public services as a cornerstone when building up their own business activities. This way the Forest Centre and Metsään.fi-website support the cross-cutting theme of the project portfolio in the National Forest Strategy 2025: Forest Data and the Platform Economy. This theme aims to make the data important for the forest sector more accessible, easier to use and connectable. This enables better planning and implementing of the current services, hence improving their effectiveness.

There are several examples available on businesses that utilise the Metsään.fi-website's open forest resource data, such as Bitcomp Oy's Kanto-on-application or Arbonaut Oy's ProMS Mobile-application. Moreover, the matter has been researched in, for example, the joint DigiElmo-project of Business Joensuu, the Natural resources institute Finland and the Finnish Forest Centre that aims to progress the development of services based on forest resource data¹³.

8 Future prospects for the Metsään.fi-website

This chapter inspects the needs and development suggestions of the website's users, both the forest owners and corporate actors. The chapter also handles the development suggestions that rise from changes in the operative environment. The addressed changes are the change of structure in the forest owner base and the development of the forest

¹³ Further information: <https://www.metsakeskus.fi/digielfmo>

sector and the operational environment. Finally, the upcoming renewal of the service and, its purpose and objectives are inspected.

8.1 The user's needs and development suggestions

To advance the utilisation of the Metsään.fi-service and to map future prospects, Pellervo Economic Research PTT implemented a survey for experts in the forest sector for this research (addressed later as the future survey). In addition, the material was composed out of the actor services user interviews (see chapter 7.2), Pyynnönen et al. (2019) research, the Finnish Forest Centre's forest owner survey from 2018 (see chapter 7.2) and the actor service's user survey from 2019, that has the Finnish Forest Centre's internal summary available.

The future survey was sent to 13 forest sector experts, out of which the organisations they represent utilise the Metsään.fi-service in several ways. There were actors present that both use the service for preparing timber sales and that utilise the nature database. Eight of them answered. Answers were received from only one out of the organisations that utilise data regarding nature sites.

The future survey (see table7) consisted of three questions that regarded challenges, strengths and future prospects of the service.

Table 7. The themes of the future survey

2. The forest resource data	3. The system's function	4. The quality of data	5. E-services
Future opportunities			
An easier way for forest owners to get to know their forests better	Notifying the locations of possibly valuable nature sites	The deeper integration of forest nature data into the service and its maps	Developing running-services by creating a mobile application
More forest resource, nature and multiple use data		The higher quality of data could add to the validity of the operation recommendations	
Regular data updates		Updates in real time (forest machines, forest owners, forest experts)	
Opening more materials and increasing research	Mobile application		
Regional planning data			

2. The forest resource data	3. The system's function	5. Doing business
The best features		
Marking nature sites on the map	The clarity and user friendliness	Forest use declaration
Forming compartments		Forest management subsidy application and notification of implementation
The equality and openness of data		Deer damage estimation
Maps	Utilising the system for small businesses	Downloading data
Interfaces for different online services, the easy usability and keeping them free of charge		The openness of data enables collaboration, data inspection and online services (consent, among other things)
Aerial photos	A link to the online wood trade site Kuutio.fi	The possibility to utilise for forest owners, easy planning of operations
		Following the situation of applications and declarations

2. The forest resource data	3. The system's function	4. The quality of data
Challenges/problems		
Delay in updating forestry management data	Slow system	Low quality, accuracy, up-to-datedness and reliability of forest resource data
Lack of compatibility for the IT platform (spatial data, among other things)	Login issues among white collar employees	Lack of data has brought complaints from forests owners and caused them disappointments
	Problems caused by a lack of instructions (solved)	
Lack of data caused by the geographical location	Being subject to charge and a trial period (solved)	Compartments based on the forest resource data are unreliable

The first question was about the challenges or issues regarding the use of the Metsään.fi-service. The second question was about the best and most useful features of the Metsään.fi-service. The third question was about the kind of opportunities or benefits the Metsään.fi-service offers. The answers to the questions were compressed and classified into themes to collect arguments of a similar type (see table 7).

The risen themes were about the usability of the service, the system's functioning, the quality of data and new materials, which are here presented in that order.

The usability of the service

Those that responded to the future survey appraised the updating of forest property compartment data (theme 2) as slow or lacking. Similar results had come from the Finnish Forest Centre's 2018 forest owner survey, where the up-to-datedness and update opportunities of the compartments were appraised as weak. Based on this, one of the most important development objects were to make it easier to update data. The forest owners that use the service more actively especially wished for the opportunity to update data on their own.

From the actor's point of view, the most prevalent problem in using and utilising the service were the issues in logging in.

Theme 5 was about making contacts with the authorities (see table 7). The respondents had not raised issues in contacting the authorities, but instead they mentioned certain good features in the service. Furthermore, a part of the respondents wished for the development of a mobile application.

The system's functionality

Another central problem in the functionality of the Metsään.fi-service was the functionality of the system in the background (theme 3, see table 7). It was highlighted in the future survey that due to the enormous amount of data it was slow to download and handle. Furthermore, one respondent mentioned the incompatibility with the corporate users own geographic information systems, which slows down working, because data must be

transferred from one system to another. One problem highlighted in the answers of the future survey was about the features of the forest use declaration data and forest resource data, which prevented the utilisation of the data with the ArcMap tool. The Forest Centre solved this problem when the actor mentioned it.

One challenge highlighted in the future survey was the central integration of the Finnish Forest Centre's several complicated system entities, which are not simple to control. And there has been delay in updating the system due to the complexity of the system entities. A central challenge in developing the service is to integrate several different sources of information into one entity that simultaneously offers forest owners and other actors all forest and nature value data.

The quality of data

In relation to the quality of data (theme 4), challenges for the use and utilisation were, according to the survey, the accuracy, reliability and up-to-datedness of the data, out of which the accuracy seemed to be the greatest challenge (see table 7). Furthermore, lacks in the coverage of the forest resource data were highlighted, and, in some areas, the outdatedness of the data. According to one respondent, the lack of accuracy of the forest resource data particularly disturbed the forest owners that know their forests well and that are used to following a forest management plan. One respondent thought that presently you gain a good approximate of the amount of trees in the stand from the forest resource data, but it was unusable at its worst. Based on one of the respondent's observations, there was not actually as much timber in the stand as the service showed. On the other hand, according to them, the results were reasonably reliable in the even thinning forests. According to another respondent, there was a lack of accuracy in the data for forest compartment borders, log percentages and tree species. The respondent also added that the lack of data can cause great disappointments at its worst.

Based on the Finnish Forest Centre's 2018 forest owner survey and the 2019 actor service user survey results, the most important development

objects were improving the up-to-datedness and the quality of the forest resource data and making it easier to update data.

Several factors that influence quality must be taken into account when utilising forest resource data. These factors are described in chapter 2.1. It's safe to assume that a part of the forest resource users were not aware of these factors based on the collected feedback. Although the Forest Centre describes the quality of forest resource data and the factors that impact it on their website¹⁴ and in the property specific data in the Metsään.fi-service, this could be highlighted by providing the data users with tight, visible data packages on the most important error causing factors. Furthermore, it could be useful to describe the differences between forest resource data collected by remote sensing and the operation recommendations calculated based on it to the traditional forest plan. This could reduce the amount of disappointments experienced by the users regarding the forest resource data. Furthermore, the accuracy of forest resource data will improve as a result of the new national laser scanning project that begins in 2020, and, thus, increase customer satisfaction.

New materials

The users of the corporate service that were interviewed for this survey (see chapter 7.2) wished that the Metsään.fi-website would offer centralised data that the forest sector requires, for example, regarding the Finnish Forest Centre's quality control on operation (such as marking for harvesting), power lines, ground wires, local detailed plan or in the future, for example, the forest harvester's return data. In general, the Finnish Forest Centre was considered to be a suitable actor for the maintenance of the developed forest data service platform. Another interviewed company saw the forest ownership objective survey included in the service as a positive development, although, according to feedback received from forest owners, its effect on the forest management and felling

¹⁴ Further information: <https://www.metsakeskus.fi/metsatiedon-laatu> , https://www.metsakeskus.fi/sites/default/files/metsavaratiedon_laatuseloste.pdf

recommendations remained unclear. Due to this reason, the diversifying of the service's operation recommendations were highlighted. They should be developed in such a way that there would be different options for forest management according to the forest owner's objectives.

Furthermore, in the interviews for the ongoing Säätyö (Weather work) project¹⁵ the need to collect data regarding forest damage into one place has been highlighted (preferably to the Metsään.fi-service), such as damage risk maps and already occurred damages (that often indicate secondary damages such as insect damages). The Finnish Forest Centre was also declared to be a suitable developer and maintainer of the forest data service platform in the interviews for the project in question.

8.2 The development objects rising from changes in the operational environment

The change of structure in the forest owner base

The change of structure in the forest owner base has already continued for long. The clearest changes have been the ageing of forest owners, the reduced number of farmers, urbanisation and the change of size structure in forest properties, so that the number of both smaller and larger properties has grown. (Among others, Hänninen et al. 2011, Karppinen et al. 2002). The development is estimated to continue in the same direction at least until 2030 (Rämö et al. 2009). The change of structure in the forest owner base leads, among other things, to the increase in the number of forest owners and the decrease in the significance of income streams from forests.

Versatile online services must be offered for those forest owners that have limited possibilities to visit their forest. Here the Metsään.fi-service is in an important role by developing online services and by bringing the forest resource material and the operation recommendations based on it to all forest owners. The growing group of forest owners living at a greater

¹⁵ Further information: <https://ilmatieteenlaitos.fi/saatyo>

distance from their forests sets demands on the development of the Metsään.fi-service also in the future – how to bring the forest more concrete and closer to forest owners and how to aid them in making decisions regarding their forests. For these reasons, for example, the timber procurement organisations of forest industry companies have introduced virtual forest applications in recent years, that enables you to visit your own forests and inspect the impact of forest management operations and fellings on the tree stand from the comfort of your own home.

The Metsään.fi-service will probably also have to take better notice of those forest owners, to whom forest do not have a great financial significance. In this case the wood productional attributes could be supplemented by an increased amount of data regarding nature and recreation values. This could encourage these forest owners to use and treat their forests. The Forest Centre has attempted this in recent years by bringing different nature materials into the service, such as data on game areas, flying squirrel nesting sites and falcon nests.

The changes in the forest sector and the operational environment

There are several other interconnected changes affecting the forest sector, in addition to the structural change of the forest owner base. Digitalisation and controlling climate change and adapting to it are phenomena that are heavily changing the sector. The inclusion of climate change as one of the challenges in maintaining the diversity of nature is likely to change the forest sector's operational environment already in the near future. Tighter climate policies, and the objectives regarding carbon balance in the EU land use sector are likely to impact the use of forests in the future. The sector's impact on the national and regional economy must be noted in the discussion for sustainable forest use. These days, versatile needs are directed towards forests that set new kinds of requirements for forest management, forest nature protection and wood use.

Many of these changes are linked to the Metsään.fi-website. As revealed in the earlier chapters, the Metsään.fi-website offers their users online services and versatile data materials needed by the sector. The

significance of these duties will without a doubt increase in the future. Furthermore, the Finnish Forest Centre and the Metsään.fi-website can also have the important job in the future to receive the reset data of operations performed by actor customers. Therefore, the role as a central data collector, maintainer and provider would only grow in the future.

The development of the Metsään.fi-service was mainly focused on serving wood productional objectives for a long time. More materials regarding nature objectives and versatility have been added in recent years. The significance of nature and recreational data is likely to be accentuated in the future through both national nature diversity preservation objectives and through the more versatile objectives of forest owners. This is also reflected in more versatile forest management methods, the demand for which will increase among forest owners. Getting data regarding nature's diversity and, for example, the carbon sink potential available for forest owners through the Metsään.fi-service is one way to further the better noting of nature values in forestry. On the other hand, data is only useful when it reaches the user. According to the surveys, a large part of forest owners and actors do not yet utilise data regarding the protection of nature's diversity.

Global warming creates more favourable conditions than before for different types of forest damage, such as snow, storm, insect and fungus damage and forest fires. This creates new data needs in the forest sector: how to identify risks aimed at forests, share information regarding the risks or to minimise the damage to forests. It is likely that the Metsään.fi-website is going to have an important role in the future in sharing data related to the health of forests. Furthermore, activating those forest owners that do not realise and acknowledge the risks for damage in their forests without prompts must be noted in the development of the service.

Developing the service: The Metsään.fi-service 2.0

The Forest Centre has begun the planning of reforming the Metsään.fi-service. As a preliminary schedule, it is meant to organise the competitive tendering during the first half of 2020. The purpose of the reformation is to answer the needs and changes in the operational environment received

from customers, such as the renewal of the collecting of forest resource data, returning implementation data to the Finnish Forest Centre, the forest resource data service platform and possibilities brought by digitalisation. Also, in the future the Metsään.fi-service's central functionalities are online services, perceiving the overall picture of a forest with the help of versatile data sources and the scalability of the service, which is its use via desktop browsers and mobile devices.

The reformed Metsään.fi-service should provide customers of the Finnish Forest Centre, which are the forest owners and corporate actors, with a more versatile overall picture of the forest's management, felling and nature objectives and their need for treatment and utilisation, specific for the individual forest owners and properties. The objective for the reformation of the Metsään.fi-service is to enable errand running with the authorities online for forest owners and actors. At the same time, the intercommunication between forest owners and corporate actors using and updating the same database is made possible. The reformed service is scalable, which means that it offers the services both via desktop browsers and mobile devices.

The collecting and updating of forest resource data is being developed in the Finnish Forest Centre, while the data produced by the Finnish Forest Centre is in an even more central role in the practical activity of the forest sector. The Metsään.fi-service's newest version 2.0 will be built as a service that utilises commonly available open forest resource data, which enables the online service module to be connected to the corporate actor's own systems and offers customers views from different background systems of which the customer can choose the best option based on their own needs. Structure wise the objective is that the background systems are their own modules (for example, the forest owner service and the corporate actor service are their own modules) and they are utilised through integrations and interfaces.

9 Conclusions and recommendations

The Metsään.fi-service is equated to several other authoritative online services that have been developed in Finland over recent years: Suomi.fi, vero.fi, kanta.fi¹⁶, among others. The supply of online services is meant to increase the opportunities of citizens, companies and communities to use public services, regardless of time and place. E-services are usually the easiest and fastest way to contact authorities regarding for example forest use declarations and cost sharing applications. When the use of online services increases, the public service production becomes more efficient and common tax money is saved. The starting point is that the public administration's online services are functional, safe and easy to use. The customer centred planning, renewal of service processes, the interoperability of services and the data security and protection are central when building online services¹⁷.

It is inherent for a service that is maintained with public funds, that it is seen as necessary and that it is being used. The Metsään.fi-service has been in use since November 2012. After a slow start the number of users has grown significantly since 2015, when the service was made free of charge to forest owners. By the end of 2018 already over 100,000 forest owners had logged into the service. This is about a third of over two hectare forest properties. Due to the long time span of commercial forestry, the need to use the service is not necessarily even annual especially on small forest holdings, so there is no routine in using it.

According to user data, the service still covers a larger part of commercial forest land than of the number of forest properties, since the average

¹⁶ Suomi.fi is a digital service of city register offices, vero.fi is a e-service of tax administration and kanta.fi provides digital services for the social welfare and healthcare sector.

¹⁷ Further information: <https://vm.fi/en/digital-services>

property size of the users is about twice as large as average. As the forest owners live increasingly further away from the property, the existence and usability of data systems are in a key position in the administration of forest resources. About half of silent forest owners, who were inactive from the forest authorities' point of view, neglect to sell wood, since they do not know if there is any harvesting possibilities in their forests (Haltia et al. 2017). Another important reason for inactivity in commercial forestry is the lack of time. The use of online services improves the administration of data and speeds up, for example, forest use declarations and deer damage announcements.

The quality of data and supplementary services stood out in the user survey. Active forest owners, in particular, wished for a better data quality. The accuracy of forest resource data will improve as a result of the new national laser scanning project that begins in 2020. However, the new laser scanning material will not change the fact that the forest resource data shared through the Metsään.fi-service is meant to supplement more accurate forest planning and not replace it. Furthermore, improving the accuracy and quality of data costs more and adds to the need for data processing capacity. The technical development and increasing the speed of data processing in the future will progress the services' cost effective development. The internal integration of several data systems also stood out in the survey, as here has been delays in updating the system due to the complexity of the system entities.

Easily available data concerning the biodiversity contributes to the protection of valuable nature sites and enhances environmental values. However, the data concerning the biodiversity was used less than other data according to the replies. In addition to the need for data concerning wood production, data concerning biodiversity and carbon sequestration will be emphasised in the future. The majority of users have multiple objectives in their forest ownership, so it could be assumed that versatile data on the forest would be of interest to forest owners.

The user activity of forest owners was increased by the management recommendations aligning with their own objectives. Those under the age

of 45 used the service more often than other age groups. In 2017, their share out of all forest owners were 11 per cent and out of the Metsään.fi-service's users 20 per cent. Therefore, they have a higher than average probability of using the service. The IT abilities of the younger populace are seen in this share of those under the age of 45. In older age groups, the differences were rather small, but those over the age of 75 had a smaller probability of using the service than the average.

The service brings cost savings to actors, for example, by reducing the time spent in the field and the transaction costs along with online services. Forest professionals were mostly happy with the service, but more versatility to the services was a common wish.

Recommendations

- The service remains free of charge for forest owners and actors, which requires constant funding. However, it is worth estimating, in the service's development, which supplementary services and levels of information accuracy could be subject to charge or provided by another operator.
- The number of users is increased by marketing the service in particular to new forest owners, but a complete coverage is not worth pursuing since the costs increase for every achieved hectare.
- The usability of the service is in a key position for a large part of forest owners, therefore the basic level's ease of use and clarity cannot decrease among the supplementary services. The easiness of the login is the first step towards using the service. The usability and convenience are supported by offering a mobile application to the users.
- Informing the users of the purpose, method and limits of the forest resource data offered by the Metsään.fi-website should be emphasised further than before, so that the expectations for the material become more realistic.

- The structure and aims of the forest owners are becoming more diverse. This is worth noting when planning the materials and management recommendations that the service offers: material related to nature and leisure values and more diverse forest treatment options will have their own user base in the future.
- In the future, the climate change mitigation and reinforcing biodiversity will likely receive more attention. The Metsään.fi-service acts as an important platform for relaying information and it makes it more effective to, for example, focus counselling towards those forest owners whose forestry activities have the largest impact on the desired goals.
- The service platform planned in connection to the Metsään.fi-website is a significant step in advancing information sharing. The needs of corporate users should be addressed through data services. Diverse data bases should be available on the same website, utilising interfaces.

10 References

Finnish Forest Centre. 2016. 'Metsäsuunnitelma'. 2016. In Finnish. Available from: <https://www.metsakeskus.fi/metsasuunnitelma>

Finnish Forest Centre's forest research data quality description 7.10.2019. Finnish Forest Centre. [Referred: 26.6.2019]. In Finnish. Available from: https://www.metsakeskus.fi/sites/default/files/metsavaratiedon_laatuseloste.pdf

Finnish Forest Research Institute (Metla). 2000. *Finnish statistical yearbook of forestry 2000*. Jyväskylä: Gummerus Kirjapaino Oy. In Finnish.

Haapoja T. 2014. The Metsään.fi forest owner services customer satisfaction and user experiences. Polythetic final year project. Seinäjoki University of Applied Sciences. In Finnish. Available from:

https://www.theseus.fi/bitstream/handle/10024/78734/Haapoja_Tuom_o.pdf?sequence=1

Haltia, E., Rämö, A-K., Pynnönen, S., Valonen, M. ja Horne, P. 2017. Why do the economic opportunities of forests remain untapped? – forest owner activity and means to influence it. PTT Reports 255. <http://www.ptt.fi/julkaisut-ja-hankkeet/kaikki-hankkeet/255.-haltia-e.-ramo-a-k-pynnonen-s.-valonen-m.-horne-p.-2017.-miksi-metsien-taloudellisia-mahdollisuuksia-jatetaan-kayttamatta-metsanomistajien-aktiivisuus-ja-siihen-vaikuttaminen..html>

Heiskanen, T. 2018. The development of the Metsään.fi-service. Final year project, Commercial forestry. South-Eastern Finland University of Applied Sciences. In Finnish.

Hänninen, H., Karppinen, H. ja Leppänen, J. 2011. Suomalainen metsänomistaja 2010. Metla's working papers 208. In Finnish. Available from: <http://www.metla.fi/julkaisut/workingpapers/2011/mwp208.pdf>

Kangas, A., Haara, A., Holopainen, M., Luoma, V., Packalen, P., Packalen, T., Ruotsalainen, R. & Saarinen, N. 2019. Kaukokartoitukseen perustuvan metsävaratiedon hyötyanalyysi: MetKu-hankkeen loppuraportti. Luonnonvara- ja biotalouden tutkimus 6/2019. Natural Resources Institute Finland (Luke). Helsinki. 32 s. In Finnish. Available from: http://jukuri.luke.fi/bitstream/handle/10024/543809/luke-luobio_6_2019.pdf?sequence=1&isAllowed=y

Kangas A. ja Packalen T. (2018). Metsävaratieto metsäalan toimijoiden päätöksenteossa – käyttötilanteet ja hyötyyn vaikuttavat tekijät. Metsätieteen aikakauskirja 2018-10031. Bulletin. 14 s. In Finnish. Available from: <https://doi.org/10.14214/ma.10031>

Karppinen, H., Hänninen, H. & Ripatti, P. 2002. Suomalainen metsänomistaja 2000. Metsäntutkimuslaitoksen tiedonantoja 852. 83 s. In Finnish. Available from: <http://jukuri.luke.fi/handle/10024/521486>

Kurttila, M., Korhonen, K., Hänninen, H. & Hujala, T. 2010a. Yksityismetsien metsäsuunnittelu 2010 – nykytilanne ja kehittämistarpeita. Metlan työraportteja 153. 43 s. In Finnish.

Law on changing the forest management association law, "Laki metsänhoitoyhdistyksistä annetun lain muuttamisesta" 20.12.2013/1090. Finlex. [Referred 17.6.2019]. In Finnish. Available from: <https://www.finlex.fi/fi/laki/alkup/2013/20131090>

Law on changing the forest management association law, "Laki metsänhoitoyhdistyksistä annetun lain muuttamisesta" 12.1.2018/66. Finlex. [Referred 11.6.2019]. In Finnish. Available from: <https://www.finlex.fi/fi/laki/alkup/2018/20180066>

Law on the Finnish Forest Centre forest data system, "Laki Suomen metsäkeskuksen metsätietojärjestelmästä". 6.5.2011/419. Finlex. [Referred 18.6.2019]. In Finnish. Available from: <https://www.finlex.fi/fi/laki/ajantasa/2011/20110419>

Ministry of Agriculture and Forestry of Finland 1999. Finland's national forest program 2010. 2/1999. Maa- ja metsätalousministeriön julkaisuja. [Referred 24.6.2019]. In Finnish. Available from: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80781/1999_2_Kansallinen%20mets%c3%a4ohjelma%202010.pdf?sequence=1&isAllowed=y

Ministry of Agriculture and Forestry of Finland 2008. Finland's national forest program 2015. More Welfare from Diverse Forests'. [Referred 24.6.2019]. Available from: http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80524/2008_3b%20Finland%27s%20National%20Forest%20Programme%202015.pdf?sequence=1&isAllowed=y

Ministry of Agriculture and Forestry of Finland 2015a. Forest data and digital services. 22.1.2015. [Referred 24.6.2019]. In Finnish. Available from: <https://mmm.fi/metsatieto-ja-sahkoiset-palvelut>

Ministry of Agriculture and Forestry of Finland 2015b. National Forest Strategy 2025 - Valtioneuvoston periaatepäätös 12.2.2015. Maa- ja metsätalousministeriön julkaisuja 6/2015. [Referred 17.6.2019]. In Finnish. Available from: <https://mmm.fi/documents/1410837/1504826/Kansallinen+mets%C3%A4strategia+2025/c8454e55-b45c-4b8b-a010-065b38a22423>

Mäki, O., Ovaskainen, V., Hänninen, H. & Karppinen, H. 2011. Metsäpolitiikan ohjauskeinot: Arviointikehikko ja sovellus Suomen metsäpolitiikkaan. Metlan työraportteja 213. 50 s. In Finnish.

Natural resources institute Finland 2019. Ownership of forest land 2016. [Referred 11.6.2019]. Available from: https://stat.luke.fi/en/ownership-forest-land-2016_en

Official Statistics of Finland (OSF): Manufacturing. ISSN=1798-6389. 2017, Appendix table 1. Value of sold industrial output by commodity, 2015-2017 1). Helsinki Statistics Finland [Referred on: 11.06.2019]. Available from: http://www.stat.fi/til/tti/2017/tti_2017_2018-11-01_tau_001_en.html

Ovaskainen, V., Hujala, T., Hänninen, H. ja Mikkola, J. (2017), Cost sharing for timber stand improvements: Inducement or crowding out of private investment? Forest Policy and Economics 74: 40–48.

Ovaskainen, V., Hänninen, H., Mikkola, J & Lehtonen, E. 2006. Cost-Sharing and Private Timber Stand Improvements: A Two-Step Estimation Approach. Forest Science 52(1): 44–54.

Pelkonen P. 2017. Suomen metsäkeskusta, metsänhoitoyhdistyksiä ja metsätietojärjestelmää koskevien lainsäädäntöuudistusten vaikutukset ja tavoitteiden toteutuminen. Arviointiraportti. The Ministry of Agriculture and Forestry of Finland [Referred 17.6.2019]. In Finnish. Available from: https://mmm.fi/documents/1410837/1504826/171102_Pelkosen_raportti.pdf/849f5f53-410a-4572-b243-a9117c8b2564/171102_Pelkosen_raportti.pdf.pdf

Primmer, E., & S. A. Wolf. 2009. Empirical accounting of adaptation to environmental change: organizational competences and biodiversity conservation in Finnish forest management. Ecology and Society 14(2): 27.

Pynnönen S., Haltia E ja Hujala T. 2019. Digital forest information platform as service innovation: Finnish Metsaan.fi service use, users and utilisation. Submitted manuscript.

Pöllänen V-P. 2014. The inactive users of the Metsään.fi -service. Polytechnic final year project. Karelia University of Applied Sciences. In Finnish. Available from:

https://www.theseus.fi/bitstream/handle/10024/87052/Pollanen_Ville-Petteri.pdf?sequence=1&isAllowed=y

Rämö, A-K., Mäkijärvi, L., Toivonen, R. ja Horne, P. 2009. Suomalaisen metsänomistajan profiili vuonna 2030. Pellervon taloudellisen tutkimuslaitoksen raportteja n:o 221. 47 s. In Finnish. Available from:

<http://www.ptt.fi/julkaisut-ja-hankkeet/kaikki-julkaisut/suomalaisen-metsanomistajan-profiili-vuonna-2030.html>

Räsänen, T., Hämäläinen, J., Rajala, M. ja Ritala, R. Metsävaratiedon hyödyntäminen puuhuollossa. Forest Big Data -hankkeen osaraportti. Metsätehon raportti 245, 29.12.2017. In Finnish. Available from:

http://www.metsateho.fi/wp-content/uploads/Raportti_245_Metsavaratiedon_hyodyntaminen_puu_huollossa.pdf

Saari, A. ja Kangas, A. 2005. Kuvioittaisen arvioinnin harhan muodostuminen. Metsätieteen aikakauskirja 12005. 5-18. In Finnish.

Available from: <https://metsatieteenaikakauskirja.fi/pdf/article6256.pdf>