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**Combining forestry and
protection of the flying squirrel
by utilizing service design**

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Abstract

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The purpose of this study is to provide the commissioner suggestions for solutions on how to combine forestry and protection of the flying squirrel. This study incorporates the private sector point of view into public sector directed development project Flying Squirrel LIFE.

The commissioner of this study is Finnish Forest Centre that participates the Flying squirrel LIFE project. Forest Centre is responsible for producing an education package for the project and participates project efforts to improve the acceptability of conservation measures for the endangered Siberian flying squirrel. The project endeavours to ease combining of commercial forestry and protection of the species.

This is qualitative and inductive research that utilizes service design to discover challenges and develop solutions for them. The perspectives of private sector representatives are needed to complement the project work. This study combines the insights of private sector forest professionals to the expertise of Forest Centre's and Flying Squirrel LIFE project personnel. Research data is gathered in in-depth interviews with forest professionals. Collaborative development is conducted in expert workshops by brainstorming.

This study provides insights on challenges forest professionals encounter while planning fellings on flying squirrel sites. This study also provides a multitude of suggestions to solve the discovered challenges. The main output of this study is a report of the solutions Forest Centre and Flying Squirrel LIFE project partners can influence on.

This study concludes that many challenges occur in combining forestry and protection of the flying squirrel. Education is suggested to ease many of the discovered challenges. However, this study demonstrated that complex and conflicted issues regarding protection of the flying squirrel in forestry require co-operation, resources and even changes for policies and legislation.

Tiivistelmä

Kirjoittaja: Heikkinen Tea

Julkaisun otsikko: Metsätalouden ja liito-oravan suojelun yhteensovittaminen palvelumuotoilua hyödyntäen.

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Tämän tutkimuksen tarkoitus on tuottaa toimeksiantajalle ratkaisuehdotuksia metsätalouden ja liito-oravan suojelun yhteensovittamiseen. Tutkimus tuottaa yksityisen sektorin näkökulmia julkisten organisaatioiden organisoimaan Liito-orava-LIFE-hankkeeseen.

Tutkimuksen toimeksiantaja on Suomen metsäkeskus, joka osallistuu hankekumppanina Liito-orava-LIFE-hankkeeseen. Metsäkeskuksen vastuulla on tuottaa hankkeelle koulutuskokonaisuus. Lisäksi Metsäkeskus osallistuu hankkeen muihin toimenpiteisiin liito-oravan suojelun hyväksyttävyyden parantamiseksi. Hankkeen tavoitteena on helpottaa kaupallisen metsätalouden ja lajinsuojelun yhteensovittamista.

Tämä tutkimus on laadullinen ja induktiivinen tutkimus, joka hyödyntää palvelumuotoilua haasteiden löytämiseksi ja sopivien ratkaisujen kehittämiseksi. Metsäalan yksityisen sektorin edustajien näkökulmia tarvitaan täydentämään Liito-orava-LIFE-hankkeen työtä. Tutkimus yhdistää yksityisellä sektorilla työskentelevien metsäammattilaisten näkökulmat Metsäkeskuksen ja Liito-orava-LIFE-hankkeen asiantuntijuuteen. Tutkimuksen aineisto kerätään syväluotaavissa haastatteluissa. Yhteistyöhön perustuva kehittäminen toteutetaan asiantuntijoiden muodostamassa aivoriihessä.

Tutkimus tuottaa näkökulmia haasteisiin, joita metsäammattilaiset kohtaavat hakkuiden suunnittelussa liito-orava-kohteilla. Lisäksi tämä tutkimus tuottaa lukuisia ehdotuksia löydettyjen haasteiden ratkaisemiseksi. Tutkimuksen pääasiallinen tuotos on raportti ratkaisuksista, joihin Suomen metsäkeskus ja Liito-orava-LIFE-hanke voivat vaikuttaa.

Tutkimuksen johtopäätös on, että metsätalouden ja liito-oravan suojelun yhteensovittamiseen liittyy monia haasteita. Koulutus voi helpottaa monien haasteiden ratkaisemista. Tämä tutkimus kuitenkin osoittaa, että liito-oravan suojelu metsätalouden yhteydessä on monimutkaista ja siihen liittyy myös ristiriitoja. Tutkimuksessa havaittujen haasteiden ratkaiseminen edellyttää eri osapuolten välistä yhteistyötä, resursseja ja jopa muutoksia vallitseviin viranomaiskäytäntöihin ja lainsäädäntöön.

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1 Introduction

This chapter presents the drivers for this study, the significance of forest sector in Finland and the challenges the endangered flying squirrel poses for the industry. The research problem and research question are introduced.

1.1 Forestry, biodiversity and flying squirrel in Finland

Forest sector produced about one fifth of the exports in Finland in 2019. Almost four percent of Finland's estimated gross domestic product in 2020 came from forest sector. Over half of it was generated by forestry. The other half is generated by pulp and paper industries and wood-product industries. Finland has the third largest tree resources in EU after Germany and Sweden.

In Finland the production of sawn softwood in 2020 was 3 percent of global production and 6 percent of worldwide exports. Wood pulp makes 6 percent of worldwide production and exports. Finland produced 2 percent of the global paper and paperboard and generated 7 percent of the exports. (Vaahtera et al., 2021.) Considering these numbers, forestry is the foundation of Finnish economy. However, utilization of natural resources comes with responsibility over nature, biodiversity, and sustainability.

Protecting biodiversity and the environment drives forest sector to evolve and develop ever more sustainable forest and nature management. In 2015 United Nations launched 17 Sustainable Development Goals. Goal 15 - Life on Land - concerns sustainability of forest management and halting loss of biodiversity. Finland is committed to the UN declaration for sustainable use of natural resources, such as forests, and *"to protect biodiversity, ecosystems and wildlife"*. Goal 15 consists of sustainable forest management and conservation. Goal 4 includes environmental education and improvement of skills for implementation. (United Nations 2015, n.d. Ministry for Foreign Affairs of Finland n.d.) The habitat directive of the European Union demands member states to protect endangered species (European Union 1992). One of the species listed in the directive is the Siberian flying squirrel (Finnish Environment Institute 2022).

In EU member states the Siberian flying squirrel lives only in Finland and in Estonia and the two countries are solely responsible for the protection of the species in the EU. (European Union 1992; Metsähallitus 2022) The changes in flying squirrel population are monitored in known habitats to

assess the conservation status. Currently, flying squirrel is considered a vulnerable species in Finland, and critically endangered in Estonia. (Hanski 2008; Hurme and Koskela 2019; Ministry of Agriculture and Forestry and Ministry of the Environment 2016)

The flying squirrel inhabits mostly forested areas, but it is also a current resident in urban areas, such as suburbs, city parks and recreational areas. (Hurme 2008; Metsähallitus 2022) Typical flying squirrel habitat is a spruce dominant forest with mixed deciduous trees (Nieminen and Ahola 2017). Forestry is found to be the main reason for declining population of the flying squirrel (Hanski 2008). In 2016 ELY-centers' prior responsibility to delineate flying squirrel habitats was removed and forest professionals' and landowners' responsibility in taking adequate measures in conserving flying squirrel habitats was increased. Due to the change in legislation forest professionals have faced legal charges when forest cuttings were suspected to overlap flying squirrel habitats. (LUVA - Natural Resources 2019)

1.2 Challenges in protecting the flying squirrel

The assumption in this study is that the challenges forest professionals encounter are related to company policies, sales targets, funding, and bureaucracy. Other anticipated challenges are the threat of facing legal charges, unclear instructions and interpretations of the law, and vague roles between officials, private companies, and forest owners. Also, forest professionals may lack experience of working with the flying squirrel or other endangered species. To summarize, many expected challenges are foreseen to be of administrative nature.

Answering to challenges such as lack of experience, lack of education and instructions, and administrative challenges are equally important. For example, if forest professional has the experience and adequate instructions, but faces impenetrable bureaucracy, the protection of the species is not resolved. Thus, this study targets to find all kinds of challenges forest professionals encounter. Not just the ones the commissioner could solve.

1.3 Finnish Forest Centre and Flying Squirrel LIFE project

This study is commissioned by Finnish Forest Centre. Forest Centre is a public organization responsible for monitoring forest legislation and granting forest subsidies. Forest Centre operates

nationally under the ministry of Agriculture and Forestry in Finland, and it has about 430 employees. (Finnish Forest Centre 2022d, 2024)

Forest Centre is a beneficiary in an international Flying Squirrel LIFE project that targets to find the best practices for combining forestry and the protection of the flying squirrel in Finland and Estonia (Metsähallitus et al. 2018). This study is commissioned by Finnish Forest Centre in connection to Flying Squirrel LIFE project. The official title of the project is “Co-operation for improving the conservation of the Flying squirrel in Europe”.

1.4 Research problem and research questions

In Finland, there were no practical instructions or examples on how to manage forests inhabited by the flying squirrel prior to the Flying squirrel LIFE project. In 2023 Forest Centre created an education package to support forest professionals in forest management on flying squirrel habitats (Finnish Forest Centre 2023). This study is conducted to support the education work in 2023 and 2024 and to expand the development of solutions beyond education. This is the research problem of this study.

The commissioner assumes that by addressing the issues complicating planning and execution of forestry actions at the vicinity of flying squirrel sites should improve the acceptance of the protection measures and enhance profitability of forestry on flying squirrel sites. This study intends to utilize service design to discover and define the challenges the forest professionals encounter and to develop practical solutions for combining forestry and protection of the flying squirrel. Thus, the research questions are:

What are the challenges forest professionals encounter in combining commercial forestry and protection of the flying squirrel?

How can the challenges be solved using service design and customer journey mapping?

1.5 Objectives and outputs of the study

The objective of this study is to develop suggestions for solutions to combine commercial forestry and protection of the flying squirrel. Forest industry requires wood, and the flying squirrel seems

to prefer inhabiting commercially utilized forests. The purpose of this study to support Forest Centre to determine the challenges forest professionals encounter in flying squirrel related situations. The output of this study is a report of the challenges forest professionals encounter while working on flying squirrel sites. The report includes practical solutions to the determined challenges.

This study is expected to produce long term solutions that can be implemented into Forest Centre's permanent activities and utilized long after the Flying Squirrel LIFE project has come to an end. However, as this study will be finished during the project, the outcomes may be applicable for project's activities.

This study is conducted through qualitative research. Expert interviews and workshops are used to gather data and develop solutions. The achievement of the goal of this study is measured by the number of challenges discovered. Also, the objective of solving the challenges is measured by the number and feasibility of the developed solutions.

1.6 Structure of this study

This chapter presented the background for the objectives and outputs of this study. The significance of forest sector in Finland, and the challenges the protection of the endangered flying squirrel poses on commercial forestry were explained. The flying squirrel and the forest professionals considered in this study were introduced. The research problem, research question and the objectives and outputs of this study were presented.

Chapter two builds the foundations for the research and presents how service design applies in public sector and how it can be utilized in determining and solving species protection issues in forestry. Chapter three presents research methods and introduces the research process.

Findings and outcomes of the research are presented in chapter four with detailed descriptions of what was done to gather and analyze information and to develop solutions. Chapter five presents conclusions. Chapter six discusses the results, as well as the limitations and needs for further research.

2 THEORETICAL FRAMEWORK - SERVICE DESIGN

This chapter introduces the theories of design, design thinking and service design. The practical tools for service design process are presented. The Double Diamond Process by Service Design Vancouver (2022a) is considered the main tool for this study, and it is presented in detail. Also, the customer journey map is explained. The benefits of utilizing service design in public sector are introduced in this chapter, as well as the commissioner's previous explorations to service design.

2.1 Design thinking

For many people the word design recalls fashion, furniture, and architecture. However, design thinking is more than just aesthetics, and the same methods utilized in product design are applicable in designing services. According to Brown (2009) design thinking can be utilized in changing the way we live and in solving fundamental questions about our society's future, such as health, government, education, and security. (Brown 2009)

Design is a way of thinking and a practical method for solving problems. Organizational development can be induced by incorporating design thinking into organizational development processes. Utilizing design as a tool is a strategic choice to create innovation, new business models and markets. (Maula and Maula 2019)

In design thinking the value is created by combining different tools and methods to *"enable comprehensive approach to problem solving"*. It requires commitment, change in organization culture and attitudes, education and sharing of information in a way that may not be familiar for traditional leaders and organizations. (Maula and Maula 2019)

Design thinking starts from defining the human need. The first step is to define the question that requires answering. Design makes the greatest impact when people become participants instead of consumers. Brown suggests that instead of bringing designers from outside the target community, the people concerned with the problem should be invited to participate. Local expertise combined with designers and specialists should collaborate to find the best solutions and alternatives. (Brown 2009)

Maula & Maula argue that design thinking can create competitive advantage for businesses. Basic guidelines for design approach are:

- customer centricity
- defining the problem by observing and listening to the customers and stakeholders
- using the double diamond (Figure 1) and other tools to map out a vast range of solutions and then to narrow down and develop them further to enable creative problem solving and out of the box thinking
- iterative processes
- flexibility, inclusion, and appreciation of different ideas
- prototyping and failing early (creating an atmosphere where failing is encouraged and seen as a part of the process for finding the best solutions)
- seeing development as a process, not a journey with an end.

2.2 Service dominant logic

Goods dominant logic perceives value to exist in goods and that the purpose of exchange is to sell more units. Service dominant logic considers goods as vessels of value, and that the purpose of exchange is to co-create value for all parties involved. According to Vargo and Lusch (2008) “*service dominant logic says that the application of competences for the benefit for another party - that is, service - is the foundation of all economic exchange*”. (Vargo and Lusch 2008)

Service dominant logic aligns the interests of the organization, customers, and the society. It applies into solving multi-stakeholder issues that require the utilization of collaborative methods in networks. (Abela and Murphy 2008) It seems, that the environment and conservation of habitats and species are multi-stakeholder issues, that benefit from utilization of service dominant logic.

Service dominant logic is not limited to service organizations and can be incorporated into manufacturing companies also. Thus, any organization striving towards customer-centricity can embrace it. (Greer, Lusch, and Vargo 2016) The potential of service dominant logic is yet to be seen. It is not merely a framework, but it is becoming a general theory, that in addition to marketing,

covers business, economics, and the society. In addition, service dominant logic can be utilized as a framework for environmental and social sustainability, as well as for developing public policy towards enabling cocreation of value within and amongst public and private sector operators. (Vargo and Lusch 2017)

2.3 Service design

Protection of endangered species may be found a nuisance. Changing the way of working, adding to it, or finding time for competence development may not be desirable for all organizations and professionals. People may not be inclined to incorporate even practical and feasible solutions into their routines. Service design offers customer centric design thinking approach for problem solving, where forest professionals are considered “the customer”.

Service design is about designing customer experiences and services. It does not require artistic talent, only thinking and testing of ideas. In practice it can be divided into two phases which are *sense making* and *problem solving*. The first step is about understanding the problem through observation and interaction. The second step is to use the gathered insights to improve an existing idea or to create a new one. Failure is inevitable in the process and the idea is to fail early, and a lot. (Hopkins 2019)

Service design utilizes design thinking in inventing new services or improving existing ones. Service design takes the viewpoint of service users and is conducted in collaboration with them. (Thoelen et al. 2015)

According to Thoelen et al. (2015), service design can be utilized in:

- *making an existing service more efficient*
- *simplifying several operations*
- *eliminating steps in a process*
- *digitizing components*
- *transferring responsibility and initiative to citizens.*

Yu (2020) suggests that service design should be considered a “*multidisciplinary contribution area*”. Service design can be strengthened by combining various service design perspectives. Thus, Yu proposes an integration of three service design perspectives, that are

1. marketing/management-centric service design
2. design-centric service design
3. multidisciplinary service design (Yu 2020).

Marketing/management perspectives can be utilized in guiding design efforts towards “*customer-oriented value propositions*”. By incorporating design thinking in how an organization operates, customer-oriented design can lead the organization towards multidisciplinary service design. Various service design methods and perspectives can be utilized in the process. Multidisciplinary service design builds on the first two perspectives but is limited due to lack of research and development. (Yu 2020)

The goal of service design is to create value to the customer. Value is proposed by the service provider and created by the user. Service development should include “*user-centred stakeholder collaboration strategies*”. The goal should be in creating “*experiential user value and stakeholder collaboration*”. Marketing/management perspectives may play a key role in incorporating design into the practices of the organization. (Yu 2020)

Possible conflicting stakeholder interests should be acknowledged. By combining user-centric and stakeholder-centric approaches designers may find ways of integrating collaboration to value co-creation. Combination of the two perspectives is inevitable since the perspectives do not consider each other. However, combining stakeholder-centric collaboration with perspective on user value requires more study. (Yu 2020)

Accessibility should be a part of any design process, whether it is about designing a product, service, or a combination of them. Including different users in testing the commodity will reduce problems with inclusivity. However, design process is a sum of various compromises between usability, accessibility, time, and cost. (Zitkus, Langdon, and Clarkson 2013) Service is a combination of commodity and experience.

2.3.1 The object of designing

Hakoköngäs & Asiala state that service designers perceive the customer they design for simultaneously in two different ways. First is the profession-centred image, where designers aim to determine the target of their design process through objective design tools. They mention for example Maslow's hierarchy of needs, user pathways and personas. (Hakoköngäs and Asiala 2020)

However, the objective and unbiased way of perceiving the human being was found limited by the design professionals that Hakoköngäs and Asiala interviewed in their study. Designers exploit their unique personal experiences to draw an image of the object of their design process. Thus, person-centred image is the second way of perceiving the customer. The main reason found for the need of a more heuristic approach was that people are complex individuals and that design tools lack the ability to comprehend the whole extent of human nature. (Hakoköngäs and Asiala 2020)

Designers utilize both profession-centred and person-centred methods and combine them in their design process with flexibility. They rely on their professional experience to define the image of their customer. Service design professionals intend to understand the diversity of human nature, but in practice generalizations are required to enable feasible outcomes. Thus, service design can be seen as a combination of objective research and utilization of the designer's subjective expertise. (Hakoköngäs and Asiala 2020) In this study, the customers are the forest professionals that benefit from the solutions generated through the design process. The characteristics of the customers – the forest professionals - are introduced in chapter 4.

2.3.2 Value co-creation

According to service dominant logic multiple stakeholders co-create value. Service users should be considered as stakeholders. (Yu 2020) Value is always created in a relation between service provider and customer in an iterative process. Value co-creation occurs in a network of social and economic actors. (Vargo and Lusch 2008) Service dominant logic is a viewpoint where value is co-created and determined by the user and that service is a perspective on value creation. This logic points service design towards understanding customer needs and in designing value propositions accordingly. Emphasis is on customer needs, and value propositions are not designed from the perspective of organization's resources. (Yu 2020)

Value-in-use is a service dominant logic concept that comprises on the idea of experiential value. Coproduction is incorporated into co-creation of value. It means that customers participate in producing or developing the service. For example, customer-assembled furniture, brand communities in social media and movie scripts produced together with consumers are co-productions. Value co-creation can be based on exchange of knowledge between the organization and customer. Data collected from customer encounters, customer feedback, and on-going customer relationships and training events are channels for value co-creation. (Greer et al. 2016)

Organizations operate in a network of stakeholders. It is not enough to examine merely bilateral relationships between stakeholders, such as service provider and customer. There are always multiple stakeholders that are affected by the organization's decisions. For example, employees and shareholders are always concerned when changes are made. Customers, subcontractors, and suppliers are affected by changes in strategy and supply. Even stakeholders that do not have direct relationship with the organizations are to be considered as influencers on the organization's behaviour. (Rowley 1997)

Value co-creation occurs within a network of stakeholders where customer utilizes an organization's output in their own value co-creation process. Value is not embedded merely in tangible assets since service dominant logic presumes value to exist in the intangible services. Value is co-created by everyone. Customers will modify the value propositions to suit their specific needs and to integrate them into their own operations. Customer accepting the service offering is co-creating value with their own experiences and preferences. The chain of value co-creation includes the firm making the value proposition, its customers, and the firm's suppliers. (Greer et al. 2016) Where the chain starts and ends is not determined, neither is the form of a "chain".

In public sector there are various stakeholders that might have conflicting interests. Forest owners have pluralistic goals consisting of economical, recreational, emotional and biodiversity goals. Forest professionals have their profit targets set by their employer, and the organizations they represent strive to maximize shareholder value. Public expects efficient use of taxes. Ministry and government expect organizational effectiveness and enforcement of legislation and statutory tasks. In addition, there is a network of stakeholders and partner organizations that have their own interests. The organization itself has its own strategy, goals, and vision. The interests of stakeholders are likely overlapping and conflicted. Thus, a public organization must be aware of different stakeholder interests in building value co-creating systems.

2.3.3 Value determination and customer experience

According to Vargo and Lusch (2008) “*value is always uniquely and phenomenologically determined by the beneficiary*”. Thus, organizations are limited to make only value propositions (Greer et al. 2016). Customer determines the meaning of value for themselves, and value is connected to the customer experience. Customer’s value-determination is not rationalistic. Customers have unique experiences on the service and value is determined based on the experiences. (Vargo and Lusch 2008)

Customer service experience is a complex phenomenon. Today’s customers do not merely seek to maximize profit or make rational purchase decisions. Helkkula and Kelleher propose a circular frame where customer’s service experience effects on customer value and vice versa. Customer’s individual experience on any service is built on their previous life experiences. All customer’s previous life experiences and individual interests’ effect on perceived value. Also, customer’s value expectations are affected by their history. Thus, new customer experiences effect on becoming experiences and value expectations. (Helkkula and Kelleher 2010)

However, not only individual experiences have effect on service experience. Other customer’s shared experiences impact on customer expectations because customers are part of a customer community that effects on service experience. Additionally, customer experience does not always form based on physical and observable events. The experiences and imagination play a role in formation of value expectations and the service experience. This sets challenges for service design because customer expectations are not simple to measure based on physical activities and phenomenon. (Helkkula and Kelleher 2010)

When considering flying squirrel and species protection related issues the media and public opinion may have an effect on forest professionals’ expectations on how fluent it is to plan and execute fellings on flying squirrel sites is. The shared experiences and rumours by other professionals’ difficulties may result a negative attitude and prejudice towards species protection, public servants and people promoting green values.

2.4 How to measure value in the experience

Customers perception on value in the experience cannot be clearly measured due to the subjective nature of experiential and phenomenological value. There are no research methods that

could capture the entirety of customers' personal experiences. However, there are methods that enable capturing the sense making process customers go through in assessing services and value propositions. Customers' sense making process does not capture what really occurred but what customers perceived, and thus give at least a glimpse of what they experienced. (Helkkula, Kelleher, and Pihlström 2012)

Measuring value in the experience should not concentrate merely on current customer experiences. It should also include the experiences of noncustomers and prospective customers. In addition to post-use experiences, measuring perceived value should target to understand the service users' past and future experiences and imagined experiences' impacts on the service experience. Research methods targeting to capture the sense making process of customers' subjective service experiences and value within are applicable for measuring value in the experience. (Helkkula et al. 2012)

Helkkula et al. (2012) introduce four value in the experience propositions that are overlapping and interrelated and are meant to broaden the perspective of value:

1. *Value in the experience is individually intrasubjective and socially intersubjective.*
2. *Value in the experience can be both lived and imaginary.*
3. *Value in the experience is constructed based on previous, current, and imaginary future experiences and is temporal in nature.*
4. *Value in the experience emerges from individually determined social contexts.*

Organizations typically base their strategic decisions on their organizational perspective including competitors, the price customers are expected to be willing to pay, profitability and so on. To enhance value propositions, service providers should endeavour to better understand the value in the experience from customers' viewpoint. Value in the experience is more than interaction between service provider and its customers. (Helkkula et al. 2012)

To enable value co-creation of value, organizations must endeavour to understand customer life-world contexts, social networks and their existing and imaginary experiences based on past and future. Additionally, customers imaginary experiences can be a source for new service innovation. Organizations should pay attention to changing conditions and their influence on customer expectations on the value in the experience. Indeed, originally positive service experience can later transform and become negative due to changing conditions. (Helkkula et al. 2012)

As an example, banking; a customer may be very happy for the service experience when granted a loan for buying a house. However, when rates start to rise and the new homeowner struggles with payments, the service experience may become negative due to the customer's subjective experience on the bank's inflexibility in changing the terms of the loan agreement.

Interpretive methods such as diaries, blogs, interviews, and observation are applicable for collecting data about value in the experience. Customer's perceptions on value are likely to change over time. Thus, value in the experience should be considered temporal, dynamic, iterative, and socially constructed. Value in the experience method does not apply for generalizable research, but it offers a possibility to capture "*subjective value experiences in social contexts*". (Helkkula et al. 2012) This could be applicable for studying a specific organization in a specific situation where value in the experience must be determined to develop enhanced or new value propositions for stakeholders. Concerning this study, the expectations of forest professionals may have a significant impact on how they see combining of forestry and protection of the flying squirrel. Managing these expectations may be a key to improve acceptability of species conservation and to enable more effective conservation measures in day-to-day forestry.

2.5 The Double Diamond

British Design Council's framework for innovation, the "Double Diamond" enables iterative and customer-oriented design process for development. The Double Diamond (Figure 1) consist of four stages, that can be repeated as many times as necessary to determine the problem or issue and to create innovative, practical, and people-centric solutions for the defined problems. (Design Council 2022)

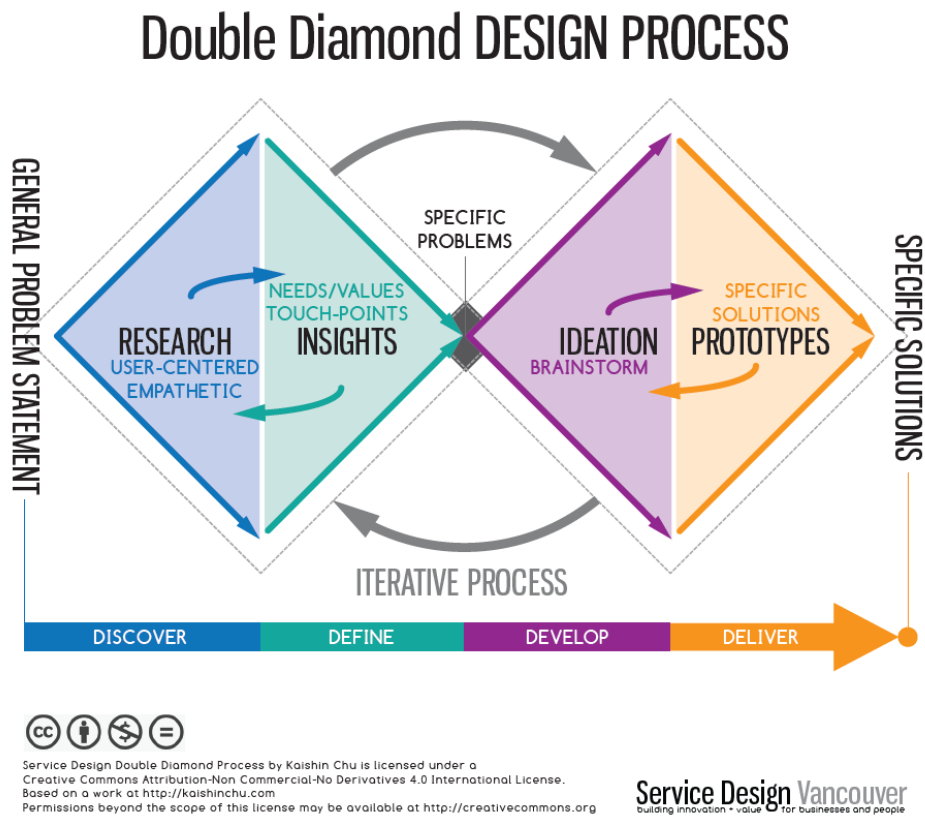


Figure 1. Double Diamond Design Process. (Service Design Vancouver 2022a)

The Double diamond is a way of illustrating the narrowing and broadening stages of service design process. It depends on the project whether the stages are followed in succession, or iteratively. The freedom of design process enables revising necessary stages all over again to find the best solutions. The process can be conformed to the specific challenge. (Thoelen et al. 2015) Double Diamond illustrations can be utilized as a communication tool to enable better understanding of the process. The idea of the Double Diamond is to expand and then narrow down the point of view. (Design Council 2022)

2.5.1 Discover

Service design process begins with the present situation. There is a challenge, but it is yet to be determined what exactly is the problem. In discovery phase service designer frames the challenge by broadening their perspective by gathering information on the situation. In practice, this can be accomplished by gathering information through interviewing the users, observing them, or utilizing other collaborative and inclusive methods. (Thoelen et al. 2015)

Discovering the challenges requires understanding the customer through interviewing and/or observing. Observation might be needed to discover problems that cannot surface in interviews due to limited questions; it is impossible for the interviewer to anticipate all factors, so observation is an objective way to discover the problems. When conducting this sort of research, it must be determined whether the observation should precede or follow the interviews. (Maula and Maula 2019) In this study, the discovery of problems was conducted by interviewing forest professionals.

2.5.2 Define

The second phase is to narrow down the problem and find a focus point: what do we want to solve through the process? This may require considering restrictions such as resources, finances, and time. (Maula and Maula 2019) Narrowing down the problem includes analysis and categorizing of the insights gathered in phase one. Analysis includes finding themes, similarities, and differences. The analysis will result clarifying definitions for the problems. (Design Council 2022)

Definition phase will converge the process through narrowing down the problem. In the first stage the viewpoint is broadened, and problems and their definitions should be found. The variety of insights must be processed and condensed to enable better understanding on the issue. This can be accomplished for example by creating personas. At this point a focused design challenge will be determined and the rest of the design process is built on it. The design challenge should be condensed into one sentence. The determination of the design challenge could be done in collaboration with the stakeholders. (Thoelen et al. 2015) In this study the definition was conducted by analysing the interview data with Atlas.ti-tools. A customer journey map was created to illustrate the process forest professionals go through in flying squirrel sites. After the analysis the discovered problems were narrowed down in a workshop with a multi-professional group.

2.5.3 Develop

Third step of the Double Diamond design process is about developing a multitude of solutions. At this point there should be no restrictions. All ideas should be brought forward, and they can be combined, developed further and new ideas and innovations might be generated through workshops, brainstorming, prototyping and mind mapping. (Maula and Maula 2019) The third step is about diverging the point of view again. Stakeholder collaboration begun in the second phase will

continue to produce a vast amount of solution-oriented scenarios. Users' point of view and the design challenge defined in phase two guide the development. Personas might help in considering users' viewpoint. Different customer journeys must be considered in creating or developing a service system. (Thoelen et al. 2015)

In this study the development continued in the multi-professional group after the problems were narrowed down. A multitude of solutions and suggestions were generated and the ones Forest Centre can affect on were chosen for further development in a second workshop with experts from Finnish Forest Centre.

2.5.4 Deliver

The last phase is about delivering the solution for the chosen problem. All previous ideas should be considered, and the best ones can be chosen into further development. The process is seldomly linear. Before reaching the delivery-phase the designers might have to iterate and repeat previous phases for several times. (Maula and Maula 2019)

Phase four is about narrowing down again. Feasibility of the scenarios is tested and evaluated through prototyping. The method for this will be chosen based on the service under development. Including users in testing prototypes will enhance the reliability of results. Thorough testing leaves little room for unexpected costs in the future. (Thoelen et al. 2015) In this study, the delivery of solutions was begun in the second workshop, where Forest Centre's expert carefully assessed the ideas generated from the interviews and the first workshop. The solutions were listed and finalized by the researcher.

2.5.5 Iterative design process

The design process introduced above shows four specific stages that seem to follow each other to reach solutions. However, the Double Diamond design process can be non-linear and iterative process, that, if necessary, repeats each step again and again (Figure 2). During the process, the designer may return to previous stages and then continue to latter in mixed order. The process is altered based on the problem, discoveries, insights, and solutions found during it. (Service Design Vancouver 2022b)

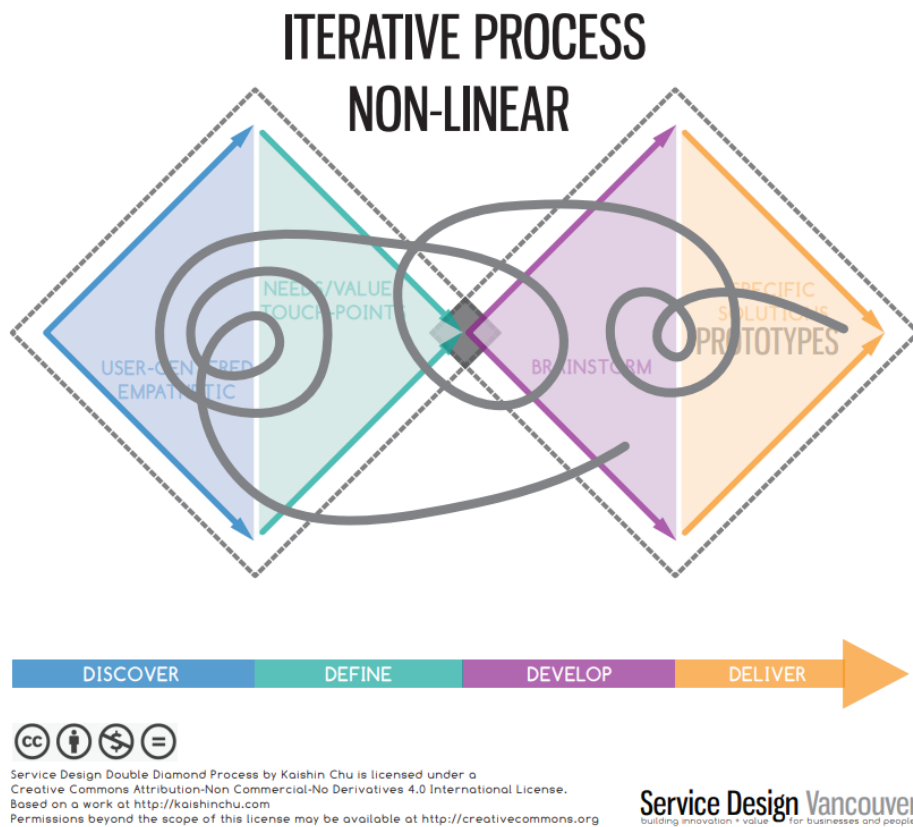


Figure 2. Non-linear Double Diamond Design process (Service Design Vancouver 2022b).

2.6 Stanford d.school desing process

Another tool for understanding the design process is the Stanford d.school process (Figure 3). It has five phases: Empathy, Defining, Ideation, Prototyping and Testing. The starting point for the process is to understand the customer through empathy. The idea is to discover human-centric solutions and to prototype and test them in practice. The supporting theme is to base the decisions on acquired knowledge rather than assumptions. (Doorley et al. 2018; Maula and Maula 2019)

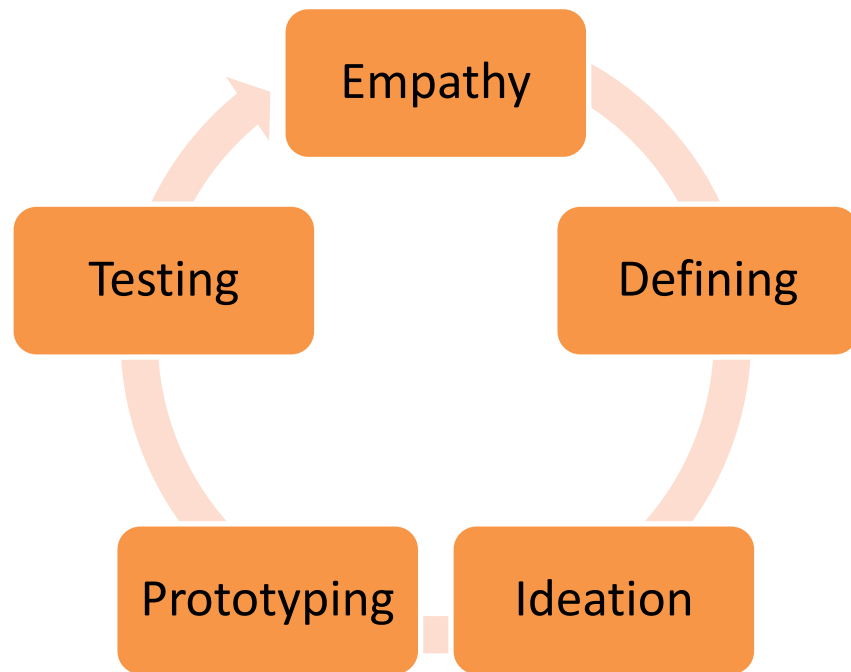


Figure 3. Stanford d. school design process. Adapted from Doorley et al. 2018; Maula and Maula 2019.

2.7 Customer journey mapping

Customer journey map presents the customer viewpoint of a service. Service blueprint showcases the entity of the process and includes the external stages (visible for customer) as well as the internal stages (hidden from the customer). (Haugstveit, Halvorsrud, and Karahasanović 2016)

There are two types of customer journeys: planned and actual customer journeys. The service provider, consciously or unconsciously, has planned a journey they perceive or prefer the customer to have. Actual customer journey can be identical to the planned. However, the inconsistent nature of customer encounters induces variation between individual customer's actual journeys. The determination of an actual customer journey requires gathering information on customer behaviour and real-life customer encounters through the touchpoints customers have with the service provider. (Haugstveit et al. 2016)

The planned customer journey should not be visualized merely based on service provider's conceptions. Customer journeys are not always consciously planned. Thus, gathering information on the planned customer journey is important since the service provider may not be aware of all the steps they have incorporated into their operations during the years. The visualization on planned

customer journey may reveal overlapping touchpoints and other inconsistencies. (Haugstveit et al. 2016)

Visualization of an actual customer journey requires gathering information from preferably recent customers. Haugstveit et al. (2016) gathered information on actual customer journeys in their case study while the customer journey took place. This enabled recording of all the touchpoints the customers had. They also recorded customers' satisfaction in each touchpoint. They found it valuable to reveal what occurred during the touchpoints and how the customers experienced it. Also, some deviations from planned customer journey were found. Some of the deviations were known but others were new findings. This enabled re-designing the customer journey. Haugstveit et al. (2016)

In this study a customer journey map was utilized to illustrate the planning process – the customer journey – the forest professionals go through while planning fellings on a flying squirrel site. The customer journey map was created based on the interviews and the professional knowledge of the researcher. The customer journey map was presented for and approved by the Flying squirrel LIFE project partners in the first workshop (chapter Develop – workshop with project partners4.5).

2.8 Service Design in Public Sector

Services add layers to the previously manufacturing dominant economies all over the world. Services provide growth possibilities for otherwise mature economies and thus the service expectations of customers, employees and businesses are increasing. Emerging of service design has spread from customer services through businesses into public sector. (Reason, Lovlie, and Flu 2015) Service design can and should be applied in developing public services. Public services are in many cases build from the perspective of the organization instead of the service users. Designing public services includes all customer journey processes. Designing should include interaction with the users as it allows building more efficient and effective public services. (Thoelen et al. 2015)

Lewandowski introduces a design framework for public organizations to measure design within the organization. The framework consists of four phases that each have their own components (Figure 4). First step is input. It consists of design skills, culture and design-oriented management

and leadership. These are the components an organization and its designers should possess to start an iterative design process. (Lewandowski 2017)

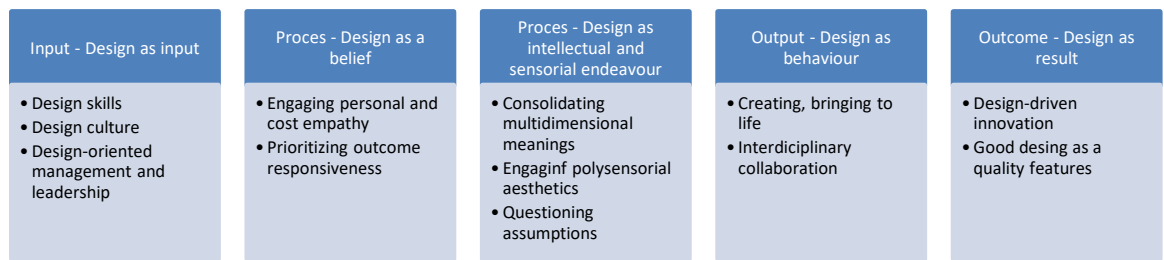


Figure 4. Design framework for public sector organizations. (Lewandowski 2017)

Lewandowski and Kozuch (2017) state that entrepreneurship is part of public service organizations as well as for-profit organizations. Business models benefit public sector as they develop services and effective production of them. Value creation, value deliberation and value capture combine all organizations, regardless of their for-profit or public basis. (Lewandowski and Kozuch 2017)

Typically, public sector organizations have various stakeholders like citizens, customers, and taxpayers. Non-governmental organizations, broader community, enterprises, decision makers and the natural environment that requires protection are also stakeholders. Public sector business model suggested by Lewandowski and Kozuch builds on co-creation, co-delivery, and co-capturing of value. Thus, co-operation is central in this model, where a network of stakeholders' exchange value. (Lewandowski and Kozuch 2017)

Public services can no longer be one-way delivery of services from public policy to public service organizations and onwards to service users. Users' participation can be incorporated into planning and producing public services. The nature of any service is that users are inevitably either voluntary or involuntary co-producers of service. Regarding public services, co-production is often involuntary. However, incorporating user perspective in enhancing quality of public services benefits both the public service organizations and service users. (Osborne, Radnor, and Stokosch 2016)

Other attribute of services is simultaneous creation/production and consumption of them. Thus, service is always co-produced by service provider and service user. Service users' experience on the quality of the service depends on their expectations on the service. User can also affect on the quality of services by actively (consciously or unconsciously) taking part to its production. (Osborne et al. 2016) For example, regarding Finnish Forest Centre, the enforcement of forest

legislation may result an involuntary co-production of the service. It is likely that the service user would not prefer associate with an inspector possibly collecting back forestry subsidiaries or inspecting possible violation of the forest act.

Service users' experiences make a distinction between otherwise identical services. Even when a service provider always produces the same service, service users' expectations lay the ground for diverse experiences. Also, the interactions between service provider and users are unique, which effects on the co-production of the service. Education is an example of co-created services. The activity or passivity of students makes great difference on service quality and experience. When students put their own time and effort to studying, both teaching and learning are more fruitful and smooth. However, even one student's reluctance towards studying might affect on experiences and service quality for the other members of the group. Therefore, co-production of the services is not individual, but other people's activity (or lack of it), and interactions can be a significant factor in service quality. (Osborne et al. 2016)

In forest sector, forest owners commonly associate with public service organizations such as Forest Centre through an agent, who is usually a forest professional from private sector. Thus, the co-production of service, its quality, and forest owner's experiences are dependent on the interaction between the agent and Forest Centre. Forest owner's own expectations and interaction with the agent are substantial factors. Also, there can be subcontractors involved, which makes co-production of forestry services ever more complex.

In this study, the perceived negative attitudes and past experiences of forest professionals may have an affect on their expectations and willingness to associate with public organizations such as Forest Centre and regional ELY-centres. The perceived difficulty of planning fellings on a flying squirrel site might make many professionals involuntary service users for public sector.

Finnish Forest Centre offers education for landowners and forest professionals. However, there are some organizational delimitations. First, the funding of education depends on fixed term projects, such as Flying Squirrel LIFE project. When project funding ends, the education within will also come to an end. Secondly, in most cases, the project staff is hired with fixed term contracts, and the knowledge produced within the project might be lost if the project personnel shift to other organizations.

2.9 Service Design in Finnish Forest Centre

In 2021 Finnish Forest Centre had a service design project that included comprehensive service development and renewing of Forest Centre's main product Metsään.fi-service. The project for renewing the online service platform Metsään.fi for landowners and forestry related service providers was in progress while this study was made. The service design project had four phases:

1. Understanding the status of services in Forest Centre
2. Further understanding the customers
3. Defining the customer personas
4. Ideation of activation methods for landowners

External service design consultants were included in the process. The goal was to enhance understanding about the customers and their current and future needs before beginning the actual software development. The project included five workshops. The first workshop was held to determine the most important features of the customer personas and to prepare for interviews. Eleven landowners and seven forest professionals were interviewed to deepen customer understanding in phase two. Also, data from current online service was gathered to build an understanding on current and future customer needs. Landowners and forestry operators were invited into workshops with Forest Centre's experts to ideate on the subject. (Airas 2023; Finnish Forest Centre 2021)

Two workshops were held in phase three to determine the customer personas and other two workshops in the final phase to ideate activation methods. The last workshops included customer representatives and Forest Centre's personnel. Customer personas were created and combined with user interviews and workshops. All three phases helped to establish the starting point for Metsään.fi-service development. (Airas 2023; Finnish Forest Centre 2021)

Finally, twelve customer personas were determined. Most of the personas were different types of landowners and the rest represented a variety of forestry related professionals and entrepreneurs. The personas were utilized in the ideation phase to create suggestions for future services and to support software development. Development ideas were divided into five categories based on the objectives the customers most likely emphasize in their decision making:

- economics

- continuous growth of the forest and nature biodiversity
- nature conservation
- recreation
- other or general objectives

Two to three development ideas were produced for each objective. The ideas were forwarded to software development for further consideration. Service design was utilized as one-off tool to determine customer personas and categorization of development ideas. Service design is not at use all the time and it is more of a project tool to solve specific challenges. The service design project produced information on Forest Centre's current services and customer personas and ideas for further service development. Especially development of one of the most important products of Forest Centre – Metsään.fi-service – has had benefits from incorporating customer point of view into the project. (Finnish Forest Centre 2021)

In 2022 Forest Centre finished a service design training program for its personnel. The idea was to answer to Forest Centre's strategic goals to emphasize customer experience in service production. 126 experts from Forest Centre participated the program that included eight workshops and 25 customer interviews. Program was completed entirely through remote connections. Also, some external experts were included into the development work. The goal of the program was to develop service design competences in Forest Centre and to incorporate the enhanced expertise into internal and external development projects. (Palvelumuotoilu Palo 2022)

Forest Centre has participated into two development projects where service design was utilized in creating guide material for forestry related enterprises. A guidebook about customer centricity in developing forest services was published in 2019 to support forest service companies in business development. The guidebook itself consist of several service design and customer centric tools that small and medium size businesses can utilize in developing their operations and new business ideas. (Antturi, Nousiainen, and Pisto 2020; Työteho-seura 2019)

Another guidebook about value creation through service design and service review was produced in a project 2018-2021. The guidebook offers argumentation for customer centric approach in developing services. It offers some basic tools for mapping customer experience, such as service blueprint and operation diagram to illustrate service processes. (Katajamäki n.d.)

Service design was utilized also in renewing Forest Centre's websites Metsäkeskus.fi. The process began with workshops where landowners and representatives from small and medium sized forest enterprises were invited to share their views on the websites. The goal for utilizing service design was to ensure that renewed webpages would answer to true customer needs. The process included four workshops of which one was directed to Forest Centre's own personnel and three for different customer segments. Workshops included customer interviews, creation of customer definitions, and assessment on current webpages. As a result, customer needs for the new webpages and their usability were determined. (Palvelumuotoilu Palo 2020)

During the last few years Forest Centre has utilized service design in internal development projects but also in developing guide material for customers. However, service design seems to be limited to project work and some projects are disconnected from the ongoing general development work. Utilization of service design in Forest Centre and in public sector might be limited due to the lack resources and strict regulations on the organization's mission and duties.

Service design seems to be utilized on regular bases and the previous experiences indicate that public sector and Finnish Forest Centre can benefit from including customer perspective and iteration into service and software development. There are no reports on how the utilization of service design has resonated amongst the customers of Forest Centre. Also, there are no studies on how customer experience has evolved after the service design projects. This study is independent and not connected to Forest Centre's other service design endeavours.

2.10 Service Design in policy making

Buchanan, Junginger, and Terrey (2017) argue that "*designing of public services begins with policy making*". They say that focusing merely on front line services service designers fail to see the processes behind them. In policy making, governments struggle to discover what problems new policies may create before implementation. Service design can be used in every level of policy making from planning to implementation. It seems that creating new policies is a separate process from implementing them. Hence, policy makers do not recognize problems that may arise among public service users. (Buchanan et al. 2017)

According to the European Commission, drivers and barriers to public sector innovation are internal, external, and political (**Virhe. Viitteen lähde ei löytynyt.**).

Table 1. Drivers and barriers to public sector innovation (adapted from Koźuch and Sienkiewicz-Małyjurek 2013; Rivera León, Simmonds, and Roman 2012)

Factor	Driver / Barrier	
<i>Internal</i>	Human resources-related factors	Education and training of public servant
		Availability of incentive schemes for motivating public servants
		Leadership and good management
		Other (e.g. availability of time, shortage in personnel)
	Bureaucracy and organizational structures and design	Internal organizational processes
		Performance management, including monitoring and evaluation practices
Internal innovation culture		
<i>External</i>	International good practice and knowledge transfer	
	International rankings, national awards	
	Co-creation, service user participation, collaboration between public-private sectors	
	Citizen and businesses demands	
<i>Political</i>	Budgeted reductions/restrictions	
	Availability of funding/financial resources	
	EU policy decisions (i.e., EU funds) and requirements at EU level	
	Political support, m(More flexible) laws and regulations	

If service design methods are utilized merely in the implementation of public policies, the design work will be restricted by the policy. If service design methods are utilized from the beginning of the process, possible problems can be foreseen and considered before implementation. This enables taking users' and public service providers' insights into account, prevent additional costs, and improve service user satisfaction. (Buchanan et al. 2017)

Policy makers "*tend to have practical outcomes in mind*". This means that for policy makers service design methods are an alternative way to tackle challenges in public sector. Designers are also needed in policy making, since they have the fullest understanding of applicable methods. However, designers must understand policy making processes. The vastness of the effects of policies on the society must be comprehended. Also, the restrictions about policies, politics, legislation, and principles concerning for example equality and accessibility must be recognized. High level policy making benefits from knowledge about citizens' and other interest groups' needs. Designing public services for citizens and organizations benefit from policy making incorporated with service design methods. Incorporating service design into policy making enables collaboration with citizens and stakeholders, enhances the process by providing clear framework for policy making process, helps in visualizing complex systems and enables more efficient idea generation. (Buchanan et al. 2017)

Customer journeys, prototyped experiences, and narrative creation are tools for policy making and public sector service design. Service design utilizes observations and material from real people's real lives. During the process, people may reveal non-compliant behaviour voluntarily or involuntarily and this information must be handled with confidentiality. Revealing information about non-compliant behaviour is not to be used to enforce legal actions or any misconduct towards citizens providing this information. (Buchanan et al. 2017)

Information on non-compliant behaviour is important when it comes to improving acceptance and effectiveness of policies and public services. Non-compliant behaviour may be a result of unclear rules and regulations. It may be a symptom of lack of knowledge and inadequate communication from public sector to its stakeholders. The policies concerning the flying squirrel in Finland have changed during the last decade (Ministry of Agriculture and Forestry and Ministry of the Environment 2016). This has generated legal actions against forest professionals that have planned and executed fellings on flying squirrel sites. (LUVA - Natural Resources 2019)

Gathering information on non-compliant behaviour when it comes to policy, legislation, and rules, can benefit the design work. In this study, forest professionals may reveal involuntary non-compliant behaviour because the nature conservation act in Finland is subject to interpretation. It seems that service design can be utilized both in higher level policy making and, in more specific policy creation within public organizations. Public sector implements policies created by the government. Democratic decision making takes time and it is wasting of public funds to create policies and figure out possible challenges during implementation. It seems that service design could offer iterative tools to consider possible outcomes and problems beforehand and enhance the effectiveness and acceptance of new policies.

3 RESEARCH STRATEGY AND RESEARCH AND DEVELOPMENT METHODS

Chapter three presents and justifies the chosen research strategy and development methods used in this study. Research strategy of this study is service design. The research approach of this study is qualitative and inductive. Data acquisition was conducted through service design tools and methods and the basis for data collection was in-depth interviews with forest professionals. The interviews were guided by open questions. Other data collection was conducted with collaborative methods in workshops. The time horizon for this study is cross-sectional, as, according to Saunders, Lewis, and Thornhill (2016) the study describes the situation at the specific time it was conducted.

3.1 Research strategy

This study draws from interpretivist and pragmatistic research philosophies. Interpretivism emphasizes the differences between people's experiences on the same phenomenon. Perceptions may vary for example based on the experiencer's possibilities to influence on it. Pragmatistic research philosophy emphasizes finding solutions to perceived problems. Pragmatism emphasizes the importance of establishing the research problem and research questions that guide the researcher in understanding what is wrong and how can it be fixed. (Saunders et al. 2016)

Research design of this study is qualitative research. Qualitative approach was chosen because the goal of the study is to determine what challenges forest professionals encounter on flying squirrel related situations. The question is not about the quantity of flying squirrel encounters in forestry, but the nature of these encounters and especially the challenges that occur. According to Saunders et al. (2016), qualitative research design complements the interpretive research philosophy, as it provides means to study the participants' perceived meanings around the research questions. Qualitative research design applies also to pragmatistic research philosophy.

Qualitative research is not restricted into questionnaires and other previously set data collection channels as a quantitative approach might be. In comparison to quantitative research, qualitative research reaches closer to the participants' point of view and thus suits for studying particular cases and understanding them in real life contexts. Qualitative research examines processes and emphasizes the creation and meaning of social experiences. It consists of many data gathering

techniques and enables altering them during the research process. Data collection can be modified as the study progresses to uncover data that the researcher did not anticipate. (Denzin and Lincoln 2011; Saunders et al. 2016)

In interpretivist qualitative research, the researcher's subjective experiences and values affect on the study as the researcher strives to empathetically understand the participants' views on the phenomenon. There is a relationship between the researcher and the participant, and that relationship shapes the outcomes of the research. (Denzin and Lincoln 2011; Saunders et al. 2016) The purpose of choosing qualitative research design was to explore the specific phenomenon of forest professionals' encountering challenges on flying squirrel related situations. In an exploratory qualitative study, the data can be collected through expert interviews that can be modified based on arising circumstances (Saunders et al. 2016).

3.2 Research approach and methodology

Research approach of this study is qualitative and inductive. Inductive approach enables better understanding of the research problem as necessary theories will be developed through data collection and analysis. Inductive approach was chosen over deductive because it perceives humanity and does not see participants merely as objects without thoughts or feelings. Inductive approach enables data collection from small sample of subjects to understand the individuals' experiences concerning the phenomenon. (Saunders et al. 2016)

According to Reason et al. (2015), service design is an inductive method for finding solutions, as it targets to invent new solutions or develop existing ones rather than merely uncovering and analysing existing solutions. Service design offers tools for understanding the customer experience and uncover new solutions for improving the service experience. Moritz (2005), states that service design is about producing ideas, solving problems, and creating solutions. It can also be utilized in explaining insights and processes.

Service design was chosen as the research approach because it enables determination of the problem prior to the solutions. In this case, the challenges of forest professionals cannot be known, as the officials in Forest Centre are not familiar with various duties forest professionals have across the forest sector in Finland. There are many service design tools and processes that apply for qualitative research. The Double Diamond process created by Design Council (2022) begins with a phenomenon in need of a solution. The researcher must at first be aware of the

problem to initiate the process of discovering, defining, developing, and delivering solutions. In comparison, Moritz (2005) suggests a six-step service design process that is more suitable for creating an over-all service design strategy for a specific organization. This study utilizes the simpler Double Diamond design process since it is likely that the solutions found must be produced in co-operation with many organizations. Also, the goal of this study is to create suggestions for practical solutions rather than establishing a service design strategy for certain organization.

3.3 Interviews in determining the problem

The approach for the interviews in this study was subjective. Saunders et al. (2016) note that in subjective approach the interviewer co-produces the insights with the interviewee. Semi-structured and in-depth interviews are suitable for exploratory studies, where an inductive approach is used to produce answers for the research questions. Bansal and Corley (2011) argue that in qualitative research the researcher interacts with the phenomenon. Semi-structured interviews are based on a list of questions that guide the conversation around the research questions. However, the list does not have to be followed exactly, and the conversation is allowed to proceed on its own course around the topic. Additional and improvised questions are utilized to gain further insight on the case and elaborate on reasons and practices behind the participant's insights. (Saunders et al. 2016; Adams 2015)

The interviews in this study also had some characteristics of an in-depth interview as the conversation were allowed to flow freely, and the interviewees were encouraged to elaborate their experiences without restriction. Semi-structured and in-depth interviews suit well for understanding reasons for the participants' attitudes and opinions. The method enables asking clarifying questions and digging deeper into the interviewee's insights on the topic and even some insights the researcher cannot anticipate finding. However, the researcher has a great responsibility to not to allow personal opinions and attitudes to impact on the data collection. (Saunders et al. 2016; Adams 2015)

Personal interviews suit for collecting sensitive data rather than questionnaires because a personal contact between the researcher and interviewee promotes trust. Also, personal interviews suit for researching sensitive issues that participants may not be willing to share in a group. However, to accomplish useful insights, the interviewer must be familiar with the topic to be able to ask clarifying questions. (Saunders et al. 2016; Adams 2015)

3.4 Data collection

The preliminary assumption in this study was that forest professionals encounter challenges when planning fellings on flying squirrel sites. According to Design Council (2022), discovering the causes behind the problems require observation and interaction with the people involved with the issue. Data collection in this study was conducted through in-depth, semi-structured interviews. The target population of this study were forest professionals that may or may not have encountered challenges on flying squirrel related situations. To reveal the challenges an in-depth dive into a number of cases was necessary to find answers to the research questions.

According to Saunders et al. (2016) semi-structured and in-depth interviews require a sample of 5-25 cases and homogeneous population require a sample of 4-12 cases. The sampling technique utilized was purposive maximum variation sampling. According to Saunders et al. (2016) purposive sampling suits for studies with in-depth focus. In maximum variation sampling the researcher chooses the sample cases based on the cases' ability to provide answer for research questions. This sampling method is not statistically representative, but in qualitative research that is not an issue. The strength of maximum variation sampling is the inclusion of diverse cases and finding themes, similarities, and differences within the sample. The goal for using maximum variation sampling in this study was to choose cases on from different parts of Finland and from different forest organizations. The goal was to find similarities and arising themes from different organizations and different geographical areas.

3.5 Inductive data analysis

In this study the approach to data analysis was inductive. Deductive analysis would be applicable for research with existing theory as a basis for the analysis (Saunders et al. 2016). In this study, there was no existing theory to build upon. In an exploratory study such as this, according to Saunders et al. (2016), an inductive approach can be used to identify emerging themes and in creating theories. The theory will not create itself. It is crucial to analyse and interpret the collected data throughout the research process. Inductive approach suits well for recognizing and understanding the viewpoints of the interviewees. It also requires adequate knowledge of the research topic.

The thematic analysis was commenced by utilizing Atlasti, qualitative data analysis software (ATLAS.ti 2024), that enables coding and creation of themes. The AI tools included in Atlasti software were not utilized in this study. AI tools were tested, but it soon became clear that they were unable to find deep enough themes and similarities from the interview data. For example, the themes that arose were “flying squirrel” and “forest management”, but these were matters embedded in the discussions, not challenges or solutions that were looked for to answer the research questions.

Thematic analysis applies for both inductive and deductive research and suits well for research that targets to find particular themes (Saunders et al. 2016). In this study, the analysis was made purely inductively, and all codes and themes were created based on the analysed interview data. Only the interviewees’ narratives were coded, as the researcher’s lines included merely the questions asked and encouragement to share detailed insights on the matter, that had little to no meaning in regards of the research questions.

Thematic analysis includes transcribing and familiarizing with the data, coding it, and developing themes as the work progresses. The process of thematic analysis is not linear and previous interview transcriptions and codes should be considered and modified as new similarities and themes arise. By conducting profound data analysis between the interviews enables the researcher to observe data saturation and to determine whether the collected data is enough. (Saunders et al. 2016). All analysis was commenced with the research problem and research questions in mind. After all interview transcripts were coded, the codes were revisited and any irregularities and overlapping codes were fixed and combined with others. The codes were categorized into themes that emerged based on research questions.

3.6 Mapping the process

Customer journeys are descriptions compiled of customer experiences that are gathered from interviews or observing customers. A customer journey describes the events from customers’ point of view, and it does not consider what is happening behind the scenes in the service organization. It may include detailed descriptions on customer experiences in each step of the journey. A service blueprint describes the whole service production process from the perspective of the service producer. It considers the customer journey but reveals also all the details going on behind

the scenes and all supporting actions that enable the service process. (Kimbell 2009; Miller and Flowers 2016)

3.7 Collaborative development methods

The theory of service design relies on collaboration. The idea of service design process is to gather insights from service users and include service producers into the design process. (Polaine, Lavrans, and Reason 2013) This study utilizes brainstorming to gather and develop ideas based on the analyzed interview data. According to (Stickdorn et al. 2018) brainstorming suits for generating ideas quickly. It allows participants to ideate without restriction and enables to go through several themes in short period of time.

Davies and Wilson n.d. suggests brainstorming for define and development phases of the Double Diamond design process. Brainstorming suits for generating ideas and establishing mutual understanding on the phenomenon under development. Addressing the issue through brainstorming enables expanding the point of view and generation many ideas and then narrowing down by choosing the most important ideas for further development. Brainstorming does not take that much time, so it enables gathering busy experts together for development work. According to (Paulus and Kenworthy 2019) a brainstorming session will benefit from facilitating and structuring brainstorming into several themes that are confronted one by one by the group.

4 COMBINING FORESTRY AND PROTECTION OF THE FLYING SQUIRREL WITH SERVICE DESIGN

This chapter presents the research process in practice. The commissioner is introduced in detail. Data procurement, data analysis and the development task conducted through two separate expert workshops are presented in this chapter.

The research question of this study is *“What are the challenges forest professionals encounter in combining commercial forestry and protection of the flying squirrel? How can the challenges be solved using service design and customer journey mapping?”*. This chapter answers the research questions and offers suggestions for practical solutions for the research question and the research problem.

4.1 The commissioner – Finnish Forest Centre

Finnish Forest Centre is a public organization responsible for monitoring forest legislation, granting forest subsidies, and promoting forestry and related livelihoods. Forest Centre operates nationally under the ministry of Agriculture and Forestry in Finland and has about 430 employees. (Finnish Forest Centre 2024, Suomen metsäkeskus, 2022d.)

According to the Act on the Finnish Forest Centre (2011/418) Forest Centre maintains and promotes biodiversity, sustainable utilization of forests and forestry-based livelihoods. Forest Centre’s tasks include education, advisement, and communication to promote forestry. (Act on the Finnish Forest Centre 2011/418)

Ecological, financial, cultural, and social sustainability are included in Forest Centre’s values and strategy (Finnish Forest Centre 2020). Complex issues related to sustainability cause challenges for competence development. Forest professionals must consider the forest owners’ goals and preferences, biodiversity (protection of endangered species and habitats), legal restrictions, finances, and company policies. This study is conducted to support the goal of sustainable forestry. Other driver for this study is to enable effective forestry, including forest planning and management.

Forest Centre participates as a partner to several projects funded by EU LIFE fund. In 2021 Forest Centre is a beneficiary in Flying Squirrel LIFE (Suomen metsäkeskus, 2022c.), Freshabit LIFE IP (Suomen metsäkeskus, 2022a.) and Hydrologia-LIFE (Suomen metsäkeskus, 2022b.).

As part of the Flying Squirrel LIFE project Forest Centre is commissioned to produce practical solutions on how to combine forestry and the protection of the flying squirrel. However, the Flying Squirrel LIFE project plan is written from the perspective of protecting species, biodiversity, and habitats and the plan does not recognize the challenges forest professionals encounter in their day-to-day work. (Metsähallitus et al. 2018).

EU LIFE fund targets funds to implementation of the EU habitats directive that includes protecting the Siberian flying squirrel. The aim of the fund's Nature and Biodiversity programme is to reverse loss of biodiversity. (CINEA n.d.) Improving the protection status of the Siberian flying squirrel is the main reason the Flying Squirrel LIFE project was created. The objectives of the project are to improve acceptance of the flying squirrel's conservation, prevent habitat loss and fragmentation and develop tools for fluent land-use and forestry. The project is expected to produce an education package for forestry to maintain and improve the flying squirrel habitats in managed forests. The project has many pilot sites all around Finland where practical habitat conservation and management are developed, implemented, and monitored. The sites are utilized for education for forest professionals and forest owners. (CINEA 2022; Metsähallitus et al. 2018)

The 18 partner organizations participating the Flying squirrel LIFE project are:

- Metsähallitus, Parks and Wildlife Finland
- Metsähallitus Forestry Ltd
- Finnish Forest Centre
- Natural Resources Institute Finland
- Finnish Museum of Natural History
- Kuopio Natural History Museum
- City of Espoo
- City of Jyväskylä

- City of Kuopio
- Central Union of Agricultural Producers and Forest Owners
- The Finnish Association for Nature Conservation
- Centre of Economic Development, Transport and the Environment for North Carelia
- Centre of Economic Development, Transport and the Environment for North Savo
- Centre of Economic Development, Transport and the Environment for Southwest Finland
- Forest Survey Bureau of Estonia
- State Forest Management Centre of Estonia
- Estonian Environmental Board
- Estonian Private Forest Union

This study is commissioned by Finnish Forest Centre in connection to Flying Squirrel LIFE and its goal of producing education material mainly directed for forest professionals. The project is targeting to find the best practices in combining forestry and protection of the flying squirrel in Finland and in Estonia. There are 18 partner organizations working with the project. Forest Centre is the one in charge of producing an education package for forestry. The project consists of several “actions” that are designed to lead towards the goal of combining opposing and controversial interests of forest owners, commercial forestry, and the flying squirrel. Flying Squirrel LIFE project is planned to create tools to ease compliance with effective legislation. The project does not target to change legislation or the interpretation of it.

Forest Centre and Flying Squirrel LIFE are working towards a common goal to promote and ease forestry related businesses, the earning opportunities of forest owners and sustainability of forestry in Finland. Targeting education to forest professionals enables knowledge spreading widely amongst professionals and from professionals to customers – the forest owners. Educating the people working on the field advances effectiveness.

4.2 Development task – how was it done

The development task in this study was conducted by utilizing the Double Diamond Design process by Service Design Vancouver (2022a). The design process includes four phases that can be followed sequentially or through iteration by repeating necessary steps of the process as many times as required to reach desired outcomes (Figure 5). In this study, the phases of the design process were followed sequentially since the desired results – practical suggestions for solutions – were reached by going through the process once. However, if this study were to proceed further into developing solutions, the iterative nature of the design process could be beneficial.

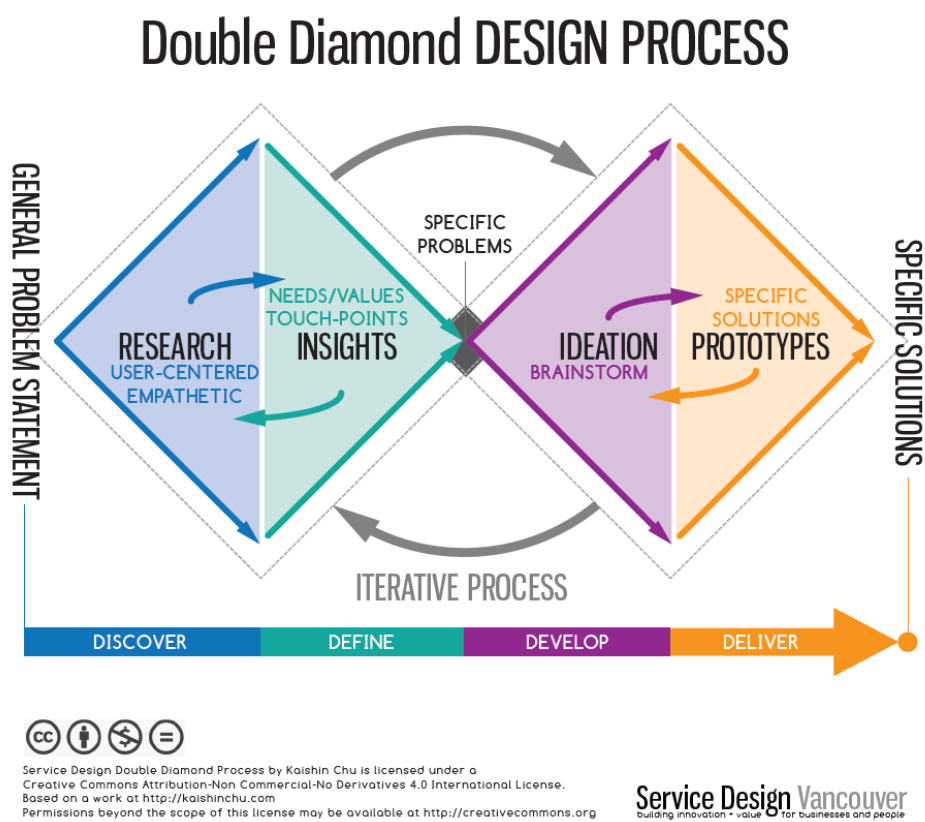


Figure 5. Double Diamond Design Process. (Service Design Vancouver 2022a)

Discovery phase was covered by interviewing forest professionals familiar with flying squirrel related issues. The interview data was analyzed by utilizing ATLAS.ti software. The analysis proceeded into definition phase by coding the interview data and dividing it into themes based on similarities and differences.

The definition phase of the design process continued with creation of a customer journey map. The mapping was based on the interview data and the researcher's professional knowledge of

forest planning process. A detailed description of the forest use planning process was created in Miro online workspace.

Definition phase was finished, and development phase launched in a multi-organizational workshop with Flying Squirrel LIFE project partners. Development continued in another workshop with Forest Centre's team of experts. The second workshop discussed the solutions suggested by project partners and began the delivery phase of the design process. Delivery phase was conducted by summing up the development suggestions and ideas for further use.

4.3 Discover – the interviews

Primary research data for this research was collected through expert interviews conducted through Microsoft Teams. All interviewees were forest professionals with previous experience on flying squirrel-related situations in forestry. The interviewees were selected based on recommendations. Various forest organizations and their management or environment units were contacted and asked for recommendations on people familiar with forestry on flying squirrel sites. No other requirements were given. The goal was to interview forest professionals from different backgrounds with varying experience and from different geographical areas in Finland. The period over which the data was collected was from 9.3.2023 until 19.4.2023. The interview lengths varied from about 40 to 90 minutes.

In this study the term forest professional is used to describe a person working in an expert position in forestry. The duties of forest professionals consist of for example forest planning, wood procurement, selling forest and nature management services to landowners and advising landowners. Forest professionals are employed in private sector in forest management associations, sawmills, pulp mills and forest service companies. In public sector forest professionals are employed in Metsähallitus forestry Ltd that manages state owned forests in Finland. Also, Finnish Forest Center, cities, municipalities, and congregations employ forest professionals.

Total of seven interviewees were recruited. All interviewees were from Finland, and the interviews were conducted in Finnish. One interviewee was based in Kainuu and one in South Ostrobothnia. Two interviewees work in South Savo and South Karelia. Three interviewees were based in Uusimaa and two of them had national duties.

All seven interviewees were forest professionals. They work on expert and management level and have made forest management plans or felling plans in flying squirrel habitats. The length of their experience in forestry varies from four to 34 years. Five of the interviewees are also forest owners. None of them have flying squirrel observations in their forest estates. One interviewee disclaimed that a flying squirrel inhabits the neighbouring estate, so there is a possibility that the species also inhabits the interviewee's forest now or in the future.

All interviewees were employed by different organizations. The interviewees represent comprehensively the Finnish forest sector as there were interviewees from large forest companies to forest management association and small or medium sized forest service company. However, there were no interviewees from sawmills. The interviewees' organizations and titles are presented in **Virhe. Viitteen lähde ei löytnyt..**

Table 2. The interviewees.

	Organization	Title	Forest owner	Company forests
1	Metsähallitus	Regional manager	Yes	Yes
2	UPM-kymmene Oyj metsä	Environmental expert	Yes	Yes
3	MHY	Forest manager	Yes	No
4	Tornator	Planning expert	No	Yes
5	Forest service company (SME)	Forest expert	Yes	No
6	Metsä Group	Forest asset manager	Yes	No
7	Stora Enso Oyj	Forest expert	No	No

Metsä Group, Stora Enso Oyj and UPM Kymmene Oyj metsä are the three largest forest organizations in Finland. Metsähallitus Metsätalous Oy manages state owned lands (Metsähallitus n.d.). Tornator Oyj manages its own forests (Tornator 2024). There are 56 forest management associations in Finland (Metsänomistajat 2024). Private forest owners are their members and associations offer forest management services for their members and other forest owners. There are also many small or medium sized entrepreneurs in forestry. Metsähallitus Metsätalous Oy, Tornator Oyj and UPM Kymmene Oyj metsä own forest that their forest experts manage. All three organizations have flying squirrel habitats in their estates. The main objective of the interviews was to answer the research question of *“what challenges forest professionals encounter in combining forestry and protection of the flying squirrel”*.

Recommendations for interviewees were asked from Forest Centre's nature management experts and Flying Squirrel LIFE project partners Metsähallitus Forestry Ltd and Central Union of Agricultural Producers and Forest Owners. An email invitation was sent to the recommended forest organizations' contact persons to inquire potential interviewees. Some of the contact persons agreed to be interviewed themselves and others forwarded the invitation further on in their organizations. All desired organizations agreed to participate to this study.

The timing of the interview was agreed between the researcher and the interviewee. A short email invitation was sent to the Teams-meeting for all interviewees. The interviewees were told that the interview will be a free form discussion that will last about an hour. It was also disclosed that the interview will include questions about the interviewee's experiences in planning fellings on flying squirrel sites.

4.3.1 Process of interviews

The interviews were conducted through Microsoft Teams -platform which enabled interviewee and interviewer to see each other through live video. Only the researcher and the interviewee were present in the online meeting. Participants were asked for a permission to record the interviews and to consent for utilization of the results in this study.

The interviews began by introducing the background and purpose of this study, the commissioner, and the researcher. The data management and data protection, especially protection of the interviewees' personal data and anonymity were explained in detail. The form of the interview is introduced to the interviewee. After the introduction the interviewees were asked to give background information about themselves. Background information gathered was the organization, region, title, length of experience on forestry and whether the interviewees themselves own forest. After determining the background of the interviewee, the discussion proceeded to the questions targeted to answer the research questions. The main objective of the questions was to determine possible challenges and solutions in respect to the research problem and research questions. Another objective was to gather information to create a customer journey map to illustrate the planning process forest professionals go through while planning fellings on flying squirrel sites. The form of the interview and the predesigned questions are presented in appendix 2.

The main interview questions were designed to entice the interviewee to share detailed descriptions on planning fellings on a flying squirrel site. In addition, the questions were designed to reveal the steps of their planning processes. The first two questions were about frequency and nature of the encounters with the flying squirrel. In many cases, the interviewee began to describe their experiences spontaneously after the first questions. This was desired, as the goal was to promote authentic descriptions about the phenomenon and the questions were merely a tool to guide the interview towards the topic.

Further questions were about the planning process of fellings, especially about the timing of the process regarding flying squirrel observation and contacting the regional ELY-centre. The interviewees were asked to describe the easiness and challenges of the planning process and consider how they would solve the perceived challenges. The questions were not presented if the interviewee addressed the issue spontaneously. Some of the interviewees were very short and efficient in their answers and the whole list of questions had to be addressed individually. Some of the interviewees were elaborate in their disclosures and it was necessary to guide the conversation back towards the topic. In these cases, the interviews brought up information the researcher had not thought to ask. This was, again, a desired outcome.

Last questions were designed to discover the interviewees' specific needs and preferences about education and guide materials. Part of the Flying squirrel LIFE project was to create an education package to support forest professionals in their efforts to combine forestry and protection of the flying squirrel. The last three questions revealed practical information about the competence development needs the interviewees have.

4.3.2 Challenges reported by the interviewees

The interviewees were forthcoming in their statements. It seemed that the less experienced and younger forest professionals were most careful and reserved with their statements. All elaborated on their experiences and difficulties and provided many useful insights on the topic. The most experienced participants had the most to tell and initiated many stories with little encouragement.

Some of the interviewees showed frustration over the ongoing challenges they encounter and felt that there is little to be done in resolving the challenges. On the other hand, some reported difficulties but did not find them particularly challenging or overwhelming. Two most experienced

interviewees were in a position where they act as internal nature management and conservation support persons in their organizations. They both shared the attitude of resolving even the most challenging situations. Sometimes the solutions could be to back away and withdraw from the felling agreement if the planned fellings are not in line with the nature conservation act.

All interviewees had positive attitude towards nature management and conservation. They reported it to be an important part of their job. Many of them found that the landowners' attitude was a substantial factor in how challenging the planning of fellings on flying squirrel site will become. Many reported that they find nature management and nurturing nature values important. They also noted that environmental sustainability belongs to their organizations values and caring for nature biodiversity is more and more emphasized by their employers.

Interviewee 1 reported that the quality of species data could be better. There are cases where a flying squirrel observation is marked in spatial data, but the location of the observation on the map does not match the actual location in the forest. The flying squirrel habitat is close to impossible to find if the forest area has no typical characteristics of a flying squirrel habitat.

Interviewee 2 reported that the differences between regional ELY-centres' interpretations of the law seem arbitrary. It seems that the flying squirrel is used as an excuse to protect some forest areas where there is strong opposition towards fellings. The interpretation of the law is challenging, as there seems to be no consensus on the area that should be retained around the nesting tree. On some regions the area is of 10-meter diameter, other regional ELY-centres require the average length of the surrounding forest to be used as indicative diameter of the protected area and some ELY-centres require retaining one hectare of forest around the nesting tree. It is challenging to justify the reason for forest conservation while there are no recent observations of a flying squirrel. However, the organization has learned to live along side with the flying squirrel.

Interviewee 3 reported four types of challenges. First, ELY-centre's inconsistent response times to flying squirrel alerts produced in forest use notification process cause challenges. Response times vary from one day to six months. Second, the forest estates in Western and coastal Finland are usually narrowly shaped and thus challenging to manage. Common width of an estate is fifty meters and the flying squirrel habitat may overlap several estates and the conservation of the habitat becomes very difficult. Third, the poor reliability of species data causes challenges. If there are older observations in databases, but nothing indicating flying squirrel presence in the forest, the planning of fellings becomes challenging.

Finally, interviewee 3 reported that polarized media reporting increases fear for the responsibility that lies on forest experts' shoulders. Interviewee 3 hoped for more humane news reports about the topic rather than black and white news where the forest experts are usually perceived as evil. The responsibility of planning fellings on flying squirrel sites should be shared between authorities and the forest expert in cases where forest expert has asked for advice from the authorities and acted based on the advice. If a breeding site and resting place is destroyed or deteriorated regardless of the advice, the responsibility of the mistake should not be solely on the forest expert's shoulders.

Interviewee 4 reported that it is challenging to determine whether the conserved moving corridors and foraging trees are enough for the flying squirrel. Also, determining the protected area around the nesting tree seems challenging, since the interviewee has no previous experience on it. It causes concern if all pellets and nesting trees have not been found.

Interviewee 5 reported that the time of the year affects on possibilities to detect flying squirrel habitats and occurrence of the species. Usually there is no advance knowledge of flying squirrel occurrence on the site. Sometimes the landowner has knowledge of the flying squirrel and shares it with forest expert. Secondly, interviewee 5 reported that it is challenging when the authorities have no advance knowledge of the flying squirrel and the forest use notification does not raise a flying squirrel alert. Also, the interviewee has learned it is easier to contact ELY-centre beforehand rather than waiting the authorities to make contact.

Interviewee 6 reported that the so-called desk drawer observations cause challenges. Previously there has been systematic withholding of observations by nature enthusiasts. The observations are shared only after operations have begun on the forest site. This causes halting of all operations on the site and possibly renewal of the whole planning process, which causes remarkable excess costs.

Interviewee 5 also reported that some landowners have negative attitude towards flying squirrel and would conduct fellings rather than comply with the law. Sometimes landowners try to affect on the fellings by determining themselves where the retention trees should be left. They also make requests on felling all aspens from the site and some have even gone to the site afterwards and cut down the aspens themselves. Interviewee 6 noted that it is challenging to make felling plans on flying squirrel sites as every site is unique and must be considered differently.

Interviewee 7 reported that landowner's fears cause challenges. The interviewee recalls cases where they have had to withdraw from the felling agreement due to flying squirrel occurrence on

the site. In those cases, there has been no legal possibilities to conduct fellings and that is what the landowners fear. Also, it is challenging to ensure storm-lasting corridors for the flying squirrel on spruce dominant sites with open areas.

Interviewee 7 also reported that regeneration fellings are challenging to plan especially if there are open areas around the regeneration site. Forest experts have tight schedules and there is not much time for field work even on flying squirrel sites. Especially young and new forest experts seem to struggle in recognizing potential flying squirrel habitats.

4.3.3 Solutions proposed by interviewees

Interviewee 1 suggested that spatial data on flying squirrel observation should be more reliable. Now, some observations are marked in wrong locations and the actual pellet observation or nesting tree is difficult or impossible to locate. Utilization of external flying squirrel expert has helped in locating habitats. Also, in state owned lands it has been decided to exclude flying squirrel concentrations from fellings and leave a 100-meter perimeter between sensitive flying squirrel sites and clear cuttings.

Interviewee 2 noted that in case of small sites, it should be remembered that planning fellings may not be a reasonable option. Rather, emphasizing possibilities of voluntary conservation could save landowner and forest professionals from many difficulties with flying squirrel sites. Quality of flying squirrel and forest resource data should be more up to date, and more data should be collected systematically in the field. Now, the data is collected in land use planning, but more systematic data collection should be conducted to support forestry measures and species protection. There are shortcomings in species data and forest organizations and professionals should put more effort into improving forest planning and doing field work in addition to utilizing remote sensing data. Remote sensing should be developed to differentiate tree species and to detect deadwood.

Interviewee 3 reported that in their organization it is customary to make the flying squirrel inventory with a colleague when making forest planning or planning fellings on flying squirrel sites. The habitat is taken into consideration and if necessary, fellings are delineated. Retention trees are marked on a map and a memo with photos is made to document the planning process. Interviewee 3 noted that field excursions and education events on known flying squirrel sites would

help to improve knowledge on planning forest use. Alternatively, remote training sessions should include a lot of photos from known sites.

Interviewee 4 reported that in their organization's planning process the moving corridors for flying squirrel are ensured by utilizing retention tree groups and shelter zones left around small water bodies. Aspens and cavity trees are saved in all fellings and retention trees are grouped around aspens or in birch-dominant forest areas. Due to forest certification criteria thick spruces are saved along with aspens.

Interviewee 4 also reported that it helps when a felling plan is created in co-operation with regional ELY-centre. To enable independent planning, the instructions should include numbers, meters and quantities to illustrate the number of trees and the size of the area that must be excluded from fellings. Species data should enable searching for specific observations close to the felling site on buffer zone determined by the forest planner. Interviewee 4 hoped that Forest centre or regional ELY-centre would offer expert assistance for field work in planning fellings. Instructions would be best shared through website that can be accessed with mobile devices.

Interviewee 5 noted that continuous cover forestry helps protecting flying squirrel habitats. Also, if the forest owner is interested in voluntary conservation the forest use planning is easier. It is customary for their organization to save all aspens and goat willows in fellings and to promote 20 percent mixture of deciduous trees. Interviewee 5 suggested that citizens should have a responsibility to report flying squirrel observations to regional ELY-centre. For educational purposes it would be useful to make field excursions to flying squirrel sites to promote forest planning in practice. Interviewee 5 would like to know what a flying squirrel site should look like after the fellings to make sure the species can move in the area. Also, the number of trees per hectare and how the moving corridors around clear cutting sites looks like should be included in education events and instructions. For educational purposes interviewee 5 prefers written online instructions combined with field excursions.

Interviewee 6 always contacts regional ELY-centre to get expert assistance for planning fellings on flying squirrel sites. They have a meticulous process for planning flying squirrel sites: field inventory, looking for nesting trees and discussion with the landowner about the felling restrictions the flying squirrel most likely causes. After receiving the forest use notification ELY-centre usually provides guidance. The goal is, if possible, to locate fellings from flying squirrel habitats to other parts of the estate. Voluntary protection through METSO-program is offered for landowner. Harvesting manager comes along to help delineate the felling site. Aspen concentrations are

delineated outside fellings especially if they are located on the side of the forest compartment. Harvester operators are instructed carefully and felling area is marked into the forest.

Interviewee 6 reported that their organization provides education also for harvester operators, as they are the people making most crucial decisions in flying squirrel sites. The organization has risen nature values as one of their most important themes and they strive to be forerunners in caring for biodiversity.

Interviewee 6 suggested that it would be easier if ELY-centre would provide answers on what to do on flying squirrel sites. Each site is different and up-to-date species data is important for successful planning. The guide material produced by Tapio Oy is frequently utilized. There is also an internal environmental expert who helps with flying squirrel situations. There are also other experts who are responsible for organizing regional education events for forest professionals within the organization. Interviewee 6 prefers online instructions that are accessible with mobile devices. Also, field excursions are preferred over online events. Photos and illustrations are usually too clear "text book" examples as the actual forest sites are not that simple.

Interviewee 7 reported that contacting regional ELY-centre during planning process helps especially in planning regeneration fellings. Their organization has internal instructions for planning fellings on flying squirrel sites. Thinning is easier to plan as the forest cover is preserved even after the felling. Aspens, cavity trees, deadwood, birches and thick spruces are saved. Interviewee 7 noted that it would be ideal if the financial position of the landowner would not be affected by flying squirrel occurrence and prohibition of fellings, and that there should be means to compensate the landowner's loss of income. For forest professionals, it is important that ELY-centre will provide instructions on how to delineate fellings. It was emphasized that the support from ELY-centre is extremely important for forest professionals.

Interviewee 7 noted that the most needed education topics are recognizing potential flying squirrel habitats and delineation of fellings. Field excursions are important especially for young and new forest professionals. Remote training cannot replace field excursions on actual forest sites. Printed instructions are perceived reliable as they do not run out of battery, however, online materials accessible by mobile devices are also useful.

4.4 Define – data analysis

After the interviews the recordings were automatically transcribed with Microsoft Stream subtitles. The automatic transcriptions were carefully reviewed and corrected as Microsoft Stream did not recognize all Finnish words, especially if the interviewee was speaking in dialect.

The reviewed transcriptions were imported into ATLAS.TI for coding. The transcriptions were coded to determine connections and themes within the interview data. The number of codes varied during the process, and new codes were created as themes arose during the data analysis. Finally, 23 codes were established. The codes represent the discovered challenges and solutions. The codes are presented in first column of **Virhe. Viitteen lähdettä ei löytenyt.3.**

Table 3. Codes and themes. Number 1 indicates which themes the codes are included in.

Categories	Challenges	Solutions	Process	Interview questions	Back-ground & education	Total
Codes/themes						
Frequency of flying squirrel situations				1	1	2
Observations - source	1		1	1		3
Observations - quality	1					1
Observations - when			1	1		2
Observations - unexpected	1			1		2
Recognition of habitats	1		1			2
Delineation of cuttings	1	1	1			3
Help from authorities	1	1	1	1		4
Attitude	1	1				2
Nature conservation as- socioation	1	1				2
Internal expert assis- tance		1	1			2
Nature management		1	1			2
Voluntary conservation		1	1			2
Conflict	1					1
Difficult	1			1		2
What does not work	1					1
What works		1		1		2
Do differently		1		1		2
Solutions		1		1		2
Forest use notification			1			1
Operating instructions			1	1		2
Received education				1	1	2
Type of education				1	1	2

The name of the codes describes the challenge, solution or phase of the planning process that interviewee's reported. The same code can belong to many categories. For example, some interviewees reported that it is challenging to get *help from the authorities*. Most of the interviewees also reported, that receiving *help from the authorities* eases the process. At the same time, the interviewees described on which point of the planning process they did or would have preferred to receive *help from the authorities*. Thus, the same code represents a challenge, a solution and a description on the planning process.

The codes were classified into five categories. The category "Interview questions" indicate codes that were established in direct relation the questions designed for the interview. The category "Background & education" indicates the codes that do not belong to any other category, and only give information about the interviewees' experience in flying squirrel related situations and the education they have received and expect in the future. The codes within this category are "Frequency of flying squirrel situations", "Received education" and "Type of education".

The main three categories are "Challenges", "Solutions" and "Process". Many of the codes fall under two or three of the main categories. *Challenges* indicate the codes that directly answer to the first research question "*what challenges forest professionals encounter in combining forestry and protection of the flying squirrel*". This category provides material for the further stages of the Double diamond design process. The *Solutions* category contains the codes that provide answers to the second research question "*How can the challenges be solved using service design and customer journey mapping*".

Process indicates the codes that include information on the process the forest professionals go through while planning fellings on flying squirrel sites. These codes include information on forest professional's communication with landowners, forest use notifications, their organization's instructions and procedures and their personal professional preferences on how to do their work most efficiently and effortlessly.

Challenges contains five independent codes, themes *Solutions* and *Process* both contain three codes (Figure 11). There are three codes that fall under both solutions and process. Two codes fall under process and challenges as well as two codes falling under challenges and solutions. Finally, there are two codes that are included in all three main categories.

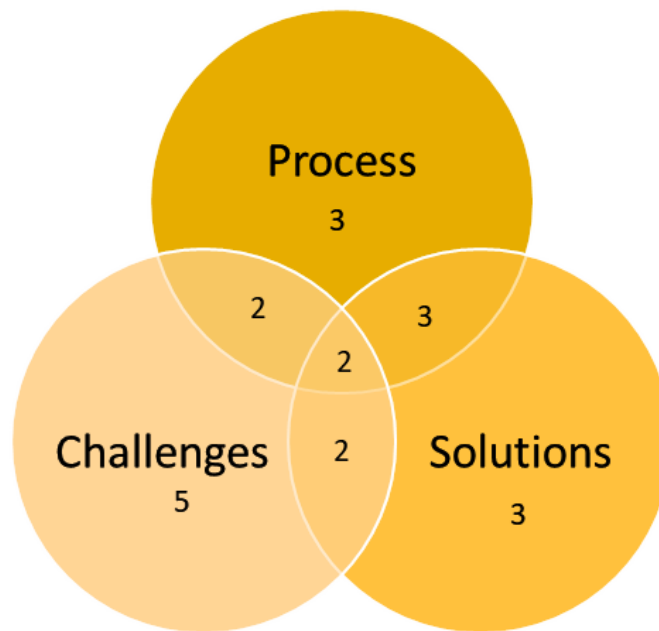


Figure 6. The number of codes within the main themes and the number of codes included in two or three themes.

The challenges the interviewees faced were somewhat similar. Most of them reported hardships in recognizing flying squirrel habitats and lack of time for finding pellets and careful planning of the fellings. Many of the interviewees reported the inconsistencies with the processes of the authorities a challenge, as well as the inconveniences when flying squirrel is found in the latter stages of the planning process.

Suggested solutions by the interviewees varied more. All but one interviewee reported their organization having internal processes and expert assistance for flying squirrel and other nature biodiversity issues. Many reported good cooperation with authorities and fluent practices of local authorities to ease the planning process.

During the data analysis the themes revealed stages of a process forest professionals typically go through while planning fellings on flying squirrel sites. The interviews and the analysis indicated a consistent process regardless of the organization the interviewee represented. All interviewees follow on most parts the same steps while making felling or forest use planning on flying squirrel sites. Based on these steps, a customer journey was created to demonstrate the structure and stages of the forest use process.

A visual presentation of the process was created to illustrate the different phases and the challenges related to each step. The illustration was created with Miro visual workspace for

innovation (Miro 2024). A ready-made customer touch point map was utilized as basis for the illustration. However, the created illustration had characteristics of a customer journey and service blueprint. The illustration is referred in this study as customer journey map.

The customer journey, or the process, was divided into four stages to help understand the relations between found challenges. The original customer journey map utilized on the workshop is presented in appendix 3. The four stages and details of the planning process are presented in table 4. The first stage, planning, consists of making felling agreement between landowner and wood purchaser, preparation of fellings at the office and on field, and finally making the mandatory forest use notification.

Table 4. Forest planning process that the first workshop was based on.

Stage	.1	.2	.3	.4	.5
1 Planning	Felling agreement	Preparation of fellings at the office	Field work	Forest use planning at the office	Forest use notification
2 Finalizing	Tendering of timber sales	New forest use notification	Automatic flying squirrel notification	Felling plan	Revision of the felling plan
3 Felling	Marking the felling area	Felling site instructions	Felling	Monitoring of fellings	The end of the process
4 Aftercare	Flying squirrel discovered during or after the fellings	The media gets interested	Police report	District court	

The second stage, finalizing, consist phases conducted after and due to the forest use notification. For forest management associations, the process includes two additional phases: tendering of the timber sales and the renewal of the forest use notification by the chosen purchaser. In other cases, the optional tendering of the timber sales is conducted prior to the felling agreement. After making a forest use notification, an automatic flying squirrel notification is sent by Forest Centre to the landowner, owner of the felling rights, and to regional ELY-centre. A detailed felling plan is prepared to clarify how the flying squirrel breeding site and resting place is combined with the intended fellings. If the regional ELY-centre demands, the felling plan will be revised to ensure compliance to the nature conservation act.

The third stage, felling, consist of work conducted on site. The felling area is marked with paint or fibre tape, the felling instructions are provided for the harvester operator and the forest is felled according to plan. In many cases, when conducting felling on delicate flying squirrel habitats,

monitoring is conducted during and after harvesting. The focus is on making sure the felling intensity is consistent with the plan and that no protected trees or areas are cut down. Usually the process ends with the monitoring and payment to the landowner.

The fourth stage, aftercare, takes place if indications of flying squirrel occurrence is discovered during or after the felling. These surprising observations during harvesting will result in suspending the work and determining whether there are any protected breeding sites and resting places and if some protected forest areas have been cut down. Sometimes the media gets interested in flying squirrel situations. In the worst-case scenario, if flying squirrel breeding site or resting place is suspected to have been destroyed or weakened a police report is made to initiate an official investigation. If the police find that the fellings were against the law, the case proceeds to district court.

4.5 Develop – workshop with project partners

After the data was analyzed two workshops were organized. The first workshop was conducted with Flying Squirrel LIFE project partners and it enabled utilization of partner organizations' expertise. Flying Squirrel LIFE project had specialists in species protection, forest and nature management, and forest ownership (Metsähallitus et al. 2018). The workshop with project partners was organized to narrow down the challenges and to brainstorm for solution development. Representatives from following Flying Squirrel LIFE project partners were invited to the workshop:

- Centre of Economic Development, Transport and the Environment for Southwest Finland (ELY-centre)
- Metsähallitus, Parks and Wildlife Finland
- Metsähallitus Forestry Ltd
- Central Union of Agricultural Producers and Forest Owners
- The Finnish Association for Nature Conservation

The representative of ELY-Centre was not able to attend the workshop, so a sparring session with the researcher and ELY-center representative was arranged on 19th December 2023 to gather

insights. The workshop with project partners was arranged on 21.12.2023 remotely through Microsoft Teams.

The effective working time of the workshop was about three hours. First, service design and the double diamond design process was introduced to participants, who were unfamiliar with both. Also, the selection process and background of the interviewees, and the progress of interviews was presented. Finally, the coding and data analysis was explained as presented in chapter 040. The workshop was based on a customer journey map that illustrated different phases of forest use planning on flying squirrel sites. First, the customer journey map and process were presented to participants. After everyone were familiar with the process and understood it, the workshop progressed into brainstorming.

The goal of the workshop was to conduct the definition phase of the double diamond design process by narrowing down the challenges that can be solved by Flying Squirrel LIFE project and/or project partners. After narrowing down the challenges the aim was to proceed into development phase of the design process and to ideate possible solutions for the chosen challenges. However, during the workshop it was determined that it would be more beneficial to the project to consider the whole forest use planning process, discovered challenges, and recognize a multitude of solutions to as many challenges as possible.

The researcher gave background information about the perceived challenges from the interviews and asked clarifying questions from the participants to promote ideas. All participants were asked to make notes during the workshop. All but one participant returned their notes for the researcher for further use. The participants' notes along with the researcher's workshop notes were combined to gather coherent overview on the workshop results.

Total of 57 propositions for solutions were generated during the three-hour workshop. Some of the solutions were identical with each other. For example, education was suggested to solve many of the discovered challenges. The solutions are presented in tables 5-8. **Bolded** challenges and solutions were chosen for further development in second workshop.

Table 5. Challenges and proposed solutions for stage 1 of the planning process.

Stage 1 Planning	Challenges	Proposed solutions
1.1 Felling agreement	Negative attitude and prejudice	Long term education and information.
	No advance info about flying squirrel	Easier access to species data.

		<p>Education on usage of data.</p> <p>Built in alarm into forest organizations' planning software to notify about flying squirrel occurrence on defined proximity of planned fellings.</p>
		<p>Enhancement of species data quality and accessibility.</p> <p>All flying squirrel observations into public databases.</p>
1.2 Preparation of fellings at the office	Species data – availability	<p>Built in alarm into forest organizations' planning software to notify about flying squirrel occurrence on defined proximity of planned fellings.</p> <p>Databases should communicate with each other, easier access to species up-to-date data.</p>
	Species data – quality	All flying squirrel observations into public databases.
	Lack of time	<p>Availability of clear instructions.</p> <p>Availability of quality species data – less time for guessing and investigating.</p>
	Wrong time of the year for finding pellets	Utilization of spatial and species data.
	Lack of time	Reserving enough time to recognize habitat characteristics and to find pellets.
1.3 Field work	Recognition of habitats	<p>Education and experience in recognizing habitats based on forest characteristics.</p> <p>Ability and time to look for pellets and urine marks from the most potential spots in the forest.</p>
	Nothing is found to indicate flying squirrel presence on the site	<p>Education for understanding the biology of the species – flying squirrel tends to move from nest to nest. Short lifespan of only about two years.</p> <p>Education and experience in recognizing habitats based on forest characteristics.</p>
	Finding expert assistance	<p>Clear instructions on whom to ask for help to delineate fellings (ELY-center).</p> <p>Utilization of nature charting dogs.</p> <p>Cooperation with voluntary experts from nature conservation associations.</p> <p>Clear instructions to determine the location and size of the breeding site and resting place on case-by-case terms.</p> <p>Utilizing spatial and species data, and habitats modelling for network-level planning.</p>
1.4 Forest use planning at the office	Differences with normal planning: how to ensure wind resistance, delineate fellings and plan corridors, how to choose retention trees and plan fellings in mature spruce dominant forests	<p>Education (events and guidebook)</p> <p>Planning at least two separate adequately wide corridors for each breeding site and resting place.</p> <p>Fellings cannot surround the breeding site or resting place that should be located next to wooded areas.</p>
	Different interpretation of the law between ELY-centers and conflicting instructions between ELY-centers.	<p>Ministry level guidance or mutual agreement between ELY-centers to minimize differing interpretations and instructions – ensuring of equality for citizens.</p> <p>OHKE-projects for developing coherent procedures and guidelines for ELY-centers.</p>

	Landscape level planning needed to ensure viability of habitat network	Cooperation and communication between neighboring landowners, nature conservation associations and ELY-centers. Regional habitat network planning and utilization of habitat modelling and forest data.
	No time limit in reacting to forest use notifications (10 days indicated in the Forest Act does not apply to ELY-centers.	Setting a timeline for ELY-centers to answer to forest use notifications- timeline can be set by law, ministry guidance or by mutual agreement between ELY-centers.
	Lack of forms and instructions to apply for compensation in case of flying squirrel prohibiting forest use	Creating a form for applying compensation from the ELY-center. Creating clear criteria for compensation.
	Landowner gets interested in continuous cover forestry only to save from regeneration costs.	Education and advising.
1.5 Forest use notification	New observation has appeared after planning.	Flying squirrel buffer in forest use notification from 100 meters to 1 kilometer. Built in alarm to notify about flying squirrel on defined proximity.
	Planner has written flying squirrel information on forest use notification (usually just to assure that they have taken the species into account.)	Forest Centre could develop a word recognition into software to prevent writing any information about the flying squirrel.

Table 6. Challenges and proposed solutions for stage 2 of the planning process.

Stage 2 Finalizing	Challenges	Proposed solutions
2.1 Tendering of timber sales	-	-
2.2 Renewed forest use notification	Differing guidelines and interpretation of the law on two forest use notifications from same flying squirrel site.	Ministry level guidance or mutual agreement between ELY-centers to minimize differing interpretations and instructions – ensuring of equality for citizens. OHKE-projects for developing coherent procedures and guidelines for ELY-centers.
2.3 Automatic flying squirrel notification	Schedule: Reaction time of ELY-center cannot be anticipated	Phone call to ELY-center – if no answer, the process will continue to fellings within a month. Setting a timeline for ELY-centers to answer to forest use notifications - timeline can be set by law, ministry guidance or by mutual agreement between ELY-centers.
	Roles between SMK and ELY-center – who will offer advice?	Clear instruction on when and whom to contact. Easy access to information about dedicated contact personnel. Ensuring expert resources of ELY-centers to increase time for law enforcement and advising.

2.4 Felling plan	Additional work, lack of time	Use of “additional information box” on forest use notification. Forest Centre could develop a word recognition into software to prevent writing any information about the flying squirrel.
	Differing and strict guidelines between ELY-centers	Coherent guidelines and interpretation of the law – building trust between forestry operators and officials to promote experiences of fair interpretation of the law and acceptability of species protection.
2.5 Revision of the felling plan	Differing interpretation between ELY-centers and contradictory guidelines	Ministry level guidance or mutual agreement between ELY-centers to minimize differing interpretations and instructions – ensuring equality for citizens. Discussion, interaction, and guidelines to promote positive attitude towards species protection.

As a result of the workshop one participant noted that if only stages one and two were in order, many challenges could be avoided. However, surprises tend to arise because of the short lifespan of the flying squirrel and the fluctuation within habitats (multiple nests, mortality of individuals and repopulation of previous habitats).

Table 7. Challenges and proposed solutions for stage 3 of the planning process.

Stage 3 Felling	Challenges	Proposed solutions
3.1 Marking the felling area	Lack of trust – observations are published by a conservation association only after something happens in the forest	Building trust between different parties. Is the late publication of observation intentional nuisance or merely a way to operate with scarce resources?
	Neighbor announces that there is a flying squirrel on the site	Educating public to record flying squirrel observation to Laji.fi-database to enable information transfer prior to fellings.
3.2 Felling site instructions	No instructions are made	
	Harvester operator does not read the instructions	
3.3 Felling	Felling intensity is too high or low	
	Flying squirrel found on the site during fellings	Improving species data and abilities to recognize habitat to save resources.
3.4 Monitoring of fellings	Landowner removes retention trees after fellings.	Education, information and promoting positive attitudes towards species protection.
	If there are challenges on previous phases, problems will arise here.	Easily accessible instructions, access to species data. Ideally most of the potential habitats would be known and recorded.
3.5 The end of the process		

Table 8. Challenges and proposed solutions for stage 4 of the planning process.

Stage 4 Aftercare	Challenges	Proposed solutions
4.1 Flying squirrel discovered during or after the fellings	Additional costs will arise as the planning may need to be revised completely.	Access to species data. Improving species data. Education on how to recognize habitats.
4.2 Media gets interested	Negative publicity	Is the species “wrongly” protected if the forest operator strives to protect the species to avoid negative media?
4.3 Police report	Responsibility for the conservation lies completely on landowner and owner of the felling rights	Clarification on the responsibilities of ELY-centers to provide guidance on how to protect the flying squirrel in forestry based on current legislation (Act on the Centre of Economic development, Transportation and the Environment and Administrative procedure act)
		Forestry operator must document everything to prove innocence and adequate protective measures for the flying squirrel.
		Including documenting guidance into education: advisement to document everything related to flying squirrel on felling site – what has been done, when and why, a summary of existing information.
4.4 District court		Presenting of gathered documentation.

4.6 Deliver – Workshop with Forest Centre’s experts

Finnish Forest Centre had specialists in forest and nature management who have practical knowledge about forest legislation, practices, bureaucracy, conservation measures, forest and nature management, and forest ownership. Forest Centre is responsible for monitoring forest legislation. The organization has possibilities to develop the work and co-operation between government agencies and private sector. (Finnish Forest Centre 2020, 2022d; Metsähallitus et al. 2018) The tools available for Forest Centre and Flying Squirrel LIFE project were competence development, communication and raising the awareness of forest professionals and public about combining commercial forestry and protection of the flying squirrel.

The final stage of the Double Diamond design process is to deliver prototypes (practical solutions) for the found challenges. The solutions generated in the first workshop were considered based on Forest Centre’s possibilities to solve them. The researcher at this point had been employed by Finnish Forest Centre for over six years and was very familiar with the organization’s possibilities to influence on the found challenges. Thus, the researcher chose 17 challenges for the second workshop for further development.

A second workshop was arranged with Forest Centre personnel to develop solutions that Forest Centre could put into action. These are, for example, competence development, development of internal practices to minimize bureaucracy, ensure fluent processes with mandatory announcements and documentation, and to develop quality instructions and education material. The challenges were arranged for the second workshop based on the solutions proposed for them (appendix 4).

Challenges were grouped under six headlines:

1. Negative attitudes
2. Recognition of habitats
3. Time consuming and demanding planning process
4. Field work and planning
5. Databases and co-operation with ELY-centres
6. Responsibility for the protection of the flying squirrel

Second workshop was arranged face-to-face in Jyväskylä in early March 2024 to further develop the proposed solutions from interviews and first workshop with project partners. All participants were Forest Centre's expert level employees working on Flying Squirrel LIFE project. Most of the participants had worked on the project from one to five years. Two participants were new to the project and the workshop was part of their orientation.

At first the background of this study was shortly presented to the participants. Then the chosen six challenges were introduced. Workshop lasted for two hours and was facilitated by the researcher. Brainstorming was chosen as development method as all participants knew each other and were familiar with Forest Centre and forest and nature management, which were the main topics the workshop was built upon. During the workshop the researcher introduced each challenge group and gave background information about how each challenge and proposed solutions had been recognized during the interviews and the first workshop. Participants made suggestions and discussed about solutions that could be put into action by Forest Centre.

Some challenges and solutions were promptly processed as the solutions had already been put into action by the project. For example, the first challenge group about negative attitudes had been addressed by the project already. All education and advising of landowners were dedicated

to increase knowledge and improve acceptability of the protection of the flying squirrel. In other words, the education and advising targeted to mitigate negative attitudes towards species conservation and nature management.

During the workshop following solutions were developed:

Challenge 1 - Negative attitudes

It was determined that the negative attitudes towards conservation and nature management exists both in forest professionals as in landowners. The experience of the attendants was that negative attitudes are more common amongst senior forest professionals and landowners, and that younger generation in general has more positive attitude towards nature values and conservation. This was in line with the opinions the forest professionals reported in the interviews.

It was agreed that the ongoing education efforts of the Flying Squirrel LIFE project were the most suitable solution for modifying attitudes towards conservation and nature management. However, the participants highlighted the importance of including information on monetary compensation and voluntary protection programs into education materials and events. In general, the education work to inform landowners and forest professionals about the importance and benefits of species conservation and nature management within forest sector was seen as an answer to promote positive attitudes.

Negative attitudes might stimulate challenging questions in education events. Thus, it was suggested that a list of carefully deliberated answers for most common difficult questions concerning protection of the flying squirrel and its affects on forestry should be prepared by project personnel. This would benefit the project's final year efforts as well as complement the usability of project outcomes after the end of the project. It was determined that the 'argument bank' must be available in Forest Centre's intranet for customer support team and all forest advisors and experts processing forest use notifications. The solutions for challenge 1 are summarized in table 9.

Table 9. Proposed solutions for challenges regarding negative attitudes.

1. Negative attitudes		
Challenge	Solutions by 1 st workshop	Solution by 2 nd workshop
1.1 Negative attitudes towards species conservation	Long term education and advisement.	Education: 1. Including information on monetary compensation and voluntary protection programs. 2. Informing landowners on the benefits and importance of species conservation and nature management. 3. Carefully deliberated answers for most common difficult questions.
1.4 Landowner gets interested on continuous cover forestry only to save from regeneration costs.	Education and advisement.	
3.4 Landowner cuts down retention trees.	Education and advisement to promote positive attitudes.	

Challenge 2 - Recognition of habitats

Typical habitat of the flying squirrel is a spruce dominant forest with deciduous trees (Nieminen and Ahola 2017). However, there are differences in known habitats. In northern Finland the flying squirrel sometimes inhabits forests with only a few deciduous trees and aspen may be missing completely. Occasionally the species has been found from habitats with many pine trees, even though it usually is not found in pine forests. (Heikkinen, Salminen, and Vaso 2023)

The difficulty of recognizing a flying squirrel habitat was reported by all interviewed forest professionals. The professional point of view seemed to be, that the species inhabits common forests where forestry measures have taken place frequently. It was seen challenging that there might not be any clear indication that a particular forest area is or has been inhabited by the flying squirrel. The pellets are difficult to detect in other seasons than spring time. Also, the interviewees reported that they usually do not have enough time to carefully look for pellets on every felling site. The workshop participants agreed that the time and ability to recognize flying squirrel habitats is crucial for the protection of the species. The expert opinion of the project personnel was that there are many habitats that are never recognized and might be deteriorated or destroyed accidentally.

It was agreed that education is the path to improve forest professionals' abilities to recognize flying squirrel habitats. The first suggestion of the workshop was to include harvester operators into Forest Centre's target group for flying squirrel related education. However, the participants agreed that getting small or medium size harvesting companies to send their personnel for a half day education event might be impossible. The price for the machines to stand still while harvester operators participate field excursions is too much for the companies to withstand. Also, the

workflow of different machinery on harvesting sites might be interrupted if harvester operators were not working.

It was suggested that the main contractor – large forest company or Metsähallitus Forestry Ltd – should demand harvester operators to be educated in species protection. The main contractors could promote this by taking part in covering their subcontractors' education costs. In addition, it was agreed that nature management exam gives harvester operators some basic information about nature management and species conservation, but is inadequate to educate them in specific practical questions. Brainstorming brought up an idea to include more specific flying squirrel and species protection topics into harvester operator education in vocational schools.

Forest Centre could offer easy-access online materials for independent studying or short live webinars of 1-2 hours in early mornings so that harvester operators could dedicate most of the day for work. Recording the webinars would benefit professionals struggling to find time for live events.

Educating the public about recording their flying squirrel observations was determined to be the responsibility of the Finnish Museum of Natural History that manages the Finnish Biodiversity Information Facility (FinBIF). However, participants agreed that in the education events in 2023 and 2024 Finnish Forest Centre should inform forest professionals on the benefits of recording species observations into official databases. The solutions for challenge 2 are summarized in table 10.

Table 10. Proposed solutions for challenges regarding recognition of habitats.

2. Recognition of habitats		
Challenge	Solutions by 1 st workshop	Solution by 2 nd workshop
1.3 Recognition of habitats	Education and experience in recognizing habitats based on forest characteristics. Ability and time to look for pellets and urine marks from the most potential spots in the forest	Education: <ol style="list-style-type: none"> Including harvester operators into Forest Centre's education target group. (Note that the involvement of main contractors/large forest companies to cover education costs of smaller subcontractors) Including flying squirrel and species protection issues into harvester operator education in vocational schools. Creating easy-access online materials for independent studying (especially for professionals)
1.3 Nothing is found to indicate flying squirrel presence on the site.	Understanding the biology of the species – flying squirrel tends to move from nest to nest. Short lifespan of only about two years. Education and experience in recognizing habitats based on forest characteristics	

3.1. & 3.3 Flying squirrel is detected during fellings: own observation, neighbor, nature conservation association. More work and costs will arise.	Educating public to record flying squirrel observation to Laji.fi-database.	4. Creating short 1-2 early morning live webinars for forest professionals to enable working for the rest of the day (recording the webinars for independent studying)
	Improving species data and abilities to recognize habitats to save resources.	5. Educating forest professionals (and the public) about the importance of recording flying squirrel observations into official databases.

Challenge 3 - Time consuming and demanding planning process

Compared to normal planning process, ensuring compliance to nature conservation act on flying squirrel sites takes a lot of time and effort. Many problems will arise if information about flying squirrel occurrence does not reach the landowner and forest professionals before beginning the planning of fellings. Interviewees reported that the whole plan might have to be renewed if flying squirrel is detected during planning or after the felling plan is completed. Thus, the workshop participants found it important to promote utilization, accessibility, and availability of species data.

A solution for availability of flying squirrel occurrence data would be to share all flying squirrel data through Metsään.fi-service. Currently, landowners and forest professionals with permission from the landowner can see flying squirrel observation from their own estates. The information about flying squirrel observations within 100 meters from estate borders are presented only in written form, not as spatial data. It would benefit forest professionals' effectiveness if all species data from Laji.fi-portal would be presented in Metsään.fi-service without limitations.

The mutual view of the workshop participants was that Metsään.fi-service should include the following information:

- Detailed information about all flying squirrel observations: the number of pellets, tree species and other written details attached to individual observations.
- At minimum the observations located on neighbouring estates, preferably all flying squirrel observations from Laji.fi-portal.
- All other observations of endangered species.

The workshop participants noted that species data should be available for forest professionals through their own organization's planning software. Species data can be transferred from Laji.fi-

service (Finbiff) into forest organizations' systems, but it is somewhat complex and requires a lot of manual work to choose the correct data sets. However, it was agreed that developing transferability of the species data is not under Forest Centre's influence.

To promote forest biodiversity workshop participants suggested that forest resource information produced by Forest Centre should include information on large aspens as potential cavity trees. It would require further system development to enable detection of specific deciduous tree species from one another. This ability would promote landscape level planning of flying squirrel moving corridors with connected individual aspens or groups of aspens. Also, all nature information for example of sites significant for forest biodiversity and sites with dead wood should be shared for all companies and professionals in forest sector. The solutions for challenge 3 are summarized in table 11.

Table 11. Proposed solutions for challenges regarding time consuming and demanding planning process.

3. Time consuming and demanding planning process		
Challenge	Solutions by 1st workshop	Solution by 2nd workshop
1.1 No advance info about flying squirrel	Education on usage of data.	Improving forest and species data quality and availability:
1.4 Differences with normal planning: how to ensure endurance of winds, how to delineate fellings and plan corridors, how to choose retention trees, how to plan mature spruce dominant forests	Education (events and guide-book)	<ol style="list-style-type: none"> 1. Sharing of all flying squirrel data from Laji.fi-portal through Metsään.fi-service without limitations. 2. Including available detailed information about each specific observation to Metsään.fi-service. 3. Including all other observations of endangered species to Metsään.fi. 4. Forest Centre's forest resource information should include information on large aspens. 5. Including and sharing information on sites significant for biodiversity and sites with dead wood into forest resource information.
4.1 Additional costs will arise as the planning may need to be revised completely.	Access to species data. Improving species data. Education on how to recognize habitats.	

Challenge 4 - Field work and planning

Most of the brainstorming about the challenge of finding expert help for field work evolved around ELY-centers. It was agreed that regional ELY-centers should have more resources to offer counselling for forest professionals and landowners, answering their phone calls and emails and if necessary, visit flying squirrel habitats. Legislation should be updated so that ELY-centers would have to react to flying squirrel notifications from forest use notifications within 10 days. Also, ELY-

centers should have their own electronic channel for receiving flying squirrel related forest use plans. These suggestions are not under Forest Centre’s influence. However, workshop participants concluded that Forest Centre could provide a solution by enabling attaching files to forest use notifications. The attachment should be automatically forwarded to ELY-center so the forest professionals would not have to send forms to two different authorities, Forest Centre and regional ELY-center.

Workshop participants found that the negative attitudes addressed in challenge 1 may arise from difficulties to get expert assistance for operating on flying squirrel sites. Participants noted that when work is fluent and information and help are easily accessible, the attitudes towards conservation are moderate. Forest Centre should make sure that after the Flying Squirrel LIFE project there are experts with adequate abilities to offer counselling for forest professionals on flying squirrel issues. Forest advisors and nature management experts were pointed out as personnel groups who are responsible for counselling on fellings and nature management. To achieve this, during the final year of the Flying Squirrel LIFE project Forest Centre should make sure its forest advisors and other related personnel participate project’s education events, at minimum in Flying squirrel in forestry webinars.

A species data webinar targeted to forest professionals could promote more efficient utilization of existing species data and enable fluent planning processes in forestry. Also, the automatic flying squirrel notification sent after forest use notification is made from a flying squirrel site should include links to Forest Centre’s Flying Squirrel in Forestry guide book. This would bring the most recent flying squirrel guidelines into forest professionals’ knowledge and utilization. The solutions for challenge 4 are summarized in table 12.

Table 12. Proposed solutions for challenges regarding field work and planning.

4. Field work and planning		
Challenge	Solutions by 1 st workshop	Solution by 2 nd workshop
1.3 Finding expert assistance	Clear instructions to determine the location and size of the breeding site and resting place on case-by-case terms. Utilizing spatial and species data, habitats modelling for network-level planning.	Education 1. Species data webinar for forest professionals to promote efficient utilization of species data in planning processes. Availability of expert assistance 2. Ensuring after the project there are experts in Forest Centre with adequate abilities to offer flying squirrel related counselling for forest professionals.
1.2 Wrong time of the year	Utilization of spatial and species data.	
1.2 Lack of time	Availability of clear instructions	3. Making sure Forest Centre’s forest advisors and nature management expert participate Flying squirrel

	<p>Availability of quality species data – less time into guessing and investigating.</p>	<p>LIFE project’s final year education events to increase knowledge and develop abilities to offer flying squirrel related counselling for landowners and forest professionals.</p> <p>4. Adding resources for regional ELY-centres to enable counselling for forest professionals and landowners.</p> <p>Updating legislation</p> <p>5. Updating relevant legislation so that ELY-centres would have to react to forest use notifications from flying squirrel sites within the 10-day limit.</p> <p>Software and system development</p> <p>6. Creating an electronic channel for ELY-centres to receive flying squirrel related forest use plans. (Alternatively developing a possibility to add attachments into forest use notifications and channelling them straight to the relevant authorities)</p> <p>7. Including links to Flying Squirrel in Forestry guidebook into forest use notification’s automatic flying squirrel alerts.</p>
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Challenge 5 - Databases and co-operation with ELY-centers

In the first workshop an idea arose to increase the buffer of flying squirrel notification in forest use notification process from 100 meters to 1 kilometer. The second workshop considered the idea and found many problems within. First, it could cause the value of the flying squirrel notifications to decrease as landowners and forest professionals would receive more notifications from sites where flying squirrel is not actually an issue. The seriousness people consider the notifications could decrease and have negative impact on species protection. Workshop participants found that increasing the buffer could enable more effective landscape level consideration of flying squirrel habitats. However, participants agreed that information on forest characteristics valuable for biodiversity should be distributed through other channels than forest use notifications.

Forest Centre has prohibited giving flying squirrel related information on forest use notifications. Regardless, forest professionals find it important to share information on an official forest use notification about how the species is taken into consideration. Most forest use notifications are made online. Workshop participants concluded that the forest use notification form should be renewed so that sharing flying squirrel information would not cause additional work at Forest Centre. Instead, the form should automatically forward any flying squirrel information straight to regional ELY-center. It was also noted, that Forest Centre’s webpage distributing information on endangered species does not have contact information for persons who can give counselling on flying squirrel related issues. The solutions for challenge 5 are summarized in table 13.

Table 13. Proposed solutions for challenges regarding databases and co-operation with ELY-centers.

5. Databases and co-operation with ELY-centers		
Challenge	Solutions by 1 st workshop	Solution by 2 nd workshop
1.5 New observation has appeared after planning	Flying squirrel buffer in forest use notification from 100 m to 1 km.	Software and system development
1.5 Planner has written flying squirrel information on forest use notification.	Forest Centre could develop a word recognition into software to prevent writing any information about the flying squirrel.	1. Renewal of forest use notification (electronic) form so that writing flying squirrel information on the notification would not cause additional work at Forest Centre.
2.3 Roles between SMK and ELY-center – who will offer advice?	Clear instruction on when and whom to contact. Easy access to information about dedicated contact personnel.	2. Forest Centre’s webpage that distributes information on endangered species should include contact information for personnel able to advice on flying squirrel related forestry.

Challenge 6 - Responsibility for the protection of the flying squirrel

The workshop participants agreed that responsibility issues are not under Forest Centre’s influence. However, Forest Centre can include information on the importance of documenting all work phases of planning fellings into Flying squirrel LIFE education events. The solutions for challenge 6 are summarized in table 14.

Table 14. Proposed solutions for challenges regarding responsibility on the protection of the flying squirrel.

6. Responsibility on the protection of the flying squirrel		
Challenge	Solutions by 1 st workshop	Solution by 2 nd workshop
4.3 Responsibility for the conservation lies completely on landowner and owner of the felling rights	Including documenting guidance to education: advisement to document everything related to flying squirrel on felling site – what has been done, when and why, a summary of existing information.	Education 1. Emphasizing the importance of documenting all work phases of planning fellings on flying squirrel sites in Forest Centre’s education events.

Table 15 illustrates the solutions developed in the second workshop adjusted to match the phases of the customer journey map. Most of the solutions were connected to the first stage of the planning process – the planning. During the first workshop, one participant noted that many challenges in latter stages could be avoided, if the challenges in the first two stages were mitigated. The most common suggestion for solution was education in its many forms. All suggested solutions were

- a) improving (the quality) forest and species data
- b) improving availability of expert assistance
- c) software and system development
- d) education and
- e) updating legislation.

Despite of the education, other suggested solutions require time, funding and a lot of work to realize.

Table 15. Solutions developed in the second workshop adjusted to the customer journey map.

Stage		Solutions	
1 Planning	1.1 Felling agreement	a. Improving forest and species data	d. Education
	1.2 Preparation of fellings at the office		
	1.3 Field work	b. Improving availability of expert assistance	
	1.4 Forest use planning at the office	a. Improving forest and species data	
	1.5 Forest use notification	c. Software and system development	e. Updating legislation
2 Finalizing	2.1 Tendering of timber sales		
	2.2. New forest use notification		
	2.3 Automatic flying squirrel notification	c. Software and system development	
	2.4 Felling plan		
	2.5 Revision of the felling plan		
3 Felling	3.1 Marking the felling area		d. Education
	3.2 Felling site instructions		
	3.3 Felling		d. Education
	3.4 Monitoring of fellings		
	3.5 The end of the process		
4 Aftercare	4.1 Flying squirrel discovered during or after the fellings	a. Improving forest and species data	
	4.2 The media gets interested		
	4.3 Police report		d. Education
	4.4 District court		

5 CONCLUSIONS

The research problem of this study included an assumption that there are challenges in combining forestry and protection of the flying squirrel. This study showed that there are challenges that forest professionals encounter when working on flying squirrel sites. Some challenges are very specific in relation to the forest professional's personal expertise. Some are more profound and larger societal issues related to legislation, interpretation of the law and how for example the media treats forest professionals when fellings on flying squirrel sites rise to public awareness.

There were 57 challenges determined in the first workshop. Some were overlapping, but the number itself shows that there is a multitude of issues challenging combining forestry and protection of the flying squirrel. It seems that the most notable challenges forest professionals encounter were inability to recognize flying squirrel habitats, inconsistencies in ELY-centres' interpretation of the law, and quality of species data.

The acceptance of the protection of the flying squirrel seems to be low amongst landowners and forest professionals due to the bureaucracies and difficulties in gaining compensation from the Finnish government in situations where fellings are interrupted or entirely prohibited due to flying squirrel occurrence. If the occurrence of the species is detected only after the felling plan is ready, or worse, while the felling is in progress, there will be extra costs for the forest planner due to the need of redoing the planning possibly for the entire site. Also, the payment for the landowner will be delayed, or the whole income lost if fellings are entirely prohibited.

It seems that increased risk of facing legal charges has put more pressure on forest professionals. There are several difficulties in anticipating flying squirrel occurrence and to take the species into account before forest cuttings take place. Forest professionals seem to lack the resources and knowledge on how to anticipate and recognize potential flying squirrel habitats. Also, time seems to be an issue since busy forest professionals have strict sales targets in buying wood and selling forest management services. The methods for ensuring the survival of the species and its habitats are not familiar to forest planners and other forest professionals.

One problem seems to be the transfer of knowledge from flying squirrel experts and scientist to forest professional. Also, the case-by-case nature of flying squirrel habitats induce problems since every flying squirrel habitat is unique and thus all fellings overlapping flying squirrel habitats must

be individually assessed and a detailed plan must be created (Ministry of Agriculture and Forestry and Ministry of the Environment 2016).

In many cases, education seems to be the most desired and straight forward solution. For example, many interviewees reported difficulties in recognizing the flying squirrel habitat, in which education and training are desired solutions. Interviewees seemed to agree that special situations such as flying squirrel habitat on a felling site requires instructions and preferably field education events. Also, participants from both workshops agreed that education is the answer for developing forest professionals' competencies in recognizing habitats, utilizing spatial data and in promoting positive attitudes towards conservation. Education is the solution that Flying Squirrel LIFE project can put into action.

Forest Centre can improve practical species protection by further developing forest resource data and sharing of species and forest data through Metsään.fi-service. Also, education is necessary to promote more effective utilization of available forest and species data. Sharing species and other relevant data through Metsään.fi-service requires cooperation with research facilities and other organizations that produce useful data for forest professionals. Developing forest use notification processes, forms and information transfer from landowners and forest professionals to authorities was a desired solution for enabling more effective planning process.

This study succeeded in discovering a multitude of challenges regarding the research questions. This study also succeeded to utilize service design tools to understand the phenomenon, define an exemplary customer journey and to create suggestions for solutions in collaboration with a range of experts from Forest Centre and Flying Squirrel LIFE project's partner organizations. However, the number of challenges is so large that all issues cannot be addressed. The importance of found challenges are subject to people's opinions and the challenges addressed and emphasized by the researcher and Forest Centre's experts in the second workshop may not be the ones that forest professionals would have preferred to be solved first. There are many restrictions in practical problem solving, as many suggested challenges require personnel, time, money and even changes to current legislation if they were to be solved. Finnish Forest Centre does not possess the resources to solve all found challenges. Flying Squirrel LIFE project lasts from 2018 to 2024 and is limited to this time span and by the project plan and funding.

6 DISCUSSION

This chapter discusses the results of this research. The first research question of this study was: *“What are the challenges forest professionals encounter in combining commercial forestry and protection of the flying squirrel?”*. In depth semi-structured interviews with forest professionals were chosen for finding answers. The interviews confirmed that there are many problems in planning fellings on flying squirrel sites.

6.1 Service design in combining forestry and protection of the flying squirrel

This study targeted to discover challenges forest professionals encounter in combining forestry and protection of the flying squirrel. According to Brown (2009) and Vargo and Lusch (2017) design and design thinking suits for solving societal, environmental and sustainability issues in collaboration with public and private sector stakeholders. Abela and Murphy (2008) state that service dominant logic aligns the interests of the organization, customers, and the society. It applies into solving multi-stakeholder issues that require the utilization of collaborative methods in networks.

Another goal of this study was to produce suggestions for solving the challenges forest professionals encounter. Many challenges have to do with public policies, such as inconsistent interpretation of the nature conservation act, or policies regarding mandatory forest use notifications. Buchanan et al. (2017) state that designing public services for citizens and organizations benefit from policy making incorporated with service design methods. They also state that service design helps in visualizing complex systems and enables more efficient idea generation.

Service design was chosen a research strategy for this study. According to Thoelen et al. (2015) service design can and should be applied into developing public services. Public services are in many cases build from the perspective of the organization instead of the service users. Moritz (2005), states that service design is about producing ideas, solving problems, and creating solutions. It can also be utilized in explaining insights and processes. Maula & Maula (2019) note that observing and listening the stakeholders is part of the design process. According to Brown (2009) design thinking provides methods for including target community into defining the challenges and that insights of target community should be combined with expertise of designers and specialists.

In this study, the baseline data was collected by interviewing forest professionals. Further development was conducted in collaboration with specialists from many related public, private and third sector organizations.

According to Hopkins (2019) service design can be divided into two phases which are sense making and problem solving. This study utilized the four stage Double Diamond design process by Design Council (2022) to discover challenges, define the problem and to develop and deliver solutions. Thoelen et al. (2015) notes that the Double Diamond (Design Council 2022) enables conforming the design process to specific challenges and it depends on the project whether the stages are followed in succession. In this study the stages were followed in succession, and the delivery of solutions was mostly limited to presenting suggestions for solutions. The testing and further development of suggested solutions lies on Forest Centre and Flying Squirrel LIFE project partners.

In addition to the Double Diamond, a customer journey map was created to illustrate the planning process of fellings on flying squirrel sites and to enable further development. According to Haugstveit et al. (2016), determining a customer journey requires gathering information on customer behaviour and real-life customer encounters. According to Hakoköngäs and Asiala (2020) designers utilize their subjective expertise to understand the target community for problem solving. In this study, an exemplary customer journey was determined based on the interviewees' disclosures and the researcher's expertise on the subject.

According to Polaine et al. (2013) service design is about collaboration and combining users' insights into service producer's perspective. In this study collaborative development was conducted in two expert workshops. Brainstorming was chosen for collaboration tool as, according to Stickdorn et al. (2018) it suits for generating ideas quickly and allows participants to ideate without restriction and enables to go through several themes in short period of time.

According to Denzin and Lincoln (2011) and Saunders et al. (2016) qualitative research approach enables modifying data collection through the process. In this study the original plan was to narrow down the discovered challenges in the first workshop with Flying Squirrel LIFE project partners. However, during the workshop participants determined that it would be more beneficial for this study and the commissioner to examine all phases of the discovered customer journey and challenges within. The narrowing down of the challenges was made by the researcher after the first workshop. The challenges were narrowed based on Forest Centre's possibilities to solve them and brought to the second workshop.

6.2 Further studies

The interviewed forest professionals and experts who participated the workshops found the differences between regional ELY-centres' interpretations of the nature conservation act a challenge. According to Finish constitution (731/1999) all people are equal before the law. However, when it comes to flying squirrel breeding sites and resting places, the interviewed forest professionals and participants of both workshops find that the interpretation of the law differs between independent ELY-centres.

The existence of differing interpretations of the nature conservation act and other related legislation should be studied. This study is based on professional experiences and opinions and is therefore subjective to participants personal views. An objective mixed method research should be conducted to determine the existence and depth of the issue and to promote equality amongst Finnish citizens. Regarding the objectives of this thesis and Flying squirrel LIFE project, it would help improving the acceptability of conservation measures to ensure equality of landowners and forest professionals.

Many challenges were found regarding forest use notification and related processes. Thus, interviewees and workshop participants suggested further development of forest use notification processes, forms and practices between Forest Centre and ELY-centres. However, forest use notification is statutory and any dramatic changes might require changing current legislation and responsibilities of Forest Centre and regional ELY-centres. This type of changes requires funding and resources.

Previous studies have been made on the forest fellings' influence on flying squirrel occurrence and viability of habitats (Jokinen 2012; Wistbacka 2023). However, there are no studies on the economic impacts of flying squirrel detection to forestry and landowners. Further studies should be made on how big of an issue the inability of recognizing flying squirrel habitats is. The amount of fellings interrupted by detection of the flying squirrel could provide information on the scale of lost income and wasted working hours. The amount of cases where the flying squirrel detection has prohibited all forest use but where the landowner has not been eligible for compensation or has not been willing to seek it would give insight on the scale of lost income.

6.3 Validity and reliability of the research

This study answered the question on what challenges forest professionals encounter in combining commercial forestry and protection of the flying squirrel. The answer to this research question was established and many practical suggestions for solutions were produced. Some solutions, such as education efforts, were already brought into action by Forest centre and Flying Squirrel LIFE project before this study was finished. For example, the education efforts by the project were planned and put into action before and along with this study. However, this study confirmed that education is a valid solution for many challenges forest professionals encounter on flying squirrel sites.

The results of this study are based mostly on the interviews and workshop. Thus, people selected to be interviewed and to participate the two workshops had an affect on the results. Seven forest professionals were interviewed to gather insights on the challenges that occur on flying squirrel sites. Saunders et al. (2016) state that data can be collected from small sample of experts to understand their experiences. The interviewees were chosen by the researcher and according to Saunders et al. (2016) the selection should be done based on the candidate's ability to provide answer for research questions.

The objective of the interviews was to gather information from a variety of organizations and from different regions of Finland. All interviewees represented different organizations and worked on different but partly overlapping regions. The interviewees were selected based on recommendations. Invitation for the interviews were sent for people with knowledge on flying squirrel in forestry. Many of the interviewees had special responsibilities about nature management in their organizations. It is possible that the selected interviewees had more positive attitudes towards species conservation and nature management than an average forest professional would have had.

Regarding this study, it was important to gain insights from people who had experience and insight on planning fellings on flying squirrel sites. Thus, more random selection process might have resulted as interviewees, that had no experience or knowledge relevant to the topic. However, it could have been possible to implement more random selection measures to avoid any biases from the interviewees. The number of interviewees was 7. There were no representative of a sawmill in the sample. However, after five interviews saturation was detected and the insights of the interviewees began to resemble each other. Thus, it was determined that seven interviews were enough to proceed with the study. The largest differences in participants' answers seemed

to relate to the length of their experience in forestry. Younger professionals seemed to be a little insecure on how to manage flying squirrel situations and what happens if a mistake occurs since they did not yet have experience on the consequences.

According to Saunders et al. (2016) and Denzin and Lincoln (2011) in an in-depth interview the interviewer co-produces the insights with the interviewee. Saunders et al. (2016) and Adams (2015) note that the researcher must pay attention not to allow personal opinions and attitudes to impact the outcomes. Personal interviews were chosen over group interview because according to Saunders et al. (2016) and Adams (2015) it suits better for gathering insights on sensitive issues where interviewees might report non-compliant behaviour. They also note that the interviewer must be familiar with the topic. In this study, the researcher targeted to be as neutral as possible during the interviews. The planned and improvised questions were targeted to encourage the interviewees to freely share their experiences. It was also important that the researcher was clear on how the results are utilized and how anonymity is ensured. However, it is possible and even likely that somehow the researcher's personal opinions and working on the Flying Squirrel had an effect on the interviews. It is impossible to determine whether there was any impact and whether it was positive or negative.

The workshop participants were chosen based on their knowledge and experience in Flying Squirrel LIFE project. It was important to utilize the expertise of people who possessed the deepest knowledge in combining protection of the flying squirrel and land use practices. The participants in the first workshop represented different organizations and areas of expertise, such as forestry, conservation, nature management and research. This complemented the data from the interviews, which was produced solely by forest professions. Bringing people outside the project into the workshop could have produced a wider range of solutions and insights that project personnel had not considered.

The participants of the second workshop were all experts from Finnish Forest Centre. They were experienced in flying squirrel LIFE project and nature management. Two of them had experience in nature management, but no experience on the project. They brought to the table new insights and a fresh point of view. It was important that the participants were mostly familiar with the project and especially familiar with Forest Centre, its tasks and development possibilities. The participants in the second workshop could have been chosen from a wider range of Forest Centre's experts. Experts in forest management, enforcing forest laws and granting forest subsidies could have complemented the workshop by bringing more in-depth knowledge of system and software development. Also, expertise in forest related legislation would have been useful. Thus, many

development suggestions and solutions created in this study need further consideration and analysis on their practicality and implementation by Forest Centre's experts.

This study produced many solution suggestions for Forest Centre for further development. However, it is likely that many suggestions will be never realized as resources are scarce and diminishing. Regarding Flying Squirrel LIFE project, many suggestions for solutions were put into action before this study was finished. However, as this report is being written, the project is closing its ending and there will be no time and resources to further develop the suggested solutions. It is up to project's partner organizations whether they utilize the results after the end of the project.

The results of this study – the solution suggestions – are mainly applicable for only flying squirrel related issues. However, there are some solutions, that have other benefits, such as developing more efficient and fluent practices between different authorities. These kinds of solutions save the society's resources and have an impact for many policies in forestry. Utilizing service design in solving forestry and nature conservation issues is transferable for multitude of organizations in Finland and the globe. Service design offers many methods that can be applied and this study shows that in sensitive issues design approach offers a valid solution for discovering challenges and developing solutions for them.

6.4 Restrictions of this study

This study was limited to practical solutions that Finnish Forest Centre and the Flying Squirrel LIFE project can produce. Forest Centre monitors effective forest legislation, and its tasks do not include promoting new legislation. Similarly, the Flying Squirrel LIFE project was tasked to coordinate differing goals of forest sector, forest professionals, landowners, species protection and legislation. The project was working towards better ways of complying with current legislation. The project's goal was not to promote legislative changes. (Act on the Finnish Forest Centre 418/2011 2012; Finnish Forest Centre 2022d; Metsähallitus et al. 2018)

Protection of endangered species and promoting biodiversity are complex issues that require measures on national level. There are many stakeholders from ministry level to private citizens who have expectations and duties concerning species protection and biodiversity. Forest and environmental legislation construct the framework for this study. All stakeholders are bound by the law. Also, public organizations such as Finnish Forest Centre and regional ELY-centers are bound by policies. Forest sector in Finland is highly digitalized and policy changes require software

updates for both public and private sector. Implementing new policies can take several years. Monetary resources also limit software and policy changes.

6.5 Position of the researcher

This study is conducted to complement the Flying Squirrel LIFE project in its task of solving flying squirrel-related challenges in forestry. The researcher is part of the project staff in Finnish Forest Centre under the title of project manager. Towards the multi-associate project, the researcher is referred as project coordinator.

The researcher is responsible for implementing the project goals designated to Forest Centre. Two largest goals are creating flying squirrel-friendly forest plans to 28 sites on privately owned forests and to create an education package on how to combine forestry and protection of the flying squirrel. Generally, the project targets to improve the conservation status of the flying squirrel. This study will support the project by creating suggestions on how to ease the conservation in everyday forestry and thus improve the acceptance of conservation efforts and promote project goals.

The researcher is forestry engineer and forest professional with 5 years' experience in Finnish Forest Centre. The interviewees are also forestry professionals with education of forestry engineer (university of applied sciences) or Master of science in forestry. However, the researcher does not have work experience in forest planning of commercial forestry. This separates the researcher from the interviewees. The researcher has knowledge and experience on public sector in forestry, but not the private (commercial) sector. The researcher's education and background enable understanding forestry related terminology and special conditions of the field. The interviews will produce information that the researcher cannot acquire any other way.

In addition to the interviews, this study includes workshops/collaborative development, in which the researcher will participate in the role of project manager and coordinator. The researcher will be a host for the workshops consisting of project staff from Forest Centre and project partners.

Bansal and Corley (2011) argue that in qualitative research the researcher interacts with the phenomenon and the transparency of the qualitative research process is inevitable for the reliability of the study.

This study developed the researcher's abilities to utilize service design in solving complex, practical issues in working life. Completing the research provided competence to find solutions for complex issues that require deeper understanding and co-operation. The most rewarding part of the study were the interviews and workshops where skilled specialists shared their knowledge and experiences to develop the forest sector in Finland. Recording and reporting the development process of complex phenomenon challenged the researcher. Acting as an interviewer was new to the researcher and it strengthened the abilities to gather experience-based information from sensitive issues that require trust between the interviewer and the interviewee. Professionally, the interviews and workshops provided desired new perspectives on the topic and its societal meaning.

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Thesis material management plan

1. General description of the material

What type of research material (e.g. interview, survey, observation) is collected or used in the thesis?

Research material of this study consist of interviews and workshops. Interviews will be recorded and transcribed.

2. Documentation and quality of the material

How is the research data documented, for example, what kind of identification information is used? How is the quality of the material and its documentation ensured?

Research material of this study consist of interview recordings and transcriptions. The interviews are conducted and recorded on Microsoft Teams-platform, and they are not anonymous.

There will be 7-8 interviewees. The data documentation will be conducted by given each interviewee a number by which they are referred to in this study. The quality of the transcriptions is critical for successful and reliable outcomes. The interviews are recorded, which enables accurate transcriptions.

The workshops' materials consist of a memorandum that does not include participants names. The document consists of workshop results/development ideas generated.

3. Storage and backup

How is the material saved? How is data security ensured (e.g. access to the material) during the thesis process? Who can access the material?

The material is saved in Finnish Forest Centre's cloud server, where automatic backup copies are generated. In addition, the material will be saved on an external hard drive. The material on cloud server can be accessed only by the interviewees, and technical support in case of emergencies. The material on hard drive can be accessed only by the researcher. The hard drive is stored in a locked drawer where only the researcher has access to. After the transcriptions are complete, the material can be accessed only by the researcher and (if necessary) technical support of Finnish Forest Centre.

4. Ethical and legal issues related to storage

How are any possible ethical issues related to the material storage considered (e.g. sensitive personal information, access by others)? How are the ownership and user rights of the material managed?

The interview topics are not sensitive in nature. However, the interviews may produce answers that the interviewees do not wish to bring into publicity under their own name. For example, an interviewee might be unsure if they have been able to comply to the Finnish Act on Nature Conservation in their line of work. Thus, the interview recordings are stored only until this study is completed and evaluated.

Transcriptions of the interviews will be anonymized. Each interviewee will be given a number by which the interviewee is referred to in the study. Due to the nature of the study, some identification information is connected to the transcriptions, such as organization the interviewee represents, title, length of experience in forestry and other information indicating the interviewee's experience, knowledge base and point of view about the subject.

The anonymized interview transcriptions are stored until this study is complete.

The workshops consist of normal development work Finnish Forest Centre conducts in various projects. There will be no sensitive information handled in the workshops. The workshops will utilize anonymized interview data, and workshop memorandum consist only a list of participants that are Forest Centre's employees.

All data is owned by Finnish Forest Centre. The interview recordings are accessed only by the interviewee. After the study is completed and evaluated, the recordings will be deleted.

5. Opening the material and long-term storage

Would it be possible to use the material later? How is any further use of the material enabled?

The workshop results might be utilized in further studies concerning similar topics about species conservation and nature management in forestry.

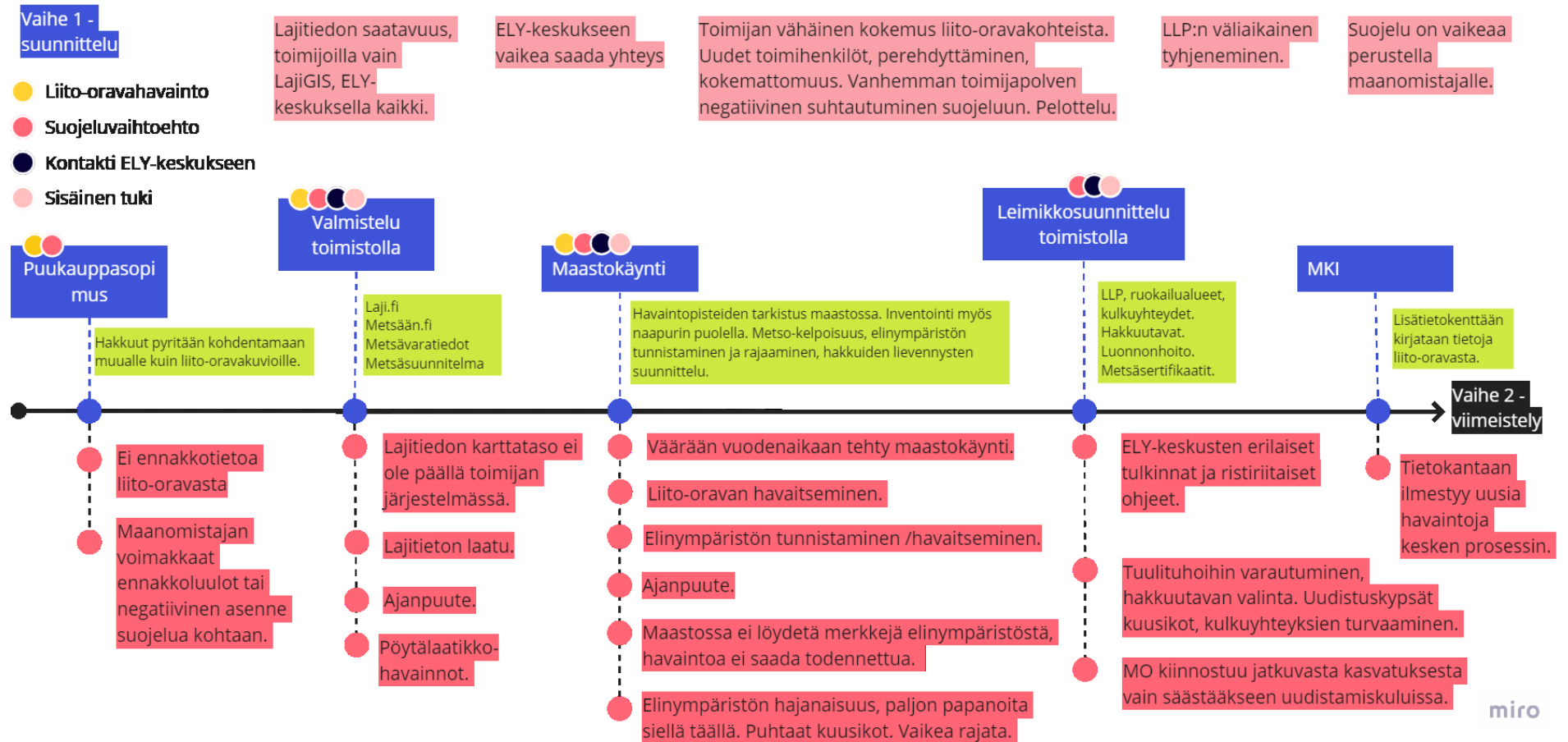
The form of the interview presented to the interviewees in the beginning of the discussion:

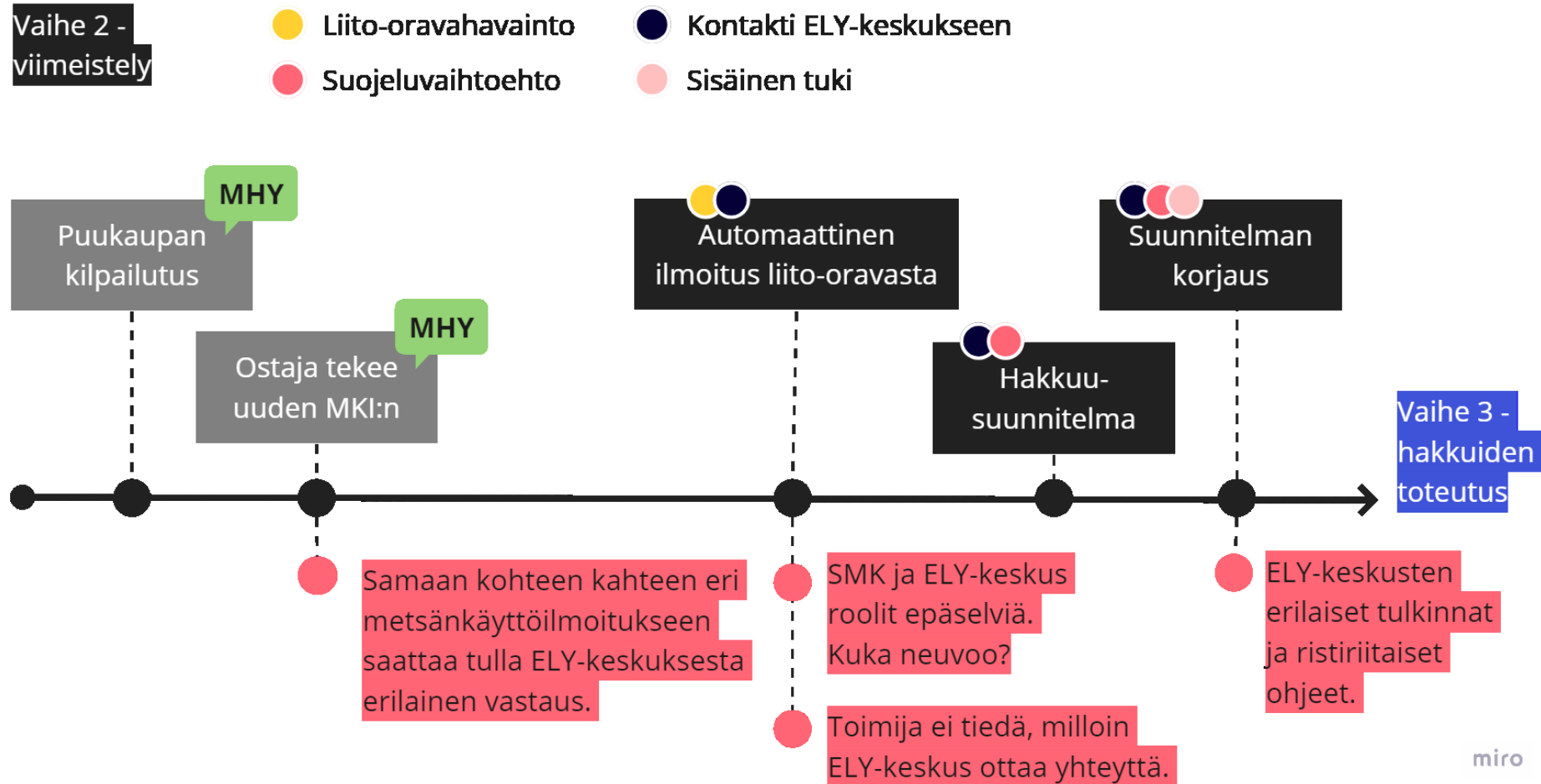
- *You will be asked a few questions, in which you are expected to answer from your professional point of view.*
- *Describe your experiences in your own words. Clarifying questions will be asked if necessary.*
- *There are no right or wrong answers to the questions in this interview.*
- *Your professional performance is not under evaluation in this interview or in this study.*
- *The objective of this interview is to discover your experiences as a forest professional.*
- *There will be no survey forms to fill, or any tests made during this interview.*
- *This interview is confidential, and your identity will not be revealed to any other than the researcher.*

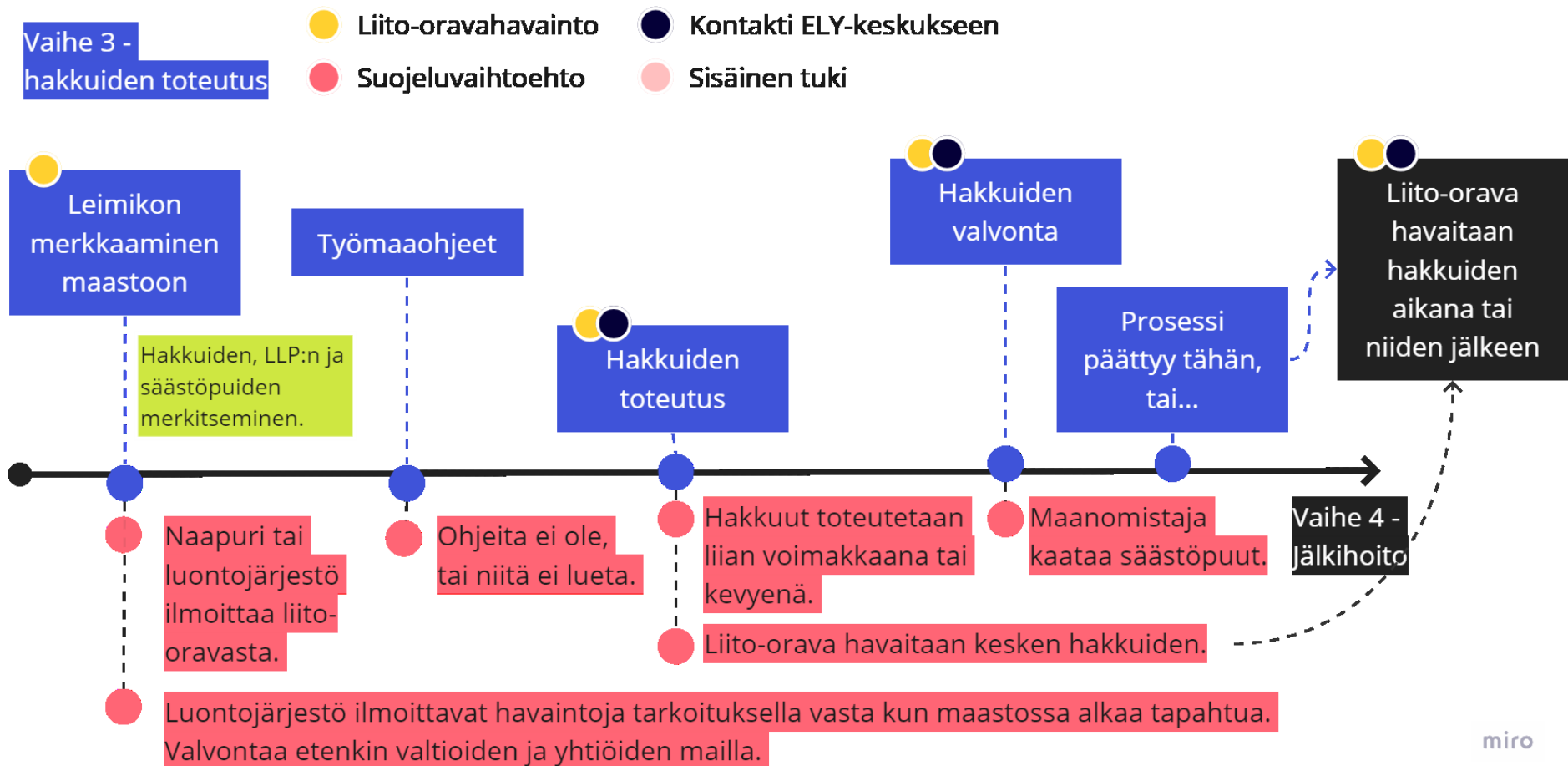
	Background question	Relevance
1	Organization	Organizational spread
2	Region or municipality	Geographical spread
3	Title	Variety of duties
4	Experience in forestry (years)	Level of experience in forestry
5	Do you own forest?	Clarification of perspective: purely a professional point of view or a landowner as well
6	Do you know if there are any sightings of the flying squirrel in your own estate?	Clarification of perspective and possible bias or prejudice.

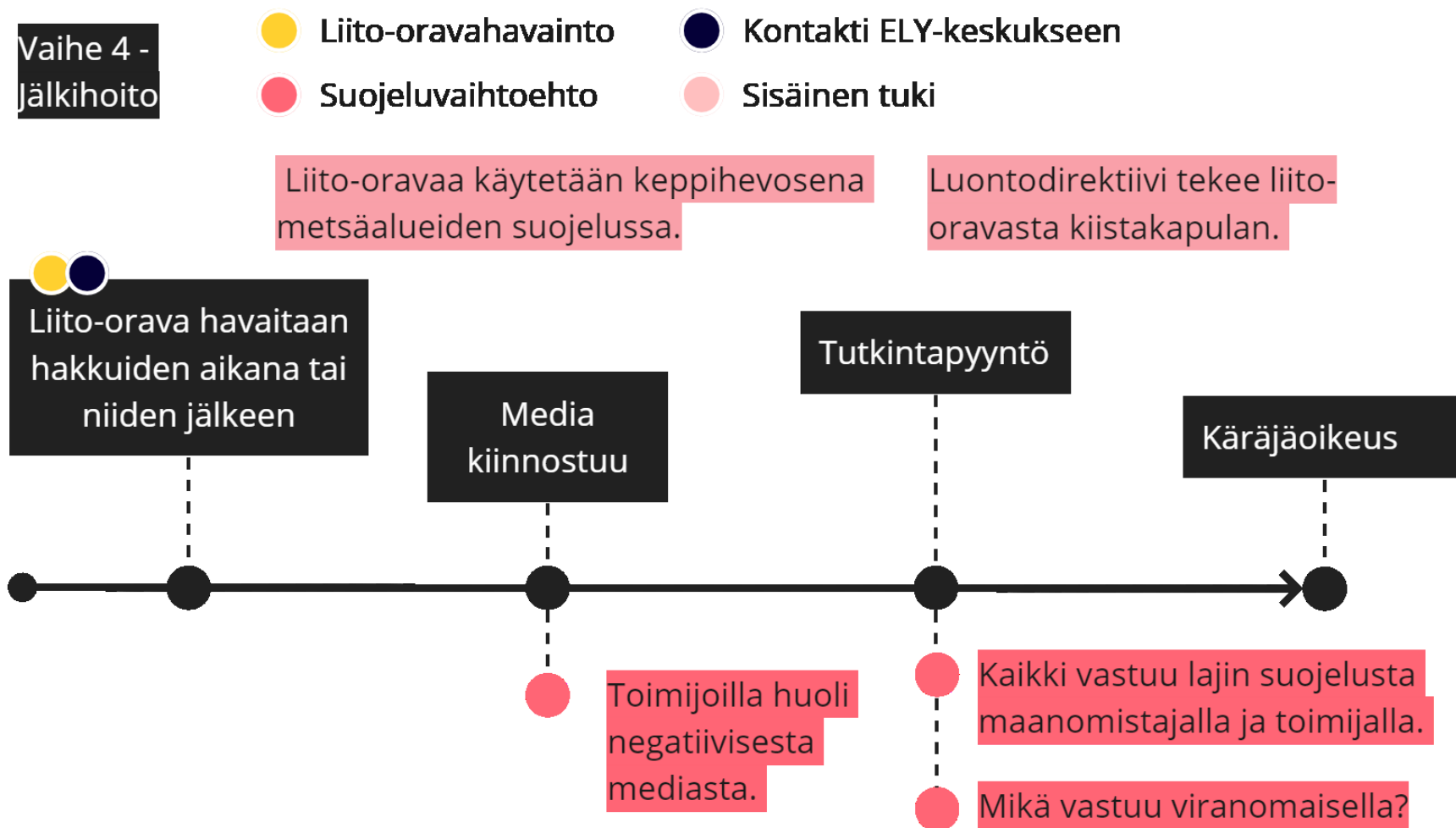
	Question	Meaning
1	Please estimate, how often have you encountered flying squirrel in any work-related situation?	To determine, how familiar the interviewee is with the flying squirrel and related situations.
2	Describe some of these situations? Clarify, how recent the situation is?	To determine the nature of the situation, and possible challenges related to it. Clarification to determine whether the circumstances are still relevant.
3	In what point of the forest planning process did you become aware of the flying squirrel observations?	To determine possible challenges and solutions. To determine customer journey.
3a	Prior or after the felling/forest plan was finished?	To determine customer journey.
3b	How did you become aware of the flying squirrel observation?	To determine possible challenges and solutions. To determine customer journey.
3c	Did you contact your regional ELY-center? Did ELY-center proactively contact you after receiving the automatic notification based on your forest use notification?	To determine possible challenges and solutions. To determine customer journey.
3c	Did you know how you were supposed to proceed? Does your organization have operating instructions for flying squirrel situations?	To determine possible challenges and solutions. To determine customer journey.
4	What was easy in the planning process?	To determine possible solution eligible for expanding to other organizations.
5	What was difficult in the planning process?	To determine possible challenges.
6	Were there any surprises?	To determine possible challenges.
7	In retrospect, would you do something differently? What?	To determine possible challenges and solutions.
8	How would you solve the challenges you encountered? Would you develop your own competences or the practices concerning the matter?	To determine possible challenges and solutions (that Flying squirrel LIFE project could affect on in its education package).
9	Have you received education concerning biodiversity and/or protecting endangered species in forestry? What kind of education?	To determine possible challenges and solutions (that Flying squirrel LIFE project could affect on in its education package).
10	What kind of support or education do you require or wish?	To determine possible challenges and solutions (that Flying squirrel LIFE project could affect on in its education package).
11	What kind of instructions do you prefer to utilize? (For example, remote or live education events, printed or digital guide material, recordings?)	To determine possible challenges, and solutions (that Flying squirrel LIFE project could affect on in its education package).

Workshop material – stages of the forest use planning process









AfterLIFE

Mitä Metsäkeskus voi vielä tehdä?
Mitä tapahtuu hankkeen jälkeen?



Metsäkeskus

Opinnäytetyön taustaa

- Haastateltu 7 metsäammattilaista
 - Mitä haasteita kohdanneet liito -oravakohteiden suunnittelussa?
- Työpaja hankekumppanien kesken
 - Mihin haasteisiin voidaan hankkeena ja kumppanien taholta vastata? Mitä ratkaisuja voidaan tarjota?
- Työpaja Metsäkeskuksen hanketiimin kesken
 - Mitä Metsäkeskus voi tehdä hankkeen viimeisen vuoden aikana ja hankkeen jälkeen?



Metsäkeskus

1. haaste: negatiiviset asenteet

- 1.1 Negatiiviset asenteet lajinsuojelua kohtaan
 - Pitkäjänteinen **koulutus** - ja tiedotustyö
- 1.4 Maanomistajan kiinnostuu jatkuvasta kasvatuksesta vain välttääkseen uudistamiskulut
 - **Koulutus** ja neuvonta
- 3.4 Maanomistaja kaataa säästöpuut
 - **Koulutusta** ja tiedotusta myönteisen asennemuutoksen aikaansaamiseksi.



Metsäkeskus

2. haaste: elinympäristön tunnistaminen

- 1.3 Elinympäristön tunnistaminen
 - **Koulutusta** ja kokemusta elinympäristöjen rakennepiirteiden tunnistamisesta
- 1.3 Maastosta ei löydy merkkejä lajista
 - Lajin biologian ymmärtäminen – pesien vaihdot, lyhytikäinen.
 - **Koulutusta** ja kokemusta elinympäristöjen rakennepiirteiden tunnistamisesta
- 3.1 ja 3.3. Liito -orava havaitaan kesken hakkuiden: oma havainto, naapuri, luontojärjestö...Tulee lisätyötä ja kustannuksia
 - **Koulutusta** ja tiedotusta (suurelle yleisölle) lajihavaintojen ilmoittamisesta laji.fi -palveluun.
 - Lajitiedon laadun parantaminen
 - **Koulutusta** elinympäristön tunnistamisesta



Metsäkeskus

3. haaste: suunnittelu vie aikaa ja vaatii osaamista

- 1.1 Ei ennakkotietoa liito -oravasta
 - **Koulutusta** lajitiedon hyödyntämisestä
- 1.4 Erot normaaliin hakkuiden suunnitteluun, tuulenkesto
 - **Koulutus** (maastokoulutus ja opas)
- 4.1 Kustannukset kasvavat, jos liito -orava löydetään kesken hakkuiden ja suunnitelma joudutaan tekemään kokonaan uusiksi
 - Lajitiedon saatavuus, lajitiedon laatu, **koulutusta** elinympäristöjen tunnistamisesta



Metsäkeskus

4. haaste: maastotyö ja kohteen suunnittelu

- 1.3 Asiantuntija -avun löytäminen maastotyön tueksi
 - Selkeät ohjeet LLP:n paikallistamiseen ja rajaamiseen, tapauskohtaisuuden huomiointi
 - Maisematason suunnittelu, paikka - ja lajitiedon sekä elinympäristömallinnuksen hyödyntäminen
- 1.2 Väärä vuoden aika maastotyölle
 - Paikka - ja lajitiedon hyödyntäminen
- 1.2 Ajanpuute
 - Selkeiden ohjeiden helppo saatavuus
 - Paikka - ja lajitiedon hyödyntäminen



Metsäkeskus

5. haaste: tietojärjestelmät ja ELY -yhteistyö

- 1.5 Uusi havainto ilmestynyt tietokantaan suunnittelun ja välissä MKI:n
 - MKI:n bufferin nosto 100 metristä 1 kilometriin.
- 1.5 MKI:n lisätietokenttään kirjoitettu liito -oravatietoa.
 - SMK voisi kehittää Sampoon sanatunnistuksen, jolla liito -oravaan liittyvän tiedon kirjoittaminen lisätietokenttään estettäisiin.
- 2.3 ELY-keskuksen ja Metsäkeskuksen roolit
 - Selkeät ohjeet milloin ja keneen ottaa yhteyttä. Oikeat yhteyshenkilöt nettiin (ei vaihteen kautta).



Metsäkeskus

6. haaste: vastuu suojelusta

- 4.3 Vastuu suojelusta täysin maanomistajan ja toimijan vastuulla.
 - **Koulutusta** ja tiedotusta liito -oravakohteen suunnitteluvaiheiden dokumentoinnista: kaikki vaiheet hakkuun suunnittelusta tallennettava – mitä on tehty, milloin ja miksi. Yhteenveto olemassa olevasta tiedosta, johon suunnitelma on pohjattu.



Metsäkeskus

Muita havaintoja/haasteita

- 1.4 Maisematason suunnittelu
 - Alueellinen elinympäristöverkoston suunnittelu ja elinympäristömallinnuksen sekä metsävaratiedon hyödyntäminen
- 3.4 Yleisesti kaikista haasteista:
 - Helposti saatavat ohjeet ja lajitieto. Ihannetilanteessa suurin osa elinympäristöistä olisivat tiedossa ja tallennettuna tietokantaan.



Metsäkeskus

Yhteenvedo ratkaisuista

- Koulutus ja tiedottaminen
- Helposti löydettävät, selkeät ohjeet
- Lajitiedon laadun parantaminen
- Lajitiedon kattavuuden parantaminen
- Paikka - ja lajitiedon nykyistä laajempi hyödyntäminen liito - oravakohteiden suunnittelussa -> koulutusta, paikkatiedon kehitystyötä
- ELY-keskusyhteistyö – miten saadaan selkeämmät ohjeet, työnjako, linjaukset laintulkinnasta, MKI -prosessista (buffereista) jne.