Dissertationes Forestales 398

Advancing the development of supervisory and management competence in higher forestry education

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Academic dissertation
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ABSTRACT

In recent years, workforce and leadership competencies, and their importance in the workplace in the forest sector, have gained considerable attention. In contrast, the ability of higher forestry education to develop the appropriate skills in supervision and management has been criticized. The main aim of dissertation was to advance the development of supervisory and management competence in higher forestry education. More specifically, it evaluated: i) the importance and competency gaps in the different supervisory and management skills at the beginning of forestry professionals' careers, and the necessity to include the teaching of these skills in higher forestry education (study **I**), ii) the current supervisory and management competencies of mid-career forestry professionals in comparison to the requirements that emerge during advancement of their divergent careers (study **II**), and iii) the organizational and employer perspectives on supervisory and managerial work in the forest sector, including its characteristics, current and future challenges, and the competencies needed for supervisory and managerial duties (study **III**).

The thesis was conducted through survey questionnaires (**I** and **II**) and in-depth interviews (**III**) that produced data for both statistical and qualitative content analyses. Supervisory duties were found to be typical among early-career forestry professionals, and supervisory skills were also seen as important for all regardless of their position (**I**). During work experience and career progression, gaps and weak development in several important supervisory skills, self-management, and change management skills were revealed (**II**). Leadership skills were recognized as a key requirement in forestry organizations (**III**). The competencies of forestry professionals with regard to human relations, feedback provision, and change management need improvement. The role of supervisors as coaches or mentors will be important in the future but is currently threatened by large team sizes and an overwhelming number of duties.

To conclude, the need for generic skills in the context of management was emphasized. Supervisory competence cannot be achieved through theory alone; practical training and experience are also essential. Higher forestry education should invest more in the teaching of supervisory and management skills through the expansion and diversification of pedagogical practices.

Keywords: Workforce competencies; forest sector; forestry professional; generic skills; leadership; pedagogical practices

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TIIVISTELMÄ

Työelämätaitojen ja johtamisosaamisen tärkeys työpaikoilla on ollut runsaasti esillä viime vuosina. Sen sijaan metsäalan korkeakoulutuksen tuottamaa esihenkilö- ja johtamisosaamista on kritisoitu. Tämän väitöskirjan tavoitteena oli edistää esihenkilö- ja johtamisosaamisen kehittämistä metsäalan korkeakoulutuksessa. Erityisesti työssä arvioitiin: i) esihenkilö- ja johtamistaitojen tärkeyttä sekä osaamispuutteita metsäammattilaisten uran alkutaipaleella, sekä tarvetta näiden taitojen opetukselle metsäalan korkeakoulutuksessa (Osatutkimus **I**), ii) urallaan keskivaiheilla olevien metsäammattilaisten nykyistä esihenkilö- ja johtamisosaamista suhteessa erilaisten urakehitysten vaatimuksiin (Osatutkimus **II**), ja iii) organisaatioiden ja työnantajien näkemyksiä esihenkilötyön ja johtamisen ominaispiirteistä, nykyisistä ja tulevista haasteista sekä osaamistarpeista näissä tehtävissä metsäalalla (Osatutkimus **III**).

Tutkielma toteutettiin kyselytutkimuksin (**I** ja **II**) sekä teemahaastatteluin (**III**), joiden tuottamat aineistot analysoitiin sekä tilastollisin että laadullisen sisällönanalyysin keinoin. Esihenkilötehtävät olivat tyypillisiä jo vastavalmistuneilla metsäammattilaisilla, ja lisäksi esihenkilötaidot koettiin tärkeiksi kaikille työtehtävästä riippumatta (**I**). Toinen osatutkimus paljasti osaamisvajeita sekä heikkoa työkokemuksen ja urakehityksen myötä tapahtuvaa kehitystä useissa esihenkilötaidoissa, itsensä johtamisessa sekä muutosjohtamisessa. Kolmannessa osatutkimuksessa ihmisten johtaminen tunnistettiin keskeiseksi osaamisvaatimukseksi metsäalan organisaatioissa. Kehitystarpeita metsäammattilaisilla oli erityisesti ihmissuhdetaidoissa, palautteenannossa ja muutosjohtamisessa. Esihenkilöiden rooli valmentajina ja mentoreina on tulevaisuudessa tärkeä, mutta se on uhattuna suurten tiimikokojen ja liiallisten työtehtävien vuoksi.

Yhteenvetona geneeristen taitojen tärkeys johtamisen kontekstissa korostui. Esihenkilöosaamista ei voi saavuttaa pelkän teorian avulla; käytännön harjoittelu ja kokemus ovat myös keskeisiä. Metsäalan korkeakoulutuksessa tulisi panostaa enemmän esihenkilö- ja johtamistaitojen opetukseen laajentamalla ja monipuolistamalla pedagogisia käytänteitä.

Asiasanat: Työelämätaidot; metsäsektori; metsäammattilainen; geneeriset taidot; johtajuus; pedagogiset käytänteet

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Mikkeli, 20th August 2026

Heikki Manninen

LIST OF ORIGINAL ARTICLES

This thesis is based on data presented in the following articles, referred to by Roman Numerals **I–III** in the text:

I Manninen H, Lehtimäki H, Kilpeläinen R, Lautanen E, Kärhä K (2024) The qualifications and competence in supervisory and management skills among recently graduated forestry professionals. Silva Fenn 58(4), article id 24007. https://doi:10.14214/sf.24007.

II Manninen H, Lehtimäki H, Kilpeläinen R, Lautanen E, Kärhä K (2025) The qualifications and competence in supervisory and management skills among experienced mid-career Finnish forestry professionals. Scand J For Res 40(2): 138–151. https://doi.org/10.1080/02827581.2025.2483335.

III Manninen H, Lehtimäki H, Kilpeläinen R, Lautanen E, Hujala T, Kärhä K (2026) Educational views of the Finnish key forestry employers on the competency needs of future foresters regarding supervision and management. Manuscript submitted.

Heikki Manninen is fully responsible for the summary of this doctoral thesis. The contribution of Heikki Manninen to the studies included in this thesis was as follows:

I Heikki Manninen (HM) was the main author. All authors participated in devising the research framework, formulation of the survey questions and revision of the manuscript. HM performed data acquisition and analyses, and drafted the manuscript. Kalle Kärhä (KK) participated in data analyses, manuscript editing, and funding acquisition.

II HM was the main author. All authors participated in devising the research framework, formulation of the survey questions and revision of the manuscript. HM performed data acquisition and analyses, and drafted the manuscript. KK participated in data analyses, manuscript editing, and funding acquisition.

III HM was the main author. HM, Hanna Lehtimäki (HL), Riitta Kilpeläinen, Eila Lautanen and KK conceptualized the study. HM performed data acquisition and analyses, and drafted the manuscript. HL and Teppo Hujala supervised the methodology. KK participated in funding acquisition. All authors participated in the revision of the manuscript.

ERRATUM

Study **I** (page 6): Equation 1:

$$G_i = I_i - C_i \qquad (1)$$

where:
G_i = the gap between the current competence in and importance of skill i
C_i = the current competence level of the respondent in skill i, 1, …, 5
I_i = the importance of skill i in the career of the respondent so far, 1, …, 5.

Equation 1 should read "$G_i = C_i - I_i$"

TABLE OF CONTENT

ABBREVIATIONS AND DEFINITIONS

HEI	Higher education institute
HFE	Higher forestry education
M-CPs	Mid-career forestry professionals
RGPs	Recently graduated forestry professionals
UAS	University of Applied Sciences

INTRODUCTION

Higher education and future workforce competencies

The challenge to identify the appropriate competencies of today's students who face an increasingly volatile, uncertain, complex and ambiguous future is shared among policy makers, academic experts, leaders, educators, parents, etc. (OECD 2018). Higher education institutes (HEIs) grapple daily with the same question, as the education of people in a way that offers knowledge and provides the skills required for a professional life is one of their core missions (Billet 2009; Orr et al. 2020; UNESCO 2022). In Finland, for instance, the duties of HEIs are to offer higher education based on the requirements and development of working life and to educate students to serve the country and humankind and are governed by national laws and decrees (Yliopistolaki 24.7.2009/558; Ammattikorkeakoululaki 14.11.2014/932). This requires reactivity in the HEIs, which must be aware of the key labor competencies and capabilities required to fulfill the expectations of society and employers with regard to work readiness of the graduates (Peersia et al. 2024).

Workforce and leadership competencies, and their importance in the workplace, have gained considerable attention in recent years. Aside from subject-specific competencies, generic skills (also known as 21st century skills, transferable skills or soft skills) are recognized as increasingly important for future professionals due to the acceleration of digitalization and polarizing labor markets (OECD 2019; Orr et al. 2020). Typically, generic skills refer to skills that are broadly needed among subject-specific skills in working life, such as critical thinking, communication skills, collaboration skills, creativity, and problem-solving skills. However, a remarkable variation in the definition of this term exists in the literature (Tuononen et al. 2022). The European Commission's Directorate-General for Research and Innovation (2023) has emphasized competencies in soft skills, leadership-in-complexity, and change management capabilities as core skills for future job success. Technological developments, such as robotics, will decrease routine tasks in the future workplace, with a concomitant increase in demand for socio-behavioral skills, such as management and teamworking skills, which cannot be replaced by robots (World Bank 2019). According to the World Economic Forum (2025), leadership and social influence are in the top three core skills required by present-day workers.

In contrast, previous findings have indicated less favorable learning outcomes in both generic skills, as well as in workforce and leadership competencies. Considerable criticism is directed toward the ability of higher education to produce market-relevant competencies, especially generic skills (Garcia-Arakil and Van der Velden 2008; Flores et al. 2012; Van Damme and Zahner 2022). In USA, higher education pays little attention to several areas of leadership and workforce skills (e.g., interpersonal interactions and group dynamics) that are crucial for graduates' success in the workplace (Seemiller and Rosch 2023). In Finland, the progress of students in developing generic skills during their higher education studies has been considered unimpressive (Ursin et al. 2021). Finnish forestry professionals echo this concern, noting longstanding inadequacies in the development of generic, supervisory, and employee skills among students engaged in higher forestry education (HFE) (Kilpeläinen and Lautanen 2024b; 2025; Opetus- ja kulttuuriministeriö and Opetushallitus 2025).

An appropriate education is not only a conducive factor to better employment but also an essential element for better productivity and job satisfaction at the individual level.

According to the self-determination theory, human well-being requires satisfaction of three universal basic psychological needs: autonomy, competence, and relatedness (Deci and Ryan 2000). This macro theory is valid across domains, such as parenting and education, but also in working life. The satisfaction of these needs "promotes autonomous motivation, high-quality performance, and wellness" (Deci et al. 2017). As competence refers here to an individual experience in which a person has the skills to function properly in their work, working-life-oriented education is crucial.

The key terms used in this study are defined as follows: Ability, attitudes and knowledge to perform at work or on a mission are generally referred to as competence, which is partly composed of specific skills (Ellström 1997; Hanhinen 2010; Salman et al 2020). In turn, skills can be understood as functional and cognitive capabilities (Hanhinen 2010). Qualifications refer to the requirements or competence expectations identified within an organization or workplace (Ellström 1997; Hanhinen 2010). In this dissertation, the focus is on the qualifications related to supervisory and managerial skills among forestry professionals. Supervisory skills encompass both the generic and subject-specific (field-specific) skills required in supervisory roles, while management skills refer to the knowledge and performance associated with various areas of managerial work.

Characteristics of managerial work in the future

Requirements for future leaders and managers are predicted to vary with changes in the working environment. Megatrends, such as climate change, demographic changes, growing social fragmentation, and democratic erosion, with their entailing consequences, will lead to an increasing need for interaction, collaboration, communication, teamwork, interpersonal skills, and skills to deal with generational and cultural differences (Baimyrzaeva and Meyer 2021). The ongoing digital transformation will emphasize leaders' abilities in communication, interaction, coaching, and change management skills, technical competencies, and enhanced decision-making and utilization of networks (Cortellazzo et al. 2019).

These foregoing progressions will not only challenge individual competency. For example, workplace trends, such as faster information flow and growth in knowledge-based work, are pushing companies to build less-hierarchical organizations by employing self-managed teams (Lee and Edmondson 2017). Organizational arrangements for team-based work require shared leadership (Pearce et al. 2009), yet digital tools enable organizations to be more dispersed than previously and can benefit from virtual teams composed of interdependent individuals. This can lead to reduced costs, easier recruitment of expertise independent of location, and fostered creativity and innovation due to team heterogeneity (Cortellazzo et al. 2019). According to Perry (2021), work team diversity, which includes both social category diversity (gender, race, age) and informational diversity (education, function, tenure) has been shown to have several positive outcomes, but may also have negative consequences.

Increasing employee diversity offers an opportunity to improve organizational performance but requires efforts in diversity management and inclusive leadership in the workplace to produce beneficial outcomes (Mor Barak et al. 2016; Randel et al. 2018). Inclusive leadership in practice involves the supervisors' ability to recognize diversity, respond to individual needs and work styles, and engage in active listening (Roberson and Perry 2022). In addition, the increase in remote working is a challenge for the

implementation of inclusion in organizations (Byrd 2022). However, the forest sector is not necessarily succeeded in advancement of diversity and the equity of the workforce (Larasatie et al. 2020; Rekola and Sharik 2022; Rekola et al. 2025).

Different generations are one example of diversity in work communities, and generational differences in the workforce have been a popular research focus (DelCampo et al. 2011). Employees from different generations may have diverging expectations toward work, careers, and management. Generations (e.g., "Baby Boomers," "Gen X," or "Millennials") are commonly recognized in the literature based on their similar life experiences from being born within a particular period. Millennials, born between 1980 and 2000, are the most recent generation to fall completely within working age and have, consequently, received much research attention. They have been frequently described negatively, often seen as a needy and fragile generation with low organizational commitment (Galdames and Guihen 2022). However, these findings were revealed to be mainly opinions without empirical support and that critical attitudes toward the youngest cohorts are common, shifting to the next working generation (Galdames and Guihen 2022). For example, in a Finnish context, the commitment to and appreciation of work by Millennials is as high as that of earlier generations (Pyöriä and Ojala 2016; Sutela et al. 2019). However, differences emerge between generations with regard to appreciation of family and leisure, which are more highly valued by Millennials than earlier generations.

The negative opinions and attitudes expressed about Millennials as a workforce may arise because earlier generations do not recognize their expectations with regard to working methods and leadership. This is important to note as leadership practices are strongly related to employee outcomes and, especially, to organizational engagement and team effectiveness (Dunst et al. 2018). According to Galdames and Guihen (2022), Millennials prefer collaborative work and a value-oriented approach and expect open dialog and feedback from their supervisors. Young Finns (aged 16–29 years old) would like their leaders to show vision and direction, and for leadership to be inspirational, appreciative, and human-oriented (Frankly Partners 2022). Similar results were obtained among undergraduate university students in the Midwestern United States, who expected openly communicative leaders and friendly mentors who lead by example (Omilon-Hodgez and Sugg 2019). However, these expectations do not appear to be met consistently, and young professionals have reported disappointment with current leadership practices in working life. In Finland, 90% of highly educated professionals who are under 40 years old have reported that they have experienced poor leadership, such as old-fashioned, hierarchic, and task-oriented, with the consequence that almost two thirds felt negative effects on their well-being at work (Mäkelä et al. 2022). Conversely, Finnish workers were found to be satisfied more than prior with supervisory work due to the increased level of encouragement, motivation, gratitude, and feedback from supervisors (Sutela et al. 2019).

Given the importance of organizational culture management for organizational success (Cameron and Quinn 2006), it is pertinent to ask what competencies are required to maintain or reshape a desired organizational culture that serves both the interests of the organization and the needs of a diversified workforce. To date, organizational culture in the forest sector has not been an extensively examined, although Näyhä (2020) revealed that Finnish forest-based companies demand innovative, agile, flexible, and an encouraging organizational culture for their transition to the circular bioeconomy. The Competing Values Framework (Quinn 1988; Cameron and Quinn 2006) is a well-known framework employed to investigate organizational culture and describe the complexity of leadership roles. According to this framework, organizational and individual management practices can be

classified along two axes: one ranging from an emphasis on control to flexibility, and the other from an internal organizational focus to an external focus. Consequently, the model identifies four quadrants of management action imperatives, each with two manager roles: "Collaborate – Facilitator and Mentor roles", "Control – Monitor and Coordinator roles", "Compete – Director and Producer roles," and "Create – Innovator and Broker roles". Utilization of this framework enables an exploration of the roles, management practices, and competencies that are currently considered desirable and emphasized in forestry organizations, as well as those expected to become desirable in the future.

Higher forestry education providing the competencies needed in the forest sector

Higher forestry education (HFE) should produce versatile subject-specific and generic skills, as the duties of graduates include, e.g., planning, development, administration, marketing, sales, management, and supervision (Kilpeläinen and Lautanen 2022; 2024a; Opetus- ja kulttuuriministeriö and Opetushallitus 2025). In Finland, higher education has provided excellent results in relation to graduates' employment and learning outcomes of forestry-specific skills (Kilpeläinen and Lautanen 2024b; 2025; Opetus- ja kulttuuriministeriö and Opetushallitus 2025). However, competence in generic skills has been observed to be inadequate among forestry professionals internationally (Rekola and Sharik 2022). The HFE curricula should "emphasize more generic competencies, such as leadership and management skills, social relations, and communication" (Rekola et al. 2017). European and North American forestry professionals have been reported to lack generic skills, particularly interpersonal and communication skills (Barret 1953; Arevalo et al. 2010; Bullard et al. 2014; Sample et al. 2015), while a lack of managerial skills has been observed among foresters both in North America and Australia (Sample et al. 1999; Vanclay 2007; Bullard et al. 2014). In Finland, employers appear dissatisfied with Bachelor of Science (For.) studies in Finnish universities and consider them to be excessively research-oriented instead of applied and entrepreneurial-driven (Shuck 2009), while Finnish graduates of HFEs have been reported to be dissatisfied with their development in customer service, supervisory, and employee skills (Kilpeläinen and Lautanen 2024b; 2025).

The mismatch in the capability of forestry professionals with regard to generic competencies in general and supervisory and management skills specifically is not trivial as the importance of these skills is also expected to increase in the forest sector. Forestry organizations operate in networks, with a clear requirement for leadership and management (Ovaskainen and Pajuoja 2020) and forestry employers value the management skills of forestry professionals when they recruit them to their organizations (Forss et al. 2023). Näyhä (2020) set several expectations and recommendations that considered the management of forest-based sector companies for their successful transition to new circular bioeconomy business. Rekola et al. (2018) highlighted that generic competencies will be essential in the forest sector in the future, and the need for leadership skills was also revealed.

Objectives of the thesis

The main objective of the dissertation was to advance the development of supervisory and management competence in HFE. The objectives, addressed in three studies (**I**–**III**), were:

(i) To evaluate the importance of different supervisory and management skills and possible competence gaps in these skills at the beginning of forestry professionals' careers, and to what extent the teaching of these skills should be included in HFE (**I**).

(ii) To identify the current supervisory and management competencies of mid-career forestry professionals and compare these to requirements that emerge in their divergent career advancement (**II**).

(iii) To examine organizational and employer perspectives on supervisory and managerial work in the forest sector, including its characteristics, current and future challenges, and the competencies needed for supervisory and managerial duties (**III**).

By combing the viewpoints of forestry professionals with divergent career paths and the key employers of the forest sector through surveys (**I** and **II**) and interviews (**III**), the dissertation addresses the following primary research question: How can we develop HFE to advance supervisory and management competence to meet the requirements of working life? The research questions for each study are displayed in Table 1.

Table 1. The objective and contribution of the thesis as described by the research questions in studies **I–III**.

Main objective		
Advance the development of supervisory and management competencies in higher forestry education		
↓	↓	↓
Research questions		
Study I	**Study II**	**Study III**
• What kind of supervisory and management competence do early-career forestry professionals need in their daily working life? • From where early-career forestry professionals' current competence in supervisory and management skills is originated? • What kind of education on supervisory and managements skills should be included in higher forestry education and how it could be developed?	• What competencies related to supervisory and management skills do experienced mid-career forestry professionals need? • Where have their current competency in supervisory and management skills originated from, and what gaps do they identify in their own competence? • What differences appear in the requirements of supervisory and management skills depending on one's position, and how do these affect post-graduation education needs? • How do we develop teaching strategies to impart these skills in higher forestry education and instill appropriate competency in forestry professionals?	• What qualifications are required for supervisory and managerial duties in the forest sector from the perspective of key forestry employers in Finland? • What current and emerging characteristics related to supervisory and managerial work challenge forestry professionals as the sector transitions to the 2030s? • How can educators and organizations better prepare forestry professionals for careers that involve supervisory and managerial responsibilities to serve better needs of Finnish forestry employers?
↓	↓	↓
Contribution of the thesis		
Knowledge and recommendations to develop higher forestry education to produce working-life-oriented learning outcomes in supervisory and management competencies.		

MATERIALS AND METHODS

Surveys in studies I and II

In study **I**, the population comprised recently graduated Finnish forestry professionals (RGPs) who had obtained the degree of forestry engineer (i.e., Bachelor of Natural Resources) or Master of Forestry (i.e., M.Sc. (For.)) and who had graduated between 2018–2021 from Finnish HEIs. The population size was 1,046 people, and comprised 771 forestry engineers and 275 Master of Forestry graduates. This set up was constructed to examine the learning outcomes of HFE, as the graduates themselves are the best data source to evaluate their job-readiness (Wilton 2008).

In study **II**, the population comprised Finnish forestry professionals who had graduated between 2010−2017 from Finnish HEIs with a forestry engineer or Master of Forestry academic degree. The population size was 1,795 professionals, of which 1,288 were forestry engineers and 507 Master of Forestry graduates. Study **II** concentrated on the skills of mid-career Finnish forestry professionals (M-CPs) in order to achieve an understanding of diverse career progression and its effect on qualifications and competence development. To meet the study aims and to attain an acceptable scope, forestry professionals with several years of work experience, but whose experiences of HFE were as fresh as possible, were sought.

The data in studies **I** and **II** were collected by a Webropol survey (from 28th February to 10th April 2023) and were part of a larger data-gathering effort. The respondents were invited to participate in the survey via personal letter. The size of the sampling group was kept as parallel and large as the study population as possible. However, deceased people, those living abroad, and people who were forbidden to disclose their contact details by the Digital and Population Data Services Agency were excluded from the sample group. Consequently, the invitation letters were sent to 868 respondents in study **I** (83.0% of the population) and 1,412 respondents in study **II** (78.7% of the total population) in February 2023. Reminder letters were also sent out three weeks after the first letter. The survey captured 318 respondents (response rate of 30.3%) in study **I**, and 376 responses to the survey (response rate of 20.9%) in study **II** (Table 2).

Table 2. Description of the data and methods employed in the three studies (**I**–**III**) of the thesis.

Study	Population (N)	Data acquisition (n)	Methods used
I	1046 recently graduated (2018−2021) Finnish forestry professionals	318 responses to the survey questionnaire in spring 2023	Basic statistical descriptives; Mann–Whitney U test; Kruskal–Wallis one-way ANOVA ($\chi 2$) test; Qualitative content analysis
II	1795 mid-career Finnish forestry professionals (graduated between 2010−2017)	376 responses to the survey questionnaire in spring 2023	Basic statistical descriptives; Mann–Whitney U test; Kruskal–Wallis one-way ANOVA ($\chi 2$) test; Qualitative content analysis
III	Human Resource representatives, upper-level managers and experienced supervisors in key Finnish forestry organizations	18 interviews in autumn 2024	Basic statistical descriptives; Abductive content analysis

The respondents in both studies received access to the 21 question survey questionnaire (Appendix 1) via a QR code and or a hyperlink provided in the invitation letter. The first section of five questions (related to age, gender, and educational history) was compulsory and was used to evaluate the sample representativeness. The next section (five questions) related to the respondents' employment situation, employers, and work and supervisory experience and provided data with regard to the respondents' career progression and positioning in the labor market and enabled a comparison of the respondents' answers, for example, in relation to their supervisory experience. The third part of the questionnaire (three questions) focused on the respondents' positioning as supervisors and their managerial responsibilities.

The fourth part of the questionnaire (two questions) was compiled in order to investigate the respondents' current competence and their need to accomplish in different supervisory and management skills. The respondents were requested to evaluate the importance of nine carefully chosen supervisory skills and eleven management skills in their career and assess their current competence in these skills. In both evaluations, respondents were asked to use a Likert-type scale of "extremely slight" (1), "slight" (2), "moderate" (3), "high" (4), and "extremely high" (5). Descriptive examples of the meaning of the skills were presented next to the questions to ensure that all respondents would understand the terminology used and increase the validity of the questions.

The final part of the questionnaire (six questions) focused on the respondents' thoughts and actions concerning their development in supervisory and management skills. They were advised to evaluate, using the Likert-type scale, to what extent different factors, such as work experience and HFE, had improved their competency in these skills. In addition, the respondents were asked to determine their possible participation in further supervisory and

management skills training. At the end of the questionnaire, the respondents were asked to reveal their thoughts on the development of HFE and the subject in general by open-ended questions.

An analysis of non-responses in the total survey data was conducted at the beginning of June 2023. Twenty-nine people from the sample group in study **I** (n = 868) and 36 people from the sample group in study **II** (n = 1,412) were systematically (systematic selection after random beginnings) selected, and attempts were made to contact them via a telephone call. A shortened version of the original questionnaire was presented to this subsample over the phone. The non-response analysis dataset was expanded by 14 responses in study **I** and by 12 responses in study **II**.

A basic description of the respondents in studies **I** and **II**, such as gender, age, and education, which are similar with the populations of the studies, is displayed in Table 3. The average age of the respondents in study **I** was 32.6 years and 62.3% were 30 years old or younger. In study **II**, the average age of the respondents was 38.1 years, while the respondents' ages ranged from 27 to 69 years old; however, the largest proportion—78.5% of the respondents—were aged 40 or below and were thus considered Millennials. Some Finnish HEIs offer the Bachelor of Natural Resources as a hybrid learning program (i.e., multiform studies), where students are typically career-changers and slightly older. This causes variation in the descriptives of age and work-experience of the total population. The notable differences in the post-graduation work experience of respondents between the studies is visualized in Figure 1. Of the respondents in study **II**, 91.5% had five or more years work experience, whereas in study **I**, all the respondents had less than five years work experience.

Table 3. Descriptive statistics of the respondents in studies **I** and **II**.

	Study I	**Study II**
Age, years		
Average	32.6 ± 8.7	38.1 ± 8.6
Median	29.0	35.0
Number of respondents / genders		
Male	218	270
Female	100	102
Other	0	4
Education		
Forestry engineer	226	262
Master of Forestry	92	114
Execution of studies		
Original	264	335
Multiform	54	41
In total	318	376

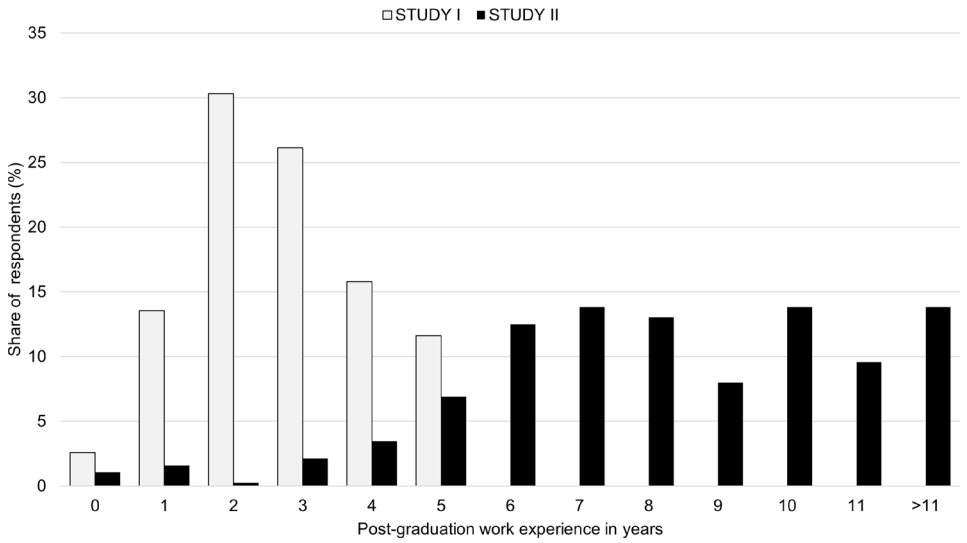

Figure 1. Distribution of personal work experience of respondents after graduation (in studies **I** and **II**).

Interviews in study III

In study **III**, in-depth interviews and qualitative content analysis were chosen as the research methods as the qualitative approach contributes to filling the research gap of the employer perspective. In-depth interviews allowed experienced organization representatives to articulate their viewpoints on the broad and complex nature of supervisory and managerial work without being constrained by overly narrow preconceptions of the subject. Here, sampling strategy was purposeful sampling for maximum variation (Creswell 2023), and aimed to find accessible interviewees with diversified experience and roles in different sections of the forest sector and who represented key forestry employers in Finland, largely recognized in studies **I** and **II**. Of the 20 selected interviewees, 18 were successfully reached by telephone, and all agreed to participate (Table 2).

Semi-structured, in-depth interviews were carried out between November and December 2024. Of these interviews, 12 were held face-to-face in quiet office spaces and with no time constraints. The remaining interviews were conducted online via Microsoft Teams, under otherwise comparable conditions. The interview protocol (Appendix 2) was based on the theoretical framework of the study and incorporated the following themes: current competence of the labor, qualifications in the forest sector, characteristics of the managerial environment, the future of management, and generational differences in the workforce. The purpose of these themes and guiding questions was to ensure comprehensive discussion rather than to restrict interview content. Interviewees were encouraged to expand upon the predetermined themes from their unique viewpoints. At the end of each interview, participants were also asked to answer multiple-choice questions (questions no. 14 and 15 in studies **I** and **II**) (cf. Table 1 in studies **I** and **II)**. However, the setup in study **III** was somewhat different in that the questions addressed competencies and

their importance on average at the organizational level. The duration of interviews ranged from 31 to 71 minutes (average: 50 minutes). Each interview was recorded and automatically transcribed using Microsoft Teams, after which transcripts were checked and revised manually.

Interviewees were classified based on their roles in their organizations. Representatives from Human Resources (HR) had extensive work experience in large forestry organizations and performed key roles in labor competence management or recruitment. Upper-level managers had extensive work experience in supervisory positions and were responsible for leading major functions within their organizations. Experienced supervisors representing various forestry organizations were linked together via their key roles in the supervision of forestry professionals. The average age of the interviewees was 48 years, and their average supervisory experience was 15 years (cf. Table 1 in study **III**).

Data analyses

To investigate the study questions with regard to gaps in the competencies of forestry professionals in studies **I** and **II**, the respondents' evaluations of the importance of supervisory and management skills in relation to their own experienced competence in these skills were compared. The comparison produced an estimation of a gap, which describes an individual experience and the relative extent of shortage in the respondents' competence in each skill. The gap was calculated by subtracting the respondents' evaluations on the importance of each skill from their experienced competence level in this skill (Eq. 1):

$$G_i = C_i - I_i \quad (1)$$

where:
G_i = the gap between the current competence in and importance of skill i
C_i = the current competence level of the respondent in skill i, 1, …, 5
I_i = the importance of skill i in the career of the respondent so far, 1, …, 5.

The surveys in studies **I** and **II** produced data mainly in numeric form, which was analyzed statistically using IBM SPSS Statistics 28.0 software. Qualitative data from open-ended questions were collected and coded in ATLAS.ti software to perform deeper content analysis. Quantitative data were arranged and evaluated as frequencies and basic statistical descriptives, such as averages, medians, and standard deviations. Comparisons between frequencies were carried out using a χ^2 test (chi-square). In addition, the respondents were classified into different representative groups based on their answers. Interfactional comparisons were based on median values in different variables and carried out with Mann-Whitney U and Kruskal-Wallis one-way ANOVA (χ^2) tests. The evaluations of statistical significance were stated at the 95% confidence level ($p < 0.05$).

In study **III**, a similar gap analysis was performed as in studies **I** and **II** with the difference that the subtraction concerned interviewees' evaluations of the perceived importance of supervisory and management skills from perceived competence levels of the organization's workforce in those skills. The estimated gap described the interviewees' evaluation of relative shortages in competence among forestry professionals in their organizations on average. Quantitative data were processed using Microsoft Excel, where

average and standard deviation values were defined. Extensive statistical analyses were not performed due to the limited available data.

In study **III**, the extensive qualitative dataset acquired by the interviews were handled and analyzed utilizing ATLAS.ti 25. The qualitative content analysis combined deductive and inductive approaches (Elo and Kyngäs 2008; Elo et al. 2022). Initially, eight code categories were established based on (a) prior knowledge, and (b) the research questions. However, their formulation was already partly influenced by familiarity with the data. Next, transcripts were read in full, and discoveries were highlighted as excerpts and categorized into one or several codes. During this process, the coding system was expanded inductively. Code categories were reorganized, and several sub-codes were created within the original codes. Following several iterative read-throughs and revisions of the coding, the analysis produced 518 excerpts and 818 codes in seven main code categories and 39 sub-categories (cf. Table 2 in study **III**). An overview of the qualitative content analysis and the final code categories in relation to the research questions is provided in Figure 2.

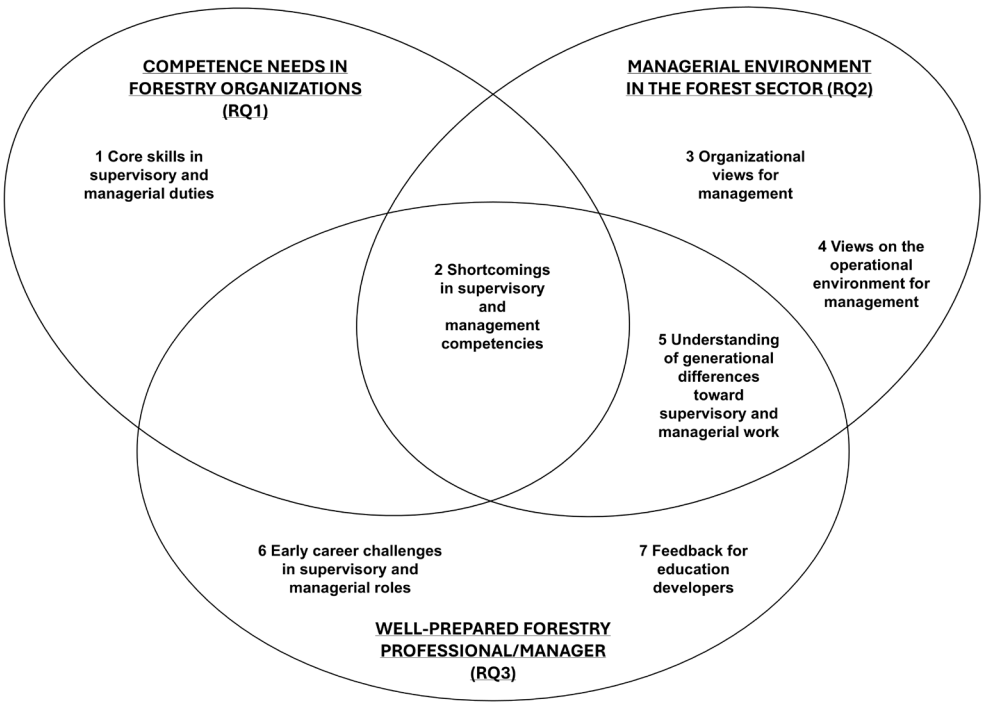

Figure 2. Qualitative content analysis consisted of the primary code categories (7) under the main themes that investigated the research questions (RQ1–3) in study **III**.

RESULTS

Supervisory and management skills among recently graduated forestry professionals (I)

The employment rate among RGPs was 91.8%. Almost one fifth (19.9%) of employed RGPs (n = 292) worked in a supervisory position, having one or more subordinates. The number of subordinates per supervisor averaged 7.2 (median: 3.5, std: 8.9). More than one third (33.9%) of employed RGPs stated that their position contained supervisory or managerial duties. From here on, this group is called "Leading Professionals". Differences between Master's graduates and forestry engineers were minor. Supervision of indirect subordinates was common among RGPs employed in the forest sector as over half (55.4%) had an indirect network of subordinates. Forest industries were clearly the largest employers of forestry professionals and contained the most supervisory positions. The next most important employers of forestry supervisors were Forest Management Associations and logging or timber trucking companies.

Despite their position or duties, RGPs evaluated the importance of all supervisory skills as being relatively high (average: 3.82 to 4.60) (Figure 3). The most important skills identified were generic skills, such as organizational skills (4.60), human relations skills (4.56), and interaction and co-operative skills (4.55). The largest calculated gaps between respondents' experienced importance and their own competence were in labor law competency skills (-1.08), negotiation skills (-1.02), feedback skills (-0.97), and motivation skills (-0.94).

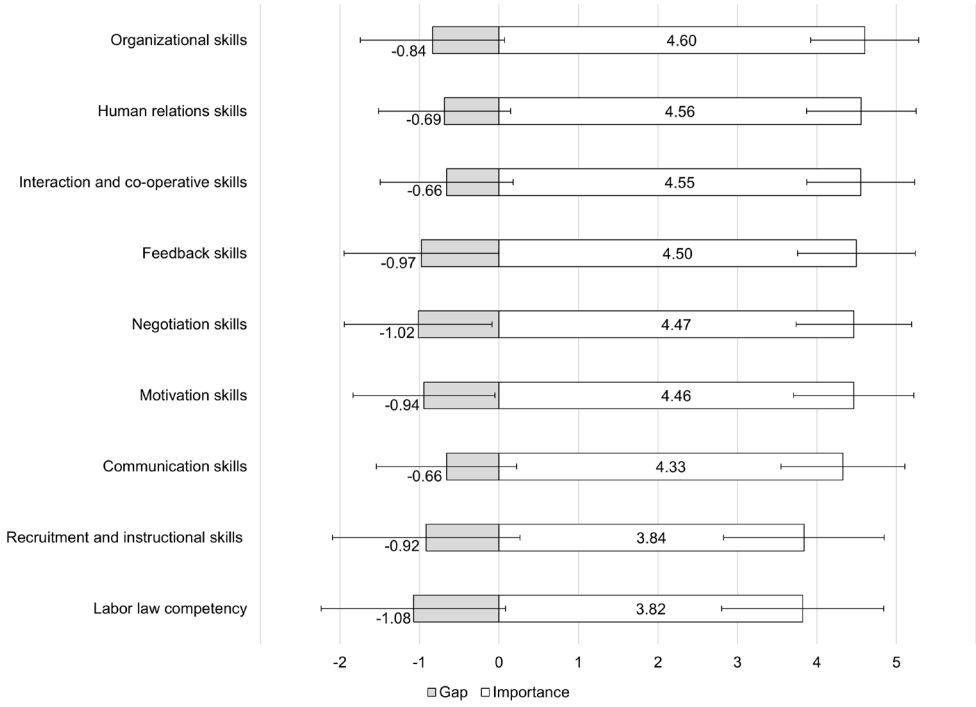

Figure 3. The averages of the respondents' (n = 318) experienced importance of supervisory skills and the calculated gap between this and their experienced own competence (from extremely slight (1) to extremely high (5)) in these skills (study **I**). Bars indicate average values and lines standard deviations.

Self-management was clearly experienced as the most important management skill (average: 4.51). In addition, team management (4.08) and well-being and occupational safety management (3.98) were slightly separated from the remaining management skills, which were divided quite evenly (average: 3.56 to 3.75) (cf. Figure 5 in study **I**). With regard to management skills, the Leading Professionals exhibited comparably higher evaluations of importance, although differences between the others were not significant with regard to self-management, project management, and customer relationship and service management. Experience of supervisory work affected ascendingly to evaluations of own competency despite self-management.

With regard to the contribution of HFE to their supervisory and management skills, RGPs reported that it ranged between *a little* to *passable*. Work experience and other factors were considered more effective. Several respondents stated that supervisory and management education would be very useful for every forestry professional regardless of position. They indicated that current teaching supervisory and management skills in HFE were too minor and theoretical. In the open-ended question section, they indicated that better utilization of project and groupwork and practice-based learning was absent during their studies.

Qualifications and competence in supervisory and management skills among mid-career forestry professionals (II)

Approximately two-thirds of M-CPs worked in the field of forestry, with 58.0% reporting "a position corresponding to their education" and 8.5% "other position in the field of forestry" (cf. Table 4 in study **II**). The employment rate of all respondents was high (96.0%). Of the employed M-CPs (n = 361), 40.2% had supervisory or managerial duties in their current position (i.e., "Leading Professionals"). Over half of MC-Ps (56.6%) had experience in supervisory or equivalent duties after graduation. Of the employed M-CPs, 29.1% worked in a supervisory position with at least one subordinate, while the average number of subordinates per supervisor was 10.0 (median: 7.0, std: 10.7). In addition, over half of the employed respondents (51.0%) stated they had indirect subordinates, such as in a subcontracting network.

The M-CPs evaluated the importance of nine supervisory skills on a scale from one to five, seven of which were found to be between high (4) and extremely high (5) (cf. Figure 3 in study **II**). Human relation skills (4.60), organizational skills (4.54), and interaction and co-operative skills (4.49) gained the highest evaluations of importance, while the highest gaps in comparison to own competence remained in motivation skills (-0.86), feedback skills (-0.85), and negotiation skills (-0.83). Position and experience of respondent had only minor effects on the evaluations.

With regard to management skills, self-management was the only skill that was clearly and commonly evaluated as more important than the other skills (average: 4.46) (Figure 4). The next most important skills: team management skills (3.88) and well-being and occupational safety managements skills (3.88) were specifically emphasized among the Leading Professionals (cf. Table 5 in study **II**). The remaining management skills were not universally seen as important for everyone but still received high evaluations (3.61−3.94) among the Leading Professionals.

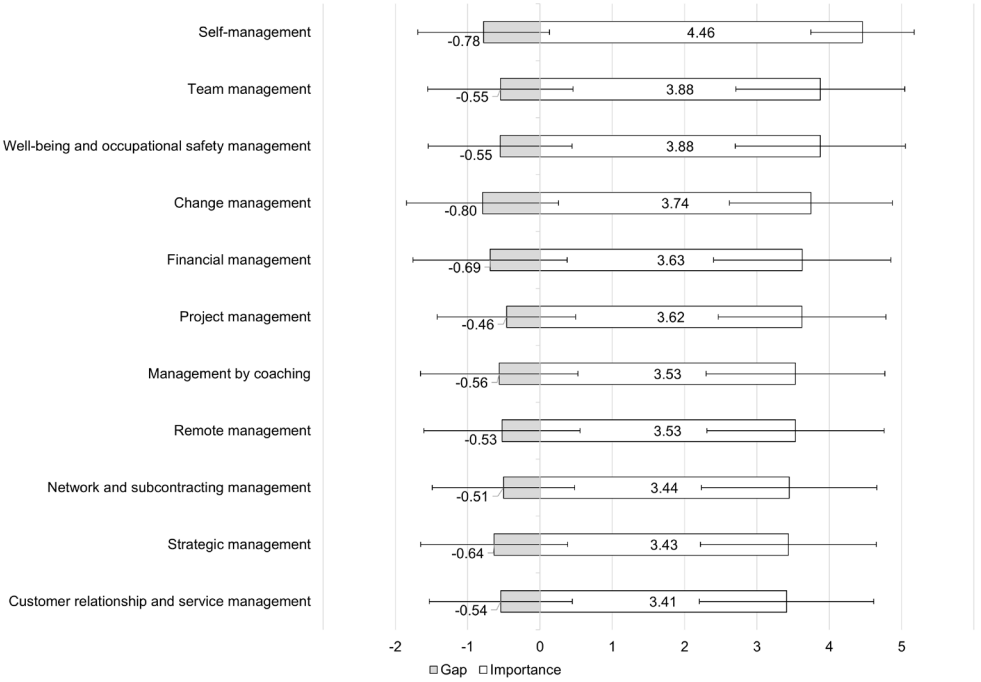

Figure 4. The averages of the respondents' (n = 376) evaluated importance of management skills, and the calculated gap between this and their experienced own competence (from extremely slight (1) to extremely high (5)) in these skills (study **II**). Bars indicate average values and lines standard deviations.

The highest calculated gaps between own competence and evaluated importance were in change management (-0.80) and self-management (-0.78), while the lowest gap was in project management (-0.46). Both Leading Professionals and forestry professionals with supervision experience evaluated their own competence markedly higher than the other respondents in all management skills except self-management. Overall, the respondents stated that their work experience had been the greatest contributing factor to the development of their supervisory and management skills. On a scale of 1 to 5, skill development due to work experience was notably high, averaging 4.22 (std: 0.90), while as higher forestry education as a contributor resulted evaluation of less than moderate (3) with the weakest average (2.56; std: 0.93).

More than a quarter of M-CPs (25.8%) had participated in supervisory or management skills training after graduation, typically organized by their employers. In the open-ended questions, they indicated that they would have liked to have learned more interaction skills and better identification and utilization of human diversity during their HFE. In addition, they suggested that project and group work could have been utilized better to develop their skills as supervisors and managers.

Views of the key forestry employers on the requirements of future foresters regarding supervisory and management skills (III)

Employer representatives underscored the need for leadership skills and knowledge of human diversity among forestry professionals. They emphasized that recognizing employees as individuals is fundamental to build trust and more effectively channel their personal strengths. Most interviewees described the role of a supervisor as that of a coach, whose duties include providing support and feedback, ensuring motivation, and managing competence. In particular, experienced supervisors emphasized these human-centric supervisory skills and highlighted the importance of ensuring employee well-being. The most frequently noted shortcoming concerned leadership skills (n = 11), which were said to have been weighted too low at the expense of subject-specific skills in the forest sector. In addition to the abovementioned deficiencies, change management skills (n = 10), feedback skills (n = 9), and the ability to demand and intervene (n = 9) were often expected to have been better.

The interviews revealed that a common challenge across the forest sector is time management in supervisory roles, which contributes in part to organizational inefficiencies. Supervisors are often tasked with additional duties, which can limit their attention to leadership issues. In addition, team size and the number of subordinates were reported to be too large in some organizations. The geographic dispersion of employees is an inherent characteristic of the forest sector, which challenges supervisory work. Many interviewees set expectations for digitalization to enhance supervisory and managerial work, noting that the effective use of digital tools could allow supervisors to devote more time to supporting their teams than to information retrieval.

Another subject that drew criticism was the limited utilization of human diversity, especially in organizational development. Traditionally, supervisory and managerial positions are filled by subject-specific experts rather than professionals with expertise in areas such as leadership. Overall, the forest sector was described as traditional, homogenous, and predominantly male-dominated. However, many interviewees noted that management practices have improved markedly in the past decades. They described that the earlier authoritarian leadership style has been replaced, and the receipt of positive feedback is more common.

Forecasting the future, interviewees stated that organizations must remain responsive to changes in the operational environment, especially the rapid pace of technological development, which requires comprehensive competency management, flatter hierarchies, and renewal of governance, including shared leadership and network management. Many interviewees underlined that the requirements of the work have increased at all levels and are likely to continue rising. Consequently, managerial duties can easily expand, and employers are stressed by information overflow. In addition, the polarization of competencies among future employees raised concerns. A few interviewees also expressed concerns about labor turnover and the availability of qualified labor.

Knowledge and utilization of human diversity were recognized as extremely important in supervisory and managerial work. Thus, interviewees were asked to describe generational differences among employers, to identify variations in work expectations, and to consider how they influence supervisory work. Interviewees shared a broadly consistent outlook of the “younger generation”. Compared to earlier generations, younger employees do not give work a high priority, as they value other aspects of life too. Supervisors observed that younger professionals value and need more personal support, feedback, and

exact instructions. In contrast, older generations appreciate more autonomy and the flexibility to organize their work. Another observation with regard to the approach to career development of the young generation was that they do not necessarily view supervisory or managerial roles as obvious goals.

Several interviewees stated that at least one compulsory course on supervisory work and management would be useful and appropriate for all forestry students. Such training would help young professionals consider whether their personal characteristics and interests are better suited to professional roles or supervisory duties. In addition, some interviewees proposed structured trainee programs at the beginning of careers, where HEIs could play a supportive role. Through such programs, new supervisors would benefit from mentoring and peer support.

Employer representatives indicated that the typical challenges faced by young or new supervisors are caused by an inability to perceive "the big picture" of functions in the field. Moreover, not all new supervisors fully understand their new role, particularly the shift from solo input to a team input for positive outcomes, which creates a risk that one tries to remain "all-powerful" and manage everything for the team. Although a humble and inclusive supervisory style is highly desirable, supervisors should demonstrate the confidence to make demands, which can be challenging. In addition, knowledge of the fundamentals of "hands-on work" is essential.

In the survey in study **III**, employer representatives evaluated (in line with the previous part of interview) that the most important supervisory skills for every forestry professional are human relations skills (4.83), interaction and co-operative skills (4.67), motivation skills (4.61), and feedback skills (4.61) (cf. Figure 2 in study **III**). The largest gaps in the competencies of forestry professionals in their organizations were to be found in feedback skills (-1.56), human relations skills (-1.44), motivation skills (-1.17) and interaction and co-operative skills (-1.06). With regard to management skills, the most important skills were well-being and occupational safety management skills (4.61), change management skills (4.56), and self-management skills (4.56). The largest competence gaps were related to change management (-1.33), self-management (-1.17), and strategic management skills (-1.06) (cf. Figure 3 in study **III**).

DISCUSSION

Requirements of supervisory and management skills during forestry professionals' careers

A remarkably large proportion of forestry professionals settle in supervisory positions soon after their graduation (**I**). Almost one third of forestry professionals work as supervisors later in their careers (**II**). Furthermore, an even larger proportion carry out supervisory or managerial duties without an actual supervisory position. In general, half of forestry professionals have an indirect network of subordinates, such as in a subcontracting chain. Consequently, supervisory duties are somewhat common in the forest sector, but supervisory skills were considered as important for every forestry professional in all studies. For instance, emphasis of excellent human relationship and interaction skills were observed in both quantitative and qualitative data in all studies. These observations are understandable as the most determined supervisory skills are also considered as generic

skills, which are generally required of forestry professionals (Schuck 2009; Arevalo 2011; Sample et al. 2015; Rekola et al. 2017; 2018) and important to learn commonly in higher education studies as well (Puhakka 2011; Virtanen and Tynjälä 2019; UNESCO 2022; Van Damme and Zahner 2022). According to Mäki (2024), management studies should be considered as part of the development of working-life skills.

The importance of self-management skills was also highlighted, as competence is demanded in the independent duties of forestry professionals (Rekola et al. 2018; Opetus- ja kulttuuriministeriö and Opetushallitus 2025). Team management and well-being and occupational safety management were considered the next most important management skills in both studies **I** and **II**, partly due to the input of Leading Professionals. In contrast, team size was argued by some to be too large, as it challenges supervisory work and leaves insufficient time for the support of subordinates (**III**). Effective team management requires active efforts by leaders to build trust (Costa et al. 2017), encourage innovativeness (Näyhä 2020), and ensure the functionality of multicultural teams (Han and Beyerlein 2016), which may also become more common in the forest sector. Supervisors are key actors for ensuring satisfaction and well-being in the workplace (Deci et al. 2017).

In study **III**, leadership skills were emphasized in the work of supervisors and managers in the forest sector. The prerequisites for successful work are knowledge of, and the ability to, utilize human diversity. Management approaches that acknowledge individuality were highlighted, and the supervisor was generally described as a coach. Similar capabilities were also highlighted in The Future of Jobs Report, where leadership and social influence, empathy, active listening, and talent management were listed among the top ten core skills of present-day workers (World Economic Forum 2025).

By setting the key results of core skills with regard to supervisory and management competencies in the forest sector (**I**–**III)** into the Competing Values Framework (Quinn 1988; Lavine 2014), enable to analyze the emphasis of leadership roles and desirable organizational culture in the forest sector. Many of the most highlighted competencies settle into the quadrant of *Collaborate* reflecting managerial behavior and the roles of *Mentor* or *Facilitator* (Figure 5). In particular, the findings of the core competencies in study **III** orient towards the emphasis of human resources having more internal organizational focus and direction of flexibility. In contrast, e.g., organizational skills and self-management skills, were found to be important for every forestry professional (**I** and **II**), and are found in the opposite corner of *Compete* highlighting the focus of maximizing output (Quinn et al. 2007). In addition, our results reflect the relevance of the *Innovator* role of leadership in the forest sector. According to Näyhä (2020), the role of a manager as a creator of an innovative and encouraging atmosphere is a crucial resource for transition to the new circular bioeconomy business of forest-based sector companies.

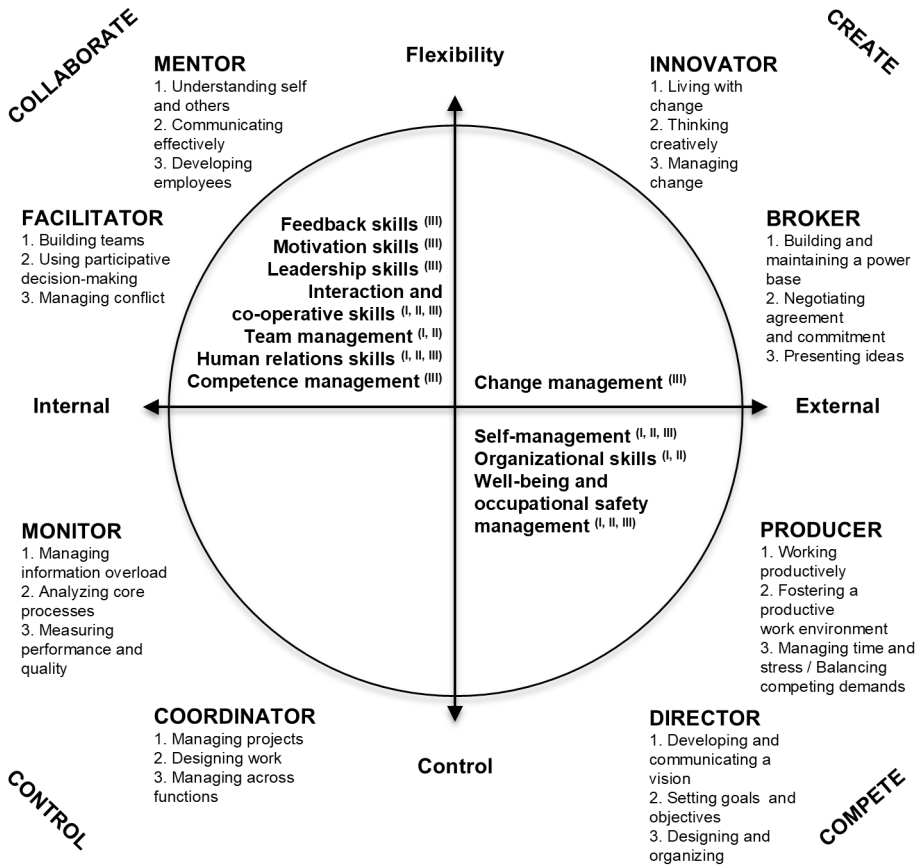

Figure 5. The core competencies in the forest sector, as recognized in studies **I–III** (inside the circle), which contribute to the Competing Values Framework (Quinn 1988) where management practices are classified along two axes: one ranging from an emphasis on control to flexibility, and the other from an internal organizational focus to an external focus. Leadership roles and related competencies settle in one of four quadrants depending on the central action focus; “Collaborate”, “Control”, “Compete”, and “Create” (Quinn et al. 2007).

Competency gaps in supervisory and management skills of forestry professionals

In contrast to the competency needs, forestry professionals reported competency gaps in many crucial skills. For instance, RGPs lack negotiation and feedback skills, which may cause problems when working with the subcontracting networks typical in forest operations (Kronholm et al. 2019; Jylhä et al. 2020; Ovaskainen and Pajuoja 2020). Employer representatives also noted the challenges of giving feedback, demanding and intervening while advancing practical changes (**III**). The M-CPs also reported notable gaps in

supervisory skills. Comparison of the competency gaps between studies **I** and **II** indicates that gaps in the most important supervisory skills seem to decrease weakly or not at all during the career progression of forestry professionals (Figure 6). Although the forestry professionals' stated that work experience promoted the development of these skills, the gaps seemed to weakly decrease or not at all during the career progression of forestry professionals. Especially, the gap in motivation skills, feedback skills, and negotiation skills remained considerable among M-CPs. Given the above and the wide demand for supervisory abilities at the beginning of a forestry professionals' career, it is important to develop pedagogics to also produce a higher level of generic skills in HFEs (Virtanen and Tynjälä 2019; Tuononen et al. 2025).

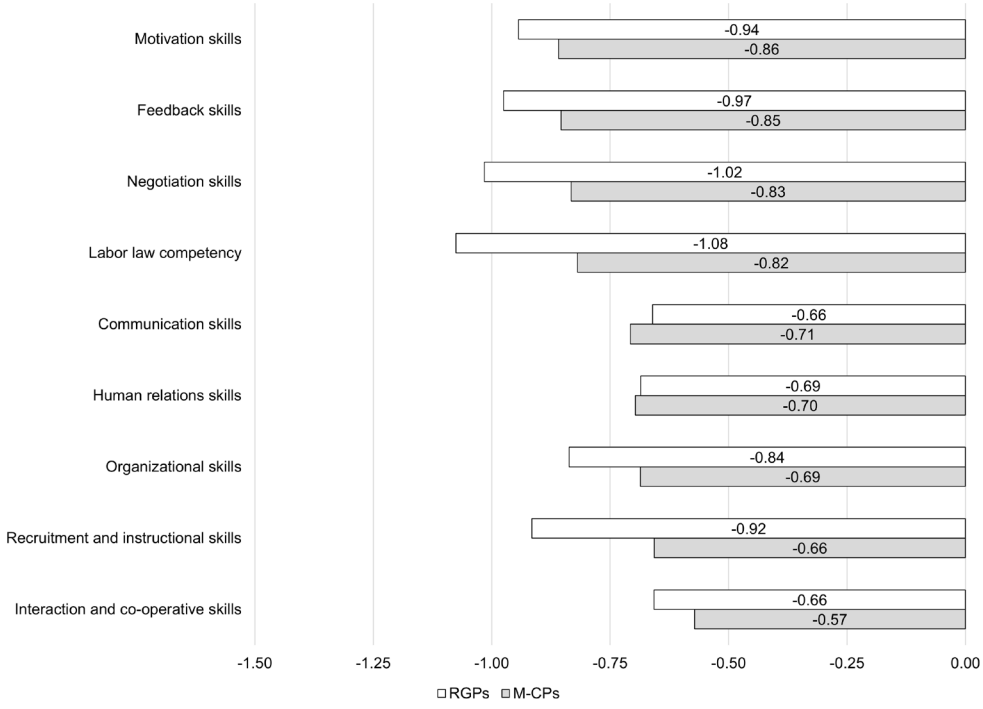

Figure 6. The averages of calculated gaps between evaluated importance of and experienced own competency in supervisory skills in two groups: recently graduated Finnish forestry professionals (RGPs) (**I**) and experienced mid-career Finnish forestry professionals (M-CPs) (**II**). Scale ranges from extremely slight (1) to extremely high (5).

The experienced competency gap in most management skills decreased in line with career progression and especially with work experience of supervisory or equivalent duties (**I** and **II**). However, self-management posed an exception as the competency gap remained considerably high for a long period after graduation. Thus, an improved strategy should be employed to teach this crucial skill in HFE or through post-graduation education activities (Rekola et al. 2018). In addition, change management skills distinguished due to the larger gap in competency even among the Leading Professionals. This deficiency is advisable to notice in development acts of the future education as the rapid pace of development in operational environments underscores the need for agile organizations and strong skills in change management at all levels of the organization (Näyhä 2020).

The respondents in studies **I** and **II** felt that their current competence in supervisor and management skills was based more on work experience and other factors, such as hobbies and life experience, than on their HFE experience. Teaching of these skills was reported to have been inadequate both quantitatively and qualitatively. Indeed, supervisory and managerial studies were not particularly visible in the mid-2010s in the Bachelor degree programs, as obligatory studies of supervisory and management skills have varied between 2−10 ECTS credits, depending on the individual HEI (Häme UAS 2015; Karelia UAS 2015; Lapland UAS 2015; South-Eastern Finland UAS 2015; Tampere UAS 2015; University of Eastern Finland 2015; University of Helsinki 2015). Moreover, Master's degree programs have mostly offered optional courses (University of Eastern Finland 2015; University of Helsinki 2015). Recently, development in the Universities of Applied Sciences (UAS) have been positive at least at a quantitative level, as these institutes have included much broader courses in generic and supervisory skills in the latest curricula than previously (Häme UAS 2024; Karelia UAS 2024; Lapland UAS 2023; Novia UAS 2023; South-Eastern Finland UAS 2024; Tampere UAS 2024). Similarly, the employer representatives in study **III** stated that leadership has traditionally staid background at the expense of field-specific orientation and remains the most important area for further development in forestry organizations. According to the results in this thesis, education of supervisory and management competencies should play a larger role in the HFE curriculum.

Managerial environment in the forest sector

A description of the challenging and demanding managerial environment in the forest sector was portrayed in study **III**. Supervisors and managers underlined the importance of leadership, but many shared their own inadequate experience of supporting their subordinates (Pirttilä et al. 2019). Large team sizes, geographical dispersion of personnel, and a considerable number of other managerial duties were named as the central challenges. This set-up is not necessarily favorable for the new generation that enter the workforce. First, Millennials and Generation Z expect open dialogue and active interaction, with feedback in leader-member relationships (Omilon-Hodgez and Sugg 2019; Galdames and Guihen 2022), which were also observed by the interviewees. The supportive role of supervisors is likely to expand if the interviewees' expectations of polarization of workforce competency materialize. Second, the attractiveness of supervisory and managerial duties may decrease due to the youngest cohort's experience of the onerous work requirements and the high level of responsibility (Leadership Barometer 2024).

Although interviewees reported positive development in regard to leadership styles and organizational structures in the forest sector, they indicated that this progression should continue in the future. The advantages of, and the need for, shared leadership, inclusion, utilization of networks and the diverse recruitment of managers were shared and expected (Mor Barak et al. 2016; Lee and Edmonds 2017; Randel et al. 2018; Cortellazzo et al. 2019). Traditional practices in managerial hiring may have weakened female representation in managerial positions by maintaining barriers, such as unconscious gender biases and masculine stereotypes (Larasatie et al. 2020). In general, the forest sector has been criticized for structures that prevent diversity (Rekola and Sharik 2022; Bullard et al. 2024; Rekola et al. 2025). According to the study results, that considered mainly gender and narrowly specified competence in Finnish organizations.

Development needs of supervisory and managerial studies in HFE

In the line with earlier studies in Finland (Kilpeläinen and Lautanen 2024b; 2025), learning outcomes in supervision and management by HFE were considered weak (**I** and **II**). With regard to the development of supervisory and managerial studies in HFE, the question is not only what to teach but also how to teach. Several respondents stated that, instead of theoretical studies, better utilized project and group working could be conducive tools to improve supervisory and management skills (**I** and **II**). The statement is not trivial as pedagogical practices, such as collaborative working, peer reviewing, and other interactive forms of learning have been shown to advance learning of many generic skills, such as problem-solving skills, decision-making skills, and social skills (Crebert et al. 2004; Smith and Bath 2006; Virtanen and Tynjälä 2019; 2022). On the other hand, the traditional forms of pedagogical practices, such as reading, lecturing and working alone, correlated negatively with the learning of generic skills (Virtanen and Tynjälä 2019; 2022). In addition, the effectiveness of traditional classroom teaching in leadership studies has largely been criticized (Juuti 2021). Instead, constructivist learning environments (e.g., sharing and utilizing students' earlier experiences and knowledge) and integrative pedagogy (e.g., acting at the interface between theory and practice), advance the development of generic skills, even in field-specific courses (Virtanen and Tynjälä 2019; 2022). Thus, the teaching of supervision and management would be useful, at least partly, to integrate into forestry-specific courses through the utilization of considered pedagogical practices.

The importance of practical experience and training in supervisory and managerial studies was displayed in all studies. In addition, early-career supervisors were stated to be commonly unable to perceive "the big picture" of functions in the field and do not necessarily understand their new role as supervisors. In other words, their understanding of working life context is limited. Emphasis of practice among theoretical approaches is justified, as practice and theory are tightly interrelated during the learning process (Griffiths and Guile 2003). Those are also key elements in the model of Integrative Pedagogy (Tynjälä et al. 2006; Tynjälä 2008; Tynjälä and Gijbles 2012), which has been proved effective in many studies (e.g., Täks et al. 2014; Ortoleva and Bétrancourt 2015; Tynjälä et al. 2016; Virtanen and Tynjälä 2019). The model combines four basic elements of expertise: theoretical knowledge, practical knowledge, self-regulative knowledge, and sociocultural knowledge. The model advises combining authentic or simulated practical experiences with theoretical contents and conceptual learning, and focusing on students' reflection and problem-solving abilities.

Integrative pedagogy could be also utilized in HFE supervisory and managerial studies in several ways: 1) Students' internship periods could be utilized extensively through assignments, reflection, and collaborative working before, during, and after internship (Billet 2015; Rekola and Sharik 2022), 2) the implementation of innovative teaching methods, such as drama, role-play and other art-based methods to simulate real working life situations and to integrate theory, practice, and self-regulation (Kettula 2012; Lehtimäki et al. 2026), 3) favoring Problem-Based Learning by creating and simulating tasks of the real challenges of working life (Hmelo-Silver 2004; Smith et al. 2022; Lucena et al. 2025), and 4) actively advancing constructivist learning by supporting reflection of students' earlier experience of work and supervisory duties (Griffiths and Guile 2003; Tynjälä and Virtanen 2022). Students' self-reflection is essential in leadership development (Solansky 2014; Mäki 2024). However, this suggestion may be challenging for teachers, who are often not experts in both forestry and management, and so are not necessarily familiar with the teaching methods presented. Thus, we encourage HEIs to offer further education to teachers and encourage them to attempt co-teaching across disciplines by combining and utilizing the available expertise to create practical supervisory and management exercises in the context of forestry (Mäki 2024).

The findings of this thesis indicate a clear need and demand for further education of forestry professionals in regard to supervisory and management skills. Employers in the forest sector make extensive efforts to further educate their employees. The most important competency gaps are presented above. Tentative interest in the further education of supervisory and managerial skills produced by HFE institutes was shown. As further studies are typically performed alongside the employees work, the HFE should engage with forestry employers to develop innovative and attractive further education programs. Integration into day-to-day work is crucial not least because of the problem of transference, which is always included in the traditional classroom teaching of leadership (Juuti 2021). For instance, Olsson and Areskoug Josefsson (2026) reported positive outcomes from leadership development programs that used reversed work-integrated learning with mid-career professionals. It would also be useful to utilize experienced mentors in the further education of supervision and management programs (Solansky 2010).

A common challenge identified by new supervisors and managers was a lack of experience, which is naturally difficult to address through education. Nevertheless, HFE could help students become aware of common processes, patterns, and roles within the forest sector, thereby providing a comprehensive overview of the field by providing practical training opportunities and active relationships with forestry employers. Since the characteristics of supervisory work appear to be unfamiliar even to experienced forestry professionals, education could be more effectively tailored to illustrate what it means to be a supervisor.

Study limitations and strengths

Performing an exploratory study of this complex subject required utilization of multiple methods and diverse data sources. Combing viewpoints of forestry professionals with divergent careers and the key employers of the forest sector produced a multifaceted outlook for the study area. However, the research frame and utilized methods still contain some minor weaknesses. By focusing on supervisory and management skills, divergent leadership styles were not specifically investigated. In studies **I** and **II**, the respondents in

supervisory positions were categorized based on their work experience, but the levels or characteristics of divergent supervisory positions could not be separated. However, common competency needs and gaps were discovered, which is useful for developing HFE. In addition, it is acknowledged that the statistical analyses of Likert scale data may raise criticism as the scale is often considered ordinal rather than interval. Nevertheless, our comparison of means supports the comprehensive argumentation put forth by Norman (2010). Surveying a large, but precisely defined population is an appropriate research method as the research questions dealt with the subjective experiences of a large number of people. The validity of the questionnaire was confirmed by several professionals. In particular, the questions on supervisory and management skills were formulated with care by applying professionality of four stakeholders.

The number of respondents in both studies **I** and **II** were acceptable (study **I**: n = 318 / 30.4% of the total population; study **II**: n = 376 / 20.9% of the total population). Relative to the number of letters sent, the response rates of the surveys showed even more extensive (study **I**: 36.6% of 868; study **II**: 26.6% of 1,412). The representativeness of the respondents was quite extensive, although the respondents who had studied at the University of Eastern Finland or South-Eastern Finland UAS were slightly over-represented in the study data.

In study **I**, the analysis of non-response did not show any remarkable systematic distortions between the respondents of the survey and the respondent population. However, none of the respondents had direct subordinates, only 14.3% had some level of supervisory or managerial duties in their current position, and only 35.7% had an indirect network of subordinates. As such, there may have been a trend in which those with supervisory or managerial duties (or similar in their current position) replied to the survey more actively than others. In study **II**, there did not appear notable differences between the key results based on the analysis of non-response. The only statistically different distribution appeared concerning the evaluated importance of feedback skills ($p < 0.05$), which averaged slightly lower (-0.47) compared to the original survey.

The premise for the reliability of study **III** relies on the careful and justified sampling, which resulted in a diversified representation of key forestry employers in Finland. The adequacy of the sample size is validated by data saturation, as few new insights emerged during the final interviews. The main part of the study observations was based on homogeneity within the sample, i.e., repetitions across most interviews. Thus, the most common viewpoints, phenomena, and aspects of shared culture relevant to our research questions were effectively represented and organized. Observations that occurred less frequently could still be considered as weak signals and should not be overlooked. Some relevant viewpoints may still have been missed but this does not, however, question the validity of the results. It must also be acknowledged that the content analysis was conducted by a single author, which may have introduced some limitations into the interpretation of the data.

The main advantage of the short survey in study **III** was its effectiveness in confirming and supplementing the interview findings. The survey questions were similar, but not identical to those used in studies **I** and **II**, thus direct comparisons between the studies are limited. However, it is still possible to draw conclusions about the nature and prevalence of qualifications and competency gaps in supervisory and management skills from the employers' viewpoint based on the order of the evaluations. Furthermore, discussions of employers' viewpoints cannot evaluate the extent to which the interviewees' impressions

reflect their personal opinions and management philosophy versus the organizations' policies.

Future prospects

The requirements of forestry professionals in regard to supervisory and management skills was approached by collecting the insights of forestry professionals and their employer representatives. However, questions that target the similarity between organizational HR policies and the visions of managers and supervisors, as well as potential contradictions in areas, such as recruitment, warrant further research. In addition, a greater international aspect to visions of forestry organizations would be desirable.

The HFE needs to search for innovative teaching methods, which would combine the development of both generic and subject-specific skills (Rodríguez-Piñeros et al. 2020). In terms of supporting teachers in HFE and in the other disciplines, it is necessary to perform pilot studies to investigate the most useful pedagogical practices: what kind of teaching methods and assignments would be most effective to integrate into field-specific courses to help students to develop supervisory and managerial skills? The most promising methods could be duplicated and utilized widely in HFE institutes. It might also be necessary to explore the educational needs of teachers for such integrations. Aside from teaching methods, learning analytics should be considered within future pilot projects as they may offer advanced tools to support students' self-reflection, which is a critically important element of learning in regard to supervisory and managerial skills especially (Kleimola and Leppisaari 2025).

CONCLUSIONS

First, the results of this thesis revealed that supervisory and managerial duties are very common early in the careers of forestry professionals but also revealed that they are useful competencies for the whole workforce. This result, along with the several global trends that will affect the future of forestry work, emphasizes the real need for this thesis. Second, the results here elucidated the most essential competency needs in supervisory and managerial duties of forestry professionals from multiple perspectives. The results can be utilized in developing HFE to produce working-life-oriented learning outcomes in supervision and management but also to ensure improvements in forestry organizations and their human resources. The findings of this thesis emphasized the need for generic skills in the context of management.

In addressing the primary research question, this research demonstrated that HFE should focus more on the teaching of supervisory and management skills, not only with regard to the quantity but also to the quality of the education. Supervisory competence cannot be achieved through theory alone; practical training and experience are also essential. Improvements are needed to the curriculum, as well as to pedagogical practices that would better enhance students' learning. The findings of this thesis offer several practical development proposals for supervisory and management education in HEIs to achieve their goals and duties of working life-oriented education. Competence in

supervision and management is so crucial that it affects the productivity of the whole field of forestry, its attractiveness to employees and their well-being at work.

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APPENDIX 1

Webropol survey questionnaire (Translated from the Finnish survey questionnaire)

Obligatory questions are marked with an asterisk (*)

Background information

1. Your age? *

2. Your gender? *
☐ Female
☐ Male
☐ Other / Prefer not to say

3. From which of the following higher education institutes did you most recently graduate with a degree of Master of Forestry or Bachelor of Natural Resources (UAS)? *
☐ University of Helsinki
☐ Häme University of Applied Sciences (Evo)
☐ University of Eastern Finland (formerly University of Joensuu)
☐ South-Eastern Finland University of Applied Sciences (formerly Mikkeli University of Applied Sciences)
☐ Karelia University of Applied Sciences (formerly North Karelia University of Applied Sciences)
☐ Lapland University of Applied Sciences (formerly Rovaniemi University of Applied Sciences)
☐ Tampere University of Applied Sciences
☐ Yrkeshögskolan Novia

4. In which year did you most recently graduate with a Master of Forestry or a Bachelor of Natural Resources (UAS)? *

5. Select the format of your degree program *
☐ Multiform studies / Hybrid learning program
☐ Day-time studies / Original program

Current employment and work experience

6. Select the option that best describes your current employment situation *
☐ A position corresponding to your education in the field of forestry
☐ Other position in the field of forestry
☐ A position corresponding to your education in a non-forestry field
☐ A position in a non-forestry field
☐ Entrepreneur
☐ Student
☐ Unemployed
☐ Other

7. Please specify your current employer more precisely * (…if option 1 or 2 chosen in question 6)
☐ Energy industries
☐ Finnish Forest Centre
☐ Forest industries
☐ Forest management association
☐ Government
☐ IT industries
☐ Logging or timber trucking companies
☐ Municipalities or public utility companies
☐ Other employer – which?
☐ Other organization, parish, foundation etc.
☐ Research organization
☐ State-owned forests
☐ Universities or other educational institutes

8. Please specify the field of your current employer or company (…if option 3−5 chosen in question 6)

9. How many years of work experience do you have BEFORE and AFTER graduating with a Master of Forestry or a Bachelor of Natural Resources (UAS)?
(Provide your answer as full years in total, excluding possible periods of unemployment or family leave. If your answer exceeds the maximum value, select the maximum. If you hold both degrees, answer based on the most recent one.)
BEFORE GRADUATION (years)*: *0−12*
AFTER GRADUATION (years)*: *0−12*

10. How many years of experience of supervisory duties or equivalent do you have BEFORE and AFTER graduating with a Master of Forestry or a Bachelor of Natural Resources (UAS)?
(Provide your answer as full years in total, excluding possible periods of unemployment or family leave. If you hold both degrees, answer based on the most recent one.)
BEFORE GRADUATION (years)*: *0−12*
AFTER GRADUATION (years)*: *0−12*

Current job role

11. Does your position contain supervisory or managerial duties? *
☐ Yes
☐ No

12. How many direct subordinates do you have? * (…if “yes” in the previous question)
Answer with a number: ___

13. How many subordinates work in indirect networks under your responsibility (e.g., entrepreneurs, employees)? *
Answer with a number: ___

Supervisory and managerial skills

14. Below are listed various SUPERVISORY SKILLS. Please evaluate, for each skill, its IMPORTANCE during your career after graduation so far and your OWN COMPETENCE LEVEL currently.*
(1 = extremely slight, 2 = slight, 3 = moderate, 4 = high, 5 = extremely high)

COMMUNICATION SKILLS (e.g., openness, clarity, timeliness, non-verbal communication)
☐ Importance
☐ Competence level
FEEDBACK SKILLS (e.g., positive and constructive feedback, listening, intervening in problems)
☐ Importance
☐ Competence level
HUMAN RELATIONS SKILLS (e.g., building trust, emotional intelligence, utilization of human diversity
☐ Importance
☐ Competence level
INTERACTION AND CO-OPERATIVE SKILLS (e.g., listening, influencing, showing appreciation)
☐ Importance
☐ Competence level
LABOR LAW COMPETENCY (e.g., duties and rights, settlement of terms and conditions of employment)
☐ Importance
☐ Competence level
MOTIVATION SKILLS (e.g., encouragement, improving the working atmosphere, generating collective targets)
☐ Importance
☐ Competence level
NEGOTIATION SKILLS (e.g., preparing, defining of goals, problem-solving)
☐ Importance
☐ Competence level
ORGANIZATIONAL SKILLS (e.g., orderliness, prioritization, delegation, detection of overall view)
☐ Importance
☐ Competence level
RECRUITMENT AND INSTRUCTIONAL SKILLS (e.g., evaluation of suitability, interview skills, orientation planning)
☐ Importance
☐ Competence level

15. Below are listed various MANAGEMENT SKILLS. Please evaluate, for each skill, its IMPORTANCE during your career after graduation so far and your OWN COMPETENCE LEVEL currently.*
(1 = extremely slight, 2 = slight, 3 = moderate, 4 = high, 5 = extremely high)

CUSTOMER RELATIONSHIP AND SERVICE MANAGEMENT (e.g., management of purchasing and sales business, production of services)
☐ Importance
☐ Competence level
CHANGE MANAGEMENT (e.g., reorganization of duties, handling of change resistance)
☐ Importance
☐ Competence level
FINANCIAL MANAGEMENT (e.g., business monitoring, utilization of business ratio, budgeting)
☐ Importance
☐ Competence level
MANAGEMENT BY COACHING (e.g., recognition of qualifications, evaluation and development of competencies and capabilities, and their encouragement)
☐ Importance
☐ Competence level
NETWORK AND SUBCONTRACTING MANAGEMENT (e.g., contracting of terms and practices of co-operation, coordination)
☐ Importance
☐ Competence level
PROJECT MANAGEMENT (e.g., planning, organizing, and involvement in periodic development projects)
☐ Importance
☐ Competence level
REMOTE MANAGEMENT (e.g., supporting and guiding remote or multi-seat workers)
☐ Importance
☐ Competence level
SELF-MANAGEMENT (e.g., self-knowledge, self-development, time management, sense of work stamina)
☐ Importance
☐ Competence level
STRATEGIC MANAGEMENT (e.g., visioning, formulation, implementation and monitoring strategy)
☐ Importance
☐ Competence level
TEAM MANAGEMENT (e.g., distribution and entrust of duties, resource allocation, directing activities)
☐ Importance
☐ Competence level
WELL-BEING AND OCCUPATIONAL SAFETY MANAGEMENT (e.g., caring about work resources and safety)
☐ Importance
☐ Competence level

Development as a manager and supervisor

16. Evaluate how much the following factors have contributed to your competency as a manager or supervisor (note: the first two are obligatory)
(1 = not at all, 2 = a little, 3 = passable, 4 = a lot, 5 = extremely high)

☐ Higher forestry education*
☐ Work experience *
☐ Reserve officers' school or non-commissioned officers' school
☐ Other degree or sub-degree – which?
☐ Othar factors – which?

17. What kinds of studies in higher education could have advanced your development as a manager or supervisor during your career?

18. Have you participated in supervisory or management skills training after completing your forestry degree? *
☐ Yes
☐ No

19. In what ways have you pursued supervisory or management education after completing your forestry degree? *
☐ Specialist Vocational Qualification in Leadership and Business Management (formerly JET -degree)
☐ Vocational Qualification in First-Level Management
☐ Study module related to supervision or management
☐ Other graduate programme of management
☐ Management training offered by employer
☐ Other management training – which?

20. What kind of competency-needs motivated you to pursue the above-mentioned education?

21. Open comments: Would you like to bring forward something else related to supervisory and management competencies or their development?

APPENDIX 2

Interview protocol (Translated from the Finnish survey questionnaire)

Background information

1. Year of birth
2. Gender
3. Educational background
4. Title / Position
5. Work experience in years
6. Supervisory and managerial experience in years

Introduction

7. How would you describe the competence of supervisors and managers in the forest sector in general? (positive aspects? shortcomings? variation?)

Competence of current personnel

8. Recent forestry graduates (Master of Forestry and Bachelor of Natural Resources (UAS)) have been reporting for over a decade that they lack supervisory and management competencies. How is this reflected in the sector in your opinion? (Frustrated managers or subordinates? Broken leadership careers? What are typical problems of young managers?)

9. Do supervisory and managerial competencies differ between those coming from other fields and those with degrees in higher forestry education? Examples?

10. What kinds of challenges do you identify in supervisory work in the forest sector? What about in other managerial positions in the sector? (What would you change/develop?)

11. How does the age of the person being supervised affect leadership needs and leadership style? (What kind of competence or situational awareness is required?)

Future management competence in the forest sector

12. When looking ahead to the 2030s, what supervisory and management skills will be emphasized in future
a) expert positions? (How will working roles/generations change?)
b) supervisory and managerial positions? (How will working roles/generations change?)

13. What kinds of further training needs do you identify in your organization regarding supervisory and managerial competencies (especially for employees with a Master of Forestry or a Bachelor of Natural Resources)?

14. How could higher forestry education institutes develop the teaching of supervisory and

management skills in your opinion? New cooperation with forestry organizations? (e.g., mentoring young employees or teachers)

Management qualifications in the forest sector

15. What supervisory and management skills were required/emphasized for the forestry engineers and/or Master of Forestry graduates most recently recruited in your organization?

16. Below are listed various SUPERVISORY SKILLS. Please evaluate, for each skill, its IMPORTANCE in the forest sector supervisory or managerial positions offered by your organization, as well as COMPETENCE LEVEL of the current personnel in these skills. (1 = extremely slight, 2 = slight, 3 = moderate, 4 = high, 5 = extremely high)

COMMUNICATION SKILLS (e.g., openness, clarity, timeliness, non-verbal communication)
☐ Importance
☐ Competence level
FEEDBACK SKILLS (e.g., positive and constructive feedback, listening, intervening in problems)
☐ Importance
☐ Competence level
HUMAN RELATIONS SKILLS (e.g., building trust, emotional intelligence, utilization of human diversity
☐ Importance
☐ Competence level
INTERACTION AND CO-OPERATIVE SKILLS (e.g., listening, influencing, showing appreciation)
☐ Importance
☐ Competence level
LABOR LAW COMPETENCY (e.g., duties and rights, settlement of terms and conditions of employment)
☐ Importance
☐ Competence level
MOTIVATION SKILLS (e.g., encouragement, improving the working atmosphere, generating collective targets)
☐ Importance
☐ Competence level
NEGOTIATION SKILLS (e.g., preparing, defining goals, problem-solving)
☐ Importance
☐ Competence level
ORGANIZATIONAL SKILLS (e.g., orderliness, prioritization, delegation, detection of overall view)
☐ Importance
☐ Competence level
RECRUITMENT AND INSTRUCTIONAL SKILLS (e.g., evaluation of suitability, interview skills, orientation planning)
☐ Importance
☐ Competence level

17. Below are listed various MANAGEMENT SKILLS. Please evaluate, for each skill, its IMPORTANCE in the forest sector supervisory or managerial positions offered by your organization, as well as COMPETENCE LEVEL of the current personnel in these skills. (1 = extremely slight, 2 = slight, 3 = moderate, 4 = high, 5 = extremely high)

CUSTOMER RELATIONSHIP AND SERVICE MANAGEMENT (e.g. management of purchasing and sales business, production of services)
☐ Importance
☐ Competence level
CHANGE MANAGEMENT (e.g., reorganization of duties, handling of change resistance)
☐ Importance
☐ Competence level
FINANCIAL MANAGEMENT (e.g., business monitoring, utilization of business ratio, budgeting)
☐ Importance
☐ Competence level
MANAGEMENT BY COACHING (e.g., recognition of qualifications, evaluation and development of competencies and capabilities, and their encouragement)
☐ Importance
☐ Competence level
NETWORK AND SUBCONTRACTING MANAGEMENT (e.g., contracting of terms and practices of co-operation, coordination)
☐ Importance
☐ Competence level
PROJECT MANAGEMENT (e.g., planning, organizing, and involvement in periodic development projects)
☐ Importance
☐ Competence level
REMOTE MANAGEMENT (e.g., supporting and guiding remote or multi-seat workers)
☐ Importance
☐ Competence level
SELF-MANAGEMENT (e.g., self-knowledge, self-development, time management, sense of work stamina)
☐ Importance
☐ Competence level
STRATEGIC MANAGEMENT (e.g., visioning, formulation, implementation and monitoring strategy)
☐ Importance
☐ Competence level
TEAM MANAGEMENT (e.g., distribution and entrust of duties, resource allocation, directing activities)
☐ Importance
☐ Competence level
WELL-BEING AND OCCUPATIONAL SAFETY MANAGEMENT (e.g., caring about work resources and safety)
☐ Importance
☐ Competence level

18. What thoughts did the previous two multiple-choice questions raise? Would you like to comment on or supplement the items or your responses to them?