

Opportunities of workplace innovation in sustainability transitions: A mixed-methods analysis of environmental initiatives at the workplace

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Abstract

Although learning and innovation are key drivers of sustainability transitions, workplace innovation has gained little attention in the research area. Workplace innovation has potential to produce local change and development toward environmentally sustainable working life and society, since employees' ideas and initiatives can foster the adoption of environmentally sustainable work practices and processes both at the workplace and within work-related networks. The empirical analysis presents findings from a representative sample of Finnish employees collected in 2022, Climate change and work survey (n=1917), and analyses the results using a mixed methods approach. The quantitative analysis reports environmental workplace innovation and its associated factors. The qualitative analysis of the survey's open-ended questions assesses employees' experiences of the hindrances in the development and innovation at work on environmental topics. The results of a mixed-method analysis show both the enabling and hindering factors of environmental initiation. The discussion section further elaborates the findings with previous research. Workplace innovation provides a relevant means for tackling societal change processes of sustainability transitions on a local level of workplace, ranging from small-scale changes in working practices to the organizational or sectoral sustainability solution provision. However, the lack of environmental workplace innovation efforts in Finland indicates that there is a need to strengthen and support local development efforts on environmental questions.

Keywords: workplace innovation, employee-driven innovation, environmental innovation, green transition, sustainability transition, climate change

Introduction

Climate change and other environmental challenges including biodiversity loss and resource depletion are wicked problems that radically change and alter living conditions on Earth. Patterns of daily life and economy have developed without questioning the planetary limits (Rockström et al., 2023; Steffen et al., 2015). In response to these environmental sustainability challenges, both research and policy communities increasingly address the need for sustainability transitions (GSDR, 2023; Köhler et al., 2019). This systemic change aiming to turn the development of the society for an environmentally sustainable trajectory also impacts working life when jobs and production processes are turning low-carbon (Abrahamsson & Larsson, 2021).

Involvement of companies and different types of organizations is needed to solve global sustainability challenges (see e.g. Delbridge et al., 2024; Kozak et al., 2022). In addition, workers can by different means act themselves for the environment and initiate a more environmentally sustainable society through their work (see e.g. Houtbeckers & Taipale, 2017; Räthzel et al., 2021). Sometimes employees' are viewed as contributing to organizational action, such as corporate social responsibility measures (Onkila & Sarna, 2022), but opportunities of employee voice have been little explored in the context of distinguishing organizations' ways of contributing to societal change processes of sustainability (Delbridge et al., 2024). In the context of sustainability transitions, it has been presented that employees can act and take part to sustainable change (Moilanen & Alasoini, 2023; Süßbauer et al., 2019). This article elaborates employee participation in the context of workplace innovation research (Oeij et al., 2023; Oeij & Dhondt, 2017) as a mean to contribute to societal change processes of sustainability transitions, and sheds light on the benefits and opportunities of workplace innovation and development on environmental topics. Previous research provides evidence on how employee involvement in organization development can benefit its environmental improvements, such as climate change mitigation efforts (see e.g. Boiral, 2002; Markey et al., 2019; Süßbauer et al., 2019). Moreover, Wallo et al. (2024) suggest that employee-driven innovation is one driver in the green transition of industries. The potential of workplace innovation as a means for organizations' environmental work makes it relevant to explore how workplaces can act on environmental challenges and how workplace innovation could contribute to sustainability transitions. This article also proposes a mean for bridging different approaches to innovation research, as called by Pålshaugen (2015).

This paper answers the following research questions:

1. How could workplace innovation contribute to solving environmental sustainability challenges?
2. What individual and organizational factors enable and hinder environmental initiation at the workplace?

Section two reviews previous research discussing sustainability transitions, workplace innovation, and employee initiation and participation in workplace development on environmental topics. Section three presents the data and method of the study, namely the Climate change and work survey data. Section four presents the findings of this study, the results of regression analysis investigating factors associated with workplace environmental innovation, and qualitative results of the content analysis investigating the hindrances of environmental initiatives. The final section discusses the results in the light of previous research and elaborates the potential of workplace innovation to contribute to societal change of sustainability transitions.

2. How workplace innovations can contribute to sustainability transitions

2.1. Innovation in sustainability transitions literature

Sustainability transitions research has evolved to investigate global environmental problems (such as climate change, use of fossil fuels, and resource depletion) and their potential solutions. In sum, sustainability transitions refer to co-evolutionary and multi-actor processes of systemic change that are needed for turning into sustainable consumption and production patterns within planetary boundaries (Köhler et al., 2019). The development and adoption of innovation plays a significant role in the process of sustainability transitions, as innovations are seen as means to shift societal systems to a more sustainable layout (Kivimaa et al., 2021; Smith et al., 2010). In addition to research, sustainability transitions are increasingly discussed in policy domain as means to provide solutions pathways for challenges of environmental (and social) sustainability (EEA, 2019; GSDR, 2023).

In sustainability transitions research, pursuit toward a more environmentally sustainable society and gain of environmental improvements act as a motivation for innovation activities and their target (Susur & Karakaya, 2021). The focus of research is often on “environmental innovation”, which are described as novelties with an environmental angle or aim (Van Den Bergh et al., 2011, p. 3). Innovation in transition research is often understood broadly, covering both technological and social innovations (Kivimaa et al., 2021). The environmentally oriented innovations are also discussed by Adams et al. (2016), who present “sustainability-oriented” innovations to cover both forms of innovation (social and technological), which can range from single and incremental initiatives to systemic solutions with a positive societal contribution. In this article, we refer to both social and technical innovations that contribute to environmental targets or aim for environmental improvements at the workplace as “environmental workplace innovation”.

The change resulting due to transition is often a consequence of innovation adoption, as noted above (however, different change trajectories of sustainability transitions have been presented where the role of innovation is less significant (see e.g. Geels & Schot, 2007).

Transitions require changes and realignments in relations between actors, technologies, and rules (Fuenfschilling & Truffer, 2016). The rules coordinating actors, including values, practices, and structures, are viewed as hindrances of transitions, although they often receive less research attention in comparison to technological solutions (O'Brien, 2018). Innovations often fail with their transformative targets (Westley & Antadze, 2010), and their impacts can remain incremental, for instance due to misalignment between actors values and preferences (Smith & Raven, 2012). However, these incremental improvements are also needed to provide environmental improvements (Adams et al., 2016). Therefore, not all innovations of sustainability transitions are themselves radical or disruptive, but they can provide environmental improvements in their local context by incremental means.

Innovations are developed by different groups taking part in transitions. These include companies and governments, but also civil society organizations and citizens, who can contribute to transitions by co-creation and innovation in local initiatives (Avelino & Wittmayer, 2016; Huttunen et al., 2022). However, research on actors of sustainability transitions is having gaps in the field, including the potential of organizational change and participation in transitions (Upham et al., 2020) and elaboration on workers in transitions (Moilanen & Alasoini, 2023; Süßbauer et al., 2019). Since the focus of workplace innovation research is on the organization change and employee participation in the change process, it provides potential for exploration on how environmentally oriented change and development can take place at the workplace, and what forms of participation employees might have in that process. Analysing the environmentally oriented change at the workplace has potential in showing the variety of values, practices, and structures different members hold, and what type of challenges can result from their change.

2.2. How could workplace innovation target environmental sustainability?

Oeij & Dhondt (2017, p. 66) define workplace innovation as "... an integral set of participative mechanisms for interventions relating structural and cultural aspects of the organization and its people with the objective to simultaneously improve the conditions for the performance and quality of working life". As such, workplace innovation covers different forms of participation and inclusion of employees in organization decision-making and problem solving, which bring different types of improvements for the workplace. Often, employees are interested in the functioning of their work organizations and its future (Dow, 2003), and employees' knowledge and learning can be sources of innovation and development of work and work organization (Alasoini & Selander, 2023; Høyrup, 2012). Although workplace innovation has previously focused on improvements in economic performance and working life quality (Oeij & Dhondt, 2017), collaborative workplace practices have potential to provide environmental improvements. For instance, a survey shows that employees want to take part to the environmental work of their company (Polman, 2023), and their knowledge can provide information for environmental questions of the organization (Boiral, 2002; Süßbauer et al.,

2019). As a consequence, environmental workplace innovations have potential in providing new topics of intervention for the research and practice of workplace innovation.

Workplace innovations are social and collaborative process of learning and development (Kibowski et al., 2019; Totterdill, 2015). Learning can be both informal (group activities, working with clients or co-coworkers, or learning by working) or formal (classroom teaching or manuals) (Eraut 2004, p. 267). Previous literature in the field of sustainability transitions has investigated activities such as experimentation (Jalas et al., 2017) and co-creation (Itten et al., 2021), which are seen as means for innovating and learning in local context. Employees' ideas and knowledge can provide solutions for organizations' local environmental challenges (Boiral, 2002; CGIA, 2021; Süßbauer et al., 2019). For instance, employees' collaboration with customers and other stakeholders can provide insight for the organization on environmental sustainability improvements (Süßbauer et al., 2019), some of which management might be unaware of (CGIA, 2021). In addition, workplaces can increase employee participation by providing some employees "environmental champion" roles, who have responsibility in workplace mundane environmental issues (Hampton, 2018). However, the frequency of such environmental and collaborative workplace activities is less researched.

Workplace innovation has various benefits (Oeij & Dhondt, 2017; Totterdill, 2019), although the benefits of different types of innovations may not be straightforward (Mathieu & Boethius, 2021). Environmental initiation can provide improvements for both employees' working life quality and for the state of the environment. For instance, employee involvement in company climate action can increase employees organizational engagement (CGIA, 2021), and a survey by Kite Insight (2022) shows that employees feel motivated when they can do climate actions at the workplace. Past research shows practical examples on how participation and inclusion of employees, i.e. workplace innovations, can improve environmental sustainability of the workplace. Markey and colleagues (2019) found in their study conducted in multiple fields of economy that employees' involvement and participation was associated with greater variety of organizational carbon reduction behaviours, such as energy saving and introduction of new work practices. In addition, Boiral (2002) shows how environmental awareness training of the industrial sector workers resulted with them addressing potential pollution sources of the company more frequently, which resulted in organizational changes with environmental improvements. Moreover, Hampton (2018) has reviewed both the successes and challenges in the practical contributions of the labour unions in the UK, for instance their initiation on the environmental decision making at the workplace (related to energy production and commuting policies for example), and presentation of environmental questions into collective agreements. Due to applicability of employees' knowledge in organizations' environmental problem solving, workplace innovations have potential to provide environmental improvements in addition to previously researched benefits.

Employers' attitude toward workplace innovation and environmental improvements influences whether the workplace is engaged in environmental work and collaborative forms

of development. The role of management is critical on whether organization has environmental workplace innovations and encourages employees to initiate on environmental topics (Yuriev et al., 2022). Moreover, sectors of the economy are known to differ between their innovativeness (Beckman et al., 2023; Mathieu & Boethius, 2021). For instance, environmentally oriented organization provides more supporting conditions for employee-driven pro-environmental innovations (Yuriev et al., 2022). Therefore, management and the sector of the workplace may be associated with environmental workplace innovations. On the employee level, participation in workplace innovation efforts and learning are found to be more common among middle-aged employee groups, but according to Gallie (2018), there are no gender differences. Socio-economic factors also play a role, and higher education level is associated with higher innovation activities (Mathieu & Boethius, 2021). As such, participatory development activities may not be equally available for workers across sectors and different social groups.

Local sustainability initiatives have challenges in becoming adopted (Lam et al., 2020) and previous research has investigated their different hindrances and drivers in more detail. Regarding the hindrances, both colleagues and employers' lack of knowledge and scarcity of resources, among other things, have been viewed hampering employees' environmental initiation (Yuriev et al., 2018). As such, attitudes of other workplace members, particularly of the management, influence if environmental innovations become adopted in the workplace. In terms of the drivers, employee engagement in innovation process, easiness in use, opportunity to voice out opinions, and subjective norms are associated with innovation adoption (Parkhill et al., 2015; Putnik et al., 2019). Motivation and willingness to adopt the innovation are other important enablers (Hölsgens, 2021). As such, if workplaces are to change in response to environmental sustainability challenges and provide solutions, such as by introducing new and more sustainable ways of working, employee engagement is central in delivering the change efficiently. This is further strengthened if the management perceives the initiatives important and is willing to use resources on them.

In addition to local workplace environment, workplace innovations are always part of a larger system (Pålshaugen, 2015). Even though employees' environmental initiatives can be directed solely to their own or to shared working practices between colleagues (Moilanen & Alasoini, 2023), they may also connect individuals and organizations with interorganizational and systemic levels (Adams et al., 2016; Westley & Antadze, 2010). On a system level, workplace environmental innovations can be seen contributing to societal goal setting targeting sustainability transitions, such as EU carbon neutrality target 2050 or UN sustainable development goals (GSDR, 2023). However, the actors located in different levels may have differing values or be coordinating according to different systems (O'Brien, 2018). These differences and potentially following contradictions present challenges for workplace innovations in the workplace context as well as outside of it. This systemic dimension is illustrated for instance in the case of transitioning from element-based construction practices to more environmentally sustainable wood-based building practices in Sweden, which shows how scaling of an innovation requires cross-sectoral collaboration from

professionals working in different fields (Hemström et al., 2017). As such, environmental workplace innovation may confront challenges also outside the workplace.

The empirical part of this article moves to discuss in more detail the enabling conditions of environmental workplace innovations quantitatively and their hindering factors qualitatively.

3. Data & method

3.1. Survey data

We conducted the Climate change and work employee survey to measure the frequency of environmental innovative practices at the workplace and employee levels. The data collection took place in spring 2022 and was collected by Statistics Finland in collaboration with Finnish Institute of Occupational Health. The final response rate of the survey was 38,3 % (n=1917). The survey data includes items similar to workplace innovations (Kibowski et al., 2019), but on environmental topics, such as a question about co-creation of environmentally friendly work practices and presentation of ideas on climate change mitigation at the workplace. The survey method, its motivation and the development of the survey are presented elsewhere (Moilanen et al., 2024; Moilanen & Toikka, 2023). Table 1 presents the descriptive statistics of survey respondents.

The majority of the respondents were women, accounting for 53.6 percent of the total (see Table 1). Approximately 24 percent of the respondents were less than 35 years old, 35.9 percent were between 35 and 50 years old, and 40 percent were aged over 50. In terms of education, the most common level among respondents was EQF 2-4, while almost half represented EQF 6 or higher. About a third of the respondents worked in the fossil intensive sector, with a slightly smaller proportion employed in private services or healthcare. Additionally, 18.9 percent worked in research, education, and administration.

Table 1 Descriptive statistics of data.

		%
<i>Gender</i>	Women	53.6
	Men	44.6
	Other or not willing to disclose their gender	1.8
<i>Age group</i>	< 35	24.0
	35-50	35.9
	50+	40.1
<i>Level of Education</i>	No reported EQF	0.4
	EQF 2-4	45.1
	EQF 5	4.4
	EQF 6	23.4
	EQF 7	23.4
	EQF 8	3.3
<i>Sector of work</i>	Fossil intensive	33.0
	Private services	23.6
	Healthcare	24.5
	Research, Education, Administration	18.9

3.2 Survey measures used in the analysis

The dependent variable in our analysis is Environmental Workplace Innovation, a factor variable derived from five survey items related to climate change actions implemented in the workplace. These items assess whether: 1) climate-friendly practices have been developed in collaboration with the employer and employees, 2) there is a designated person or team responsible for promoting climate change or ecological sustainability at the workplace, 3) information on employees' skills in environmental and climate affairs has been gathered, 4) experiments or competitions on climate action have been organized, and 5) work practices have been adapted based on employees' suggestions to be more climate-friendly.

The independent variables in our study consist of Environmental Employee Initiation, Employer's Sustainable Attitude, and Sustainable Organization.

Environmental Employee Initiation was assessed using three questions, which were rated on a 5-item Likert scale. The questions focused on whether respondents had ideas for incorporating climate change mitigation or ecological sustainability into their work, had made changes to promote these initiatives, and had proposed environmental suggestions to their workplace. Responses of "I don't know" were excluded from the analysis.

Employer's Sustainable Attitude was measured through three questions concerning the importance placed on climate change mitigation by the employer, the willingness of the employer to allocate resources for this purpose, and the employer's willingness to intervene in practices that are harmful to the climate.

Sustainable Organization was evaluated using six questions related to climate change mitigation efforts within the workplace, including the organization's operational focus, changes in work practices, employee awareness, use of climate-friendly technologies, efficient use of raw materials, and the integration of climate change mitigation or ecologically sustainable products or services into the core business.

Additionally, the analysis incorporated respondent characteristics such as gender, age, education level, and sector of economy where they work as covariates.

For further details on the survey items, response scales, polychronic factor loadings, and factors used in the analysis, please refer to the Appendix.

3.3. Research method of quantitative analysis

Ordinary Least Squares Regression was used to investigate whether Environmental Employee Initiation, Employer's Sustainable Attitude, and Sustainable Organization are associated with Environmental Workplace Innovation among Finnish workplaces.

As posited in section 2, workplace innovations may be influenced by the employer's attitude towards such activities, the sector of work, and its environmental orientation. Three separate regression analyses were conducted. Model one was estimated using only Environmental Employee Initiation, Employer's Sustainable Attitude, and Sustainable Organization as independent variables. The second model included additional individual-level covariates such as sex, age, and level of education. The third model incorporated the sector of work as an additional covariate.

The absence of multicollinearity was analysed and confirmed by calculating the Variance Inflation Factor for each covariate.

3.4. Analytical framework of qualitative analysis

Workplace innovations are collaborative processes of learning and reflection (Kibowski et al., 2019), but quantitative analysis does not show details of these development processes. Consequently, a qualitative analysis was conducted to gain deeper insight on the workplace environmental development and innovation efforts.

The Climate change and work questionnaire form included an open-ended question to collect data on respondents' experiences of the development of work in topics related to climate change and ecological sustainability. The response guidance in the survey form encouraged to address the challenges and enablers in the development of work in these topics. The aim was to provide deeper insight into the workplace changes due to the green transition that the survey questions would not cover. Since most of the respondents described the challenges and not the enablers, the focus here is on the hindrances of environmental workplace development only. The open-ended responses consisted of 17 sheets of paper in total and they were analysed with inductive data-based coding with Atlas.ti software. Data extractions are used as illustrations of workplace environmental innovation hindrances in the analysis section 4.2.

The inductive coding enabled to broadly capture the reasons the employees experienced hindering the workplace environmental development efforts. Earlier research of Westley & Antadze (2010) and O'Brien (2018) was utilized for categorizing the findings. The challenges articulated by the employees can be located into different levels (Westley & Antadze, 2010) and different social dimensions of work, namely values and practices (O'Brien, 2018). First, we categorized the hindrances discussing the lack of environmental workplace innovation (i.e. why there is no development efforts at the workplace on climate change or other environmental topics). Second, we grouped the hindrances of the workplace level, which relate to individual, interpersonal and organizational level reasons. The findings emphasize the benefits workplace innovation would provide for workplace development, since the results show that current development is not collaborative or participatory, which further hampers the change efforts. Third, the hindrances of workplace innovation can emerge beyond workplace, and these reasons are interorganizational and systemic, as illustrated by Westley & Antadze (2010). Although these hindrances were less discussed in the data, they show that even though novel environmental ways of working were shared between workplace members, they can still encounter barriers from external factors.

4. Results

4.1. Survey results

Table 2 presents the regression results from three models. Depending on the model, the number of respondents varies between 1,017 and 1,088. The adjusted R-squared value for the regression models is close to 0.40, indicating that approximately 40% of the variance in the dependent variable is explained by the independent variables included in the model.

Model 1 presents the estimates from the regression analysis using only Environmental Employee Initiation, Employer's Sustainable Attitude, and Sustainable Organization as independent variables. All the independent variables demonstrate statistically significant associations with Environmental Workplace Innovation, the dependent variable. The estimate for Environmental Employee Initiation is 0.08 (95% Confidence Interval: 0.06–0.10), while for the Employer's Sustainable Attitude, it is 0.07 (95% CI: 0.04–0.10). Notably, the estimate for Sustainable Organization is higher in magnitude at 0.14 (95% CI: 0.11–0.17).

Model 2 presents the estimates from the regression analysis using additional employee-level covariates, including female gender, age, and level of education. The estimates for Environmental Employee Initiation and Employer's Sustainable Attitude are consistent with Model 1, although slightly smaller in magnitude, at 0.07 (95% CI: 0.05–0.09) and 0.06 (95% CI: 0.03–0.09), respectively. In contrast, the estimate for Sustainable Organization is 0.16 (95% CI: 0.13–0.19), a bit higher in magnitude in comparison to Model 1. Additionally, the estimates for female gender and higher education levels (EQF 7 and 8) are positive and statistically significant.

Model 3 includes an additional covariate for the sector of business. Again, the estimates for Environmental Employee Initiation and Employer's Sustainable Attitude are consistent with both Models 1 and 2, although slightly smaller in magnitude, at 0.06 (95% CI: 0.04–0.08) and 0.06 (95% CI: 0.02–0.09), respectively. The estimate for Sustainable Organization is 0.17 (95% CI: 0.14–0.20). Furthermore, the estimates for female gender, higher education, and the research, education, and administration sector are positive and statistically significant.

In practical terms, the consistent estimates ranging from 0.06 to 0.08 for Environmental Employee Initiation mean that an increase of one point in the factor variable Environmental Employee Initiation adds between 0.06 and 0.08 points to the value of Environmental Workplace Innovation, depending on the model. Similarly, an additional one point in the factor variable Sustainable Organization adds between 0.14 to 0.17 points to the value of Environmental Workplace Innovation, depending on the model.

It is noteworthy that the inclusion of additional covariates does not significantly affect the adjusted R-squared; however, the estimates for Environmental Employee Initiation,

Employer's Sustainability, and Sustainable Organization remain consistent over different models.

Table 2. Ordinary Least Squares regression estimates with 95% confidence intervals.

	MODEL 1		MODEL 2		MODEL 3	
	β	95% Confidence interval	β	95% Confidence interval	β	95% Confidence interval
Constant	-0.50	-0.56--0.44	-0.54	-0.62--0.47	-0.54	-0.63--0.47
Environmental Employee Initiation	0.08*	0.06-0.10	0.07*	0.05-0.09	0.06*	0.04-0.08
Employer's Sustainability Attitude	0.07*	0.04-0.10	0.06*	0.03-0.09	0.05*	0.02-0.09
Sustainable Organization	0.14*	0.11-0.17	0.16*	0.13-0.19	0.17*	0.14-0.20
Female			0.07*	0.04-0.10	0.06*	0.02-0.09
Age group, <35			REF		REF	
35-50			-0.03	-0.07-0.01	-0.03	-0.07-0.01
50+			-0.02	-0.07-0.02	-0.02	-0.07-0.02
Education, EQF 2-4 or lower			REF		REF	
EQF 5			-0.03	-0.10-0.05	-0.03	-0.11-0.05
EQF 6			0.03	-0.01-0.07	0.03	-0.01-0.07
EQF 7			0.07*	0.03-0.11	0.05*	0.01-0.09
EQF 8			0.13*	0.05-0.22	0.12*	0.03-0.22
Sector of Business, Fossil intensive					REF	
Private services					0.01	-0.03-0.06
Healthcare					0.03	-0.02-0.08

Research, Education, Administration				0.06*	0.02–0.11
	N=1,088	N=1,068	N=1,017		
	Adjusted R^2 = 0.39	Adjusted R^2 = 0.41	Adjusted R^2 = 0.40		

Note 1. The dependent variable is Environmental Workplace Innovation. It is a polychronic factor variables with values from 0 to 1.11. The independent variables of interest were Environmental Employee Initiation, Employer's Sustainable Attitude, and Sustainable Organization. Gender, Age, Education and Sector of work were used as covariates. Statistically significant estimates are marked with an asterisk.

4.2. Results of open-ended survey questions

The findings shed light on the hindrances of there being no environmental workplace innovation in many organizations. Some respondents note that they haven't experienced any environmental improvements in the workplace. In many workplaces, awareness of climate change and other environmental topics has not resulted in shared development efforts.

At the employee level, a key reason is the lack of interest. Some respondents write that they are not interested in climate change or other environmental topics. Moreover, some respondents say that they don't have resources to reflect such topics at work. As such, some employees do not have the capacity or willingness to develop work toward a greener direction.

The workload is often so huge that it is not possible for an employee to stop and think about ecological sustainability.

There is also a lack of interest in environmental innovations perceived among the employer or colleagues. Some respondents view their employer uninterested in climate change and related issues which prevent any improvements on topics. Moreover, the organizations are evaluated to pay attention only to those things that are mandatory or necessary to fulfil the basic functioning of the organization. In this context, considering the environment or climate is not essential. For these reasons, improvement and development by innovation in environmental topics is considered by some employees as unnecessary, or even harmful, to the maintenance of the core business.

In describing the challenges of green development of work, most respondents focused on the workplace level in their responses. Most of the respondents describe their colleagues as not engaging with sustainable practices, such as recycling, sorting, or eating vegetarian dishes. Moreover, colleagues might not follow the guidance provided on topic. The reasons for disengagement with green practices relate to values and attitudes, and some note that

changing the “old-established attitudes” is the most challenging part of workplace development.

The employee level challenges also relate to the materials and capabilities (un)available at work. For instance, lacking recycling units at the workplace prevents us from engaging with environmental practices. In addition, organizations are viewed to not providing enough training or guidance for the personnel to engage with them and get them into use. One informant points out that teaching of sustainable development is challenging due to lack of expertise on the topic. As a consequence, the new practices are not adopted by all members due to lacking capabilities, which results in the desired target to include environmental tasks at work only partially attained. Although novel environmental ways of working are introduced, their implementation is not provided enough resources at the workplace.

Some respondents say that they themselves, or their colleagues, engage with various environmental practices, such as planning or implementing tasks at work in such ways that they consider their potential environmental questions at the same time. However, these innovative environmental practices lack potential to provide change when they are not shared by all members of the workplace. For instance, one practical challenge may relate to the management, who is responsible of the overall management of the workplace, but whose lacking capabilities or interest on environmental topics hinder development of work in that dimension.

It's difficult to have sustainability as part of activities of the municipality, when there is no personal interest in the management or capacities to develop affairs toward a sustainable direction.

Survey respondents also voiced challenges that relate to the inter-personal or organizational challenges. For instance, the way of introducing the new means of working in the organization is perceived to be challenging, since employees have not always been part of their development process. The introduced new ways of working might be experienced unfit for one's working practice. In addition, some respondents do not understand the expected environmental improvements the initiatives are said to attain, or they do not perceive them feasible. Consequently, adoption of these innovations in the workplace is a challenge if the new practices make work more complicated in comparison to older ways of working, or if their environmental benefits are seen questionable. As such, there is a need to improve the current means how work organizations introduce the change and improvements at the workplace on environmental topics. These findings highlight the benefits collaborative processes would provide, which currently are not utilized in many workplaces.

Bans and guidance for single employees rarely lead to desired outcomes. They only raise the protest mood and decrease work ability, which increases indifference towards the climate.

The hindrances of workplace innovation may also be interorganizational. For instance, one respondent notes that their work on environmental sustainability in their office has not been adopted or acknowledged in other offices of the branch. As such, organizations in other branches of a larger parent company may develop and adopt green innovations at different phases than others. Moreover, some employees write about the challenges presented from the customers' side. For instance, customers might not want to move to an electronic and paperless service interface if they have become accustomed to have papers and persons, even though such shift would be a mean for the organization to become more low carbon.

Introduction of environmental work practices can also be dependent on the material artifacts outside the workplace. A couple of respondents note the challenge of using climate-friendly means of mobility at work due to less developed infrastructure for e-bikes and e-cars. Using low-carbon mobility is challenging if the services they are dependent on do not develop at the same time. That can result in slower or more complicated means of commuting. Moreover, the location of the workplace might be a barrier for low-carbon mobility. It is challenging to target greenhouse gas emissions cuts by low-carbon work mobility if the workplace premise is far and if it cannot be reached by public transport.

The hindrances in scaling up workplace innovation also touch upon actors beyond the workplace, including citizens and decision-makers, which highlights the potential systemic nature of environmental workplace innovation. For instance, it was noted that regulation may prevent the upscaling of products made of recycled material, and citizens' lack of knowledge can hinder the entrance of novel carbon sequestration methods in gardening work practices. Therefore, even though in some cases the workplace members would adopt new and innovative working practices, they may lack institutional acceptability from the rest of the system. As such, in some cases environmental innovations introduced at the workplace need to be accepted by other actors outside the workplace to make ways of working more environmentally sustainable.

5. Discussion and conclusions

The aim of the analysis was to investigate both the enabling and hindering factors of environmental workplace innovations. The results section investigated quantitatively the factors associated with environmental workplace innovation and qualitatively the hindrances preventing the environmental development efforts at the workplace. This section discusses the findings in the light of previous research.

Innovating, improving, and developing work on environmental topics (including climate change and resource efficiency for instance) is not present in many workplaces in Finland. Even though actions and initiatives to organize and produce sustainably is required from different types of organizations and companies (Delbridge et al., 2024; Kozak et al., 2022),

collaborative practices of environmental workplace innovations are not a mean applied in many organizations as a way of contributing to sustainability transitions.

For workplaces to successfully implement environmental workplace innovations, the quantitative analysis identifies the organizational characteristics associated with these activities. The employer's perceived sustainability attitude and sustainability of the organization are significantly associated with environmental workplace innovation. Management of the organization plays an important role in enabling employee participation, and this applies also in the context of environmental workplace innovation, as discussed elsewhere (see e.g. Yuriev et al., 2022). Employee participation is one mean to strengthen the overall environmental work in organizations (Boiral, 2002; Markey et al., 2019; Süßbauer et al., 2019), and this opportunity is acknowledged already among some of the environmentally oriented workplaces in Finland.

At the employee level, environmental employee initiation, involving one's own actions on climate change mitigation or ecological sustainability, is linked to the emergence of environmental workplace innovations. Additionally, higher education levels among employees are associated with increased levels of environmental workplace innovation, as well as employment on sector such as public administration, research, and education. Innovation-conducive jobs are often of better quality (Gallie, 2018), and since opportunities to participate to organization development are provided for expert professionals in the above mentioned fields, environmental workplace innovations potentially align with the participation of this group in other topics of workplace development. Regarding gender differences, the findings seem to illustrate that women would be more often involved in workplace environmental work, which contradicts earlier findings (Gallie, 2018). Environmental values and climate change worry might be a reason for gender differences (Moilanen et al., 2024), but this requires further research.

The qualitative results illustrate the multiple challenges environmental development and innovation efforts may confront at the workplace. Environmental development efforts at the workplace challenge the accustomed values and norms of the workplace members, as discussed by O'Brien (2018) for instance. Introducing even small-scale changes, such as sorting practices, can be challenging when employees do not view such activities necessary or important. Awareness raising, cultural change, as well as guidance and target setting from the management side are needed to further support the workplace change as a response to environmental challenges.

The qualitative findings indicate that much of the environmentally oriented change at the workplace level is not done in collaborative means. This can further strengthen employees' disengagement with new ways of working and raise resistance against change efforts, as discussed by Parkhill et al. (2015) for instance. Workplace innovations and joint development between workplace members could help facilitate change processes. Those participative mechanisms would allow presentation of different opinions and views, which can be further

discussed, and solutions proposed. Collaborative practices as well as personal motivation and norms support the adoption of innovations, as discussed in previous literature (Hölsgens, 2021; Putnik et al., 2019). If workplaces are to change their ways or working and producing more environmentally sustainable, as the policy agendas illustrate (EEA, 2019), shared dialogue and understanding of the changes and their target can ease their social acceptability.

The findings also show how environmental development efforts can take place in different phases between different workplace members and organizations. Some employees and workplaces try to make changes at work by engaging with different environmental actions, as presented in this study and also by Houtbeckers & Taipale (2017), for instance. However, there can be mismatches between some members embracing the new environmental practices whereas others, such as the management or members in other organizational branches, continue with the accustomed, less environmentally sustainable ways of working. This illustrates how targeting environmental improvements by changing ways of working might not be a shared idea between all members who are affected by them, or the new practices may lack their commitment. The hindrances of environmental innovations emerging from social relationships at work emphasize the reciprocal nature of change and innovation.

Social relationships between employees, co-workers, and customers have adjusted to particular means of working and collaborating in certain time and place, which are coordinated by shared values, practices, and norms (Fuenfschilling & Truffer, 2016; O'Brien, 2018). Environmental workplace innovations challenge these means of working, because norms and practices at work have evolved without acknowledging environmental problems or environmental questions. The processes of sustainability transitions are associated with struggles and conflicting values when sectors or communities are undergoing change (Avelino & Wittmayer, 2016), and this applies to change in the workplace. Adopting environmental sustainability as part of work through an environmental workplace innovation requires effort and willingness from all actors affected by it. This is crucial for environmental workplace innovations to achieve local sustainability shifts, as initiatives of single employees or workplaces are insufficient for affecting a systemic sustainability transformation.

In contrast to hindrances, the positive association with environmental workplace innovation, organizational sustainability, and employees' initiation highlight the systemic nature of sustainability transitions and the importance of a shared target to sustainability (Köhler et al., 2019). Environmental innovations are more frequent when the workplace conditions are aligned to support them, and these conditions are already found from some workplaces in Finland. However, it can be assumed that environmental workplace innovations could be developed elsewhere. An area of improvement is to enhance organizational and sectoral commitment to environmental sustainability through various means, as noted above. It is acknowledged that increasing workplace action in sustainability transitions requires the introduction of policy agendas which further articulate the activities for different types of

workplaces to contribute to sustainability transitions. Environmental workplace innovation could be one mean introduced in these agendas, as suggested elsewhere (Markey et al., 2019; Wallo et al., 2024), and current low activity can signal absent regulatory pressure. Policy agendas could articulate the benefits of environmental workplace innovations and aim for awareness raising especially in those organizations where there is no internal motivation among workplace leaders to engage with environmental sustainability.

Workplace innovation provides a lot of insight for the field of sustainability transitions on how to collaboratively and by different forms of workplace participation to engage with employees and try to improve fairness of change processes. In times of rapidly changing working life, being heard and engaged in the change processes provides a way to smoothen the transitions period (Abrahamsson & Larsson, 2021). Green transitions processes so far are viewed to lack opportunities for employees to participate and collaborate in Europe (Crespy & Munta, 2023), and our findings on the education level and sectoral differences raise a concern of just transitions, since opportunities to participate in organizations' environmental development are not provided across working population. Even though workplace innovations are viewed to bring benefits for workplaces, including both management and employees, they are not widespread.

Future research could take a closer look at the labour unions, including the environmental training they provide, climate champions they might train, and other formal employee representative bodies, and examine, how unions address environmental questions at the workplace. Past research has examined labour union actions in particular on climate change mitigation and provides important findings for future research (Hampton, 2018; Rätzzel et al., 2021). In addition, workplace innovation is a mean to contribute to organization competences and resilience in times of change (Oeij et al., 2023), and the environmental challenges and the following transitions are expected to change working life in multiple ways. For now, many organizations are not engaged with environmental workplace innovations as a response to the effects of climate change or the green transition, and the results show how the measured actions are most common in sectors with quality jobs. This raises questions if environmental workplace innovations are only a new element of working life quality, and if they can be adopted in sectors most affected by the transition, such as the workplaces in the fossil intensive sectors. These questions require further research, especially since the results show that fossil intensive sectors are least engaged with the measured environmental workplace innovations. Future research could examine the role and significance of workplace innovation as part of organizations' overall responses to environmental challenges and their solutions, and whether employers' view employees' ideas useful in their responses to changes in the market and the environment. It is likely that old-established norms, practices, and structures maintaining stability between employers and employees influence if environmental questions are addressed together at the workplace.

In considering the levels of micro, meso, and macro, workplace environmental innovation has potential to generate change in all these levels. First, environmental targets or policy agendas,

such as sustainable development goals (GSDR, 2023), provide the target for environmental workplace innovations. On the meso levels of workplace or interorganizational relationships, collaborative practices of environmental workplace innovations bring together the workplace members, which enables to consider the potential differences in their values, practices and structures (O'Brien, 2018) and how the generation and adoption of workplace innovation may influence and change them. On a micro level, employees' ideas and initiatives contribute to the workplace environmental development. At the same time, the participatory development efforts support the adoption of workplace innovations when all influenced employees have been able to participate in the development process. The desired end result of the environmental workplace innovation is to provide environmental improvements, which align with environmental targets or policy agendas (such as greenhouse gas emission cuts or improvements in resource efficiency) and contribute to their attainment. However, it is important to note that environmental innovations do not always result with environmental improvements and their impact might be challenging to calculate (see e.g. Susur & Karakaya, 2021; Van Den Bergh et al., 2011). Assessing the environmental impact of workplace innovation is out of scope of this article but provides an important topic for future research attempts in the area.

There has been a call to explore employee participation in organizations' contributions to societal challenges (Delbridge et al., 2024; Upham et al., 2020), and this article presents that workplace innovation has potential in facilitating societal change processes, as presented by Oeij and colleagues (2023). The target of this article has been to explore the opportunities and benefits of workplace innovation in the context of climate change and other environmental crises and discuss the enablers and hindrances of such efforts. The findings indicate that at some workplaces, employees can participate and organization's members collectively initiate and present ideas on how to develop ways of working toward an environmentally sustainable direction. Environmental workplace innovation provides new questions for the workplace innovation literature. Future research could examine the potential impacts of environmental innovation for employee well-being, organizational engagement, or economic performance, which are often at the focus of workplace innovations literature (Oeij et al., 2023). Most importantly, more research is needed to better understand the potential and benefits in facilitating environmental change processes related to climate change mitigation, adaptation, or other environmental problems at the workplace by the means of workplace innovations.

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