Navigating Organizational Change:
Managing the Modern Workplace and Embracing Sustainability

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To make the best of what is in our power, and take the rest as it occurs.

– Epictetus

Acknowledgments

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1 Introduction

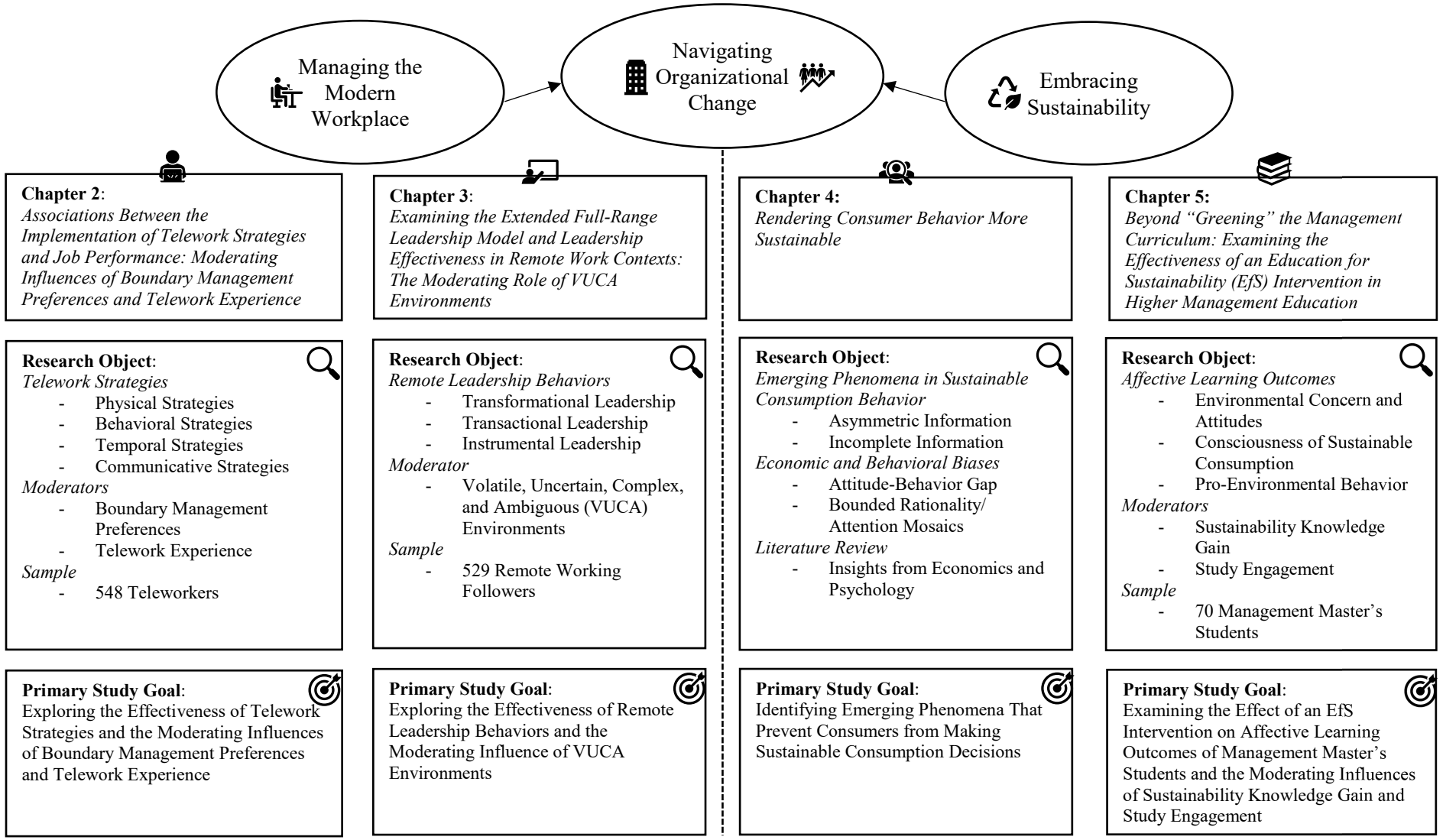
1.1 Aim and Scope

The dynamic and rapidly evolving nature of the modern business environment presents organizations with unprecedented challenges, forcing them to transform core components of their organization, such as ways of working or underlying business models. Drawing on the adoption perspective of organization theory (Chandler, 1962; Cyert & James, 1992; Lawrence & Lorsch, 1967), organizational change becomes imperative as organizations must adapt to evolving environmental contexts to ensure performance and viability (March & Simon, 1958; Pfeffer & Salancik, 2003; Thompson, 1967). In today's dynamic business landscape, organizations face the emergence of two critical imperatives that demand their attention and strategic navigation (Hart & Milstein, 2003; Kniffin et al., 2021; Rudolph et al., 2021): first, the surge in teleworking and remote leadership caused by the COVID-19 pandemic (Kramer & Kramer, 2020; Milasi et al., 2021) necessitates a reevaluation of the traditional workplace and the cultivation of effective individual telework and remote leadership capabilities within a context of persistent uncertainty (Luthans & Broad, 2022). Second, in light of the environmental footprint of business, sustainability has gained pivotal importance (Brundtland, 1987), compelling organizations to adopt a holistic view on their ecological, social, and economic impacts (Elkington, 1997). Organizations have the opportunity to capitalize on the market shift toward sustainable consumption patterns by adapting their business models and fostering innovative and sustainable practices (Biswas et al., 2022; Wei et al., 2014; Zott et al., 2011). However, embracing sustainability at the organizational level requires a top-down approach (Leisinger, 2015), which calls for educational interventions aimed at equipping future leaders with the knowledge, skills, and values required to effectively balance ecological integrity, social equity, and economic prosperity over the long term (Figueiró et al., 2022; Jones et al., 2008; Lozano, 2006).

This dissertation contributes to the emerging research fields of telework, remote leadership, sustainable consumption behavior, and management education for sustainability by drawing on a range of theoretical perspectives (e.g., person-environment fit theory; Edwards, 2008; Kristof, 1996; full-range leadership theory; Bass, 1985; theory of planned behavior; Ajzen, 1991; signaling theory; Spence, 1973) and mostly empirical research. The four research objects included in this dissertation (see Figure 1) offer novel insights for organizations seeking to navigate organizational change by effectively managing the modern workplace and embracing sustainability. Chapter 2 (Härtel et al., 2023) sheds light on the individual strategies teleworkers implement to organize their remote work processes. By focusing on teleworkers'

Figure 1

Overview of Research Objects and Primary Study Goals of Each Chapter



remote job performance as the key outcome and teleworkers' individual boundary management preferences and telework experiences as additional moderators, this chapter provides fine-grained insights to enhance the effectiveness of this rapidly expanding way of working. Chapter 3 presents novel insights into the effectiveness of established (transformational-transactional leadership; Bass, 1985) and aspiring (instrumental leadership; Antonakis & House, 2014) leadership behaviors in remote work contexts that have received little attention before. By considering the moderating role of volatile, uncertain, complex, and ambiguous (VUCA; Bennett & Lemoine, 2014) environments, this chapter delivers practical insights for organizations to effectively manage their remote workforce in emerging virtual and rapidly changing organizational contexts. Shifting the focus to sustainability, Chapter 4 synthesizes the literature on sustainable consumption behavior, integrating insights from economics and psychology. By uncovering the economic and behavioral biases that prevent consumers from making sustainable consumption decisions, this chapter proposes actionable policies for organizations to steer consumers toward more sustainable consumption paths. Finally, Chapter 5 examines the effectiveness of an Education for Sustainability (EfS; Sidiropoulos, 2014) intervention among management Master's students, addressing the "triple bottom line" (Elkington, 1997) of ecological, social and economic sustainability. The presented EfS intervention serves as a tangible blueprint for both educators and practitioners to cultivate sustainable behavior in the next generation of future leaders, facilitating the internal top-down process of organizations (Leisinger, 2015) necessary to embrace sustainability.

1.2 Detailed Outline

Table 1 presents a brief overview of the research articles featured in each chapter of this dissertation, detailing their publication status, author contributions, aim, method, analysis, and main findings. The main text that follows elucidates how this research advances the current state of knowledge and emphasizes its main contributions.

Table 1

Overview of Research Articles Included in This Dissertation

Publication Status	Author Contributions	Aim	Method	Analysis	Main Findings
Chapter2: Associations Between the Implementation of Telework Strategies and Job Performance: Moderating Influences of Boundary Management Preferences and Telework Experience					
Härtel, T. M., **Hüttemann, D**., & Müller, J. (2023). Associations between the implementation of telework strategies and job performance: Moderating influences of boundary management preferences and telework experience. *Frontiers in Psychology*, *14*, 1099138. https://doi.org/10.3389/fpsyg.2023.1099138. [The data, codebook, R-script, and supplementary results are publicly available on the open science framework: https://osf.io/gqpdf.]	JM devised the initial idea for the Home Office Project (HOC). TH conceived the idea for this article, supported by DH and JM. TH and DH organized the data collection, supervised by JM. TH and DH prepared the data and ran the statistical analyses. TH took the lead in writing the manuscript, supported by DH. TH and DH prepared the supplementary material.	We shed light on the effectiveness of the individual ways in which teleworkers organize their work processes by examining telework strategies' associations with job performance, and the moderating influences of boundary management preferences and telework experience.	We assessed the self-reported implementation of 85 telework strategies derived from previous research and popular media, self-reported job performance, boundary management preferences, and telework experience in a sample of 548 teleworkers.	We performed multiple linear regression analyses to identify telework strategies' associations with job performance and moderating influences of boundary management preferences and telework experience.	The most implemented telework strategies were found to be those most positively associated with job performance. These are less likely to serve the purpose of drawing boundaries between work and private-life, but rather the purposes of working task-oriented and productively by adopting a conducive work attitude and of keeping social contact by using modern communication technology. Results also suggest that the effectiveness of telework strategies depends on teleworkers' boundary management preferences and telework experience.
Chapter 3: Examining the Extended Full-Range Leadership Model and Leadership Effectiveness in Remote Work Contexts: The Moderating Role of VUCA Environments					
Hüttemann, D., Härtel, T. M., & Müller, J. (2023). Examining the extended full-range leadership model and leadership effectiveness in remote work contexts: The moderating role of VUCA environments. Submitted to *Human Performance*. [The data, codebook, R-script, and supplementary results are publicly available on the open science framework: https://bit.ly/3EzKmou.]	DH conceived the idea for the Remote Leadership Project (LEAD) and this article, supported by TH and JM. DH organized the data collection and data preparation. DH ran the statistical analyses, supported by TH. DH took the lead in writing the manuscript, supported by TH. DH prepared the supplementary material, supported by TH.	We illuminate the effectiveness of leadership behaviors drawn from the extended full range leadership model (eFRLM) in remote work contexts and the moderating influence of volatile, uncertain, complex, and ambiguous (VUCA) organizational environments.	We assessed self-reported follower perceptions of their leaders' manifestation of eFRLM behaviors and leadership effectiveness, and follower evaluations of their organizational environment as VUCA in a sample of 529 remote workers.	We performed hierarchical linear regression analyses to examine associations of eFLRM behaviors with leadership effectiveness in remote work contexts and the moderating influence of VUCA environments.	Instrumental leadership was found to be perceived as highly effective in remote work contexts, explaining unique variance beyond transformational-transactional leadership. We also found that the perceived effectiveness of remote leadership behaviors was dependent on follower evaluations of the organizational environment as being VUCA, with instrumental leadership proving more effective and transformational-transactional leadership becoming less effective in pronounced VUCA environments.
Chapter 4: Rendering Consumer Behavior More Sustainable					
Hüttemann, D., Upmann, T., & Müller, J. (2023). Rendering consumer behavior more sustainable. Revision of the manuscript completed.	JM and TU devised the initial idea for the Sustainability Project (SUS). DH conceived the idea for this article, supported by JM and TU. DH conducted the literature review and literature structuring. DH took the lead in writing the	We shed light on the the prospects and obstacles to make consumption (more) sustainable, asking how consumers can learn to act in a	Drawing on a literature review, we identify emerging phenomena in the field of sustainable consumption.	We synthesize the fragmented literature on sustainable consumption by integrating insights from economics and psychology.	We identify asymmetric and incomplete information as key economic and behavioral biases preventing consumers from making sustainable consumption decisions. Drawing on our literature analysis, we differentiate between consumer

Publication Status	Author Contributions	Aim	Method	Analysis	Main Findings
	manuscript, supported by TU and JM.	sustainable manner – in their purchase and recycling decisions and in their waste behavior – and relinquish their environmentally harmful habits.			groups and products to recommend policies suitable to mitigate the identified information deficits and to counteract behavioral biases, rendering consumers' choices more sustainable.
Chapter 5: Beyond "Greening" the Management Curriculum: Examining the Effectiveness of an Education for Sustainability Intervention in Higher Management Education					
Hüttemann, D & Müller, J. (2023). Beyond "greening" the management curriculum: Examining the effectiveness of an education for sustainability intervention in higher management education. Submitted to *Journal of Management Education*. [The data, codebook, and R-script are publicly available on the open science framework: https://t.ly/XnnS.]	DH conceived the idea for the Education for Sustainability Project (EfS) and this article, supported by JM. DH organized the data collection and data preparation. DH ran the statistical analyses. DH wrote the manuscript. DH prepared the supplementary material.	We shed light on the effectiveness of an EfS intervention in higher management education, examining its direct effect on management students' affective learning outcomes (environmental concern and attitudes, consciousness of sustainable consumption, and pro-environmental behavior, and the moderating influences of students' sustainability knowledge gain and study engagement.	We employed a quasi-experimental research design with pre- and post-intervention surveys in a sample of 70 management Master's students to test our pre-registered (https://osf.io/q5s74) hypotheses regarding the effectiveness of an EfS intervention ("Sustainable Management" Master's course at Osnabrück University during the summer semester of 2022).	We performed structural equation modeling to examine the direct effect of the EfS intervention on the latent constructs environmental concern and attitudes, pro-environmental behavior, and consciousness of sustainable consumption and the moderating influences of students' sustainability knowledge gain and study engagement.	We found that the exposure to the EfS intervention had a positive direct effect on students' pro-environmental behavior, but not on their environmental concern and attitudes or consciousness of sustainable consumption. Neither students' sustainability knowledge gain nor their study engagement moderated the association between the EfS intervention and students' affective learning outcomes.

1.2.1 Telework Strategies and Job Performance

With this research article, we shed light on the individual ways in which teleworkers organize their work processes, contributing to an emerging area of research that is still in its early stages of development. In response to scholarly calls (Allen et al., 2021; Rudolph et al., 2021; see also Binnewies et al., 2020), we aim to examine the effectiveness (i.e., associations with job performance) of telework strategies and explore the moderating factors that may influence their effectiveness, such as individual boundary management preferences and telework experience. To this end, we collected survey data of 548 teleworkers and adopted a quantitative approach that examines a comprehensive set of 85 telework strategies from different theoretical perspectives pursuing various goals (e.g., drawing boundaries between work- and private-life; Basile & Beauregard, 2016; Fonner & Stache, 2012; Golden, 2021). We conduct our analyses at both the aggregate level, focusing on broader telework strategy categories (e.g., strategies related to the physical separation of work and leisure), and the individual strategy level (e.g., using a separate, dedicated room for working) to draw nuanced inferences. While there are numerous telework recommendations available in popular media, the scientific literature has yet to provide ample evidence on the effectiveness of telework strategies. Therefore, our study aims to bridge this gap by complementing telework strategies from the popular media. Our findings suggest that teleworkers tend to implement and benefit from telework strategies that promote task-oriented and productive telework (e.g., Greer & Payne, 2014) by adopting a conducive work-attitude, as well as telework strategies that help to maintain social contact (e.g., Kowalski & Swanson, 2005) through the use of modern communication technology. Our research underscores the merits of expanding the narrow focus beyond boundary related telework strategies (e.g., Basile & Beauregard, 2016; Fonner & Stache, 2012) to include additional factors that may affect teleworker productivity. Our study further reveals that the effectiveness of telework strategies depends on teleworkers' individual boundary management preferences and telework experience, underscoring the value of integrating the literature streams of person-environment fit (Edwards, 2008; Kristof, 1996), particularly boundary congruence/fit (Ammons, 2013; Kreiner, 2006), and telework strategies. The practical implications of our research are significant for organizations, particularly during crises like the COVID-19 pandemic, where telework becomes essential without prior preparation or experience. By identifying effective telework strategies that align with teleworkers' individual preferences and needs, organizations can enhance their telework training and support programs, anticipate potential challenges (e.g., lack of childcare), and improve workforce productivity and overall organizational outcomes (e.g., profitability).

1.2.2 Effective Remote Leadership in VUCA Environments

This research article illuminates the effectiveness of established (transformational-transactional leadership, FLRM; Bass, 1985) and aspiring (instrumental leadership, eFLRM; Antonakis & House, 2014) leadership behaviors in rarely explored remote work contexts, as well as the moderating role of volatile, uncertain, complex, and ambiguous (VUCA; Bennett & Lemoine, 2014) organizational environments. We address calls to examine the impact of contextual factors on leadership effectiveness (Liden & Antonakis, 2009; Oc, 2018; Porter & McLaughlin, 2006) and the impact of the COVID-19 pandemic on remote leadership (Rudolph et al., 2021). Our study also seeks to fill the gap in knowledge regarding the effectiveness of instrumental leadership, encompassing leadership behaviors that may excel in challenging conditions (Antonakis & House, 2014). We surveyed 529 remote working followers and enrich the literature by capturing their insightful follower perspective on effective remote leadership, and examining the effectiveness of (e)FLRM leadership behaviors at the dimensional and factor levels. Our findings allow us to draw high-level conclusions while also delving deeper into the nuanced leadership behaviors driving effectiveness. We found that instrumental leadership is perceived as a highly effective leadership dimension in remote work contexts, explaining unique variance beyond transformational-transactional leadership. We also found that the effectiveness of remote leadership behaviors depends on follower perceptions of the organizational environment as VUCA-like, with instrumental leadership proving more effective and transformational and transactional leadership becoming less effective in pronounced VUCA environments. Overall, our results highlight the theoretical and methodological necessity of extending the FRLM (Antonakis & House, 2014; Rowold, 2014) and suggest that augmenting FRLM leadership behaviors with instrumental leadership may be a fruitful avenue for future research on effective leadership in dynamic business environments. These findings also have practical implications for organizations seeking to effectively navigate remote workers through challenging times, emphasizing the value of training and development programs that equip organizational leaders with instrumental leadership skills.

1.2.3 Rendering Consumer Behavior More Sustainable

In this conceptual research article, we delve into the challenges our economies face in promoting sustainable consumption patterns, with a particular focus on the often-overlooked consumption side. Recognizing that rendering human behavior towards (more) sustainable consumption is crucial for achieving sustainability and the United Nations Sustainable Development Goals, we address the gap in understanding why individuals struggle to translate their environmentally conscious thoughts into actions. Despite progress made in psychology

and economics, the reasons behind individuals' failure to make sustainable choices and their disregard for available information, such as eco-labels, remain not fully understood (e.g., Barr & Gilg, 2007; Schäufele & Hamm, 2018; Vermeir & Verbeke, 2008). To bridge this literature gap, we synthesize insights from economics and psychology to unravel the underlying barriers (i.e., phenomena) that prevent consumers from making sustainable consumption decisions. Our analysis identifies asymmetric information (e.g., Brach et al., 2018; Hainmueller et al., 2015) and incomplete information (e.g., Beal et al., 2013; Cohen & Winn, 2007) as key market failures that impede sustainable consumption. These informational deficits manifest across various areas and stages of consumption, from the purchase decision to consumption and disposal, as consumers often fail to consider the full life cycle of products and services (Girod et al., 2014). To overcome these market failures arising from asymmetric or incomplete information, we propose providing relevant information (e.g., actual consumption levels) and leveraging behavioral economics measures to address consumers' cognitive biases (e.g., feedback, risk/loss aversion). Further, we recommend policy measures tailored to specific consumer groups and products. By properly motivating "light-green" consumers, who are more inclined to make sustainable choices, we can dissolve barriers to sustainable consumer behavior and facilitate environmentally responsible decision-making processes. Our findings thereby lay the groundwork for future research to apply established concepts (e.g., the value of information; see Williams et al., 2011) to evaluate the costs and benefits of providing sustainability information through signaling schemes for consumption decisions. Furthermore, market inefficiencies related to incomplete and asymmetric information present business opportunities for entrepreneurs to bridge the information gap between consumers and marketers (Cohen & Winn, 2007). By meeting the growing demand for sustainable products and services, organizations can contribute to embracing sustainability challenges while capitalizing on market needs.

1.2.4 Beyond "Greening" the Management Curriculum

This research article contributes much-needed "outcome-focused" (Wahr & de la Harpe, 2015, p. 174) insights into the effectiveness of an Education for Sustainability (EfS) intervention in higher management education. Our novel "Sustainable Management" Master's course, combining traditional teaching methods (e.g., weekly lectures and exercises; Betihavas et al., 2016) with transformative learning approaches (e.g., case studies and a guest speaker; Erskine & Johnson, 2012), embraced the triple bottom line of ecological, social, and economic sustainability (Elkington, 1997) and went beyond the mere "greening" of management curricula. We addressed previous limitations in EfS research by employing a quasi-

experimental research design with standardized measures and a suitable sample (Corcoran et al., 2004; Fien, 2002; Hallinger et al., 2020; Redman et al., 2021; Zwickle & Jones, 2018) that allowed us to draw causal inferences about the impact of the Master's course on 70 management students' affective learning outcomes, hypothesizing a positive direct effect on students' environmental attitudes and concern, consciousness of sustainable consumption, and pro-environmental behavior. We further add to the underexplored body of outcome-oriented EfS research by being the first to explore the moderating influences of students' sustainability knowledge gain and study engagement on the effectiveness of EfS interventions in management education. Aligning with our initial hypothesis, our findings reveal a significant positive effect of the EfS intervention on students' self-reported pro-environmental behavior, thereby highlighting its efficacy in promoting tangible sustainable actions. However, contrary to our initial hypotheses, we did not observe a direct effect of the EfS intervention on students' environmental concern and attitudes or consciousness of sustainable consumption. Furthermore, students' sustainability knowledge gain and study engagement did not yield the hypothesized moderating influences on the effectiveness of the EfS intervention in positively impacting students' affective learning outcomes. In addition, zooming into students' affective learning outcomes at the sub-dimensional level reveals that specific domains such as "mobility," "private energy consumption," "waste management," and "consumption choices" drove the observed behavioral change toward sustainability. Overall, our findings demonstrate the effectiveness of the "Sustainable Management" Master's course in promoting pro-environmental behavior among management students, offering guidance for educators, policymakers, and practitioners in tailoring impactful EfS interventions that cultivate pro-environmental behavior among future leaders. Moreover, our research paves the way for further impact-oriented studies that delve deeper into the underlying mechanisms driving the effectiveness of EfS interventions in management education.

1.3 Concluding Remarks and Outlook

This dissertation provides valuable insights for organizations to successfully navigate today's dynamic and ever-evolving business landscape by addressing the challenges of the modern workplace and the urgent need to promote sustainability. In the face of VUCA environments, organizational leaders are faced with the daunting task of assessing their organizational environment and seizing emerging opportunities to ensure the long-term success and longevity of their organizations (Sarta et al., 2021). By applying established theoretical foundations (e.g., person-environment fit theory; Edwards, 2008; Kristof, 1996; full-range leadership model; Bass, 1985; theory of planned behavior; Ajzen, 1991; signaling theory;

Spence, 1973) to contemporary organizational challenges, we bridge gaps in emerging areas of research. Through our evidence-based approach, we derive practical recommendations that organizations can take to effectively manage the sudden changes of the modern workplace, embrace sustainability practices, and ultimately navigate organizational change.

Chapters 2 and 3 explore how organizations can effectively manage the modern workplace to keep their workforces productive– a crucial area of research made urgent by the rise of telework brought about by COVID-19 (Rudolph et al., 2021). Given that flexible work arrangements such as telework are likely to persist beyond the COVID-19 era (Athanasiadou & Theriou, 2021) and that organizations will face increasingly complex and uncertain environments (Luthans & Broad, 2022), we provide much-needed insights for organizations by not only illuminating the most effective strategies for teleworkers to organize their remote work processes but also identifying leadership behaviors that are particularly effective in virtual and crises-ridden environments. Our research also considers individual characteristics of teleworkers, such as boundary management preferences, telework experience, and perception of the organizational environment as VUCA, providing granular insights into how to effectively adopt to this new way of working.

In Chapter 4, which shifts our focus to sustainability, we integrate economic and psychological perspectives from the fragmented literature (Geiger et al., 2018) to unravel the barriers to (more) sustainable consumption behavior. Through our literature analysis, we uncover market failures that impede sustainable outcomes, focusin on asymmetric and incomplete information. These informational deficiencies pose significant challenges but also create a unique opportunity for organizations to facilitate sustainable consumption decisions. By leveraging sustainability signaling schemes, such as ecolabels (Brach et al., 2018), organizations can guide and empower consumers towards more informed choices. Our research presents a comprehensive understanding of these dynamics, providing actionable recommendations for organizations to capitalize on market failures and foster sustainable consumption practices.

In Chapter 5, we advance the EfS literature by filling the knowledge gap regarding the integration of sustainability into management education and its impact on sustainability-specific learning outcomes. We present a valuable blueprint that outlines the design, implementation, and evaluation of an effective EfS intervention within higher management education. This blueprint can serve as a crucial stepping stone towards cultivating a new generation of sustainability-conscious leaders capable of balancing ecological integrity, social equity, and economic prosperity.

Although each research article in this dissertation adds to the literature, it is important to acknowledge certain limitations and identify avenues for further inquiry. First, our exploratory research on telework strategies and remote leadership involved a substantial sample of over 1,000 teleworkers, which was driven by the urgent need for practical recommendations during the COVID-19 pandemic. However, this research is constrained by its cross-sectional design, relying on data from a single source at a specific time point. To enhance the validity of our findings and allow for causal inference, future research should consider utilizing longitudinal studies or (quasi-) experimental designs that gather data from multiple sources.

Second, while our conceptual research on sustainable consumption behavior has successfully integrated insights from the psychological and economic literature, there are opportunities for future research to expand and enhance our findings. To further advance the field, we recommend that scholars employ systematic literature review methods that adhere to established standards (see, e.g., Xiao & Watson, 2019). In addition, our analysis suggests that applying the concept of the value of information (see, e.g., Williams et al., 2011) to sustainable consumption holds promise for future research. Specifically, examining the value associated with reducing uncertainty in sustainable consumption decisions and comparing the value gained from additional measures (e.g., sustainability signaling schemes) with the cost of acquiring information can be a fruitful avenue to pursue. This way, we can develop effective entrepreneurial and/or policy measures to help consumers make (more) informed consumption choices, considering the ecological, social, and economic impacts of their decisions.

Third, while our quasi-experimental research on sustainability integration in management curricula represents an important initial step in providing impact-oriented evidence on the effectiveness of EfS interventions in higher management education, its validity may be limited by potential confounding variables and counterfactual inference. To address these limitations, we recommend future research to employ "gold standard" experimental designs (Cook & Payne, 2001), such as randomized controlled trials. Moreover, to enhance the generalizability and external validity of our findings, we advocate for conducting large-scale studies that encompass a more diverse student population. Building upon our promising initial findings, we also encourage future research to delve deeper into the effectiveness of innovative teaching techniques, such as transformative learning (Dieleman & Huisingh, 2006; Steiner & Posch, 2006; Svanström et al., 2008), in the context of sustainability management education. Although our research cannot establish a causal link to the effectiveness of specific transformative learning elements, our findings cautiously suggest that this innovative approach to learning holds promise for future educational endeavors.

This dissertation endeavors to bridge the growing divide between academia and practice (Anderson et al., 2001; Deadrick & Gibson, 2007; Kaufman, 2022; Rynes et al., 2002) by providing actionable and evidence-based management principles that effectively navigate the complexities of the modern business landscape. Rooted in real-world contexts, our research embraces a collaborative approach that integrates the perspectives of practitioners, rather than adopting a purely "top-down" stance from academics seated in their ivory towers (see Kaufman, 2022). To ensure transparency and accessibility, we have opted for open-access publication (see Härtel et al., 2023) and established Open Science Framework (OSF) projects for each empirical study (Chapters 2, 3, and 5). These OSF projects provide publicly available raw data sets, analysis scripts, codebooks, and supplementary results, thus bolstering the reproducibility and confidence in our findings. In Chapter 5, for our EfS intervention, we took the proactive step of pre-registering (https://osf.io/q5s74) our study (see Simmons et al., 2021) to mitigate the risks of p-hacking and minimize the potential for false-positive results (Moore, 2016). Through these open science practices, we aim to showcase the reliability, accuracy, and verifiability (van der Zee & Reich, 2018) of our research, encouraging practitioners to incorporate our findings into their professional endeavors.

First, our exploratory research on the new ways of working reveals that teleworkers have a natural understanding of effective telework strategies. However, by adopting conducive work attitudes and reviewing the importance of time flexibility in telework strategies, there is room for improvement in their telework productivity. Remote leaders may benefit from employing instrumental leadership behaviors that are strategic and work-facilitating. However, recognizing that we have not found a "one-size-fits-all" solution, organizations are well advised to tailor their training programs to align with individual employee characteristics (e.g., telework experience) and broader environmental factors (e.g., perceptions of the environment as being VUCA). By fostering an appreciation for the contextual nuances of effective work behaviors in virtual and dynamic organizational settings, organizations can manage the complexities of the modern workplace.

Second, our research on sustainable consumption uncovers market inefficiencies that organizations can leverage to meet the growing demand for sustainable products and services. The existence of asymmetric and incomplete information between consumers and marketers creates a significant gap that represents a business opportunity for organizations to provide solutions to the growing number of consumers willing to pay a premium for sustainability. Although some sectors, such as food and energy, have made progress in this regard, others, such as tourism, have yet to catch up. In addition to eco-labels, it is crucial to consider emerging

sustainability tagging and other signaling mechanisms, particularly in the e-commerce space. Furthermore, expanding sustainability certification schemes beyond products to encompass entire production processes or services can generate value for organizations and society at large. By capitalizing on these opportunities, businesses can contribute to a more sustainable future while meeting consumer demands.

Third, our research on sustainability education in higher management reveals practical implications of EfS interventions beyond academia, extending to educational and organizational contexts. To begin with, our—in terms of induced pro-environmental behavior change—effective EfS intervention expands the narrow focus on ecological sustainability and advocates for the triple bottom line approach (Elkington, 1997), encouraging business schools and HEIs to enrich their curricula by addressing ecological integrity, social equity, and economic prosperity. In addition, there is initial evidence of a potential narrowing of the attitude-behavior gap, as students exhibited a greater inclination towards pro-environmental behaviors following the EfS intervention, despite already holding high levels of environmental concern and attitudes, as well as consciousness of sustainable consumption. Lastly, our EfS intervention proved effective in promoting "light green" behaviors (Kagawa, 2007) involving minor lifestyle adjustments, such as recycling, energy and water conservation. Therefore, in organizational contexts, the implementation of sustainability-related training courses and workshops (e.g., Armstrong & Sadler-Smith, 2017; Haugh & Talwar, 2010) may be particularly effective in fostering sustainable behaviors among employees who already hold sustainable attitudes and consciousness, leading to positive environmental outcomes and reduced ecological footprints for organizations.

In conclusion, the primary aim of this dissertation was to catalyze positive transformations in the modern workplace and organizational sustainability. Therefore, I sincerely hope that the insights and recommendations presented here will enable organizations to effectively navigate organizational change and actively contribute to a prosperous and sustainable future. Furthermore, I aspire for this dissertation to serve as a stimulus for further research in these nascent areas and to encourage the adoption of evidence-based management practices within organizations.

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2 Associations Between the Implementation of Telework Strategies and Job Performance: Moderating Influences of Boundary Management Preferences and Telework Experience

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Abstract

Boosted by the COVID-19 pandemic, more than ever, an organization's success depends on its teleworkers' performance. However, little attention has been paid to the individual strategies implemented by teleworkers to achieve goals such as drawing boundaries between work- and private-life, working task-oriented and productively, and keeping social contact. We collected quantitative survey data of 548 teleworkers indicating their implementation of 85 telework strategies derived from scientific literature and popular media (e.g., working in a separate room, wearing work clothes at home), self-reported job performance, boundary management preferences, and telework experience. We identified (a) the implementation of telework strategies, (b) associations with job performance, (c) divergences between the implementation and the performance association, and (d) moderating influences of boundary management preferences and telework experience. The results suggest that the most implemented telework strategies tend to be the ones most positively associated with job performance. These telework strategies serve goals related to working task-oriented and productively by adopting a conducive work attitude as well as keeping social contact by using modern communication technology rather than goals related to drawing boundaries between work- and private-life. The findings underscore the benefits of expanding a narrow focus on telework strategies stemming from boundary theory to unravel telework strategies' puzzling impacts on (tele-) work outcomes. Also, taking a person-environment fit perspective appeared to be a promising approach to tailor evidence-based best practice telework strategies to teleworkers' individual preferences and needs (boundary management preferences and telework experience).

Keywords. Telework, telework strategies, job performance, boundary theory, boundary management preferences, telework experience, person-environment fit.

Open Science Statement. The data, codebook, R-script, and supplementary results are made transparent on the open science framework: https://osf.io/gqpdf.

2.1 Introduction

Teleworking has become a popular work mode (Allen et al., 2015) and its prevalence has recently been further boosted by the COVID-19 pandemic (Kniffin et al., 2021; Kramer & Kramer, 2020; Milasi et al., 2021; Rudolph et al., 2021). Thus, more than ever before, an organization's success depends on its teleworkers' performance and this trend is likely to continue due to demographic workforce changes, widespread distribution of information communication technology, as well as sustainability and work-life balance considerations (Athanasiadou & Theriou, 2021).

Some exploratory qualitative research (e.g., Basile & Beauregard, 2016; Fonner & Stache, 2012) has identified telework strategies, that is, individual strategies teleworkers implement when organizing their telework, that might impact work outcomes such as job performance. Also, the popular media is full of telework strategies (often referred to as "tips and tricks for working from home") that are suggested to enhance job performance. Examples of such telework strategies are using a separate room for teleworking or wearing work clothes at home. With this study, we respond to multiple calls for research on the differential impacts of the implementation of telework strategies on (tele-) work outcomes and potentially moderating factors (Allen et al., 2021; Rudolph et al., 2021; see also Binnewies et al., 2020). More specifically, we address blank spots of previous research on telework strategies by providing empirical evidence on (a) how much telework strategies are implemented, (b) how the implementation of telework strategies is associated with job performance, (c) divergences between the telework strategies' implementation and association with job performance, and (d) how the association between the implementation of telework strategies and job performance is moderated by teleworker characteristics such as boundary management preferences and telework experience.

Overall, this study advances the young literature on telework strategies by demonstrating that extending a narrow focus on telework strategies stemming from boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996) with telework strategies focusing on goals such as working productively (e.g., Greer & Payne, 2014) by adopting a conducive work attitude and keeping social contact (e.g., Kowalski & Swanson, 2005) by using modern communication technology might be a fruitful avenue for research illuminating impacts of telework strategies on work outcomes. Also, taking a person-environment fit perspective (Edwards, 2008; Kristof, 1996), particularly boundary congruence/fit (Ammons, 2013; Kreiner, 2006), appeared to be a promising approach to identifying evidence-based best practice telework strategies taking

individual teleworker characteristics (boundary management preferences and telework experience) into account.

2.2 Theoretical Background

2.2.1 Implementation of Telework Strategies

Telework is a work practice enabling employees (*teleworkers*) to conduct all or a share of their work away from their on-site workplace, typically from home (Allen et al., 2015). Whereas numerous studies examined the impacts of teleworking (Gajendran & Harrison, 2007), such as reduced work-family conflict (e.g., Allen et al., 2013; Golden et al., 2006; Raghuram & Wiesenfeld, 2004), enhanced job performance (e.g., Bailey & Kurland, 2002; Bloom et al., 2015; Gajendran et al., 2015), and professional isolation (e.g., Baruch & Nicholson, 1997; Gainey & Kelley, 1999; Kurland & Cooper, 2002), little attention has been paid to the individual strategies teleworkers implement (*telework strategies*) when organizing their telework. These telework strategies may serve different goals such as drawing boundaries between work- and private-life (e.g., Basile & Beauregard, 2016; Fonner & Stache, 2012; Golden, 2021, see also Allen et al., 2021, calling for research), working task-oriented and productively (e.g., Greer & Payne, 2014; Troll et al., 2022), and keeping social contact (e.g., Ilozor et al., 2001; Turetken et al., 2011).

Most research on telework strategies stems from *boundary theory* (Ashforth et al., 2000; Nippert-Eng, 1996) proposing that individuals follow idiosyncratic approaches (*boundary management strategies*) to establish or dismantle boundaries in order to organize transitions between their work- and private-life. In an interview-based landmark study, Kreiner et al. (2009) distinguished four categories of boundary management strategies implemented by priests: Physical (manipulating physical space/items, e.g., setting up a separate workstation), temporal (manipulating time, e.g., setting work/non-work times), behavioral (inter alia establishing technological routines, e.g., not taking work-related calls after hours), and communicative (setting expectations and making arrangements, e.g., confronting boundary violators) boundary management strategies. Basile and Beauregard (2016) applied boundary management strategies to the telework context in which boundaries between work- and private-life are particularly prone to blur. They found qualitative evidence for the implementation of physical (e.g., mimicking the physical boundary of an on-site office at home), temporal (e.g., establishing set times to finish the workday at home), behavioral (e.g., recreating technological routines of stationary work to ending up the workday at home), and communicative (e.g., making arrangements with household members facilitating undisturbed work at home) telework strategies. Other qualitative studies found similar telework strategies

to be implemented (Allen et al., 2021; Fonner & Stache, 2012; Mustafa, 2010; Mustafa & Gold, 2013; Myrie & Daly, 2009; Nansen et al., 2010; Tietze, 2002; Tietze & Musson, 2003). First quantitative studies provide initial evidence on boundary related (telework) strategies' global (Kossek et al., 2006; Wepfer et al., 2018) and differentiated level of implementation (differentiating between the aforementioned categories; Binnewies et al., 2020; Haun et al., 2022; Park et al., 2020) along with impacts on outcomes such as family-to-work conflict, recovery experiences, and well-being.

Whereas most studies embedded telework strategies in the framework of boundary theory, Greer and Payne (2014) identified complementing telework strategies by asking 86 high-performing teleworkers to freely recall telework strategies facilitating task-oriented and productive telework. Keeping connected with colleagues, supervisors, and customers (e.g., being accessible via various communication channels), using modern technologies (e.g., using a technological setup at home close to the on-site setup), and showing a conducive work attitude (e.g., adopting a work-oriented mindset) were frequently mentioned. Taking a quantitative approach, Troll et al. (2022) recently found telework strategies related to self-control (Duckworth et al., 2014), in particular, altering somatic conditions (optimizing the physical state to work productively, e.g., sleeping sufficiently) and autonomous motivation (motivating oneself to start and endure work tasks), to be frequently implemented and associated with working productively among 106 teleworkers.

Furthermore, some research has found telework strategies related to keeping social contact (e.g., seeking social interaction; Kowalski & Swanson, 2005) to be associated with job satisfaction (Ilozor et al., 2001), knowledge sharing (Golden & Raghuram, 2010), and the reduction of social isolation (Mann et al., 2000). In a similar vein, building on media richness theory (MRT; Daft & Lengel, 1986), Turetken et al. (2011) examined the impacts of telework strategies related to communication media richness (i.e., the extent to which a medium approximates face-to-face communication).

Overall, mainly qualitative approaches were used to identify telework strategies stemming from different theoretical frameworks and pursuing different goals, particularly establishing boundaries between work- and private-life (Basile & Beauregard, 2016; Binnewies et al., 2020; Fonner & Stache, 2012; Golden, 2021; Haun et al., 2022; Kossek et al., 2006; Kreiner et al., 2009; Myrie & Daly, 2009; Nansen et al., 2010; Nippert-Eng, 1996; Park et al., 2020; Tietze, 2002; Tietze & Musson, 2003; Wepfer et al., 2018), but also working task-oriented and productively (Greer & Payne, 2014; Troll et al., 2021), and keeping social contact (Golden & Raghuram, 2010; Ilozor et al., 2001; Kowalski & Swanson, 2005; Mann et

al., 2000; Turetken et al., 2011). Whereas qualitative approaches are suited to exploratively identify telework strategies, they come with limitations that can be targeted by quantitative approaches: First, participants might forget to mention implemented telework strategies. Second, the binary classification of (not) implementing a telework strategy does not display gradual differences. Both aspects impede the identification of the impacts of implementing telework strategies. Quantitative research, however, is scarce and has either been conducted outside the telework context (Binnewies et al., 2020; Wepfer et al., 2018), or has placed a narrow focus on a specific facet of telework strategies, namely, telework strategies related to boundary management (Haun et al., 2022), to self-control (Troll et al., 2022), or to keeping social contact (Golden & Raghuram, 2010; Ilozor et al., 2001; Kowalski & Swanson, 2005; Mann et al., 2000; Turetken et al., 2011). Also, previous research reported results solely on an aggregated level differentiating between broad telework strategy categories.

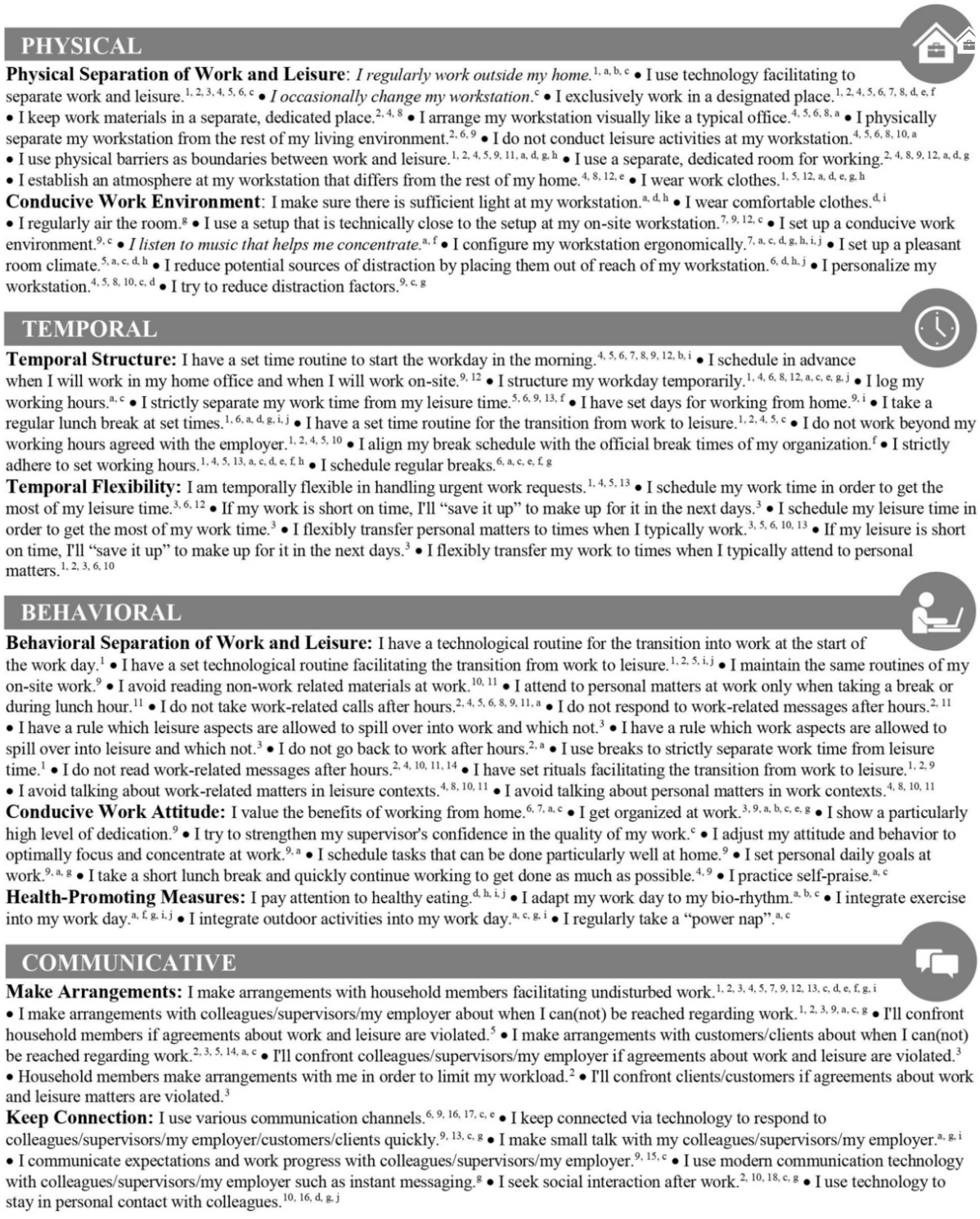
With this study, we advance the young literature on telework strategies by (a) quantitatively examining a comprehensive set of 85 telework strategies stemming from different theoretical streams and pursuing different goals, and (b) thereby conducting analyses on both an aggregated category level to identify overarching patterns (Binnewies et al., 2020; Haun et al., 2022; Troll et al., 2022), and on an individual telework strategy level to draw highly resolved, zoomed-in inferences. To paint a comprehensive picture, we complement telework strategies derived from the scientific literature with telework strategies from popular media (see Figure 2.1). Online practical guides on telework strategies have flourished during the COVID-19 pandemic and many teleworkers have presumably been searching for advice.

2.2.2 Associations Between Telework Strategies and Job Performance

There is initial evidence that the implementation of telework strategies is associated with outcomes such as well-being, recovery, satisfaction, knowledge sharing, and reduced isolation (Binnewies et al., 2020; Golden & Raghuram, 2010; Haun et al., 2022; Ilozor et al., 2001; Mann et al., 2000; Park et al., 2020; Wepfer et al., 2018). However, we know little about how the implementation of telework strategies is related to job performance. For instance, Binnewies et al. (2020) call for research on the consequences of boundary management strategies for job performance. Rudolph et al. (2021, p. 13) call for research on telework strategies and state that "it would be useful to have empirical information on the efficacy". Allen et al. (2021, p. 81) conclude that "additional work is needed that provides guidance concerning the effectiveness of various strategies".

Figure 2.1

Overview of Telework Strategies



Note. Telework strategies in italics were recoded. Telework strategies extracted from scientific literature (popular media) were indicated with numbers (letters). [1]Fonner & Stache (2012); [2]Basile & Beauregard (2016); [3]Kreiner et al. (2009); [4]Mustafa & Gold (2013); [5]Myrie & Daly (2009); [6]Nansen et al. (2010); [7]Kowalski & Swanson (2005); [8]Mustafa (2010); [9]Greer & Payne (2014); [10]Wepfer et al. (2018); [11]Kossek et al. (2006); [12]Tietze (2002); [13]Tietze & Musson (2003); [14]Park et al. (2020); [15]Ilozor et al. (2001); [16]Golden & Raghuram (2010); [17]Turetken et al. (2011); [18]Mann et al. (2000). [a]Mai (n.d.); [b]Prophet (2017); [c]Schulz (2020); [d]Cobler (n.d.); [e]Stross (n.d.); [f]Westdeutsche Zeitung (2020); [g]Flatley (2020); [h]Vollmer (2018); [i]Unger (2020); [j]Rewe (n.d.).

Kossek et al. (2006) provide initial evidence that boundary related telework strategies' global implementation might not be associated with job performance. Greer and Payne (2014) provide first hints on telework strategies freely-recalled by high performers (in particular keeping connected, using modern technology, showing a conducive work attitude) that might be positively associated with job performance. However, to reliably identify telework strategies associated with job performance the inclusion of low performers is needed to (a) rule out that low performers use the same telework strategies as high performers, (b) identify telework strategies that might deteriorate job performance, and (c) make use of the full job performance range facilitating to detect significant associations by mitigating range restrictions. Troll et al. (2022) found self-control telework strategies related to autonomous motivation and somatic condition to be unique positive predictors of job performance. Turetken et al. (2011) found a positive association between telework strategies related to communication media richness and self-reported job performance.

In this study, we examine associations of a broad set of highly resolved telework strategies with job performance to paint a comprehensive, fine-grained picture. As we examine both the implementation of telework strategies and their association with job performance, this also offers the possibility to examine whether teleworkers have an intuitive understanding of telework strategies' relation to job performance, that is, whether telework strategies that are more (less) associated with job performance are implemented more (less). In particular, telework strategies can then be identified that are "under (over) implemented", that is, that are implemented less (more) frequently than they actually should be according to their high (low) association with job performance.

2.2.3 Moderating Influences of Boundary Management Preferences and Telework Experience

It is crucial to understand which telework strategies might be more or less strongly related to job performance for specific groups of employees sharing common characteristics (see also Binnewies et al., 2020, calling for research on moderators of boundary management strategies) to provide advice or training interventions tailored to employees' individual preferences and needs (see also Kossek, 2016). Following *person-environment fit approaches* (P-E fit; Edwards, 2008; Kristof, 1996; see also Arthur Jr. et al., 2006), a (mis-) match between person and environment induces additional effects beyond the respective separate main effects. More specifically, the preferences/needs-supplies fit considers individual preferences and needs (here related to boundary management preferences and telework experience) and environmental

supplies (here related to telework strategies) interacting to predict work outcomes (here job performance).

Boundary management preferences represent the degree to which employees prefer to separate (versus integrate) work- and private-life (Ashforth et al., 2000; Kreiner, 2006): Whereas employees leaning toward separation ("separators") aim to draw rigorous boundaries, employees leaning toward integration ("integrators") aim to remove boundaries. Individual boundary management preferences are crucial in telework contexts (Allen et al., 2021; Kerman et al., 2021; Kossek et al., 2006) because borders between work- and private-life are particularly prone to blur. Following P-E fit approaches, telework strategies congruent with individual boundary management preferences may be particularly beneficial to job performance because a fit between individual preferences and needs, and the environment is achieved. Thus, telework strategies aligned to separating work- and private-life (e.g., not working beyond agreed hours) might be more beneficial for separators, whereas telework strategies aligned to integrating work- and private-life (e.g., being flexible in handling work requests) might be more beneficial for integrators. This reasoning is supported by the *boundary congruence approach* (Kreiner, 2006) combining the P-E fit approach (Edwards, 2008; Kristof, 1996) with boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996). Following the boundary congruence approach, a (mis-)fit (*boundary congruence* versus *boundary incongruence*) between individual boundary management preferences and environmental boundary influences such as workplace policies and conditions induces additional effects beyond the respective separate main effects (see Chen et al., 2009; Kreiner, 2006; Rothbard et al., 2005, for initial evidence on positive impacts of boundary congruence on outcomes such as reduced work-family conflict, higher job satisfaction, and commitment). In a similar vein, the *boundary fit approach* (Ammons, 2013) proposes that a (mis-) match (*boundary fit* versus *boundary misfit*) between individual boundary management preferences and boundary enactments (actual borders that individuals establish to separate work- and private-life) induces additional effects beyond the respective separate main effects (see Haun et al., 2022). In this study, we, for the first time, explore interaction effects related to boundary congruence/fit predicting job performance, whereby telework strategies might be either seen as environmental boundary influences or actual boundary enactments. During the COVID-19 pandemic, many employees were sent to the home office without choice (Kniffin et al., 2021) providing a unique opportunity to investigate moderating influences of boundary management preferences by mitigating self-selection effects: Typically, separators tend to prefer stationary on-site work over telework because

telework is to some extent inherently incongruent with the preference to separate work- and private-life (Shockley & Allen, 2010).

The COVID-19 pandemic also provides the opportunity to examine moderating influences of the individual level of telework experience as many employees who have had little experience with telework migrated to the home office (Kramer & Kramer, 2020; Milasi et al., 2021). The wide range of experience levels allows us to examine moderating influences without self-selection biases and range restrictions. Following the P-E fit approach, teleworkers with low experience might have different needs than teleworkers with high experience so telework strategies might be differently beneficial for job performance. For instance, telework strategies providing structure (e.g., maintaining routines of the on-site stationary work) might be more beneficial for unexperienced teleworkers, whereas telework strategies demanding adaptivity (e.g., flexibly transferring work to times designated for personal matters) might be more beneficial for experienced teleworkers.

2.3 Present Study

With this study, we shed light on the individual ways teleworkers organize their work processes to achieve different goals, in particular, drawing boundaries between work- and private life, working task-oriented and productively, and keeping social contact. We aim to better understand (research question 1; RQ 1) the implementation of telework strategies, (RQ 2) associations with job performance, (RQ 3.1, 3.2) divergences between the implementation and association with job performance, and (RQ 4.1, 4.2) moderating influences of boundary management preferences and telework experience building on P-E fit theory. For this purpose, we collected survey data from 548 teleworkers assessing the implementation of 85 highly resolved telework strategies (see Figure 2.1), self-reported job performance, boundary management preferences, and telework experience. Due to the novelty and explorative nature of this research topic, and because this study was not preregistered, we do not formulate hypotheses but more open research questions:

- RQ 1: How much are telework strategies implemented?
- RQ 2: How is the individual implementation of telework strategies associated with job performance?
- RQ 3.1/3.2: How is the telework strategies' average implementation associated with the telework strategies' association with job performance?/How does the telework strategies' relative average implementation diverge from their relative association with job performance?

- RQ 4.1/4.2: How is the association between the individual implementation of telework strategies and job performance moderated by boundary management preferences/telework experience?

2.4 Method

2.4.1 Sample

Our final sample consists of 548 German-speaking teleworkers[1] (336 women) from various sectors (the most represented are 16.61% IT, telecommunication, media; 11.13% health and social services; 9.85% research and development) and professions (the most represented are 48.18% highly skilled and 29.38% skilled employees). We recruited participants via posting the online survey in online professional (LinkedIn, Xing) and social (Facebook) network groups without offering compensation. Participants on average spend most of their weekly working days teleworking ($M = 3.85$, $SD = 1.33$). The average age is 39.91 ($SD = 11.63$). Most participants (339, 71.72%) hold a bachelor's degree or higher. Participants have extensive years of work experience ($M = 15.52$, $SD = 11.92$) and their weekly contractual working hours ($M = 35.77$, $SD = 7.42$) are similar to the weekly working hours of German full-time employees. Data collection took place between July and December 2020 and thus, started five months after the onset of the COVID-19 pandemic declared by the World Health Organization. This should ensure that teleworkers who had been teleworking for the first time due to the pandemic have had the opportunity to develop telework strategies (Lally et al., 2010). For an overview of the survey structure and assessed variables see the Codebook at https://osf.io/gqpdf.

2.4.2 Measures

2.4.2.1 Telework Strategies

We originally extracted 157 telework strategies from scientific literature (Basile & Beauregard, 2016; Fonner & Stache, 2012; Golden & Raghuram, 2010; Greer & Payne, 2014; Ilozor et al., 2001; Kossek et al., 2006; Kowalski & Swanson, 2005; Kreiner et al., 2009; Mann et al., 2000; Mustafa, 2010; Mustafa & Gold, 2013; Myrie & Daly, 2009; Nansen et al., 2010; Park et al., 2020; Tietze, 2002; Tietze & Musson, 2003; Turetken et al., 2011; Wepfer et al., 2018)[2] and added 179 telework strategies from popular media (Cobler, n.d.; Flatley, 2020; Mai, 2022; Prophet, 2017; Rewe, n.d.; Schulz, 2022; Stross, n.d.; Unger, 2020; Vollmer, 2018;

[1] From 1406 participants who started the online survey, we excluded 812 participants without sufficient responses, 22 participants without sufficient German skills, 18 participants without telework experience, three participants who did not respond seriously, and three students as we aimed for a permanently employed working sample.

[2] As Troll et al. (2022), Golden et al. (2021), and Haun et al. (2022) were published after our data collection, we could not derive telework strategies from these sources.

Westdeutsche Zeitung, 2020) to get a comprehensive selection of highly resolved telework strategies. We extracted telework strategies from popular media by reviewing the ten first listed websites of a Google search using the keyword "home office tips" (in German). After eliminating redundant telework strategies and exotic telework strategies from popular media (e.g., playing online casino to revive attention; Westdeutsche Zeitung, 2020), we finally included 85 distinct telework strategies in our online survey (see Figure 2.1). Whenever necessary, we translated the telework strategies into German and reformulated them into questionnaire items (e.g., the physical telework strategy "recreating the physical boundary of an office environment by designating areas for work activities" reported in Basile & Beauregard, 2016, p. 106, was transformed into the item "I physically separate my workstation from the rest of my living environment."). Participants indicated the extent to which they implement telework strategies on a 6-point Likert scale ranging from 1 (*not at all*) to 6 (*completely*). Participants could also indicate not being aware of a particular telework strategy leading to missing values. However, the implementation of telework strategies was answered by most participants for each telework strategy ($M = 534.49$, $SD = 23.25$, $Min = 420$, $Max = 548$).

To enhance the comparability of our results with previous research and to identify overarching patterns on a higher aggregated level, we categorized the 85 telework strategies into physical, temporal, behavioral, and communicative superordinate categories (see Basile & Beauregard, 2016; Kreiner et al., 2009). Because telework strategies within the respective assigned superordinate categories were still heterogeneous, we simultaneously distinguished nine subordinate categories (e.g., "physical separation of work and leisure" and "conducive work environment" within the superordinate physical category; see Figure 2.1). Following guidelines for exploratory analyses (Miller, 1995) Cronbach's alpha was acceptable for all superordinate ($.66 \leq \alpha \leq .84$) and subordinate categories ($.56 \leq \alpha \leq .84$), except for temporal flexibility ($\alpha = .56$; see Table 2.1). Three telework strategies ("I regularly work outside my home.", "I occasionally change my workstation." within physical separation of work and leisure; "I listen to music that helps me concentrate." within conducive work environment) needed to be recoded as they were negatively correlated with the respective subordinate categories' overall score.

2.4.2.2 Job Performance

Participants were instructed that the assessment of job performance refers to their job performance when teleworking. Self-reported job performance ($\alpha = .70$, $M = 4.13$, $SD = 0.52$) was assessed using three items translated into German ("How would you rate your job

performance as an individual employee?", "Think about your most recent assessment of your job performance or the most recent time you received feedback from your supervisor. How do you think your supervisor would rate your performance?", "How would you rate your performance as a work team member?"; Bal & De Lange, 2015). Participants responded on a 5-point Likert scale ranging from 1 (*very poor*) to 5 (*excellent*). Participants could indicate "not applicable" on the item referring to their team performance. 19 participants aborted the survey before reporting their job performance leading to missing values. Even though self-reported job performance measures have limitations they substantially overlap with supervisor ratings (e.g., Heidemeier & Moser, 2009).

2.4.2.3 Boundary Management Preferences

Inspired by Kossek et al. (2006), we presented participants the following prompt translated into German: "With the increasing demands of work and home, employees may work in different ways to handle these demands.". We then measured gradual interindividual differences in boundary management preferences with the item: "All in all, do you currently see yourself as someone who tries to keep work and personal roles separated most of the time or someone who tries to keep them integrated?". Participants responded on a 6-point Likert scale ranging from 1 (*I prefer to separate the roles*) to 6 (*I prefer to integrate the roles*). We recoded responses so that higher scores indicate preferences for separation ($M = 3.76$, $SD = 1.67$). 16 participants aborted the online survey before reporting their boundary management preferences leading to missing values. In the following, we use the terms *integrators*/*separators* to refer to individuals relatively lower/higher on the continuous dimension of boundary management preferences.

2.4.2.4 Telework Experience

Gradual interindividual differences in telework experience ($M = 4.08$, $SD = 1.67$) were assessed with the item "How experienced are you with teleworking?" translated into German. Participants responded on a 6-point Likert scale ranging from 1 (*completely unexperienced*) to 6 (*completely experienced*). 24 participants aborted the online survey before reporting their telework experience leading to missing values. In the following, we use the terms *unexperienced*/*experienced teleworkers* to refer to individuals relatively lower/higher on the continuous dimension of telework experience.

2.4.3 Analytical Approach

We used the statistical program R (version 4.1.0; R Core Team, 2018) and the interface RStudio (version 1.2.5042; RStudio Team, 2016) for all analyses. The data and statistical code can be found in the Online Supplement at https://osf.io/gqpdf. To identify broader patterns of

results on a higher aggregated level, we summarized all appropriate results for super- and subordinate categories of telework strategies by computing (weighted) means.

To answer the question of how much telework strategies are implemented, we computed the means of the individual implementation of each of the 85 telework strategies. We then computed 85 multiple linear regressions of the individual implementation of each telework strategy on job performance. We included boundary management preferences and telework experience as additional predictors in each multiple linear regression to examine their interaction effects with telework strategies on job performance. We also included control variables (e.g., Binnewies et al., 2020; Troll et al., 2021), that is, basic demographic (age, gender) and situational aspects (living space in m^2, $M = 109.87$, $SD = 50.16$; living with children, $M = .25$, $SD = .43$). Job performance and all predictor variables were *z*-scaled, except for the dummy-coded variables gender (0/1 = female/male) and living with children (0/1 = no/yes). We answer the question of how the individual implementation of telework strategies is associated with job performance based on the β-coefficients of the telework strategies on job performance. We answer the questions of the moderation effects of boundary management preferences and telework experience, respectively, on the association between telework strategies and job performance based on the βs corresponding to these interaction effects in the multiple linear regressions.

To examine how the telework strategies' average implementation is associated with the telework strategies' association with job performance, we correlated the 85 means of the implementation of the telework strategies with the 85 β-coefficients of the telework strategies on job performance in the outlined multiple linear regressions. To answer the question of how the telework strategies' relative implementation diverges from their relative association with job performance, we computed differences between a telework strategy's *z*-scaled implementation and a telework strategy's *z*-scaled β-coefficient on job performance in the outlined multiple linear regressions.

2.5 Results

The results of all research questions except RQ 3.1 are summarized in Table 2.1 (see Appendix 2.A for the corresponding Table 2.1A including information on standard deviations of the implementation of telework strategies, bivariate correlations between telework strategies and job performance, further regression coefficients (intercept, boundary management preferences, telework experience, and control variables), R^2, R^2_{Adjusted}, and results of the *F*-test).

Table 2.1

Telework Strategies' Implementation, Multiple Linear Regression Results of Telework Strategies and Interaction Effects with Boundary Management Preferences and Telework Experience Predicting Job Performance, and Divergences Between Telework Strategies' Implementation and Association with Job Performance

Telework strategy	*M*	β_T	$\beta_{T \times BMP}$	$\beta_{T \times TE}$	$\Delta M, \beta_T$
Physical (α = .84)	3.95 [3.80, 4.10]	0.07 [-0.02, 0.16]	-0.01 [-0.10, 0.07]	-0.02 [-0.11, 0.07]	-0.22
Physical separation of work and leisure (α = .83)	3.81 [3.64, 3.97]	0.07 [-0.03, 0.16]	0.00 [-0.08, 0.09]	-0.03 [-0.12, 0.05]	-0.09
I regularly work outside my home.	5.39 [5.30, 5.49]	0.09 [-0.01, 0.19]	0.08 [-0.01, 0.17]	**-0.12** [-0.22, -0.02]	-1.75
I use technology facilitating to separate work and leisure.	4.65 [4.51, 4.80]	**0.11** [0.01, 0.20]	0.02 [-0.07, 0.11]	0.02 [-0.07, 0.10]	-0.65
I occasionally change my workstation.	4.57 [4.43, 4.71]	**0.10** [0.01, 0.19]	0.05 [-0.04, 0.13]	0.00 [-0.09, 0.08]	-0.67
I exclusively work in a designated place.	4.51 [4.37, 4.64]	**0.14** [0.05, 0.23]	0.01 [-0.08, 0.09]	0.01 [-0.07, 0.09]	-0.07
I keep work materials in a separate, dedicated place.	4.46 [4.32, 4.60]	0.07 [-0.02, 0.17]	0.00 [-0.09, 0.08]	-0.06 [-0.15, 0.02]	-0.79
I arrange my workstation visually like a typical office.	3.68 [3.52, 3.83]	0.06 [-0.03, 0.15]	-0.03 [-0.11, 0.05]	**-0.09** [-0.18, 0.00]	0.02
I physically separate my workstation from the rest of my living environment.	3.57 [3.40, 3.74]	0.03 [-0.07, 0.12]	-0.02 [-0.11, 0.06]	0.03 [-0.06, 0.12]	-0.24
I do not conduct leisure activities at my workstation.	3.39 [3.24, 3.53]	**0.12** [0.02, 0.21]	-0.04 [-0.13, 0.04]	-0.04 [-0.12, 0.04]	0.95
I use physical barriers as boundaries between work and leisure.	3.27 [3.10, 3.44]	0.00 [-0.10, 0.10]	-0.03 [-0.11, 0.06]	-0.01 [-0.10, 0.08]	-0.19
I use a separate, dedicated room for working.	3.21 [3.03, 3.40]	0.01 [-0.09, 0.10]	-0.03 [-0.12, 0.06]	-0.01 [-0.09, 0.08]	-0.05
I establish an atmosphere at my workstation that differs from the rest of my home.	2.58 [2.44, 2.73]	0.05 [-0.04, 0.15]	0.00 [-0.09, 0.09]	-0.05 [-0.14, 0.03]	1.23
I wear work clothes.	2.37 [2.23, 2.50]	0.02 [-0.07, 0.11]	0.06 [-0.03, 0.15]	-0.06 [-0.15, 0.03]	1.10
Conducive work environment (α = .62)	4.11 [3.97, 4.24]	0.07 [-0.02, 0.16]	-0.03 [-0.11, 0.06]	0.00 [-0.09, 0.08]	-0.36
I make sure there is sufficient light at my workstation.	5.40 [5.32, 5.48]	0.06 [-0.03, 0.15]	-0.07 [-0.15, 0.01]	-0.06 [-0.15, 0.03]	-2.02
I wear comfortable clothes.	5.37 [5.29, 5.45]	**0.14** [0.05, 0.22]	-0.06 [-0.15, 0.02]	**-0.10** [-0.19, -0.01]	-1.19
I regularly air the room.	4.98 [4.88, 5.09]	0.03 [-0.06, 0.11]	-0.05 [-0.13, 0.03]	0.00 [-0.09, 0.10]	-1.94
I use a setup that is technically close to the setup at my on-site workstation.	4.84 [4.72, 4.96]	**0.15** [0.06, 0.25]	-0.07 [-0.16, 0.02]	0.06 [-0.02, 0.14]	-0.36
I set up a conducive work environment.	4.33 [4.21, 4.45]	**0.16** [0.07, 0.25]	-0.07 [-0.15, 0.01]	0.06 [-0.02, 0.15]	0.30
I listen to music that helps me concentrate.	4.22 [4.06, 4.37]	0.05 [-0.04, 0.14]	**0.10** [0.01, 0.18]	-0.04 [-0.12, 0.05]	-0.74
I configure my workstation ergonomically.	4.08 [3.93, 4.23]	0.02 [-0.07, 0.12]	-0.04 [-0.12, 0.04]	-0.01 [-0.09, 0.08]	-0.89
I set up a pleasant room climate.	3.82 [3.68, 3.95]	0.06 [-0.03, 0.15]	0.03 [-0.05, 0.12]	-0.02 [-0.10, 0.07]	-0.18
I reduce potential sources of distraction by placing them out of reach of my workstation.	2.88 [2.75, 3.02]	0.06 [-0.03, 0.15]	-0.02 [-0.11, 0.06]	0.00 [-0.09, 0.08]	0.91
I personalize my workstation.	2.71 [2.56, 2.86]	-0.03 [-0.12, 0.05]	-0.02 [-0.11, 0.07]	0.07 [-0.02, 0.15]	0.11
I try to reduce distraction factors.	2.57 [2.45, 2.70]	**0.12** [0.03, 0.21]	-0.01 [-0.09, 0.08]	0.00 [-0.09, 0.08]	2.00
Temporal (α = .66)	3.61 [3.46, 3.76]	0.03 [-0.06, 0.12]	-0.01 [-0.09, 0.08]	-0.03 [-0.12, 0.06]	-0.23
Temporal structure (α = .80)	3.65 [3.50, 3.81]	0.05 [-0.04, 0.15]	0.01 [-0.07, 0.10]	-0.05 [-0.13, 0.04]	-0.03
I have a set time routine to start the workday in the morning.	4.80 [4.68, 4.92]	0.02 [-0.07, 0.10]	-0.05 [-0.13, 0.03]	**-0.09** [-0.17, 0.00]	-1.82
I structure my workday temporarily.	4.51 [4.39, 4.63]	**0.18** [0.08, 0.27]	-0.07 [-0.16, 0.01]	-0.07 [-0.16, 0.01]	0.26

Telework strategy	*M*	β_T	$\beta_{T \times BMP}$	$\beta_{T \times TE}$	ΔM, β_T
I schedule in advance when I will work in my home office and when I will work on-site.	4.36 [4.22, 4.51]	0.09 [-0.01, 0.18]	0.00 [-0.09, 0.09]	0.02 [-0.06, 0.11]	-0.54
I log my working hours.	4.30 [4.13, 4.48]	**0.15** [0.06, 0.24]	0.08 [-0.01, 0.17]	-0.05 [-0.14, 0.04]	0.24
I strictly separate my work time from my leisure time.	4.07 [3.94, 4.20]	**0.22** [0.12, 0.31]	0.00 [-0.08, 0.09]	**-0.14** [-0.22, -0.05]	1.23
I have set days for working from home.	3.75 [3.58, 3.93]	0.02 [-0.07, 0.11]	-0.02 [-0.11, 0.06]	0.01 [-0.07, 0.10]	-0.52
I take a regular lunch break at set times.	3.70 [3.56, 3.85]	-0.03 [-0.12, 0.06]	-0.03 [-0.12, 0.05]	-0.03 [-0.11, 0.06]	-1.03
I have a set time routine for the transition from work to leisure.	3.38 [3.23, 3.53]	0.02 [-0.07, 0.11]	0.01 [-0.08, 0.09]	**-0.10** [-0.19, -0.02]	-0.13
I do not work beyond my working hours agreed with the employer.	3.15 [3.00, 3.29]	-0.02 [-0.11, 0.07]	**0.13** [0.05, 0.22]	-0.02 [-0.10, 0.07]	-0.20
I align my break schedule with the official break times of my organization.	2.82 [2.65, 2.99]	0.07 [-0.03, 0.16]	0.01 [-0.08, 0.10]	-0.04 [-0.13, 0.05]	1.07
I strictly adhere to set working hours.	2.64 [2.50, 2.78]	-0.01 [-0.10, 0.09]	0.05 [-0.04, 0.14]	-0.08 [-0.16, 0.01]	0.50
I schedule regular breaks.	2.29 [2.17, 2.41]	-0.04 [-0.13, 0.05]	0.03 [-0.06, 0.11]	0.02 [-0.07, 0.10]	0.56
Temporal flexibility (α = .56)	3.54 [3.40, 3.68]	-0.01 [-0.10, 0.08]	-0.03 [-0.12, 0.05]	0.00 [-0.08, 0.09]	-0.57
I am temporally flexible in handling urgent work requests.	4.79 [4.68, 4.90]	0.08 [-0.01, 0.18]	**-0.10** [-0.19, -0.01]	0.04 [-0.05, 0.12]	-1.10
I schedule my work time in order to get the most of my leisure time.	3.97 [3.85, 4.10]	-0.02 [-0.11, 0.06]	0.01 [-0.07, 0.10]	-0.01 [-0.10, 0.07]	-1.27
If my work is short on time, I'll "save it up" to make up for it in the next days.	3.65 [3.50, 3.79]	-0.05 [-0.14, 0.04]	-0.04 [-0.12, 0.05]	**-0.10** [-0.18, -0.01]	-1.20
I schedule my leisure time in order to get the most of my work time.	3.49 [3.36, 3.62]	**0.16** [0.08, 0.25]	**-0.08** [-0.16, 0.00]	0.00 [-0.08, 0.08]	1.33
I flexibly transfer personal matters to times when I typically work.	3.17 [3.04, 3.30]	**-0.15** [-0.24, -0.06]	-0.01 [-0.10, 0.07]	0.01 [-0.07, 0.10]	-1.74
If my leisure is short on time, I'll "save it up" to make up for it in the next days.	3.00 [2.87, 3.13]	0.00 [-0.08, 0.09]	0.02 [-0.06, 0.11]	-0.03 [-0.12, 0.06]	0.18
I flexibly transfer my work to times when I typically attend to personal matters.	2.68 [2.55, 2.81]	-0.07 [-0.17, 0.04]	-0.04 [-0.14, 0.05]	**0.09** [0.00, 0.18]	-0.19
Behavioral (α = .83)	3.87 [3.73, 4.01]	**0.10** [0.01, 0.19]	0.00 [-0.09, 0.08]	-0.03 [-0.11, 0.06]	0.19
Behavioral separation of work and leisure (α = .84)	3.69 [3.54, 3.85]	0.08 [-0.02, 0.17]	0.02 [-0.07, 0.10]	-0.06 [-0.14, 0.03]	0.15
I have a technological routine for the transition into work at the start of the work day.	5.11 [5.00, 5.22]	**0.15** [0.05, 0.24]	0.03 [-0.05, 0.12]	-0.08 [-0.16, 0.00]	-0.74
I have a set technological routine facilitating the transition from work to leisure.	4.89 [4.76, 5.02]	**0.14** [0.04, 0.25]	0.06 [-0.04, 0.15]	-0.03 [-0.12, 0.06]	-0.56
I maintain the same routines of my on-site work.	4.21 [4.09, 4.34]	**0.24** [0.15, 0.33]	0.02 [-0.06, 0.10]	**-0.22** [-0.30, -0.13]	1.32
I avoid reading non-work related materials at work.	3.88 [3.75, 4.01]	**0.15** [0.06, 0.25]	-0.01 [-0.09, 0.07]	-0.02 [-0.10, 0.06]	0.76
I attend to personal matters at work only when taking a break or during lunch hour.	3.82 [3.69, 3.96]	**0.17** [0.08, 0.26]	0.03 [-0.05, 0.12]	-0.06 [-0.15, 0.02]	1.00
I do not take work-related calls after hours.	3.73 [3.57, 3.89]	-0.01 [-0.10, 0.09]	0.03 [-0.06, 0.12]	-0.06 [-0.14, 0.03]	-0.80
I do not respond to work-related messages after hours.	3.62 [3.46, 3.78]	0.01 [-0.09, 0.11]	0.01 [-0.08, 0.10]	**-0.14** [-0.23, -0.05]	-0.48
I have a rule which leisure aspects are allowed to spill over into work and which not.	3.48 [3.33, 3.63]	**0.13** [0.04, 0.22]	0.02 [-0.06, 0.11]	0.09 [0.00, 0.17]	1.02
I have a rule which work aspects are allowed to spill over into leisure and which not.	3.47 [3.32, 3.62]	0.08 [-0.01, 0.17]	-0.02 [-0.11, 0.06]	-0.02 [-0.11, 0.07]	0.47
I do not go back to work after hours.	3.45 [3.31, 3.60]	0.03 [-0.06, 0.12]	0.04 [-0.05, 0.12]	-0.09 [-0.17, 0.00]	-0.07
I use breaks to strictly separate work time from leisure time.	3.32 [3.19, 3.46]	-0.03 [-0.12, 0.06]	-0.02 [-0.11, 0.06]	-0.02 [-0.11, 0.06]	-0.59
I do not read work-related messages after hours.	3.27 [3.11, 3.43]	0.03 [-0.07, 0.12]	0.00 [-0.09, 0.09]	**-0.14** [-0.23, -0.05]	0.10
I have set rituals facilitating the transition from work to leisure.	3.25 [3.10, 3.39]	0.04 [-0.05, 0.13]	0.03 [-0.05, 0.12]	-0.05 [-0.14, 0.03]	0.26
I avoid talking about work-related matters in leisure contexts.	2.98 [2.85, 3.10]	0.01 [-0.08, 0.11]	-0.02 [-0.11, 0.07]	-0.05 [-0.14, 0.04]	0.33
I avoid talking about personal matters in work contexts.	2.89 [2.77, 3.01]	0.00 [-0.09, 0.09]	0.02 [-0.06, 0.11]	0.03 [-0.05, 0.12]	0.29
Conducive work attitude (α = .65)	4.44 [4.32, 4,56]	**0.19** [0.10, 0.27]	-0.03 [-0.11, 0.05]	-0.02 [-0.10, 0.07]	0.46
I value the benefits of working from home.	5.28 [5.18, 5.38]	**0.13** [0.04, 0.22]	**-0.08** [-0.17, 0.00]	0.00 [-0.08, 0.08]	-1.15

Telework strategy	*M*	β_T	$\beta_{T \times BMP}$	$\beta_{T \times TE}$	$\Delta M, \beta_T$
I get organized at work.	4.98 [4.88, 5.09]	**0.15** [0.06, 0.24]	-0.04 [-0.12, 0.04]	0.02 [-0.06, 0.10]	-0.58
I show a particularly high level of dedication.	4.78 [4.69, 4.88]	**0.43** [0.35, 0.51]	-0.05 [-0.12, 0.03]	-0.01 [-0.09, 0.07]	2.69
I try to strengthen my supervisor's confidence in the quality of my work.	4.78 [4.67, 4.88]	**0.26** [0.17, 0.35]	0.03 [-0.06, 0.11]	0.02 [-0.06, 0.11]	0.86
I adjust my attitude and behavior to optimally focus and concentrate at work.	4.70 [4.61, 4.80]	**0.31** [0.22, 0.39]	-0.05 [-0.12, 0.03]	-0.06 [-0.14, 0.02]	1.48
I schedule tasks that can be done particularly well at home.	4.61 [4.47, 4.74]	0.05 [-0.04, 0.14]	0.01 [-0.08, 0.10]	-0.06 [-0.15, 0.02]	-1.25
I set personal daily goals at work.	4.44 [4.32, 4.56]	**0.15** [0.06, 0.24]	-0.04 [-0.13, 0.04]	**-0.09** [-0.18, -0.01]	0.06
I take a short lunch break and quickly continue working to get done as much as possible.	3.31 [3.17, 3.44]	0.06 [-0.03, 0.14]	-0.02 [-0.10, 0.07]	-0.04 [-0.13, 0.04]	0.39
I practice self-praise.	3.06 [2.92, 3.20]	**0.14** [0.05, 0.23]	-0.03 [-0.11, 0.06]	0.07 [-0.02, 0.16]	1.63
Health-promoting measures (α = .61)	3.39 [3.25, 3.53]	0.01 [-0.08, 0.10]	-0.02 [-0.10, 0.06]	0.03 [-0.05, 0.12]	-0.22
I pay attention to healthy eating.	4.27 [4.15, 4.39]	**0.13** [0.04, 0.21]	0.00 [-0.08, 0.08]	0.00 [-0.08, 0.09]	0.03
I adapt my work day to my bio-rhythm.	3.74 [3.61, 3.87]	0.03 [-0.06, 0.12]	-0.01 [-0.09, 0.08]	0.03 [-0.05, 0.12]	-0.38
I integrate exercise into my work day.	3.51 [3.38, 3.64]	0.02 [-0.07, 0.11]	0.00 [-0.08, 0.08]	0.02 [-0.06, 0.11]	-0.24
I integrate outdoor activities into my work day.	3.44 [3.30, 3.58]	-0.01 [-0.10, 0.07]	-0.01 [-0.09, 0.07]	**0.09** [0.01, 0.18]	-0.51
I regularly take a "power nap".	1.96 [1.83, 2.08]	**-0.13** [-0.21, -0.04]	-0.08 [-0.17, 0.00]	0.01 [-0.07, 0.10]	0.01
Communicative (α = .78)	4.03 [3.89, 4.17]	**0.12** [0.03, 0.21]	-0.03 [-0.12, 0.06]	-0.01 [-0.09, 0.08]	0.29
Make arrangements (α = .82)	3.54 [3.39, 3.70]	0.09 [0.00, 0.18]	-0.03 [-0.12, 0.06]	-0.01 [-0.10, 0.08]	0.52
I make arrangements with household members facilitating undisturbed work.	4.51 [4.38, 4.64]	**0.17** [0.08, 0.26]	0.04 [-0.05, 0.12]	0.01 [-0.08, 0.10]	0.22
I make arrangements with colleagues/supervisors/my employer about when I can(not) be reached regarding work.	4.18 [4.04, 4.33]	0.08 [-0.01, 0.17]	-0.07 [-0.16, 0.01]	**-0.10** [-0.18, -0.01]	-0.35
I'll confront household members if agreements about work and leisure are violated.	3.79 [3.64, 3.95]	0.07 [-0.03, 0.16]	0.00 [-0.09, 0.09]	0.05 [-0.04, 0.14]	-0.09
I make arrangements with customers/clients about when I can(not) be reached regarding work.	3.66 [3.50, 3.82]	0.05 [-0.04, 0.14]	-0.04 [-0.13, 0.05]	-0.01 [-0.10, 0.07]	-0.07
I'll confront colleagues/supervisors/my employer if agreements about work and leisure are violated.	3.04 [2.89, 3.19]	**0.15** [0.06, 0.24]	-0.03 [-0.12, 0.06]	0.00 [-0.10, 0.09]	1.75
Household members make arrangements with me in order to limit my workload.	2.79 [2.64, 2.93]	0.04 [-0.05, 0.13]	-0.04 [-0.13, 0.05]	0.00 [-0.09, 0.09]	0.85
I'll confront clients/customers if agreements about work and leisure matters are violated.	2.61 [2.45, 2.77]	0.07 [-0.03, 0.17]	-0.03 [-0.13, 0.06]	0.03 [-0.06, 0.13]	1.35
Keep connection (α = .60)	4.46 [4.32, 4.59]	**0.15** [0.06, 0.24]	-0.03 [-0.12, 0.05]	0.00 [-0.09, 0.08]	0.05
I use various communication channels.	5.54 [5.47, 5.62]	**0.17** [0.08, 0.27]	0.03 [-0.06, 0.11]	-0.04 [-0.12, 0.04]	-0.97
I keep connected via technology to respond to colleagues/supervisors/my employer/customers/clients quickly.	5.42 [5.34, 5.50]	**0.20** [0.11, 0.29]	-0.01 [-0.09, 0.08]	0.04 [-0.05, 0.12]	-0.57
I make small talk with my colleagues/supervisors/my employer.	4.63 [4.52, 4.74]	**0.09** [0.00, 0.17]	-0.07 [-0.16, 0.02]	-0.03 [-0.11, 0.05]	-0.84
I communicate expectations and work progress with colleagues/supervisors/my employer.	4.20 [4.08, 4.33]	**0.21** [0.12, 0.29]	-0.05 [-0.14, 0.03]	0.03 [-0.05, 0.11]	0.96
I use modern communication technology with colleagues/supervisors/my employer such as instant messaging.	4.14 [3.97, 4.30]	**0.14** [0.05, 0.23]	**-0.10** [-0.19, -0.02]	0.03 [-0.05, 0.11]	0.32
I seek social interaction after work.	3.70 [3.58, 3.83]	**0.14** [0.05, 0.23]	0.05 [-0.04, 0.13]	-0.05 [-0.13, 0.03]	0.86
I use technology to stay in personal contact with colleagues.	3.54 [3.38, 3.69]	**0.10** [0.01, 0.19]	-0.05 [-0.14, 0.03]	-0.01 [-0.09, 0.08]	0.59

Note. T = telework strategy; BMP = boundary management preferences; TE = telework experience. β_T represents the main effect of the telework strategy on job performance. $\beta_{T \times BMP}$ represents the interaction effect between the telework strategy and boundary management preferences on job performance. $\beta_{T \times TE}$ represents the interaction effect between the telework strategy and telework experience on job performance. ΔM, β_T is based on the difference between the *z*-scaled mean implementation (M) and the z-scaled beta-coefficient on job performance (β_T) of the telework strategy. M, β_T, $\beta_{T \times BMP}$, and $\beta_{T \times TE}$ are reported with 95%-confidence intervals. Telework strategies in italics were recoded. Multiple regression results were controlled for age, gender, living space, and living with children.
Results in bold are significant at the $p \leq .05$ level.

Concerning the implementation of telework strategies (RQ 1), we found communicative telework strategies on average to be the most implemented ($\overline{M}$ = 4.03 [3.89, 4.17]), followed by physical ($\overline{M}$ = 3.95 [3.80, 4.10]), behavioral ($\overline{M}$ = 3.87 [3.73, 4.01]), and temporal ($\overline{M}$ = 3.61 [3.46, 3.76]) telework strategies. Zooming-in on the level of subcategories, telework strategies related to keep connection ($\overline{M}$ = 4.46 [4.32, 4.59]) and to conducive work attitude ($\overline{M}$ = 4.44, [4.32, 4.56]) were on average most implemented and more implemented than the telework strategies related to all remaining subcategories. To facilitate quickly grasping which specific telework strategies drive these effects, we ordered the telework strategies in Table 2.1 by the mean of implementation (from high to low) in their respective subcategory.

Concerning associations between the individual implementation of telework strategies and job performance (RQ 2), we found communicative ($\overline{\beta}$ = 0.12 [0.03, 0.21]) and behavioral ($\overline{\beta}$ = 0.10 [0.01, 0.19]) telework strategies on average to be positively associated. The average performance associations of telework strategies of the respective subcategories allow us to paint a more differentiated picture: Telework strategies related to keep connection ($\overline{\beta}$ = 0.15 [0.06, 0.24]; 7 of 7 composing telework strategies had significant βs) and to conducive work attitude ($\overline{\beta}$ = 0.19 [0.10, 0.27]; 7 of 9 composing telework strategies had significant βs) were on average positively associated with job performance driving the positive performance association of communicative and behavioral telework strategies, respectively. This pattern of results remained robust when applying alternative analytical approaches, that is, computing (factor analytically identified) scales for telework strategy subcategories averaging the implementation of the respective composing telework strategies per participant and simultaneously entering these scales into multiple linear regressions predicting job performance (see Appendix 2.B and Appendix 2.C).

Concerning the association between the telework strategies' average implementation and association with job performance (RQ 3.1), we found a positive correlation between the 85 means of the implementation of the telework strategies and the 85 β-coefficients of the telework strategies on job performance (r = .55 [.39, .69], $t(83) = 6.06$, $p < .001$). Concerning the divergence between the telework strategies' relative implementation from their relative association with job performance (RQ 3.2), we found positive averaged differences between a telework strategy's z-scaled implementation and a telework strategy's z-scaled β-coefficient on job performance for communicative ($\overline{\Delta}$ = 0.29) and behavioral ($\overline{\Delta}$ = 0.19) telework strategies, indicating that these categories' telework strategies in average had relative associations with job performance exceeding their relative implementations. As communicative and behavioral telework strategies were on average positively associated with job performance, the related

telework strategies might be on average considered under implemented. The higher resolved level of subcategories allows us to draw more nuanced inferences: Telework strategies related to keep connection and to conducive work attitude were the only subcategories on average positively associated with job performance, and thus, of most interest when identifying under implemented telework strategies. Here, we found telework strategies related to conducive work attitude showing on average large positive differences ($\overline{\Delta} = 0.46$), indicating that particularly these telework strategies might be seen as under implemented, whereas telework strategies related to keep connection had on average substantially less positive differences ($\overline{\Delta} = 0.05$). In comparison, we found the most negative averaged differences for temporal telework strategies ($\overline{\Delta} = -0.23$), driven by telework strategies related to temporal flexibility ($\overline{\Delta} = -0.57$), indicating that the related telework strategies on average had relative associations with job performance subceeding their relative implementations and might thus be considered over implemented.

Concerning the moderation effects of boundary management preferences (RQ 4.1) on the association between telework strategies and job performance, we found a positive interaction effect for a telework strategy related to temporal structure ("I do not work beyond my working hours agreed with the employer.", $\beta = 0.13$ [0.05, 0.22], $p = .002$**),** indicating that this telework strategy might be more suitable for separators. We found negative interaction effects for specific telework strategies related to temporal flexibility ("I am temporarily flexible in handling urgent work requests.", $\beta = -0.10$ [-0.19, -0.01], $p = .025$; "I schedule my leisure time in order to get the most of my work time.", $\beta = -0.08$ [-0.16, 0.00], $p = .050$)**,** keep connection ("I use modern communication technology with colleagues/supervisors/my employer such as instant messaging.", $\beta = -0.10$ [-0.19, -0.02], $p = .014$), conducive work environment ("I listen to music that helps me concentrate.", $\beta = 0.10$ [0.01, 0.18], $p = .028$), this telework strategy was recoded so that the interaction effect needs to be reversed), and conducive work attitude ("I value the benefits of working from home.", $\beta = -0.08$ [-0.17, 0.00], $p = .050$), indicating that these telework strategies might be more suitable for integrators.

Concerning the moderation effects of telework experience (RQ 4.2) on the association between telework strategies and job performance, we found positive interaction effects for specific telework strategies related to physical separation of work and leisure ("I regularly work outside my home.", $\beta = -0.12$ [-0.22, -0.02], $p = .015$, this telework strategy was recoded so that the interaction effect needs to be reversed), health-promoting measures ("I integrate outdoor activities into my work day.", $\beta = 0.09$ [0.01, 0.18], $p = .031$), and temporal flexibility ("I flexibly transfer my work to times when I typically attend to personal matters.", $\beta = 0.09$ [0.00, 0.18], $p = .044$), indicating that these telework strategies might be more suitable for experienced

teleworkers. We found negative interaction effects for specific telework strategies related to behavioral separation of work and leisure ("I maintain the same routines of my on-site work.", β = -0.22 [-0.30, -0.13], $p < .001$; "I do not read work-related messages after hours.", β = -0.14 [-0.23, -0.05], $p = .002$; "I do not respond to work-related messages after hours.", β = -0.14 [-0.23, -0.05], $p = .002$), temporal structure ("I strictly separate my work time from my leisure time." β = -0.14 [-0.22, -0.05], $p = .001$, "I have a set time routine for the transition from work to leisure.", β = -0.10 [-0.19, -0.02], $p = .016$; "I have a set time routine to start the workday in the morning.", β = -0.09 [-0.17, 0.00], $p = .043$), conducive work environment ("I wear comfortable clothes.", β = -0.10 [-0.19, -0.01], $p = .031$), make arrangements ("I make arrangements with colleagues/supervisors/my employer about when I can(not) be reached regarding work.", β = -0.10 [-0.18, -0.01], $p = .028$), temporal flexibility ("If my work is short on time, I'll 'save it up' to make up for it in the next days.", β = -0.10 [-0.18, -0.01], $p = .035$), conducive work attitude ("I set personal daily goals at work.", β = -0.09 [-0.18, -0.01], $p = .027$), and physical separation of work and leisure ("I arrange my workstation visually like a typical office.", β = -0.09 [-0.18, 0.00], $p = .041$), indicating that these telework strategies might be more suitable for unexperienced teleworkers.

Following up on this, we explored whether the telework strategies with significant interaction effects on job performance were implemented more by the group of teleworkers the interaction effect was in favor of (see Table 2.2). We therefore divided the sample into separators versus integrators and experienced versus unexperienced teleworkers, respectively, and computed two-sample *t*-tests concerning the implementation of the telework strategies with significant interaction effects. We divided the sample using the respective scale centers (3.50) as cut-off values. This led to a group of separators ($n = 288$, 54%) ranking themselves closer to the scale anchor indicating a preference for separation (> 3.50) versus a group of integrators ($n = 244$, 46%) ranking themselves closer to the scale anchor indicating a preference for integration (< 3.50). Likewise, we divided the sample into a group of experienced teleworkers ($n = 348$, 66%) ranking themselves closer to the scale anchor indicating high telework experience (> 3.50) versus a group of unexperienced teleworkers ($n = 176$, 34%) ranking themselves closer to the scale anchor indicating low telework experience (< 3.50). Of the 20 significant interaction effects, we found higher implementations by the group of teleworkers the respective interaction effect was in favor of for six interaction effects, whereas we found significant lower implementations by the group of teleworkers the respective interaction effect was in favor of for two interaction effects.

Table 2.2

Mean Value Differences of the Implementation of Telework Strategies With Significant Interaction Effects on Job Performance for Boundary Management Preferences and Telework Experience

	Separators		Integrators					
Telework strategies for boundary management preferences	*M*	*SD*	*M*	*SD*	Δ*M*	*t*	*df*	*p*
I do not work beyond my working hours agreed with the employer.	3.47	1.69	2.76	1.65	**0.70**	**4.80**	521	<.001
I value the benefits of working from home.	5.34	1.17	5.22	1.21	0.12	1.16	525	.25
I use modern communication technology with colleagues/supervisors/my employer such as instant messaging.	4.17	1.93	4.08	1.93	0.10	0.56	512	.58
I listen to music that helps me concentrate.	4.19	1.87	4.23	1.86	-0.04	-0.25	525	.80
I schedule my leisure time in order to get the most of my work time.	3.36	1.56	3.66	1.43	**-0.30**	**-2.29**	521	.022
I am temporally flexible in handling urgent work requests.	4.60	1.34	5.06	1.06	**-0.46**	**-4.37**	523	<.001
	Experienced		Unexperienced					
Telework strategies for telework experience	*M*	*SD*	*M*	*SD*	Δ*M*	*t*	*df*	*p*
I arrange my workstation visually like a typical office.	3.91	1.82	3.24	1.81	**0.67**	**3.95**	521	<.001
I flexibly transfer my work to times when I typically attend to personal matters.	2.82	1.55	2.38	1.40	**0.44**	**3.16**	517	.002
I set personal daily goals at work.	4.54	1.35	4.27	1.51	**0.27**	**2.10**	516	.037
I integrate outdoor activities into my work day.	3.52	1.66	3.28	1.69	0.23	1.51	522	.13
If my work is short on time, I'll "save it up" to make up for it in the next days.	3.70	1.63	3.55	1.76	0.15	0.92	471	.36
I make arrangements with colleagues/supervisors/my employer about when I can and cannot be reached regarding work matters.	4.22	1.69	4.13	1.71	0.09	0.58	511	.56
I wear comfortable clothes.	5.37	0.92	5.35	1.00	0.02	0.23	515	.82
I maintain the same routines of my on-site work.	4.24	1.50	4.23	1.45	0.01	0.09	509	.93
I have a set time routine to start the workday in the morning.	4.78	1.46	4.84	1.39	-0.05	-0.40	522	.69
I strictly separate my work time from my leisure time.	4.04	1.53	4.19	1.56	-0.15	-1.08	522	.28
I have a set time routine for the transition from work to leisure.	3.33	1.77	3.47	1.78	-0.15	-0.90	519	.37
I regularly work outside my home.	5.32	1.17	5.58	0.96	**-0.26**	**-2.72**	415	.007
I do not read work-related messages after hours.	3.17	1.90	3.49	1.96	-0.32	-1.80	521	.073
I do not respond to work-related messages after hours.	3.46	1.91	3.94	1.84	**-0.48**	**-2.76**	521	.006

Note. Δ*M* = mean value difference of the implementation of the telework strategy between separators and integrators/experienced and unexperienced teleworkers. The sample was divided into separators (n = 288, 54%) versus integrators (n = 244, 46%) using the scale center (3.50) of the variable boundary management preferences as cut-off value. The sample was divided into experienced (n = 348, 66%) versus unexperienced (n = 176, 34%) teleworkers using the scale center (3.50) of the variable telework experience as cut-off value. Telework strategies in italics were recoded. Telework strategies sorted by Δ*M* in descending order.
Δ*M* and *t*-values in bold are significant at the $p \leq .05$ level.

2.6 Discussion

Drawing from previous research and the popular media, we examined a comprehensive set of 85 highly resolved telework strategies in a sample of 548 teleworkers. We found that the most implemented telework strategies tend to be the ones most positively associated with job performance (RQ 3.1). These serve less the purpose of drawing boundaries between work- and private-life (e.g., Basile & Beauregard, 2016; Fonner & Stache, 2012) but rather purposes of working task-oriented and productively (e.g., Greer & Payne, 2014) by adopting a conducive work attitude and of keeping social contact (e.g., Kowalski & Swanson, 2005; Turetken et al., 2011) by using modern communication technology (RQ 1, 2). Taking the level of implementation into account, teleworkers might be particularly advised to implement telework strategies related to conducive work attitude (RQ 3.2). In alignment with P-E fit (Edwards, 2008; Kristof, 1996) and boundary congruence/fit approaches (Ammons, 2013; Kreiner, 2006), we found that separators tend to benefit from telework strategies establishing boundaries between work- and private-life, whereas integrators tend to benefit from telework strategies dismantling boundaries between work- and private-life (RQ 4.1). Likewise, experienced teleworkers tend to benefit from telework strategies providing flexibility, whereas unexperienced teleworkers tend to benefit from telework strategies providing structure (RQ 4.2).

2.6.1 Implementation of Telework Strategies

We found telework strategies related to keep connection and to conducive work attitude to be most implemented. Aligning this result with previous research, Greer and Payne (2014) and Troll et al. (2022) observed similar patterns. Greer and Payne (2014) found telework strategies related to “be accessible” and to “communicate with coworkers/supervisor” to be among high performing teleworkers’ most frequently mentioned telework strategies, matching our finding of telework strategies related to keep connection. They also found telework strategies related to “adopt a work-oriented mindset”, “be extra productive”, “plan tasks”, and “set goals and prioritize” to be commonly mentioned, matching our finding of telework strategies related to conducive work attitude. Troll et al. (2022) found telework strategies related to modifying social conditions to be frequently implemented, but they laid a specific focus on getting motivated by friends/colleagues to work productively not matching the core of our telework strategies related to keep connection. However, Troll et al. (2022) also found telework strategies related to autonomous motivation (motivating oneself to start and endure work tasks) being frequently implemented that overlap with telework strategies related to

conducive work attitude (e.g., practicing self-praise, showing dedication, reducing breaks to make progress).

It catches the eye that we found boundary related telework strategies to be less implemented than telework strategies related to keep connection and to conducive work attitude. This is remarkable because the largest proportion of research on telework strategies stems from boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996) transferring boundary management strategies to the telework context (Allen et al., 2021; Basile & Beauregard, 2016; Fonner & Stache, 2012; Haun et al., 2022; Kossek, 2016; Mustafa, 2010; Mustafa & Gold, 2013; Myrie & Daly, 2009; Nansen et al., 2010; Tietze, 2002; Tietze & Musson, 2003). Also in the popular media (e.g., Cobler, n.d.; Stross, n.d.; Westdeutsche Zeitung, 2020) boundary related telework strategies receive much attention. Due to boundary related telework strategies being in the spotlight, one might be tempted to conclude that these are the most implemented. In contrast, the present study suggests that it is valuable to complement telework strategies serving other goals such as keeping social contact (Golden & Raghuram, 2010; Ilozor et al., 2001; Kowalski & Swanson, 2005; Mann et al., 2000; Turetken et al., 2011), and working task-oriented and productively (Greer & Payne, 2014; Troll et al., 2021) to paint a comprehensive picture of telework strategies' implementation.

2.6.2 Associations Between Telework Strategies and Job Performance

Responding to multiple calls for research on the effectiveness of boundary management strategies (Binnewies et al., 2020) and telework strategies (Allen et al., 2021; Rudolph et al., 2021), we found telework strategies related to conducive work attitude (driven by showing dedication, adjusting behavior and attitude to focus, strengthening the supervisors' confidence in the own work quality, getting organized, setting goals, practicing self-praise, and valuing telework benefits) and to keep connection (driven by communicating expectations and work progress, keeping connected via technology, using various communication channels, seeking social interaction after work, using modern communication technology, and using technology to stay in personal contact with colleagues) being positively associated with job performance. These results fit with high performers' implemented telework strategies: Greer and Payne (2014) found "adopt a work-oriented mindset", "be extra productive", "plan tasks", and "set goals and prioritize" as well as "be accessible" and "communicate with coworkers/supervisor"

to be commonly mentioned.[3] Troll et al. (2021) found telework strategies related to autonomous motivation to predict job performance, matching our finding of a positive association between telework strategies related to conducive work attitude and job performance.[4,5] Finally, our finding of telework strategies related to keep connection being positively associated with job performance might be aligned with MRT (Daft & Lengel, 1986) and goes well with Turetken et al.'s (2011) finding of communication media richness predicting teleworkers' job performance.

We found telework strategies related to conducive work attitude and to keep connection to be positively associated with job performance, whereas boundary related telework strategies were less associated with job performance. On the one hand, this is in line with Kossek et al. (2006), who found the global implementation of boundary related telework strategies not being associated with job performance. On the other hand, this is striking because boundary related telework strategies are regularly referred to as "best-practice" (Golden, 2021) and proposed to foster productive teleworking in the popular media (e.g., Prophet, 2017; Schulz, 2022). The young literature on telework strategies might profit from complementing telework strategies serving goals of working task-oriented and productively, and keeping social contact when examining telework strategies' impacts on work outcomes and deriving practical recommendations.

[3] Greer and Payne (2014) also found telework strategies related to "use advanced technologies" (i.e., establishing a technological setup at home close to the on-site setup) being frequently mentioned by high performing teleworkers for which no separate subcategory emerged in the present study. However, we found the single related telework strategy "I use a setup that is technically close to the setup at my on-site workstation." to be positively associated with job performance in the present study matching Greer and Payne's (2014) initial findings.

[4] However, whereas Troll et al. (2021) did not find goal-setting related self-control strategies (i.e., setting goals and deadlines, making to-do-lists) to be a unique predictor of job performance, goal-setting related telework strategies (e.g., setting goals, getting organized) were part of the subcategory conducive work attitude associated with job performance in the present study. A reason for the divergent findings might be controlling for other sets of self-control strategies in Troll et al. (2021). We also controlled for other subcategories of telework strategies in our supplemental analyses (see Appendix 2.B and Appendix 2.C) and found the same pattern of results reported in the main paper. However, in the present study, goal-setting related telework strategies were integrated into the subcategory conducive work attitude. Thus, in the present study, goal-setting related telework strategies were not controlled for telework strategies related to conducive work attitude, whereas in Troll et al. (2021) goal-setting related self-control strategies were controlled for self-control strategies related to autonomous motivation. Indeed, Troll et al. (2021) found positive bivariate correlations between goal-setting related self-control strategies and job performance.

[5] The second set of self-control strategies identified as unique predictor of job performance in Troll et al. (2021) were strategies related to somatic condition (i.e., optimizing the physical state to work productively, for instance, through sufficient sleep, coffee consumption, wearing fresh clothes). Self-control strategies related to somatic condition were most similar to the present study's telework strategies related to health-promoting measures (e.g., adapting work-day to bio-rhythm, eating healthy) for which we did not find a positive association with job performance. Future research might pick up on these divergent results and more closely examine impacts of telework strategies related to altering the somatic condition/health-promoting measures on job performance.

2.6.3 Divergences Between Telework Strategies' Implementation and Association With Job Performance

The present study is the first to quantitatively examine a large number of telework strategies on a highly resolved level, which enabled us to suggest that telework strategies more positively associated with job performance tend to be implemented more often. Thus, it seems that teleworkers have an intuitive understanding of the telework strategies important to job performance and tend to implement them accordingly. However, there were also telework strategies with substantial divergence s in terms of their relative association with job performance and their relative implementation enabling us to derive initial fine-grained practical recommendations. We identified telework strategies related to conducive work attitude (driven by showing dedication, practicing self-praise, and adjusting attitude and behavior to focus) to be under implemented. In comparison, telework strategies related to keep connection were more implemented and less associated with job performance, leading to a smaller divergence. Thus, taking the current level of implementation into account, teleworkers might be advised to pay particular attention to implementing telework strategies related to conducive work attitude. Concerning telework strategies for which their relative association with job performance subceeded their relative implementation, we particularly found telework strategies related to temporal flexibility being over implemented (driven by transferring personal matters to work times, scheduling work time to get the most of leisure time, banking work times), so that teleworkers might be advised to reduce their implementation.

2.6.4 Moderating Influences of Boundary Management Preferences and Telework Experience

Following P-E fit approaches (preferences/needs-supply fit; Edwards, 2008; Kristof, 1996) and specific approaches related to boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996), that is, the boundary congruence approach (Kreiner, 2006) and the boundary fit approach (Ammons, 2013), telework strategies congruent with individual boundary management preferences might be particularly beneficial to job performance as a fit between individual preferences and needs (boundary management preferences) and environmental boundary influences/boundary enactments (telework strategies) is achieved. Indeed, we found a telework strategy aligned to separating work- and private-life (i.e., not working beyond agreed hours) being more beneficial to job performance for separators. In comparison, we found telework strategies aligned to integrating work- and private-life (i.e., flexibly handling urgent work requests and scheduling leisure time to get the most of the work time) being more beneficial to job performance for integrators. We also identified three further telework strategies particularly

beneficial to integrators that might align with a preference for integrating work- and private-life. First, using modern communication technology such as instant messaging might blur the borders between work- and private-life due to being continuously accessible for work matters. Second, listening to music that helps to concentrate might be seen as mingling a typical leisure activity with work. Third, valuing the benefits of telework might be particularly beneficial to integrators as many benefits of teleworking are aligned to a better integration of work- and private-life due to enhanced flexibility.

Concerning moderating influences of telework experience, we found two telework strategies related to spatial flexibility (i.e., working outside from home, for instance, in a café and integrating outdoor activities into the workday) and one telework strategy related to temporal flexibility (i.e., flexibly transferring work to times when typically attending personal matters) being more beneficial to job performance for experienced teleworkers. In comparison, we found mainly telework strategies related to establishing routines (i.e., maintaining the routines of the on-site work, establishing routines to start and to end the work day, setting daily goals) and to adhering to work/non-work rules (i.e., strictly separating work and leisure time, not reading/responding to work messages after hours, making arrangements about when (not) to be reached regarding work) being more beneficial to job performance for unexperienced teleworkers. Thus, following the P-E fit approach (Edwards, 2008; Kristof, 1996), it seems that telework strategies related to flexibility might rather meet the preferences and needs of experienced teleworkers that might desire and be able to handle alternation resulting in a more positive association with job performance. In comparison, telework strategies related to establishing routines and work/non-work rules might rather meet the preferences and needs of unexperienced teleworkers that might desire and need structure resulting in a more positive association with job performance.

Overall, in the present study, we identified the effects of P-E fit on job performance, whereas previous research in the context of boundary congruence/fit (Ammons, 2013; Kreiner, 2006) rather focused on outcomes such as work-family-conflict, job satisfaction, commitment, and recovery (see Chen et al., 2009; Haun et al., 2022; Kreiner, 2006; Rothbard et al., 2005). The pattern of results underlined the utility of transferring P-E fit, in particular, boundary congruence/fit, to telework contexts to paint a differentiated picture of telework strategies' effectiveness depending on teleworkers' individual preferences and needs.

2.6.5 Theoretical Implications

The present study sheds light on the puzzling impacts of individual telework strategies, an under-explored field of research that is not yet well-anchored in the scientific literature.

Whereas most previous studies have focused on telework strategies aligned to establishing/dismantling boundaries between work- and private-life in the tradition of boundary theory (Ashforth et al., 2000; Nippert-Eng, 1996), the present results suggest that the young field of research on telework strategies might profit from expanding this narrow focus. In particular, we demonstrate that teleworkers rather tend to implement telework strategies serving goals such as working task-oriented and productively (e.g., Greer & Payne) as well as keeping social contact (e.g., Kowalski & Swanson, 2005). Even more so, these telework strategies were most decisive for job performance. Thus, future research on telework strategies could progress by adopting a broader focus on telework strategies serving divergent goals to understand more comprehensively telework strategies' enigmatic impacts on various (tele-) work outcomes. The present study also contributes to the literature by demonstrating that applying the P-E fit framework (Edwards, 2008; Kristof, 1996) to the telework context helps to unravel the differential impacts of telework strategies when considering teleworkers' individual preferences and needs. We did not find a one-fits-all solution to effective telework strategies uniformly applying to all teleworkers. The present findings rather suggest that the effectiveness of many telework strategies depends on teleworkers' individual boundary management preferences and experience with working from home. Thus, marrying the literature streams of P-E fit, in particular boundary congruence/fit (Ammons, 2013; Kreiner, 2006), and telework strategies seems to be another promising avenue for future research to advance progress in this nascent research field.

2.6.6 Organizational Implications

Whereas there are plenty of recommendations for implementing individual telework strategies spread throughout the popular media, the scientific literature still lags behind in providing empirical evidence on telework strategies' effectiveness (Allen et al., 2021; Rudolph et al., 2021; see also Binnewies et al., 2020). The present study aims to fill this gap and delivers reassuring results on the implementation of commonly circulating telework strategies: In general, teleworkers seem to have an intuitive understanding of which telework strategies are effective. That is, teleworkers tend to implement telework strategies more often that are more positively associated with job performance. However, we still found telework strategies related to adopting a conducive work attitude (e.g., practicing self-praise) to be less implemented than they probably should be according to their strong association with job performance. If verified in future confirmatory research, organizations might pick up on these findings by taking measures to educate teleworkers about effective telework strategies, especially those that are yet poorly implemented. On the other side, we also identified telework strategies for which

organizations might be advised to take measures to educate their teleworkers to implement them less. In particular, we found telework strategies related to temporal flexibility (e.g., transferring personal matters to work times) to be implemented more often than they probably should be based on their low or even negative association with job performance. However, organizations need to consider that the implementation of telework strategies may not always be a matter of choice. Real-life circumstances can occasionally hinder teleworkers from implementing effective strategies and from avoiding ineffective strategies. For instance, during the COVID-19 pandemic, many teleworkers have been affected by sudden school and daycare closures due to lockdown measures to limit the spread of the pandemic. Thus, many teleworkers might have had to switch flexibly between work requests and demands spilling over from their private-life (e.g., taking care of the children). Organizations might therefore also try to anticipate potential reasons (e.g., lack of childcare) for implementing less conducive telework strategies (e.g., transferring personal matters to work times) and to take action to mitigate these reasons (e.g., organizations might offer (virtual) childcare programs). Finally, organizations may adopt measures to identify groups of employees sharing common characteristics critical to the effectiveness of telework strategies and tailor advice (e.g., via organizational e-mail newsletters) or trainings educating about effective telework strategies to employees' individual preferences and needs. This is particularly intriguing in situations such as the COVID-19 pandemic in which employees may be urged to telework considering themselves not prepared to do so (e.g., separators and unexperienced teleworkers).

2.6.7 Limitations and Directions for Future Research

First, due to the cross-sectional design, we cannot draw causal inferences, that is, we can only demonstrate which telework strategies are associated with job performance, but this does not imply that the telework strategies cause between person differences in job performance. We thus suggest future research to apply longitudinal research designs (e.g., experience sampling/daily diary methods, Larson & Csikszentmihalyi, 2014; structural equation modeling approaches to cross-lagged panel models, Hamaker et al., 2015) to examine the directional impacts telework strategies and job performance have on one another over time. We also encourage future research to adopt (quasi-) experimental designs, for instance, to examine a training intervention in a pre-post control group design monitoring the implementation of telework strategies and job performance after the training (see also Binnewies et al., 2020; Rexroth et al., 2016). This could also demonstrate telework strategies' trainability with practical implications for teleworkers that might be able to learn to telework productively by applying effective telework strategies. Against the background of ongoing change processes of work in

the digital age, such as technological advances and increasing flexibility of working time and space, particularly online training interventions might be a promising starting point to do so (see Rexroth et al., 2017).

Second, our data is based on self-reports assessed at one measurement time point, which may have introduced common-method bias (CMB; Podsakoff et al., 2012). However, CMB does not always compromise results. For instance, in the present study, despite the large sample size, the majority of telework strategies did not show significant associations with job performance, which should have been the case, if CMB was a severe problem (Spector, 2006). Also CMB is less of a problem in regression models with multiple predictors and when testing interaction effects (Siemsen et al., 2010). Nevertheless, we suggest future research to assess telework outcomes such as job performance with multiple independent, objective indicators (e.g., supervisor/coworker ratings, customer satisfaction, objective records such as the number of claims processed). Also, telework strategies might be assessed through acquaintance reports (e.g., household members, coworkers). Measuring the implementation of telework strategies and telework outcomes at different time points would be a further approach to mitigate CMB.

Third, the directionality of boundary related telework strategies (see Allen et al., 2014; Hecht & Allen, 2009; Wepfer et al., 2018) might be considered, that is, telework strategies can either be geared toward keeping private matters out of work (versus integrating) or toward keeping work out of private matters (versus integrating). In our study, we summarized findings of telework strategies related to both boundary management directions as both indicate a separation/integration of work- and private-life. However, telework strategies with a different directionality might differentially impact work outcomes. Such a differentiated pattern might be masked because divergent effects might cancel each other out. Indeed, for some telework strategies, we observed a pattern that might provide initial support for this notion (however, this pattern does not apply uniformly to all concerned telework strategies requiring to draw conclusions with caution): We found rather positive performance associations for telework strategies geared to keeping private matters out of work (e.g., avoiding to read non-work related material at work, attending to personal matters only during breaks), whereas we found rather zero performance associations for telework strategies geared to keeping work out of private matters (e.g., not going back to work after hours, not reading/responding to work-related messages/calls after hours). Future research should consider telework strategies' boundary management directionality to examine potential divergent effects on telework outcomes.

Fourth, the lack of associations of boundary related telework strategies with job performance does not imply that they do not have other positive effects. Quite the opposite,

these telework strategies are likely to have various positive effects, particularly when it comes to outcomes such as reduced stress, well-being, and satisfaction (Binnewies et al., 2020; Haun et al., 2022). It should also be considered that telework strategies that have been found to be positively associated with job performance in the present study (e.g., scheduling leisure time to get the most out of work time) could have detrimental effects on other outcomes such as stress and well-being. Future research will profit from examining the effects of telework strategies on a broad set of telework outcomes to draw a differentiated picture of telework strategies' various impacts.

Fifth, in the present study, we focused on boundary management preferences and telework experience as two important individual characteristics of teleworkers that had a moderating influence on the relationship between telework strategies and job performance. Future research could examine other individual characteristics that might affect the effectiveness of telework strategies. This would contribute to a more nuanced understanding of the puzzling effects of telework strategies on (tele-) work outcomes. For instance, whereas teleworkers' personality traits such as extraversion and conscientiousness have already been shown to directly affect telework outcomes (O'Neill et al., 2009), little is known about their moderating effects. For example, it may be that extraverted teleworkers suffer particularly from social isolation (especially during times of pandemic), so they could benefit from implementing communicative telework strategies related to keep connection, such as engaging in virtual small talk with colleagues. Similarly, teleworkers with low conscientiousness might particularly benefit from telework strategies that help to maintain a clear daily structure, such as adhering to fixed work/non-work hours. However, these moderating factors are not limited to the individual characteristics of the teleworker but may also represent broader situational factors. For example, whereas we found that most boundary related telework strategies do not positively impact job performance, this could change when children are at home. In light of the lockdown measures during the COVID-19 pandemic, many teleworkers may have faced this situation. In these cases, for example, physical telework strategies related to physical separation of work and leisure, such as working in a separate room, could be beneficial because they may facilitate undisturbed work. A better understanding of the moderating factors that influence the relationship between telework strategies and (tele-) work outcomes could have immediate practical implications for organizations to tailor advice on telework strategies to employees' individual characteristics and situational circumstances.

Sixth, in the present study, we applied a P-E fit approach (Edwards, 2008; Kristof, 1996) to a teleworker sample, which stands out due to teleworkers having great latitude to self-adjust

various work environmental aspects (in contrast to stationary on-site workers). It might be an exciting future research topic to examine whether performance differences between teleworker and non-teleworker samples (Gajendran & Harrison, 2007) might (to some extent) be driven by enhanced P-E fit in telework contexts, in which teleworkers are empowered to self-adjust their working environment in a way that corresponds to their individual preferences and needs. Indeed, we found initial indications that teleworkers to some extent successfully customize their telework environment. For example, whereas we found separators to profit more from not working beyond their agreed working hours, we also found separators to implement this telework strategy more. Likewise, whereas we found integrators to profit more from being temporally flexible in handling urgent work requests and from scheduling their leisure time to get the most out of their work time, we also found integrators to implement these telework strategies more. Future confirmatory research could build on these exploratory findings.

Seventh, future research would profit from establishing a mutually accepted taxonomy of telework strategies by deriving theoretically sound dimensions of telework strategies and testing these with factor analytical or structural equation modeling procedures. A self-report questionnaire might be developed to measure the implementation of telework strategies meeting psychometric test properties. In particular, future research in this vein should make efforts to demonstrate that such a test actually measures the dimensions of telework strategies that it is claimed to measure, that is demonstrating construct validity (Badenes-Ribera et al., 2020). This would ensure that researchers use terms consistently and increase the comparability of research findings streamlining progress in this nascent research field.

Finally, we would like to emphasize the Northern European cultural context of our study, which is likely to have affected the individual ways in which participants organized their work processes from home. The cultural context has a strong influence on work-related values and norms (e.g., Hofstede, 1984; Schwartz, 1999), which also affect telework constellations (e.g., Adamovic, 2022; Peters & den Dulk, 2003). In addition, there have been cross-cultural differences in pandemic related measures to limit the spreading of the COVID-19 virus (e.g., imposing lockdowns; Bajaj et al., 2021) and in individuals' psychological responses to the COVID-19 pandemic (Yap et al., 2021), which may have caused further cross-cultural differences in the adoption of telework strategies. We therefore suggest future research to address cross-cultural similarities and differences in the way teleworkers organize their work processes.

2.7 Conclusion

This study contributes to the young literature on telework strategies by demonstrating that extending a narrow focus on telework strategies stemming from boundary theory seems to be a fruitful avenue for research illuminating the puzzling impacts of the individual ways in which teleworkers organize their work processes. In particular, future research would profit from complementing telework strategies aligned to working task-oriented and productively by adopting a conducive work attitude and to keeping social contact by using modern communication technology. Also, taking a P-E fit perspective appears to be a promising approach to paint a more fine-grained picture of telework strategies' differential impacts on work outcomes by taking teleworkers' individual preferences and needs into account.

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Appendix 2.A

Table 2.1A

Standard Deviations of the Implementation of Telework Strategies, Bivariate Correlations Between Telework Strategies and Job Performance, and Supplemental Results to the Multiple Linear Regressions Predicting Job Performance in the Main Paper

Encoding	SD_{Imp}	$r_{Imp, JP}$	*p*	β_0	*p*	β_{BMP}	*p*	β_{TE}	*p*	β_{Age}	*p*	β_{Gender}	*p*	β_{Space}	*p*	$\beta_{Children}$	*p*	R^2	$R^2_{Adj.}$	*F*	*p*
P_	1.62	.07		-0.03		0.00		**0.20**		0.02		0.01		-0.02		0.09					
P_PSWL	1.75	.06		-0.03		-0.01		**0.20**		0.02		0.01		-0.02		0.09					
P_PSWL_1_r	1.14	.02	.63	-0.05	.41	-0.01	.80	**0.23**	<.001	0.02	.72	0.01	.95	-0.02	.71	0.09	.42	**.06**	**.04**	**3.63**	<.001
P_PSWL_2	1.73	**.11**	.009	-0.01	.89	-0.02	.62	**0.19**	<.001	0.02	.68	0.01	.87	-0.02	.75	0.05	.66	**.06**	**.04**	**3.27**	<.001
P_PSWL_3_r	1.66	.06	.17	-0.03	.63	-0.01	.82	**0.22**	<.001	0.02	.72	-0.02	.85	-0.02	.67	0.12	.30	**.05**	**.04**	**3.16**	<.001
P_PSWL_4	1.63	**.13**	.002	-0.04	.50	-0.02	.73	**0.20**	<.001	0.00	.97	0.02	.84	-0.03	.61	0.13	.24	**.06**	**.05**	**3.76**	<.001
P_PSWL_5	1.71	.07	.093	-0.03	.63	-0.01	.83	**0.20**	<.001	0.02	.69	0.03	.75	-0.03	.52	0.10	.36	**.05**	**.04**	**3.15**	.001
P_PSWL_6	1.84	.07	.085	0.00	.95	0.00	.99	**0.19**	<.001	0.03	.60	0.00	.99	-0.03	.59	0.09	.44	**.06**	**.04**	**3.35**	<.001
P_PSWL_7	2.02	.05	.23	-0.03	.65	0.00	.92	**0.20**	<.001	0.02	.63	0.01	.92	-0.02	.67	0.09	.41	**.05**	**.03**	**2.70**	.004
P_PSWL_8	1.74	**.11**	.013	-0.01	.82	-0.03	.57	**0.20**	<.001	0.01	.91	0.01	.89	-0.03	.53	0.09	.41	**.06**	**.04**	**3.49**	<.001
P_PSWL_9	2.01	.02	.69	-0.02	.77	0.01	.90	**0.20**	<.001	0.03	.53	0.01	.95	-0.01	.82	0.08	.48	**.04**	**.03**	**2.61**	.006
P_PSWL_10	2.18	.04	.37	-0.03	.67	0.01	.90	**0.20**	<.001	0.02	.66	0.01	.91	-0.01	.79	0.09	.42	**.05**	**.03**	**2.68**	.005
P_PSWL_11	1.71	.05	.30	-0.01	.83	0.01	.89	**0.20**	<.001	0.01	.82	0.01	.94	-0.01	.81	0.09	.42	**.05**	**.03**	**2.91**	.002
P_PSWL_12	1.62	.04	.38	-0.04	.57	0.01	.88	**0.20**	<.001	0.02	.72	0.02	.85	-0.01	.84	0.10	.35	**.05**	**.04**	**3.08**	.001
P_CWE	1.48	.08		-0.03		0.00		**0.20**		0.02		0.01		-0.02		0.09					
P_CWE_1	0.95	**.11**	.01	-0.01	.89	0.00	.95	**0.19**	<.001	0.02	.75	0.01	.95	-0.01	.81	0.07	.51	**.06**	**.04**	**3.38**	<.001
P_CWE_2	0.94	**.15**	<.001	-0.02	.70	0.01	.77	**0.21**	<.001	0.00	.94	0.01	.87	-0.01	.89	0.10	.36	**.07**	**.06**	**4.37**	<.001
P_CWE_3	1.25	.04	.40	-0.02	.79	0.00	.96	**0.20**	<.001	0.03	.59	0.01	.93	-0.01	.81	0.10	.39	**.05**	**.03**	**2.78**	.003
P_CWE_4	1.46	.16	<.001	-0.03	.68	0.00	.97	**0.17**	<.001	0.00	.99	-0.02	.80	-0.03	.56	0.08	.46	**.07**	**.05**	**4.14**	<.001
P_CWE_5	1.42	**.17**	<.001	-0.04	.48	-0.01	.82	**0.17**	<.001	0.02	.74	0.01	.95	-0.04	.42	0.11	.32	**.08**	**.06**	**4.47**	<.001
P_CWE_6_r	1.85	.05	.23	-0.03	.59	0.01	.88	**0.22**	<.001	0.02	.74	0.03	.79	-0.01	.87	0.10	.38	**.06**	**.04**	**3.47**	<.001
P_CWE_7	1.79	.05	.23	-0.01	.83	0.01	.88	**0.20**	<.001	0.02	.65	0.00	.96	-0.02	.76	0.08	.47	**.05**	**.03**	**2.63**	.006
P_CWE_8	1.61	.05	.24	-0.05	.43	0.00	.98	**0.20**	<.001	0.02	.62	0.05	.63	-0.02	.71	0.11	.34	**.05**	**.03**	**2.93**	.002
P_CWE_9	1.64	.04	.33	-0.03	.68	0.00	.97	**0.20**	<.001	0.02	.65	0.02	.83	-0.02	.76	0.10	.39	**.05**	**.03**	**2.80**	.003
P_CWE_10	1.83	-.02	.62	-0.03	.59	0.00	.93	**0.20**	<.001	0.03	.53	0.02	.84	-0.02	.73	0.10	.38	**.05**	**.03**	**2.98**	.002
P_CWE_11	1.48	**.10**	.018	-0.04	.48	-0.02	.72	**0.20**	<.001	0.00	.98	0.04	.67	-0.01	.86	0.10	.37	**.06**	**.04**	**3.47**	<.001
T_	1.62	.03		-0.04		-0.01		**0.20**		**0.02**		0.02		-0.01		0.09					
T_TS	1.70	.04		-0.04		-0.02		**0.20**		0.02		0.02		-0.01		0.09					
T_TS_1	1.42	.03	.53	-0.02	.76	0.00	.99	**0.20**	<.001	0.02	.63	0.03	.75	-0.01	.84	0.08	.48	**.05**	**.04**	**3.21**	<.001
T_TS_2	1.38	**.17**	<.001	-0.01	.82	-0.04	.36	**0.20**	<.001	0.00	.94	0.02	.81	-0.01	.80	0.09	.42	**.08**	**.07**	**5.03**	<.001

Encoding	SD_{Imp}	$r_{Imp, JP}$	p	β_0	p	β_{BMP}	p	β_{TE}	p	β_{Age}	p	β_{Gender}	p	β_{Space}	p	$\beta_{Children}$	p	R^2	$R^2_{Adj.}$	F	p
T_TS_3	1.70	**.12**	.007	-0.04	.56	-0.02	.61	**0.18**	<.001	0.02	.71	0.03	.79	0.00	.96	0.07	.54	**.05**	**.03**	**2.76**	.004
T_TS_4	2.09	**.10**	.022	-0.07	.28	-0.03	.51	**0.20**	<.001	0.01	.89	0.05	.58	-0.01	.89	0.10	.38	**.07**	**.05**	**3.95**	<.001
T_TS_5	1.54	**.15**	<.001	-0.04	.55	-0.09	.064	**0.22**	<.001	-0.03	.53	0.01	.88	-0.01	.83	0.09	.38	**.10**	**.08**	**6.03**	<.001
T_TS_6	2.06	.03	.56	-0.03	.64	-0.01	.91	**0.19**	<.001	0.04	.41	0.02	.85	0.00	.94	0.08	.48	**.05**	**.03**	**2.68**	.005
T_TS_7	1.76	-.04	.39	-0.02	.75	0.02	.74	**0.20**	<.001	0.03	.52	0.02	.85	-0.01	.81	0.08	.45	**.05**	**.03**	**2.73**	.004
T_TS_8	1.78	.01	.78	-0.03	.62	0.00	.98	**0.21**	<.001	0.03	.60	0.02	.86	-0.03	.63	0.10	.35	**.06**	**.04**	**3.39**	<.001
T_TS_9	1.71	-.04	.41	-0.05	.41	-0.01	.82	**0.20**	<.001	0.03	.52	-0.01	.91	-0.03	.56	0.13	.24	**.07**	**.05**	**4.04**	<.001
T_TS_10	1.90	.02	.74	-0.05	.44	-0.01	.76	**0.19**	<.001	0.04	.47	0.04	.68	-0.02	.71	0.12	.30	**.04**	**.03**	**2.37**	.013
T_TS_11	1.62	-.02	.61	-0.05	.39	0.01	.91	**0.20**	<.001	0.03	.58	0.00	.97	-0.01	.81	0.09	.40	**.05**	**.04**	**3.05**	.001
T_TS_12	1.44	-.04	.41	-0.04	.56	0.01	.76	**0.21**	<.001	0.03	.56	0.02	.80	-0.03	.60	0.10	.37	**.05**	**.03**	**2.76**	.004
T_TF	1.50	.00		-0.04		0.01		**0.21**		0.01		0.01		-0.01		0.09					
T_TF_1	1.26	.07	.10	-0.03	.60	0.03	.52	**0.20**	<.001	0.02	.67	-0.01	.90	-0.01	.83	0.08	.49	**.06**	**.04**	**3.35**	<.001
T_TF_2	1.46	-.03	.57	-0.02	.72	0.02	.73	**0.20**	<.001	0.02	.74	0.01	.92	-0.02	.77	0.10	.39	**.05**	**.03**	**2.65**	.005
T_TF_3	1.67	-.04	.36	-0.04	.59	0.01	.87	**0.22**	<.001	0.00	.98	0.01	.95	0.00	.96	0.12	.31	**.06**	**.04**	**3.37**	<.001
T_TF_4	1.50	**.15**	<.001	-0.05	.41	0.04	.34	**0.20**	<.001	0.02	.64	0.04	.71	-0.02	.76	0.12	.29	**.08**	**.06**	**4.44**	<.001
T_TF_5	1.57	**-.13**	.004	-0.03	.62	-0.02	.60	**0.22**	<.001	-0.01	.90	0.03	.75	-0.01	.86	0.07	.53	**.06**	**.05**	**3.78**	<.001
T_TF_6	1.52	-.01	.89	-0.02	.81	0.02	.71	**0.23**	<.001	-0.01	.89	0.01	.90	0.00	.99	0.07	.53	**.06**	**.04**	**3.09**	.001
T_TF_7	1.52	-.02	.63	-0.07	.30	-0.02	.75	**0.21**	<.001	0.01	.88	0.00	.99	0.00	.95	0.11	.31	**.05**	**.04**	**3.15**	.001
B_	1.53	**.10**		-0.04		-0.01		**0.20**		0.02		0.03		-0.01		0.08					
B_BSWL	1.65	.06		-0.04		-0.02		**0.21**		0.01		0.02		-0.01		0.07					
B_BSWL_1	1.30	**.14**	.001	-0.02	.79	-0.03	.55	**0.20**	<.001	-0.01	.86	0.03	.74	0.00	.97	0.04	.69	**.07**	**.06**	**4.28**	<.001
B_BSWL_2	1.52	**.11**	.012	-0.05	.47	-0.04	.36	**0.20**	<.001	0.01	.85	0.03	.74	-0.01	.86	0.08	.49	**.06**	**.04**	**3.61**	<.001
B_BSWL_3	1.48	**.19**	<.001	-0.05	.37	-0.08	.078	**0.21**	<.001	-0.03	.48	0.11	.24	-0.03	.53	0.10	.36	**.13**	**.11**	**8.04**	<.001
B_BSWL_4	1.56	**.16**	<.001	-0.04	.54	-0.02	.61	**0.19**	<.001	-0.01	.89	0.07	.44	-0.02	.65	0.05	.63	**.07**	**.05**	**3.97**	<.001
B_BSWL_5	1.60	**.15**	<.001	-0.07	.29	-0.02	.58	**0.21**	<.001	-0.02	.64	0.06	.51	-0.04	.47	0.11	.30	**.08**	**.06**	**4.60**	<.001
B_BSWL_6	1.93	-.03	.53	-0.03	.60	0.01	.78	**0.20**	<.001	0.02	.66	0.00	.97	-0.01	.81	0.09	.40	**.05**	**.03**	**2.84**	.003
B_BSWL_7	1.90	-.02	.67	-0.04	.54	0.01	.85	**0.21**	<.001	0.02	.65	0.00	.96	0.00	.93	0.07	.54	**.06**	**.05**	**3.72**	<.001
B_BSWL_8	1.73	**.16**	<.001	-0.04	.52	-0.04	.41	**0.21**	<.001	0.01	.77	-0.02	.83	0.00	.95	0.03	.75	**.08**	**.06**	**4.50**	<.001
B_BSWL_9	1.76	**.11**	.012	-0.01	.82	-0.02	.64	**0.20**	<.001	0.03	.60	-0.01	.88	0.00	.99	0.05	.67	**.06**	**.04**	**3.11**	.001
B_BSWL_10	1.74	.01	.74	-0.04	.49	-0.01	.87	**0.21**	<.001	0.02	.66	-0.01	.93	-0.01	.86	0.08	.47	**.05**	**.04**	**3.13**	.001
B_BSWL_11	1.62	-.04	.40	-0.01	.91	0.01	.90	**0.19**	<.001	0.04	.45	0.00	.98	-0.01	.87	0.07	.54	**.05**	**.03**	**2.60**	.006
B_BSWL_12	1.92	.01	.90	-0.03	.60	0.00	.96	**0.22**	<.001	0.02	.69	0.00	.96	-0.02	.71	0.07	.52	**.06**	**.05**	**3.82**	<.001
B_BSWL_13	1.70	.03	.45	-0.04	.53	0.00	.93	**0.20**	<.001	0.03	.51	0.02	.85	-0.02	.72	0.07	.50	**.05**	**.03**	**2.98**	.002
B_BSWL_14	1.53	.01	.90	-0.03	.64	0.00	.96	**0.21**	<.001	0.01	.76	0.02	.85	-0.01	.87	0.08	.45	**.05**	**.03**	**2.84**	.003
B_BSWL_15	1.44	-.01	.74	-0.02	.69	0.01	.88	**0.21**	<.001	0.04	.45	0.02	.82	-0.02	.70	0.06	.60	**.05**	**.03**	**2.85**	.003
B_CWA	1.35	**.20**		-0.04		0.00		**0.18**		0.01		0.05		-0.02		0.08					
B_CWA_1	1.20	**.15**	<.001	-0.02	.79	0.00	.93	**0.18**	<.001	0.04	.42	0.02	.84	0.00	.97	0.07	.52	**.07**	**.05**	**3.92**	<.001

Encoding	SD_{Imp}	$r_{Imp, JP}$	p	β_0	p	β_{BMP}	p	β_{TE}	p	β_{Age}	p	β_{Gender}	p	β_{Space}	p	$\beta_{Children}$	p	R^2	$R^2_{Adj.}$	F	p
B_CWA_2	1.22	**.16**	<.001	-0.06	.37	0.02	.63	**0.19**	<.001	0.01	.84	0.07	.44	-0.01	.89	0.10	.37	**.07**	**.05**	**3.89**	<.001
B_CWA_3	1.15	**.44**	<.001	-0.08	.16	0.00	.93	**0.14**	<.001	-0.02	.65	0.16	.063	-0.06	.27	0.08	.42	**.22**	**.20**	**15.44**	<.001
B_CWA_4	1.21	**.26**	<.001	-0.03	.57	-0.02	.58	**0.18**	<.001	0.07	.16	0.06	.49	-0.01	.87	0.01	.93	**.12**	**.10**	**7.00**	<.001
B_CWA_5	1.13	**.31**	<.001	-0.06	.34	-0.03	.50	**0.17**	<.001	-0.06	.24	0.11	.24	-0.03	.52	0.09	.39	**.14**	**.12**	**9.05**	<.001
B_CWA_6	1.55	.06	.15	-0.02	.78	0.00	.95	**0.22**	<.001	0.02	.72	0.01	.93	-0.01	.91	0.08	.47	**.06**	**.04**	**3.22**	<.001
B_CWA_7	1.42	**.16**	<.001	-0.03	.57	0.01	.86	**0.19**	<.001	0.00	.97	0.03	.72	-0.02	.76	0.11	.32	**.08**	**.06**	**4.72**	<.001
B_CWA_8	1.61	.06	.15	-0.02	.71	0.01	.87	**0.19**	<.001	0.04	.40	0.00	.97	-0.02	.64	0.10	.36	**.05**	**.03**	**2.81**	.003
B_CWA_9	1.63	**.16**	<.001	-0.05	.44	0.02	.67	**0.19**	<.001	0.02	.69	-0.01	.89	-0.01	.77	0.09	.39	**.07**	**.06**	**4.20**	<.001
B_HPM	1.52	.02		-0.03		0.01		**0.20**		0.03		0.02		-0.01		0.09					
B_HPM_1	1.38	**.11**	.008	-0.04	.47	0.00	.96	**0.19**	<.001	0.03	.55	0.05	.61	-0.01	.80	0.12	.26	**.06**	**.04**	**3.57**	<.001
B_HPM_2	1.55	.05	.22	-0.03	.61	0.01	.87	**0.20**	<.001	0.03	.50	0.00	.99	-0.01	.89	0.09	.41	**.05**	**.03**	**2.78**	.004
B_HPM_3	1.55	.02	.58	-0.03	.68	0.00	.99	**0.20**	<.001	0.03	.50	0.00	.97	-0.01	.78	0.10	.39	**.05**	**.03**	**2.71**	.004
B_HPM_4	1.66	.00	.93	-0.03	.66	0.00	.92	**0.21**	<.001	0.03	.57	0.01	.91	-0.01	.80	0.07	.52	**.05**	**.04**	**3.16**	.001
B_HPM_5	1.43	**-.10**	.019	-0.04	.51	0.02	.72	**0.21**	<.001	0.03	.49	0.04	.70	-0.01	.83	0.07	.51	**.07**	**.05**	**3.93**	<.001
C_	1.54	**.13**		-0.01		-0.01		**0.19**		0.02		0.01		-0.02		0.07					
C_MA	1.66	**.09**		0.00		-0.02		**0.20**		0.02		-0.01		-0.03		0.06					
C_MA_1	1.47	**.17**	<.001	0.03	.59	-0.01	.83	**0.22**	<.001	-0.01	.78	-0.04	.64	-0.04	.48	0.02	.82	**.08**	**.06**	**4.14**	<.001
C_MA_2	1.69	.08	.064	-0.02	.80	-0.01	.76	**0.20**	<.001	0.03	.56	0.06	.51	-0.01	.89	0.05	.62	**.07**	**.05**	**3.94**	<.001
C_MA_3	1.66	.08	.10	0.00	.99	0.00	.93	**0.22**	<.001	0.02	.65	-0.01	.91	-0.05	.40	0.07	.52	**.06**	**.04**	**2.99**	.002
C_MA_4	1.81	.06	.19	-0.01	.92	-0.04	.45	**0.19**	<.001	0.02	.73	-0.04	.70	-0.01	.92	0.08	.48	**.05**	**.03**	**2.57**	.007
C_MA_5	1.68	**.16**	<.001	0.00	.94	-0.05	.29	**0.18**	<.001	0.02	.70	0.05	.64	-0.03	.66	0.06	.63	**.07**	**.05**	**3.39**	<.001
C_MA_6	1.62	.05	.32	0.03	.66	0.00	.93	**0.22**	<.001	0.02	.63	-0.07	.50	-0.05	.36	0.07	.51	**.06**	**.04**	**2.81**	.003
C_MA_7	1.68	.06	.23	-0.02	.79	-0.07	.16	**0.19**	<.001	0.02	.72	0.01	.96	-0.02	.75	0.10	.37	**.06**	**.03**	**2.54**	.007
C_KC	1.43	**.16**		-0.02		0.00		**0.19**		0.03		0.02		-0.02		0.08					
C_KC_1	0.92	**.22**	<.001	-0.01	.83	0.00	.95	**0.17**	<.001	0.01	.80	0.00	.96	-0.03	.60	0.08	.45	**.08**	**.06**	**4.61**	<.001
C_KC_2	0.98	**.21**	<.001	-0.04	.56	0.01	.85	**0.17**	<.001	-0.01	.87	0.03	.72	-0.02	.75	0.08	.44	**.08**	**.06**	**4.81**	<.001
C_KC_3	1.33	**.11**	.016	-0.02	.70	0.02	.63	**0.19**	<.001	0.04	.36	0.02	.87	-0.01	.83	0.07	.50	**.06**	**.04**	**3.42**	<.001
C_KC_4	1.49	**.21**	<.001	-0.03	.64	-0.02	.66	**0.19**	<.001	0.04	.42	0.04	.69	-0.02	.69	0.07	.54	**.09**	**.08**	**5.66**	<.001
C_KC_5	1.93	**.15**	<.001	-0.01	.89	0.01	.84	**0.19**	<.001	0.04	.46	0.01	.93	-0.02	.65	0.05	.64	**.08**	**.06**	**4.61**	<.001
C_KC_6	1.49	**.12**	.008	-0.05	.45	-0.02	.73	**0.21**	<.001	0.04	.41	0.03	.73	-0.01	.87	0.10	.37	**.07**	**.05**	**4.19**	<.001
C_KC_7	1.87	**.12**	.006	-0.02	.77	0.03	.55	**0.19**	<.001	0.03	.59	0.01	.91	-0.01	.88	0.08	.49	**.06**	**.04**	**3.39**	<.001

Note. Gender was dummy-coded (0/1 = female/male). Children was dummy-coded (0/1 = no/yes). Imp = implementation of telework strategy; JP = self-reported job performance; BMP = boundary management preferences; TE = telework experience; P_ = physical; T_ = temporal; B_ = behavioral; C_ = communicative; PSWL = physical separation of work and leisure; CWE = conducive work environment; TF = temporal flexibility; TS = temporal structure; BSWL = behavioral separation of work and leisure; CWA = conducive work attitude; HPM = health-promoting measures; MA = make arrangements; KC = keep connection; P_PSWL_1 = I regularly work outside my home.; P_PSWL_2 = I use technology facilitating to separate work and leisure.; P_PSWL_3 = I occasionally change my workstation.; P_PSWL_4 = I exclusively work in a designated place.; P_PSWL_5 = I keep work materials in a separate, dedicated place.; P_PSWL_6 = I arrange my workstation visually like a typical office.; P_PSWL_7 = I physically separate my workstation from the rest of

my living environment.; P_PSWL_8 = I do not conduct leisure activities at my workstation.; P_PSWL_9 = I use physical barriers as boundaries between work and leisure.; P_PSWL_10 = I use a separate, dedicated room for working.; P_PSWL_11 = I establish an atmosphere at my workstation that differs from the rest of my home.; P_PSWL_12 = I wear work clothes.; P_CWE_1 = I make sure there is sufficient light at my workstation.; P_CWE_2 = I wear comfortable clothes.; P_CWE_3 = I regularly air the room.; P_CWE_4 = I use a setup that is technically close to the setup at my on-site workstation.; P_CWE_5 = I set up a conducive work environment.; P_CWE_6 = I listen to music that helps me concentrate.; P_CWE_7 = I configure my workstation ergonomically.; P_CWE_8 = I set up a pleasant room climate.; P_CWE_9 = I reduce potential sources of distraction by placing them out of reach of my workstation.; P_CWE_10 = I personalize my workstation.; P_CWE_11 = I try to reduce distraction factors.; T_TS_1 = I have a set time routine to start the workday in the morning.; T_TS_2 = I structure my workday temporarily.; T_TS_3 = I schedule in advance when I will work in my home office and when I will work on-site.; T_TS_4 = I log my working hours.; T_TS_5 = I strictly separate my work time from my leisure time.; T_TS_6 = I have set days for working from home.; T_TS_7 = I take a regular lunch break at set times.; T_TS_8 = I have a set time routine for the transition from work to leisure.; T_TS_9 = I do not work beyond my working hours agreed with the employer.; T_TS_10 = I align my break schedule with the official break times of my organization.; T_TS_11 = I strictly adhere to set working hours.; T_TS_12 = I schedule regular breaks.; T_TF_1 = I am temporally flexible in handling urgent work requests.; T_TF_2 = I schedule my work time in order to get the most of my leisure time.; T_TF_3 = If my work is short on time. I'll “save it up” to make up for it in the next days.; T_TF_4 = I schedule my leisure time in order to get the most of my work time.; T_TF_5 = I flexibly transfer personal matters to times when I typically work.; T_TF_6 = If my leisure is short on time, I'll “save it up” to make up for it in the next days.; T_TF_7 = I flexibly transfer my work to times when I typically attend to personal matters.; B_BSWL_1 = I have a technological routine for the transition into work at the start of the work day.; B_BSWL_2 = I have a set technological routine facilitating the transition from work to leisure.; B_BSWL_3 = I maintain the same routines of my on-site work.; B_BSWL_4 = I avoid reading non-work related materials at work.; B_BSWL_5 = I attend to personal matters at work only when taking a break or during lunch hour.; B_BSWL_6 = I do not take work-related calls after hours.; B_BSWL_7 = I do not respond to work-related messages after hours.; B_BSWL_8 = I have a rule which leisure aspects are allowed to spill over into work and which not.; B_BSWL_9 = I have a rule which work aspects are allowed to spill over into leisure and which not.; B_BSWL_10 = I do not go back to work after hours.; B_BSWL_11 = I use breaks to strictly separate work time from leisure time.; B_BSWL_12 = I do not read work-related messages after hours.; B_BSWL_13 = I have set rituals facilitating the transition from work to leisure.; B_BSWL_14 = I avoid talking about work-related matters in leisure contexts.; B_BSWL_15 = I avoid talking about personal matters in work contexts.; B_CWA_1 = I value the benefits of working from home.; B_CWA_2 = I get organized at work.; B_CWA_3 = I show a particularly high level of dedication.; B_CWA_4 = I try to strengthen my supervisor's confidence in the quality of my work.; B_CWA_5 = I adjust my attitude and behavior to optimally focus and concentrate at work.; B_CWA_6 = I schedule tasks that can be done particularly well at home.; B_CWA_7 = I set personal daily goals at work.; B_CWA_8 = I take a short lunch break and quickly continue working to get done as much as possible.; B_CWA_9 = I practice self-praise.; B_HPM_1 = I pay attention to healthy eating.; B_HPM_2 = I adapt my work day to my bio-rhythm.; B_HPM_3 = I integrate exercise into my work day.; B_HPM_4 = I integrate outdoor activities into my work day.; B_HPM_5 = I regularly take a “power nap”.; C_MA_1 = I make arrangements with household members facilitating undisturbed work.; C_MA_2 = I make arrangements with colleagues/supervisors/my employer about when I can(not) be reached regarding work.; C_MA_3 = I'll confront household members if agreements about work and leisure are violated.; C_MA_4 = I make arrangements with customers/clients about when I can(not) be reached regarding work.; C_MA_5 = I'll confront colleagues/supervisors/my employer if agreements about work and leisure are violated.; C_MA_6 = Household members make arrangements with me in order to limit my workload.; C_MA_7 = I'll confront clients/customers if agreements about work and leisure matters are violated.; C_KC_1 = I use various communication channels.; C_KC_2 = I keep connected via technology to respond to colleagues/supervisors/my employer/customers/clients quickly.; C_KC_3 = I make small talk with my colleagues/supervisors/employer.; C_KC_4 = I communicate expectations and progress with colleagues/supervisors/my employer.; C_KC_5 = I use modern communication technology with colleagues/supervisors/my employer such as instant messaging.; C_KC_6 = I seek social interaction after work.; C_KC_7 = I use technology to stay in personal contact with colleagues; _r = recoded.

Results in bold are significant at the $p \leq .05$ level.

Appendix 2.B

The pattern of results of the for each telework subcategory aggregated β-coefficients predicting job performance reported in the main paper remained robust when computing scales for telework strategy subcategories averaging the implementation of the respective composing telework strategies per participant and simultaneously entering these scales into a multiple linear regression predicting job performance (using *z*-scaled variables and including control variables), and thus, remained robust when controlling for the overlap among telework strategies from different subcategories (see Table 2.1B). More specifically, the subcategories conducive work attitude (β = 0.34 [0.24, 0.43], $p < .001$) and keep connection (β = 0.21 [0.12, 0.30], $p < .001$) were the most important positive predictors of job performance. These were followed by conducive work environment (β = 0.04 [-0.07, 0.16], $p = .45$), temporal structure (β = 0.01 [-0.10, 0.13], $p = .81$), physical separation of work and leisure (β = 0.01 [-0.10, 0.13], $p = .81$), make arrangements (β = 0.00 [-0.10, 0.10], $p = .97$), behavioral separation of work and leisure (β = -0.03 [-0.16, 0.09], $p = .59$), temporal flexibility (β = -0.03 [-0.12, 0.05], $p = .44$), and health-promoting measures (β = -0.12 [-0.22, -0.03], $p = .011$). Thus, in accordance with the results reported in the main paper, telework strategies from the subcategories conducive work attitude and keep connection appeared to be the most important positive predictors of job performance, whereas boundary related telework strategies appeared to be less important. We decided to not base our main results on the multiple linear regression based on scales of telework strategy subcategories, as the Cronbach's alphas for the subcategories were in some instances quite low ($\alpha_{\text{Temporal flexibility}} = .56$) indicating that telework strategies within subcategories were still heterogeneous. Thus, we report the results in the main paper on the level of the individual telework strategies and descriptively summarize results for the subcategories making this heterogeneity transparent.

Table 2.1B

Multiple Linear Regression of Telework Strategy Scales Following the Categorization in the Main Paper Predicting Job Performance

	β	95%-CI	*p*
Intercept	-0.09	[-0.20, 0.02]	.12
Age	0.00	[-0.09, 0.09]	.97
Gender	**0.18**	[0.01, 0.35]	.043
Space	-0.04	[-0.13, 0.06]	.46
Children	0.06	[-0.14, 0.27]	.54
Physical separation of work and leisure	0.01	[-0.10, 0.13]	.81
Conducive work environment	0.04	[-0.07, 0.16]	.45
Temporal structure	0.01	[-0.10, 0.13]	.81
Temporal flexibility	-0.03	[-0.12, 0.05]	.44
Behavioral separation of work and leisure	-0.03	[-0.16, 0.09]	.59
Conducive work attitude	**0.34**	[0.24, 0.43]	<.001
Health-promoting measures	**-0.12**	[-0.22, -0.03]	.011
Make arrangements	0.00	[-0.10, 0.10]	.97
Keep connection	**0.21**	[0.12, 0.30]	<.001
$F(13, 495)$	**8.72**		<.001
R^2	**.19**		
$R^2_{Adj.}$	**.16**		

Note. $n = 509$. Gender was dummy-coded (0/1 = female/male). Children was dummy-coded (0/1 = no/yes). CI = confidence interval.
Results in bold are significant at the $p \leq .05$ level.

Appendix 2.C

The pattern of results of the for each telework subcategory aggregated β-coefficients predicting job performance reported in the main paper remained robust when simultaneously entering factor analytically identified scales averaging the implementation of the respective composing telework strategies per participant as predictors into a multiple linear regression predicting job performance (using *z*-scaled variables and including control variables), and thus, remained robust when controlling for the overlap among telework strategies from different factor analytically identified subcategories. To conduct this supplemental analysis, we first randomly split the data and computed an exploratory factor analysis (principal component analysis with varimax rotation computed with the *psych* package in R; Revelle, 2021; see Table 2.1C) with one half of the data. Based on the scree-plot, we identified eight factors. We labeled these factors based on the rule that a factor received the same label as the majority of the composing telework strategies in the taxonomy of the main paper (three telework strategies were assigned to a different factor than proposed by the taxonomy of the main paper). The eight factors identified were physical separation of work and leisure (seven telework strategies, α = .89), temporal structure (four telework strategies, α = .71), temporal flexibility (three telework strategies, α = .53), behavioral separation of work and leisure (four telework strategies, α = .90), conducive work attitude (three telework strategies, α = .70), health-promoting measures (three telework strategies, α = .66), make arrangements (five telework strategies, α = .79), and keep connection (two telework strategies, α = .65). Based on the other half of the data set, we computed a confirmatory factor analysis using maximum likelihood estimation (computed with the *lavaan* package in R; Rosseel, 2012; $\chi^2(406) = 614.68$, $p < .001$; CFI = .88; TLI = .87; SRMR = .075; RMSEA = .057). We then computed scales averaging the implementation of telework strategies per participant for each factor and entered these scales simultaneously in a multiple linear regression predicting job performance (see Table 2.2C). The pattern of results was similar to the results of the for each telework strategy subcategory aggregated β-coefficients predicting job performance reported in the main paper. The factors conducive work attitude (β = 0.25 [0.16, 0.34], $p < .001$) and keep connection (β = 0.21 [0.13, 0.30], $p < .001$) were the most important positive predictors of job performance. These were followed by make arrangements (β = 0.05 [-0.04, 0.15], $p = .26$), physical separation of work and leisure (β = 0.04 [-0.05, 0.14], $p = .37$), behavioral separation of work and leisure (β = 0.02 [-0.07, 0.11], $p = .65$), health promoting measures (β = -0.04 [-0.13, 0.05], $p = .38$), temporal structure (β = -0.05 [-0.14, 0.04], $p = .30$), and temporal flexibility (β = -0.06 [-0.15, 0.03], $p = .18$). We decided to not base our main results on factor analytically identified telework strategy scales because the data generation process was not tailored to do so, leading to a somewhat arbitrary factor analytically identification of telework strategy categories (if previous research and popular

media described similar telework strategies in detail factors would emerge, whereas if previous research and popular media described standalone, definite telework strategies no factors would emerge) and to a removal of a large proportion of telework strategies (potentially leading to overseeing relevant telework strategies for job performance). Considering that research on telework strategies is still in its' infancy, the focus of the present study was to assess the broad range of heterogeneous telework strategies present in the scientific literature and popular media to paint a comprehensive, highly resolved picture.

Table 2.1C

Principal Component Analysis of the 85 Telework Strategies With Varimax Rotation

Telework strategy	Factor loadings								Commu-nalities
	PC2: P_PSWL	PC7: B_BSWL	PC1: T_TS	PC3: C_MA	PC4: B_CWA	PC6: B_HPM	PC5: C_KC	PC8: T_TF	
I regularly work outside my home. (recoded)		.27	.14	-.13			.13		.14
I use technology facilitating to separate work and leisure.	.28	.36	.21	.22			.24	.11	.37
I occasionally change my workstation. (recoded)	.28	.27	.32	-.11	-.11	-.20		-.16	.34
I exclusively work in a designated place.	.45	.18	.39	-.15					.43
I keep work materials in a separate, dedicated place.	.57	.16	.12		.29		.10		.46
I arrange my workstation visually like a typical office.	**.74**				.17	.18	.10		.63
I physically separate my workstation from the rest of my living environment.	**.86**								.74
I do not conduct leisure activities at my workstation.	.52	.23	.17		.18			-.20	.44
I use physical barriers as boundaries between work and leisure.	**.77**								.61
I use a separate, dedicated room for working.	**.81**								.68
I establish an atmosphere at my workstation that differs from the rest of my home.	**.66**		.15	.14	.11	.18			.52
I wear work clothes.	.29			.19	.15	.12		-.12	.18
I make sure there is sufficient light at my workstation.	.21	.16			.17	.48	.17		.36
I wear comfortable clothes.		.28		-.13	.14	.16	.15		.17
I regularly air the room.	.22				.12	**.62**			.47
I use a setup that is technically close to the setup at my on-site workstation.	.48		.13				.37		.39
I set up a conducive work environment.	**.62**				.22	.19	.19		.52
I listen to music that helps me concentrate. (recoded)				-.21	.16			-.20	.13
I configure my workstation ergonomically.	**.66**		.13			.25			.52
I set up a pleasant room climate.	.18			.19	.20	.37			.26
I reduce potential sources of distraction by placing them out of reach of my workstation.	.30			.16	.40	.19	-.18	-.14	.37
I personalize my workstation.	.28			.24		.11	.15		.20
I try to reduce distraction factors.	.31	.19	.12	.29	.34		-.19	-.26	.46
I have a set time routine to start the workday in the morning.	.13		**.65**		.14	.13	.12	-.17	.53

Telework strategy	Factor loadings								Commu-nalities
	PC2: P_PSWL	PC7: B_BSWL	PC1: T_TS	PC3: C_MA	PC4: B_CWA	PC6: B_HPM	PC5: C_KC	PC8: T_TF	
I schedule in advance when I will work in my home office and when I will work on-site.			.42		.21			.32	.34
I structure my workday temporarily.	.21	.28	.36			.38	.16		.43
I log my working hours.		.45			.11		.27		.31
I strictly separate my work time from my leisure time.	.23	.52	.46	.14	.20	.12		-.14	.62
I have set days for working from home.	.20	.19	.40					.24	.30
I take a regular lunch break at set times.		.19	**.60**	.11	-.16	.26			.51
I have a set time routine for the transition from work to leisure.		.20	**.61**	.24	.11				.49
I do not work beyond my working hours agreed with the employer.	.11	.43	.35				-.10	.21	.38
I align my break schedule with the official break times of my organization.	.16	.24	.52			.15			.39
I strictly adhere to set working hours.		.31	**.64**	.15				-.12	.55
I schedule regular breaks.	.12		.17	.28		.43	-.14	.20	.38
I am temporally flexible in handling urgent work requests.	.23		-.48	-.15		.10			.35
I schedule my work time in order to get the most of my leisure time.						.11		**.65**	.45
If my work is short on time, I'll “save it up” to make up for it in the next days.	.12	-.14						**.51**	.30
I schedule my leisure time in order to get the most of my work time.	.16				.35	.14		.11	.19
I flexibly transfer personal matters to times when I typically work.		-.21	-.30		-.20			**.62**	.57
If my leisure is short on time, I'll “save it up” to make up for it in the next days.				.21				**.58**	.40
I flexibly transfer my work to times when I typically attend to personal matters.		-.58	-.32			.10		.20	.50
I have a technological routine for the transition into work at the start of the work day.	.18	.37	.21				.51		.49
I have a set technological routine facilitating the transition from work to leisure.	.13	.49	.25			.14	.40		.50
I maintain the same routines of my on-site work.	.19	.14	.52		.43		.13	-.14	.55
I avoid reading non-work related materials at work.	.27	.18	.15		.56			-.22	.50
I attend to personal matters at work only when taking a break or during lunch hour.	.16	.12	.37		.39	.13		-.24	.40
I do not take work-related calls after hours.		**.76**	.12	.22			-.10		.65
I do not respond to work-related messages after hours.		**.85**	.17	.13			-.10		.78
I have a rule which leisure aspects are allowed to spill over into work and which not.		.18	.30	.49	.16			-.11	.41

Telework strategy	Factor loadings								Commu-nalities
	PC2: P_PSWL	PC7: B_BSWL	PC1: T_TS	PC3: C_MA	PC4: B_CWA	PC6: B_HPM	PC5: C_KC	PC8: T_TF	
I have a rule which work aspects are allowed to spill over into leisure and which not.		.28	.37	.47		.10			.44
I do not go back to work after hours.		**.77**	.12				-.11		.63
I use breaks to strictly separate work time from leisure time.	.15	.19	.41	.30		.42		.20	.53
I do not read work-related messages after hours.		**.83**	.19	.16					.75
I have set rituals facilitating the transition from work to leisure.		.19	.34	.32		.39			.42
I avoid talking about work-related matters in leisure contexts.	.23	.21	.28	.22	.10	-.10		.22	.29
I avoid talking about personal matters in work contexts.	.14	.25		.19	.19		-.19		.19
I value the benefits of working from home.		.22				.13	.33	.26	.25
I get organized at work.				.15	**.64**			.11	.46
I show a particularly high level of dedication.	.16				.57		.30		.47
I try to strengthen my supervisor's confidence in the quality of my work.				.11	.41		.34		.31
I adjust my attitude and behavior to optimally focus and concentrate at work.	.23	.11	.20		**.61**	.13			.50
I schedule tasks that can be done particularly well at home.			.23	.15	.45		-.13	.20	.35
I set personal daily goals at work.					**.64**	.18			.47
I take a short lunch break and quickly continue working to get done as much as possible.		-.21	-.20		.21	-.21	.21		.23
I practice self-praise.				.28	.11	.24	.34	.16	.30
I pay attention to healthy eating.			.20	.15	.26	.50			.39
I adapt my work day to my bio-rhythm.			-.14	.11	.15	.25		.52	.38
I integrate exercise into my work day.				.16	.19	**.60**			.43
I integrate outdoor activities into my work day.		-.11		.15		**.61**			.43
I regularly take a “power nap”.		-.19	.15	.10	-.13	.39		.27	.31
I make arrangements with household members facilitating undisturbed work.	.24	.15	.13	.44	.37				.44
I make arrangements with colleagues/ supervisors/my employer about when I can(not) be reached regarding work.		.20	.31	.49	.25		.10	.20	.50
I'll confront household members if agreements about work and leisure are violated.				**.68**	.12	.19			.53
I make arrangements with customers/clients about when I can(not) be reached regarding work.			.12	**.56**	.15		.14	.24	.44
I'll confront colleagues/supervisors/my employer if agreements about work and leisure are violated.		.21		**.77**		.16			.67

Telework strategy	Factor loadings								Commu-nalities
	PC2: P_PSWL	PC7: B_BSWL	PC1: T_TS	PC3: C_MA	PC4: B_CWA	PC6: B_HPM	PC5: C_KC	PC8: T_TF	
Household members make arrangements with me in order to limit my workload.	.15	-.16		**.53**	.11	.17		.11	.39
I'll confront clients/customers if agreements about work and leisure matters are violated.		.16		**.79**		.18		.12	.69
I use various communication channels.							**.64**		.43
I keep connected via technology to respond to colleagues/supervisors/my employer/customers/clients quickly.					.21		**.61**		.42
I make small talk with my colleagues/supervisors/employer.			.11		-.27		.35		.22
I communicate expectations and progress with colleagues/supervisors/my employer.			.23	.37	.19		.36	.10	.37
I use modern communication technology with colleagues/supervisors/my employer such as instant messaging.		-.24		.21	-.14		.44		.33
I seek social interaction after work.	-.10	.14		.11		.38	.23		.26
I use technology to stay in personal contact with colleagues.		-.14	-.25	.24		.19	.46		.40
Eigenvalue	5.72	2.29	13.19	4.87	3.16	2.32	2.78	1.94	
Sum of squared loadings	6.31	5.73	5.28	4.77	4.29	3.75	3.19	2.96	
Proportion of variance (in %)	7.40%	6.70%	6.20%	5.60%	5.00%	4.40%	3.80%	3.50%	
Cumulative proportion of variance (in %)	7.40%	14.10%	20.30%	25.90%	30.90%	35.30%	39.20%	42.70%	

Note. $n = 274$. Factor loadings < |.10| are not displayed. Telework strategies in italics represent strategies being assigned to a different factor than in the categorization of the main paper. PC = principal component; P_ = physical; B_ = behavioral; T_ = temporal; C_ = communicative; PSWL = physical separation of work and leisure; BSWL = behavioral separation of work and leisure; TS = temporal structure; MA = make arrangements; CWA = conducive work attitude; HPM = health-promoting measures; KC = keep connection; TF = temporal flexibility.

Factor loadings >|.30| and loading >|.30| on the respective factor than on any other factor are bold.

Table 2.2C

Multiple Linear Regression of Factor Analytically Identified Telework Strategy Scales Predicting Job Performance

	β	95%-CI	*p*
Intercept	-0.07	[-0.19, 0.05]	.24
Age	-0.05	[-0.14, 0.05]	.33
Gender	0.12	[-0.06, 0.30]	.19
Space	-0.01	[-0.12, 0.10]	.85
Children	0.10	[-0.11, 0.31]	.35
Physical separation of work and leisure	0.04	[-0.05, 0.14]	.37
Temporal structure	-0.05	[-0.14, 0.04]	.30
Temporal flexibility	-0.06	[-0.15, 0.03]	.18
Behavioral separation of work and leisure	0.02	[-0.07, 0.11]	.65
Conducive work attitude	**0.25**	[0.16, 0.34]	<.001
Health-promoting measures	-0.04	[-0.13, 0.05]	.38
Make arrangements	0.05	[-0.04, 0.15]	.26
Keep connection	**0.21**	[0.13, 0.30]	<.001
$F(12, 489)$	**6.18**		<.001
R^2	**.13**		
$R^2_{Adj.}$	**.11**		

Note. $n = 502$. Gender was dummy-coded (0/1 = female/male). Children was dummy-coded (0/1 = no/yes). CI = confidence interval.
Results in bold are significant at the $p \leq .05$ level.

References Appendix 2.C

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3 Examining the Extended Full-Range Leadership Model and Leadership Effectiveness in Remote Work Contexts: The Moderating Role of VUCA Environments

Publication Status

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Abstract

The COVID-19 pandemic has amplified the importance of effectively leading a remote workforce in volatile, uncertain, complex, and ambiguous (VUCA) environments. This study examines the effectiveness of transformational-transactional leadership (Full-Range Leadership Model, FRLM) and its recent extension of instrumental leadership (eFRLM) in remote work contexts. We surveyed 529 remote working followers providing perceptions on (a) their leaders' manifestation of eFRLM dimensions and factors, (b) their leaders' leadership effectiveness, and (c) their organizational environment as VUCA. Results show that instrumental leadership represents a strongly effective leadership dimension in remote work contexts explaining unique variance beyond transformational-transactional leadership. Moreover, VUCA environments moderated the association between eFRLM leadership behaviors and leadership effectiveness, with instrumental leadership being particularly effective in more pronounced VUCA environments, and transformational-transactional leadership being less effective. Overall, instrumental leadership appears crucial to consider when predicting leadership effectiveness in virtual and uncertain contexts.

Keywords. Remote leadership, instrumental leadership, transformational-transactional leadership, (extended) Full-Range Leadership Model, leadership effectiveness, VUCA.

Open Science Statement. The data, codebook, R-script, and supplementary results are made transparent on the open science framework: https://bit.ly/3EzKmou.

3.1 Introduction

The COVID-19 pandemic has induced various substantial changes in daily working life. In particular, effective leadership of a geographically dispersed, remote workforce in volatile, uncertain, complex, and ambiguous (VUCA) contexts has grown in significance (Krehl & Büttgen, 2022; Rudolph et al., 2021; Stoker et al., 2022). Effective remote leadership was especially challenging during the COVID-19 pandemic due to (a) employees' relative lack of remote work experience, (b) employees' lacking technological infrastructure, (c) pandemic-induced mental strain, and (d) economic pressure (Contreras et al., 2020; Dasborough & Scandura, 2022; Kniffin et al., 2021; Stoker et al., 2022).

The Full Range Leadership Model (FRLM) is a well-established framework to understand leadership effectiveness in traditional on-site work settings (e.g., DeGroot et al., 2000; Dumdum et al., 2013; Judge & Piccolo, 2004; Lowe et al., 1996), yet little is known about its applicability to remote work settings. In addition, instrumental leadership in a more recent extension of the FRLM—the eFRLM—has been shown to explain incremental variance in predicting leadership effectiveness (Antonakis & House, 2014), but it has not been examined in remote work contexts. This is striking because flexible work arrangements, such as remote work, are prone to persist in the post-COVID-19 era (Athanasiadou & Theriou, 2021). Moreover, organizations will likely face pronounced VUCA environments in the future (Luthans & Broad, 2022). Therefore, remote work and VUCA environments represent highly relevant contextual factors that require further investigation to elucidate their impact on the effectiveness of eFRLM leadership (Antonakis & House, 2014).

To address these gaps in the literature, we collected survey data from 529 remote workers, gathering follower perceptions on (a) their respective leader's manifestation of eFRLM dimensions (i.e., transformational, transactional, and instrumental leadership) and factors (e.g., "articulating a vision," "contingent reward," and "outcome monitoring"), (b) their respective leader's leadership effectiveness, and (c) evaluations of their respective organization's environment as VUCA. We captured the follower perspective on effective leadership, which is particularly informative in remote work contexts (e.g., Kelloway et al., 2003; Purvanova & Bono, 2009). Specifically, we examined associations between the eFRLM and perceived leadership effectiveness in remote work contexts at dimensional and factor levels. This way, we could draw higher-level conclusions on the perceived effectiveness of the eFRLM dimensions and, at the same time, delve deeper into the specific eFRLM factors driving these effects. Thereby, we examine instrumental leadership's incremental predictive validity of leadership effectiveness beyond the original FRLM in remote work contexts. Also, the present

study is the first to explore the moderation effect of VUCA environments on the association between the eFRLM and leadership effectiveness at dimensional and factor levels.

Results showed that the instrumental leadership dimension was perceived as the most effective leadership dimension in remote work contexts, closely followed by transformational and then transactional leadership dimensions. At the factor level, the significant predictors of perceived leadership effectiveness were, for instrumental leadership, "environmental monitoring," "path-goal facilitation," and "outcome monitoring"; for transformational leadership, "articulating a vision," "providing an appropriate model," "fostering the acceptance of group goals," and "individualized support"; and for transactional leadership "contingent reward." We thereby found instrumental leadership to explain unique variance beyond the original FRLM at dimensional and factor levels, indicating that omitted variable bias may occur when not considering instrumental leadership to predict leadership effectiveness. Also, we found that perceived effectiveness of the eFRLM dimensions and factors were moderated by VUCA environments: Whereas transformational-transactional leadership dimensions appeared to be less effective in more-pronounced VUCA environments, instrumental leadership appeared to be particularly effective. Leaders in VUCA environments may therefore focus on strategic and work-facilitating (instrumental) leadership rather than charismatic and visionary (transformational) or quid pro quo (transactional) leadership. Zooming-in on the factor level, these moderation effects might be especially traced back to the transactional leadership factor "contingent reward" being less effective in more-pronounced VUCA environments and the instrumental leadership factor "outcome monitoring" being particularly effective in more-pronounced VUCA environments. Thus, leaders in remote work and VUCA environments might be advised to focus less on value exchange (e.g., rewarding/punishing followers contingent on their performance) and more on facilitating followers' work (e.g., monitoring outcomes, anticipating goal deviations, providing corrective feedback) instead.

The present study extends the leadership literature by shedding light on the merits of established (transformational-transactional leadership, FRLM) and aspiring (instrumental leadership, eFRLM) leadership theories in unaddressed remote work and VUCA contexts through the follower lens. We heeded a call to examine how contextual factors affect instrumental leadership's effectiveness (Antonakis & House, 2014) and thereby advanced the young eFRLM literature in several ways: We determined the extent to which instrumental leadership incrementally explained variance in perceived leadership effectiveness beyond the FRLM in remote work contexts at dimensional and factor levels. Furthermore, we explored the moderation effect of VUCA environments on the association of eFRLM dimensions and their

factors with perceived leadership effectiveness. Examining the perceived eFRLM effectiveness at the dimensional and more nuanced factor levels allowed us to derive tangible implications for real-life organizations, such as an apparent need for training interventions or 360°-feedback informing about the specific eFRLM skills that foster effective leadership in virtual and crisis-ridden organizational contexts.

3.2 Theoretical Background

3.2.1 The Extended Full-Range Leadership Model

The FRLM (Bass, 1985) comprises the transformational, transactional, and laissez-faire dimensions of leadership. These dimensions are typically further divided into transformational leadership factors, transactional leadership factors, and a non-leadership, laissez-faire factor (Avolio & Bass, 1988; Bass, 1999; Podsakoff et al., 1990). Transformational leaders strive to (a) identify new opportunities and inspire through a shared vision (*articulating a vision*), (b) embody and model the values they espouse (*providing an appropriate model*), (c) foster collaboration to achieve a shared goal (*fostering the acceptance of group goals*), (d) set high quality and performance standards (*high performance expectations*), (e) show respect and prioritize followers' personal feelings and needs (*individualized support)*, and (f) challenge followers to re-evaluate their work and find new, innovative ways of working (*intellectual stimulation*). Transactional leaders reward their followers with tangible commodities (e.g., salary increases) or intangible commodities (e.g., recognition) when followers meet expectations (*contingent reward*). Laissez-faire leaders do not lead in an obvious sense, rather they avoid taking a position or making decisions.

However, prior research questioned whether the FRLM covers the full range of leadership factors critical to effective leadership (Antonakis & House, 2013, 2014; Hunt, 2004; Judge & Piccolo, 2004; Yukl, 1999, 2008). In particular, the FRLM has been challenged for lacking (a) strategic factors (i.e., scanning the external environment, implementing strategic goals) and (b) work-facilitating factors (i.e., facilitating follower work by providing resources and corrective, performance-enhancing feedback) rooted in task-oriented leadership (Antonakis & House, 2013; Yukl, 1999).

To address the FRLM's lack of strategic and work-facilitating factors, Antonakis and House (2004, 2014) extended the FRLM into the eFRLM. Specifically, the eFRLM proposes that (i) monitoring the organizational environment (*environmental monitoring*), (ii) implementing strategic initiatives (*strategy formulation and implementation*), (iii) implementing tactical solutions (*path-goal facilitation*), and (iv) monitoring follower performance (*outcome monitoring*) are instrumental to effective leadership. These four factors

are subsumed under the *instrumental leadership* dimension. Initial research found evidence for instrumental leadership's construct validity (Antonakis & House, 2014) and critically addressed the validity of previous findings that were solely based on FRLM factors but omitted instrumental leadership factors when predicting leadership outcomes (Antonakis & House, 2014; Rowold, 2014). Adding instrumental leadership factors in predictive models alters the estimated coefficients of FRLM factors (i.e., omitted variable bias; Cinelli & Hazlett, 2020).

There is initial empirical evidence on instrumental leadership's predictive validity. Instrumental leadership is positively associated with followers' (a) health-related outcomes (e.g., reduced stress, work-family conflict, and burnout; Allgood et al., 2022; Poethke et al., 2021; Rowold et al., 2017), (b) satisfaction-related outcomes (e.g., increased job and leadership satisfaction and higher affective commitment; Antonakis & House, 2014; Rowold, 2014), and (c) performance-related outcomes (e.g., increased task and innovation performance, higher decision-making effectiveness; Chammas & Hernandez, 2019; Delbecq et al., 2013; Gerlach et al., 2020; Kramer et al., 2019; Rowold et al., 2017). Indeed, there is also initial evidence that instrumental leadership helps to explain followers' (d) perceptions of effective leadership (Antonakis & House, 2004, 2014).

3.2.2 eFRLM and Leadership Effectiveness

Leadership effectiveness refers to a leader's efficiency in influencing and guiding followers toward achieving organizational objectives (Hogan et al., 1994; Stogdill, 1950) and represents the "standard by which leaders should be judged" (Hogan et al., 1994, p. 494). The most common assessments of effective leadership are based on followers' ratings (i.e., perceptions) of their respective leader's effectiveness (Judge et al., 2002). Perceived leadership effectiveness is considered particularly informative as it directly induces actual follower behavior (Hogan et al., 1994; Meindl, 1995) and accounts for performance above expectations (Avolio & Bass, 1988; Lowe et al., 1996). Also, perceived leadership effectiveness converges with objective leadership effectiveness criteria, such as team or organizational unit performance (Hogan et al., 1994) and has been the subject of several meta-analyses examining the effectiveness of the FRLM's dimensions and factors (e.g., Judge & Piccolo, 2004; Lowe et al., 1996).

Transformational leadership and its factors are more strongly associated with perceived leadership effectiveness than transactional leadership and its contingent reward factor (Judge & Piccolo, 2004; Lowe et al., 1996). In contrast, laissez-faire leadership is perceived as ineffective (Antonakis & House, 2013; Avolio et al., 1995; Bass & Avolio, 1993). Instrumental leadership factors were found to explain unique variance beyond FRLM factors when predicting

perceived leadership effectiveness (Antonakis & House, 2004): Three of four instrumental leadership factors—"strategy formulation and implementation," "path-goal facilitation," and "outcome monitoring"—were found to predict leadership effectiveness when simultaneously considering transformational, transactional, and instrumental leadership factors, whereas only the transformational leadership factor "idealized influence" and the transactional leadership factor "contingent reward" predicted leadership effectiveness. In terms of variance explanation, instrumental leadership turned out to be equally important as transformational leadership when predicting perceived leadership effectiveness in traditional on-site work contexts (Antonakis & House, 2014).

3.2.3 eFRLM and Leadership Effectiveness in Remote Work Contexts

However, previous findings on the perceived effectiveness of eFRLM dimensions and factors in traditional on-site work contexts do not necessarily apply to widespread (Allen et al., 2015; Gajendran & Harrison, 2007) remote work settings. During remote work, the leader-follower dyad differs significantly from on-site work due to spatial distance and thus, technology-mediated and often asynchronous rather than face-to-face communication (Avolio et al., 2000, 2014; Hertel et al., 2005; Kelley & Kelloway, 2012). Accordingly, leadership in remote work contexts—*remote leadership*—is defined as a social influence process mediated by information and communication technologies (ICTs), such as video conferencing, instant messaging, or digital document sharing. Employees led remotely—*remote-working followers*—perform some or all of their work away from their traditional on-site workplace, usually from home (e.g., Bailey & Kurland, 2002; Härtel et al., 2023). Thus, effective remote leaders enhance the performance of geographically dispersed followers via ICTs (Avolio et al., 2000, 2014; Van Wart et al., 2019). The rapidly evolving shift to remote work, recently amplified by the COVID-19 pandemic (Kniffin et al., 2021; Kramer & Kramer, 2020; Milasi et al., 2021; Rudolph et al., 2021), has raised questions about whether the reduced face-to-face interaction and asynchronous communication associated with remote work compromise the effectiveness of traditional leadership (Hertel et al., 2005). Initially, the leader-follower distance was assumed to have a "neutralizing effect" (Antonakis & Atwater, 2002, p. 685) on follower perceptions of leadership effectiveness. For instance, transformational leaders may require physical proximity to show attention and consideration in order to be perceived as effective by their followers (Andressen et al., 2012; Dubinsky et al., 1995; Howell et al., 2005).

The current state of research paints a mixed and incomplete picture of the generalizability of findings on the effectiveness of the FRLM from on-site to remote work contexts. Whereas some studies found supportive evidence for the effectiveness of FRLM dimensions and factors

in remote work constellations (Kelloway et al., 2003; Neufeld et al., 2010; Purvanova & Bono, 2009; Ramserran & Haddud, 2018), other studies found FRLM dimensions and factors to be less effective in remote work than in traditional on-site work settings (Andressen et al., 2012; Eisenberg et al., 2019; Hoch & Kozlowski, 2014; Howell et al., 2005). On the one hand, for instance, transformational leaders have been found to achieve higher team performance in remote working teams than in traditional teams interacting face-to-face (Purvanova & Bono, 2009). Also, for example, charismatic and intellectually stimulating e-mails were shown to be associated with increased individual and team performance (Kelloway et al., 2003). On the other hand, some studies (Andressen et al., 2012; Dubinsky et al., 1995; Eisenberg et al., 2019; Hoch & Kozlowski, 2014) found the performance of teams led by transformational leaders to decrease with increasing physical distance. As for instrumental leadership in the eFRLM, there is no research to date that has examined its association with perceived leadership effectiveness in remote work contexts.

Thus, the lack of research on the effectiveness of eFRLM dimensions and factors in remote work contexts opens the door to the present study. First, to our knowledge, only one study (Neufeld et al., 2010) captured the most common (Judge et al., 2002) and particularly insightful (Hogan et al., 1994; Meindl, 1995; Murphy & Cleveland, 1991) follower perspective on leadership effectiveness, which limits its comparability with prior research conducted in traditional on-site work contexts. Second, we are not aware of any research that examined factor-level associations of the FRLM and perceived leadership effectiveness in remote work settings. Although a higher-level perspective should provide valuable insights into a leadership dimension's (e.g., transformational leadership) overall effectiveness, it does not allow one to draw fine-grained conclusions about the specific leadership factors (e.g., "articulating a vision") driving these effects. However, understanding which specific leadership factors might foster leadership effectiveness would facilitate the derivation of tangible recommendations for practitioners aimed at teaching specific FRLM-related skills that promote effective remote leadership. Third, and most remarkably, no study has yet examined the associations between instrumental leadership and perceived leadership effectiveness in remote work settings. Omitting instrumental leadership factors when predicting remote leadership effectiveness with FRLM factors could reduce the validity of research findings (Antonakis & House, 2014; Rowold, 2014). Also, supporting followers with resources and removing obstacles for goal achievement ("path-goal facilitation"), and providing positively framed, performance-enhancing feedback ("outcome monitoring") might be particularly beneficial to remote workers

and perceived by them as effective leadership strategies (Bartsch et al., 2020; Krehl & Büttgen, 2022; Liao, 2017).

3.2.4 Moderating Role of VUCA Environments

The leadership behaviors that foster leadership effectiveness depend on environmental context (e.g., Osborn et al., 2002; Waldman et al., 2001). For example, dynamic and volatile organizational environments were found to moderate associations between the FRLM and firm-level outcomes (e.g., innovation or financial performance; Ensley et al., 2006; Prasad & Junni, 2016). However, less is known about the moderation effect of dynamic and volatile organizational environments on follower perceptions of effective leadership. Research suggests follower perceptions of the behaviors that influence leadership effectiveness to change in extreme contexts (Hannah et al., 2009). The extent to which an extreme environmental context is perceived as threatening varies across individuals (Benner, 1984), though. Therefore, followers may perceive eFRLM dimensions and factors as more or less effective depending on their individual perceptions of dynamic and extreme settings, such as VUCA environments. VUCA environments (Bennett & Lemoine, 2014) have recently received attention both in practice (e.g., Arkenberg, 2019; Huesmann & Khoroshylova, 2020; Kothari et al., 2021) and academia (e.g., Bennett & Lemoine, 2014; Elkington, 2018). Due to COVID-19-induced disruptions (e.g., novel forms of work communication and interaction due to remote work, financial uncertainty due to economic strain, and health concerns; Mihalache & Mihalache, 2022), followers might have perceived their then-current organizational environment as VUCA. Thus, the COVID-19 pandemic provided a unique opportunity to explore the moderation effect of follower-perceived VUCA environments on associations of eFRLM dimensions and factors with leadership effectiveness.

During the COVID-19 pandemic, followers faced a multifaceted crisis (Contreras et al., 2020) that was both a global health crisis and an economic threat to organizations and their people (Kniffin et al., 2021). Organizational environments during the COVID-19 pandemic could have been perceived as VUCA (Bennett & Lemoine, 2014) because they were (a) *volatile* (i.e., future developments were difficult to predict; e.g., dynamic pandemic events triggered adverse market reactions), (b) *uncertain* (i.e., critical information was missing; e.g., the duration that organizations were affected by COVID-19-induced preventive measures), (c) *complex* (i.e., organizational environments consisting of many interconnected parts were difficult to oversee; e.g., upstream and downstream supply chains were affected by the COVID-19 pandemic), and (d) *ambiguous* (i.e., unknown cause-effect relationships of organizational measures taken due to lacking experience; e.g., the workforce's ad hoc shift to remote work had unknown

organizational impacts; Dima et al., 2021; Hadar et al., 2020; Luthans & Broad, 2022; Schulze et al., 2021; Sum, 2022; Worley & Jules, 2020). Recent research applied the VUCA concept to leadership by exploring leadership skills that may be required to succeed in such challenging environments (e.g., Giones et al., 2019; Millar et al., 2018; Schoemaker et al., 2018). Initial evidence suggests that leaders in VUCA environments tend to employ more leadership behaviors related to instrumental leadership and that such behaviors also appear to be perceived as more effective than traditional leadership behaviors.

In VUCA environments, followers may require guidance by strategic vision (Hitt et al., 2010; Klein & House, 1995; Tavares et al., 2021). Thus, instrumental leadership's strategic factors ("environmental monitoring" and "strategy formulation and implementation") may be perceived as effective because they limit follower uncertainty and ambiguity by "redirecting attention to new goals, initiating new work structures and processes, and providing guidance and feedback" (Allgood et al., 2022, p. 7). Indeed, recent qualitative studies (Baran & Woznyj, 2021; Giones et al., 2019; Schoemaker et al., 2018) underscore the effectiveness of strategic leadership skills (e.g., considering an organization's external environment) in VUCA environments. Another strand of research (Bartsch et al., 2020; Stoker et al., 2022) found leadership behaviors resembling the work-facilitating factors of instrumental leadership ("path-goal facilitation" and "outcome monitoring") to be effective in VUCA environments. Both work-facilitating factors of instrumental leadership are rooted in directive and task-oriented leadership (i.e., limiting followers' individual decision-making by giving clear instructions, structuring tasks, and monitoring compliance with instructions; see Kamphuis et al.,2011; Stoker et al., 2019), which has already been explored in extreme contexts (Hannah et al., 2009). Applying the *threat-rigidity-hypothesis*—organizations and their people behave rigidly in threatening environments by restricting information and constricting control (see Staw et al., 1981)—to VUCA environments, leaders might respond with increased levels of directive and task-oriented leadership to buffer potential losses of control (Stoker et al., 2019, 2022) and followers may perceive such behaviors as effective. Indeed, initial evidence suggests that directive and task-oriented leadership are perceived as more effective during extreme events (e.g., Mulder & Stemerding, 1963; Mulder et al., 1971, 1986).

We advance the young eFRLM literature by adding to the underexplored stream of research examining organizational environments' impacts on perceptions of leadership outcomes (Porter & McLaughlin, 2006). More specifically, we explore the moderation effect of the extent to which followers perceive their organizational environment as VUCA on the association between the eFRLM and leadership effectiveness. Thereby we focus on the clearly

defined constructs VUCA (Bennett & Lemoine, 2014) and instrumental leadership (Antonakis & House, 2014). In addition, previously observed main effects of leadership behaviors on perceived leadership effectiveness in dynamic and crisis environments do not necessarily preclude that these exact leadership behaviors are also perceived as effective in non-crisis environments. In comparison, explicitly testing moderating effects allows us to draw conclusions about leadership behaviors that are particularly effective in dynamic and crisis environments.

3.3 Present Study

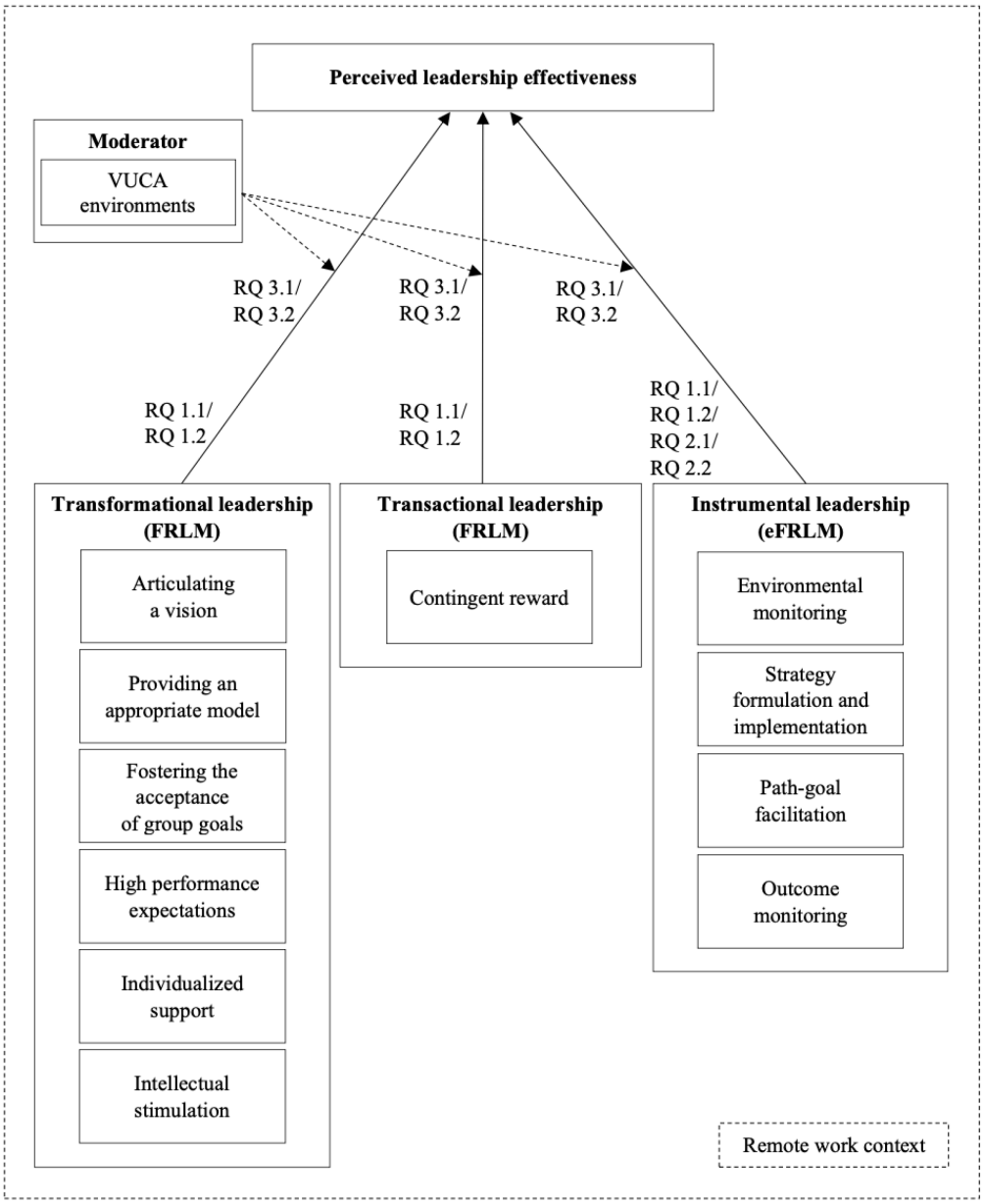
The present study is the first to shed light on the merits of established (transformational-transactional leadership, FRLM) and up-and-coming (instrumental leadership, eFRLM) leadership theories in virtual and crisis-ridden organizational contexts through the follower lens. Specifically, we go beyond previous research by examining associations between the eFRLM and perceived leadership effectiveness in remote work settings at dimensional (research question, RQ 1.1) and factor levels (RQ 1.2). Heeding the call to examine how contextual factors affect impacts of instrumental leadership (Antonakis & House, 2014), we advance the young eFRLM literature in several ways: We determine the extent to which instrumental leadership explains incremental variance in perceived leadership effectiveness beyond the FRLM in remote work contexts at dimensional (RQ 2.1) and factor levels (RQ 2.2). We also explore the moderation effect of follower-perceived VUCA environments on associations between the eFRLM and perceived leadership effectiveness at dimensional (RQ 3.1) and factor levels (RQ 3.2). For this purpose, we surveyed 529 remote workers that provided follower perceptions on (a) their respective leader's manifestation of eFRLM dimensions and factors, (b) their perceptions of their respective leader's leadership effectiveness, and (c) evaluations of their respective organization's environment as VUCA. We formulated the following research questions (see Figure 3.1):

- RQ 1.1: Which eFRLM dimensions are associated with perceived leadership effectiveness in remote work contexts?
- RQ 1.2: Which eFRLM factors are associated with perceived leadership effectiveness in remote work contexts?
- RQ 2.1: Does the instrumental leadership dimension explain incremental variance beyond the original FRLM dimensions when predicting perceived leadership effectiveness in remote work contexts?

- RQ 2.2: Do instrumental leadership factors explain incremental variance beyond the original FRLM factors when predicting perceived leadership effectiveness in remote work contexts?
- RQ 3.1: How does the perceived VUCA environment moderate associations between eFRLM dimensions and perceived leadership effectiveness?
- RQ 3.2: How does the perceived VUCA environment moderate associations between eFRLM factors and perceived leadership effectiveness?

Figure 3.1

Conceptual Framework of the Present Study Mapping the Focal Dependent and Independent Variables and Providing an Overview of the Research Questions (RQs)



Note. VUCA = volatile, uncertain, complex, and ambiguous environments; FRLM = Full-Range Leadership Model; eFRLM = extended Full-Range Leadership Model.

3.4 Method

3.4.1 Sample

German-speaking participants in our online survey study were recruited via convenience sampling by placing advertisements in professional (LinkedIn, Xing) and social media (Facebook, Instagram, Twitter, Nebenan) network groups, on research platforms for mutual participant recruitment (SurveyCircle, PollPool[6]), and in a lecture at Osnabrück University[7]. Participation was voluntary and respondents were informed that their responses would be anonymous and that they had the right to withdraw without any consequences. All participants gave informed consent prior to participation. To ensure that participants reported to a direct leader and had experience with remote work, two screening questions were presented: "Do you report to a direct leader?" and "Do you already have remote work experience?" Participants had to agree to both questions to begin the survey. Data collection took place between July 2021 and April 2022. During this time period, preventive measures to protect against COVID-19 infections (i.e., legal obligation for employers to enable remote work) forced a large proportion of the workforce to work remotely. This should have ensured that remote-working followers gained reasonable experience with their respective leader's remote leadership in organizational environments considered as VUCA. For an overview of the survey structure and detailed information on all variables collected, see the Codebook at https://bit.ly/3EzKmou.

The final sample[8] consisted of 529 followers (67.24% female) working the majority of their weekly workdays remotely ($M = 3.27$, $SD = 1.51$). Follower age ranged from 19 to 63 years ($M = 30.91$, $SD = 10.04$) and 74.76% of participants held at least a bachelor's degree. Followers' weekly working hours ($M = 34.25$, $SD = 13.83$) equaled the average weekly working hours of the employed population in Germany (Eurostat, 2022). Followers held professional positions mainly as highly qualified employees, such as research associates, engineers, and department heads (38.81%) or as qualified employees, such as clerks,

[6] Participants recruited via SurveyCircle ($n = 150$) and PollPool ($n = 49$) received "participation points" to recruit participants for their own surveys.

[7] Participants recruited at Osnabrück University ($n = 28$) attended the undergraduate course "Human Resource Management" and received "bonus points" to add to their course grade. Most participants recruited through lecture announcements indicated that they were participating on behalf of an affiliated student who was taking the course but was not employed at that time. This way, students who did not meet the participation prerequisites (i.e., reporting to a direct leader and being experienced with telework) could also receive the bonus points, which should have mitigated unwished incentives for participating when not meeting the requirements.

[8] Of 1,120 participants who began the survey, we excluded 86 participants who did not meet the initial participation prerequisites (i.e., reporting to a direct leader and having remote work experience), 477 participants who did not provide sufficient responses (i.e., discontinuing survey participation before providing all responses except for control variables), nine participants without reasonable participation durations (i.e., less than five minutes), three participants with no variance in response patterns, three participants who indicated flawed participation via comments (e.g., an unintentional second participation), and 13 participants without reasonable remote work experience, that is, respondents working less than 0.5 workdays per week.

accountants, and technical draftsmen (30.78%) across various industries (most represented were 21.22% information technology, telecommunications, and media; 16.83% manufacturing industry; 14.53% research and development). The average follower had worked with their respective leader for roughly three years at the time of the study ($M = 2.89$, $SD = 1.36$). The leaders referred to by the participating followers were mostly between 40 and 44 years old and predominantly male (62.07%). On average, leaders led about 15 followers ($M = 14.75$, $SD = 15.67$) and most leaders could be located in middle management (e.g., department heads).

3.4.2 Measures

3.4.2.1 Transformational and Transactional Leadership (FRLM)

Transformational ($\alpha = .92$, $M = 3.26$, $SD = 0.60$) and transactional leadership ($\alpha = .87$, $M = 3.55$, $SD = 0.99$) were measured with 22 items and four items, respectively, using the German translation (Heinitz & Rowold, 2007; Krüger et al., 2011) of the Transformational Leadership Inventory (TLI; see Podsakoff et al., 1990, 1996a, 1996b). The six transformational leadership factors were assessed using five items for "articulating a vision" ($\alpha = .86$, $M = 3.26$, $SD = 0.85$; e.g., "My manager paints an interesting picture of the future for our group"), three items for "providing an appropriate model" ($\alpha = .80$, $M = 3.28$, $SD = 0.89$; e.g., "My manager provides a good model to follow"), four items for "fostering the acceptance of group goals" ($\alpha = .88$, $M = 3.49$, $SD = 0.93$; e.g., "My manager fosters collaboration among work groups"), three items for "high performance expectations" ($\alpha = .69$, $M = 3.42$, $SD = 0.82$; e.g., "My manager shows us that he/she expects a lot from us"), four items for "individualized support" ($\alpha = .85$, $M = 3.61$, $SD = 0.95$; e.g., "My manager behaves in a manner that is thoughtful of my personal needs"), and three items for "intellectual stimulation" ($\alpha = .82$, $M = 3.12$, $SD = 0.91$; e.g., "My manager has provided me with new ways of looking at things which used to be a puzzle for me"). The transactional leadership factor "contingent reward" ($\alpha = .87$, $M = 3.55$, $SD = 0.99$; e.g., "My manager provides me with positive feedback if I perform well") was assessed using four items. We did not assess laissez-faire leadership because it was found to be the "most inactive, as well as most ineffective" (Avolio, 1999, p. 50) dimension of leadership. Followers provided their ratings on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

3.4.2.2 Instrumental Leadership (eFRLM)

We assessed instrumental leadership ($\alpha = .94$, $M = 3.55$, $SD = 0.74$) using a German translation (Rowold et al., 2017) of the instrumental leadership scale provided by Antonakis and House (2004) comprising 16 items (four items per factor) for the four factors "environmental monitoring" ($\alpha = .80$, $M = 3.83$, $SD = 0.66$; e.g., "My manager capitalizes on opportunities presented by the external environment"), "strategy formulation and

implementation" (α = .87, *M* = 3.43, *SD* = 0.90; e.g., "My manager translates the mission into specific goals"), "path-goal facilitation" (α = .86, *M* = 3.39, *SD* = 0.86; e.g., "My manager facilitates my goal achievement"), and "outcome monitoring" (α = .90, *M* = 3.54, *SD* = 0.97; e.g., "My manager provides me with constructive feedback about my mistakes"). Followers provided their ratings on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

3.4.2.3 Leadership Effectiveness

Follower ratings of their respective leader's leadership effectiveness (α = .84, *M* = 3.52, *SD* = 0.87) were assessed using four items (e.g., "My manager is effective in meeting organizational requirements") from the Multifactor Leadership Questionnaire (MLQ; Bass & Avolio, 1995; adapted and translated into German by Felfe & Goihl, 2002). Followers provided their ratings on a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

3.4.2.4 VUCA Environment

We asked followers to evaluate their respective organizational environment's level of VUCA (α = .73, *M* = 3.67, *SD* = 1.03) using four self-formulated items (e.g., "The organizational environment is uncertain, i.e., there is a lack of knowledge about whether events—despite knowledge about cause and effect relationships—will cause significant changes in the organizational environment"; see the Codebook for all items at https://bit.ly/3EzKmou), one item for each VUCA dimension (i.e., volatility, uncertainty, complexity, and ambiguity). For item formulation, we drew on the most widespread VUCA framework (Bennet & Lemoine, 2014). Followers responded on a 6-point Likert scale ranging from 1 (*completely disagree*) to 6 (*completely agree*).

3.4.2.5 Control Variables

We measured control variables typically considered in leadership research (e.g., Antonakis & House, 2014; Liden & Antonakis, 2009). On the follower-level, we assessed age, gender, education, average number of days working remotely per week, average weekly working hours, organizational tenure in years, number of years working with the leader, and interaction frequency with the leader. On the leader-level, we assessed age, gender, hierarchical level, and control span (see the Codebook at https://bit.ly/3EzKmou for a detailed overview of all assessed control variables and response formats). Some participants aborted the online survey before providing their demographic information, leading to six missing values for each control variable except for follower gender (ten missing values) and leader gender (seven missing values).

3.4.3 Analytical Approach

To examine the associations between the eFRLM dimensions and perceived leadership effectiveness in remote work contexts (RQ 1.1), we ran hierarchical linear regression analyses (Cohen & Cohen, 1983). We sequentially entered the control variables (Model D1) and the aggregated dimensions of transformational leadership (Model D2), transactional leadership (Model D3), and instrumental leadership (Model D4) as independent variables to predict perceived leadership effectiveness. To examine the associations between eFRLM factors and perceived leadership effectiveness (RQ 1.2), we ran analogous hierarchical linear regressions and sequentially entered the control variables (Model F1), transformational leadership factors (Model F2), transactional leadership factors (Model F3), and instrumental leadership factors (Model F4). Perceived leadership effectiveness and all predictor variables were *z*-scaled before running the hierarchical regression analyses, except for the dummy-coded variables follower and leader gender (0 = male, 1 = female).

Hierarchical regression analyses are suited to mitigate multicollinearity among independent variables (Cohen & Cohen, 1983), which has become a serious concern in leadership research (Bass, 1999). We checked for multicollinearity by computing variance inflation factors (VIF) and tolerance statistics (TOL) for the control variables and eFRLM dimensions and factors (Mansfield & Helms, 1982; see Appendix 3.A Table 3.1A and Table 3.2A). We found no signs for multicollinearity (VIF ≤ 4 and TOL $\geq .25$; O'Brien, 2007).

To answer the question whether instrumental leadership explains incremental variance beyond the original FRLM at dimensional (RQ 2.1) and factor (RQ 2.2) levels when predicting perceived leadership effectiveness in remote work contexts, we tested the differences in variance explanation (R^2) between Model D3/F3 (including control variables and FRLM dimensions/factors) and Model D4/F4 (including control variables and eFRLM dimensions/factors), respectively, using *F*-tests. This way, we also tested for distorted estimates due to overstated FRLM dimensions and factors when omitting the instrumental leadership dimensions and factors (Antonakis & House, 2014; Rowold, 2014; Rowold et al., 2017).

To explore the moderating effect of VUCA environments on associations of eFRLM dimensions and factors with perceived leadership effectiveness (RQ 3.1, 3.2), we added a fifth model to the outlined hierarchical linear regressions. Model D5/F5 additionally includes the main effect of perceived VUCA environments on perceived leadership effectiveness and the respective interaction terms of each eFRLM leadership dimension/factor with perceived VUCA environments on perceived leadership effectiveness.

For all statistical analyses, we used R (version 4.1.0; R Core Team, 2021) and the RStudio interface (version 2022.2.1.461; RStudio Team, 2022). To test the interaction effects (RQ 3.1, 3.2), we used the R package *interactions* (Long, 2021). The data and statistical code are publicly available in an online supplement at https://bit.ly/3EzKmou.

3.5 Results

Table 3.1 provides descriptive statistics and zero-order correlations among all variables. Because previous studies questioned instrumental leadership's discriminant validity (see Bormann & Rowold, 2018; Chammas & Hernandez, 2019), we checked the construct redundancy of all eFRLM factors. Of the twelve factors inspected, no zero-order correlation was above Shaffer et al.'s (2016) cut-off value of .90, indicating no lack of discriminant validity.

Table 3.2 shows the results of the hierarchical linear regression analyses at the dimensional level. Regarding associations between eFRLM dimensions and perceived leadership effectiveness in remote work contexts (RQ 1.1), instrumental leadership ($\beta = 0.40$ [0.32, 0.49], $p < .001$) represented the strongest predictor of leadership effectiveness in the full Model D4 (including control variables and the dimensions of transformational, transactional, and instrumental leadership), followed by transformational ($\beta = 0.36$ [0.28, 0.43], $p < .001$), and transactional leadership ($\beta = 0.20$ [0.14, 0.25], $p < .001$).

Table 3.3 shows the results of the hierarchical linear regression analyses at the factor level. Regarding associations between eFRLM factors and perceived leadership effectiveness in remote work contexts (RQ 1.2), we found the transformational leadership factors "articulating a vision" ($\beta = 0.22$ [0.14, 0.30], $p < .001$), "providing an appropriate model" ($\beta = 0.14$ [0.07, 0.22], $p < .001$), "fostering the acceptance of group goals" ($\beta = 0.13$ [0.05, 0.20], $p = .003$), and "individualized support" ($\beta = 0.09$ [0.02, 0.16], $p = .015$); the transactional leadership factor "contingent reward" ($\beta = 0.10$ [0.03, 0.16], $p = .003$); and the instrumental leadership factors "environmental monitoring" ($\beta = 0.15$ [0.08, 0.22], $p < .001$), "outcome monitoring" ($\beta = 0.15$ [0.07, 0.22], $p < .001$), and "path-goal facilitation" ($\beta = 0.12$ [0.04, 0.19], $p = .003$) predicting leadership effectiveness in the full Model F4 (including control variables and all factors of transformational leadership, transactional leadership, and instrumental leadership).

Table 3.1

Descriptive Statistics and Intercorrelations Between the Study Variables

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1. Age[a]	30.91	10.04	-	**-.18**	**.19**	**.14**	**.32**	**.69**	**.54**	.06	**.35**	-.07	**.13**	**.09**	**-.12**	**-.14**	**-.09**	**-.09**	.02	-.06	**-.12**	-.05	**-.11**	-.02	**-.11**	**-.12**	**-.12**	**-.16**	**.13**
2. Gender[a]	0.67	0.47		-	-.06	.02	**-.18**	**-.13**	-.09	-.05	-.08	.11	.01	-.01	.07	.06	.01	.04	.07	.02	.08	-.04	.03	.06	.04	.01	.01	.04	-.04
3. Education[a]	5.93	1.12			-	**.14**	**.37**	-.03	-.01	.01	**.13**	-.05	**.15**	.02	-.01	.00	.00	-.04	.03	.07	.05	.03	-.03	.00	-.07	-.02	.00	.03	.08
4. Remote working time[a]	3.27	1.51				-	**.16**	**.14**	.10	**-.09**	**.06**	-.02	-.04	-.02	.03	.04	.05	.00	.04	-.01	.00	.02	.02	.03	.05	.00	-.01	.00	.07
5. Weekly working time[a]	34.25	13.83					-	**.20**	**.14**	**.13**	**.25**	**-.12**	.07	**.11**	-.04	-.08	-.05	**-.11**	**.15**	**-.12**	.00	-.09	**-.10**	-.07	**-.09**	**-.13**	-.04	-.06	**.20**
6. Corporate tenure[a]	4.99	6.79						-	**.64**	.05	**.29**	-.02	.05	**.13**	-.06	-.08	-.04	-.04	.02	-.02	-.04	-.03	-.03	.02	-.02	-.04	-.05	-.08	.05
7. Duration of working with leader[a]	2.89	3.55							-	**.09**	**.36**	-.06	**.11**	.06	-.05	-.06	.00	-.04	-.06	-.03	-.05	-.03	-.01	.02	-.02	-.02	.00	-.06	.04
8. Interaction frequency with leader[a]	4.26	1.36								-	.01	-.03	.01	-.06	**.16**	**.11**	**.11**	**.17**	.04	.10	**.19**	**.18**	**.20**	**.21**	**.12**	**.13**	**.23**	**.21**	.04
9. Age[b]	6.58	1.93									-	-.12	**.29**	**.10**	**-.14**	**-.12**	**-.10**	**-.16**	-.04	-.07	**-.10**	-.08	**-.13**	**-.13**	**-.15**	**-.13**	-.06	-.07	.06
10. Gender[b]	0.38	0.49										-	**-.18**	**-.13**	.00	-.03	-.01	.04	.00	.01	-.02	-.04	.02	-.01	.08	.00	.00	-.02	.01
11. Hierarchical level[b]	3.25	1.13											-	**.22**	-.02	.03	-.07	-.06	.07	-.06	-.03	-.05	-.05	.00	-.06	-.08	-.03	-.01	**.11**
12. Control span[b]	14.75	15.67												-	.07	**.09**	-.01	.08	**.10**	-.07	-.01	-.03	.00	.02	.04	-.02	-.04	.02	.01
13. Transformational leadership	3.26	0.60													-	**.91**	**.81**	**.85**	**.38**	**.43**	**.81**	**.55**	**.81**	**.70**	**.72**	**.70**	**.68**	**.79**	-.04
14. Articulating a vision	3.26	0.85														-	**.68**	**.73**	**.28**	**.38**	**.71**	**.51**	**.74**	**.68**	**.69**	**.64**	**.58**	**.74**	-.04
15. Providing an appropriate model	3.28	0.89															-	**.74**	.07	**.62**	**.64**	**.60**	**.76**	**.65**	**.63**	**.69**	**.65**	**.76**	**-.11**
16. Fostering the acceptance of group goals	3.49	0.93																-	**.10**	**.53**	**.60**	**.55**	**.76**	**.63**	**.64**	**.69**	**.66**	**.74**	**-.11**
17. High performance expectations	3.42	0.82																	-	**-.26**	**.18**	-.04	**.12**	**.14**	**.22**	.01	.05	**.09**	**.17**
18. Individualized support	3.61	0.95																		-	**.45**	**.70**	**.58**	**.49**	**.38**	**.58**	**.56**	**.61**	**-.21**
19. Intellectual stimulation	3.12	0.91																			-	**.49**	**.69**	**.57**	**.55**	**.62**	**.65**	**.67**	-.06
20. Transactional leadership/ contingent reward	3.55	0.99																				-	**.62**	**.51**	**.46**	**.58**	**.59**	**.65**	**-.16**
21. Instrumental leadership	3.55	0.74																					-	**.83**	**.86**	**.89**	**.88**	**.81**	**-.15**

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
22. Environmental monitoring	3.83	0.66																						-	**.69**	**.64**	**.63**	**.71**	-.08
23. Strategy formulation and implementation	3.43	0.90																							-	**.67**	**.62**	**.64**	**-.15**
24. Path-goal facilitation	3.39	0.86																								-	**.76**	**.73**	**-.16**
25. Outcome monitoring	3.54	0.97																									-	**.73**	**-.13**
26. Perceived leadership effectiveness	3.52	0.87																										-	**-.13**
27. VUCA	3.67	1.03																											-

Note. $520 \leq n \leq 529$. VUCA = volatile, uncertain, complex, and ambiguous environments.
[a]Follower-related control variables.
[b]Leader-related control variables.
Results in bold are significant at the $p \leq .05$ level.

Table 3.2

Results of the Hierarchical Linear Regression Analyses Predicting Perceived Leadership Effectiveness at the eFRLM Dimensional Level

Variables	Model D1			Model D2			Model D3			Model D4			Model D5		
	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*
Constant	-.01	[-.17, .15]	.92	.04	[-.06, .14]	.40	-.01	[-.10, .09]	.92	-.01	[-.09, .08]	.89	-.01	[-.09, .08]	.85
Controls															
Age[a]	**-.21**	[-.34, -.08]	.001	**-.08**	[-.16, .00]	.047	**-.10**	[-.17, -.02]	.012	**-.07**	[-.14, .00]	.044	**-.07**	[-.14, .00]	.039
Gender[a]	.04	[-.15, .22]	.69	-.05	[-.16, .07]	.44	.01	[-.10, .11]	.89	.02	[-.08, .12]	.68	.02	[-.08, .12]	.65
Education[a]	**.10**	[.00, .19]	.050	**.06**	[.00, .12]	.048	.04	[-.02, .09]	.15	.04	[-.02, .09]	.17	.04	[-.01, .09]	.14
Remote working time[a]	.04	[-.05, .13]	.35	.-01	[-.06, .05]	.79	-.01	[-.06, .04]	.59	-.02	[-.06, .03]	.49	-.01	[-.06, .04]	.70
Weekly working time[a]	-.08	[-.18, .02]	.099	**-.06**	[-.13, .00]	.040	-.03	[-.08, .03]	.39	-.01	[-.06, .05]	.85	-.01	[-.06, .05]	.85
Corporate tenure[a]	.06	[-.07, .19]	.39	.01	[-.07, .09]	.83	.01	[-.07, .08]	.82	-.01	[-.08, .06]	.86	.00	[-.07, .07]	.93
Duration of working with leader[a]	.01	[-.10, .13]	.82	-.01	[-.08, .06]	.83	.00	[-.06, .07]	.95	-.02	[-.08, .04]	.50	-.03	[-.09, .03]	.35
Interaction frequency with leader[a]	**.23**	[.15, .32]	<.001	**.10**	[.04, .15]	.001	**.06**	[.01, .11]	.014	.05	[.00, .09]	.060	.04	[.00, .09]	.073
Age[b]	-.02	[-.12, .07]	.62	**.07**	[.01, .13]	.028	**.06**	[.01, .12]	.025	**.07**	[.02, .12]	.010	**.07**	[.02, .12]	.008
Gender[b]	-.07	[-.24, .11]	.46	-.04	[-.15, .07]	.47	-.01	[-.10, .11]	.89	-.04	[-.13, .06]	.46	-.02	[-.11, .08]	.69
Hierarchical level[b]	.00	[-.09, .09]	.99	-.01	[-.07, .05]	.56	.01	[-.05, .06]	.83	.01	[-.04, .06]	.71	.01	[-.03, .06]	.57
Control span[b]	.05	[-.04, .14]	.26	-.03	[-.09, .02]	.24	-.02	[-.07, .03]	.51	.00	[-.05, .04]	.86	.00	[-.05, .04]	.93
Transformational leadership				**.78**	[.73, .84]	<.001	**.62**	[.57, .68]	<.001	**.36**	[.28, .43]	<.001	**.36**	[.28, .43]	<.001
Transactional leadership							**.29**	[.23, .35]	<.001	**.20**	[.14, .25]	<.001	**.19**	[.13, .25]	<.001
Instrumental leadership										**.40**	[.32, .49]	<.001	**.42**	[.34, .50]	<.001
Interaction effects															
VUCA													.00	[-.05, .04]	.92
Transformational leadership x VUCA													**-.08**	[-.16, .00]	.044
Transactional leadership x VUCA													**-.08**	[-.14, -.02]	.010
Instrumental leadership x VUCA													**.14**	[.05, .22]	.002
R^2	**.09**			**.65**			**.70**			**.75**			**.76**		
ΔR^2				**.56**			**.06**			**.05**			**.01**		
Adj. R^2	**.07**			**.64**			**.70**			**.74**			**.75**		
AIC	1455.34			965.48			877.27			789.68			785.68		
BIC	1514.03			1028.31			944.22			860.74			873.11		

Note. n = 519. Regressions were computed using z-standardized data except for followers' and leaders' gender, which was dummy-coded (0/1 = male/female).
VUCA = volatile, uncertain, complex, and ambiguous environments.
[a]Follower-related control variables.
[b]Leader-related control variables.
Results in bold are significant at the $p \leq .05$ level.

Table 3.3

Results of the Hierarchical Linear Regression Analyses Predicting Perceived Leadership Effectiveness at the eFRLM Factor Level

Variables	Model F1			Model F2			Model F3			Model F4			Model F5		
	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*
Constant	-.01	[-.17, .15]	.92	.01	[-.08, .10]	.83	-.01	[-.09, .08]	.86	-.01	[-.09, .07]	.77	-.02	[-.10, .06]	.65
Controls															
Age[a]	**-.21**	[-.34, -.08]	.001	-.08	[-.15, -.01]	.021	**-.09**	[-.16, -.02]	.012	**-.08**	[-.14, -.01]	.023	**-.09**	[-.15, -.02]	.008
Gender[a]	.04	[-.15, .22]	.69	.00	[-.10, .10]	.99	.02	[-.08, .12]	.71	.02	[-.07, .11]	.68	.02	[-.07, .11]	.66
Education[a]	**.10**	[.00, .19]	.050	.02	[-.04, .07]	.53	.02	[-.03, .07]	.49	.02	[-.03, .06]	.54	.02	[-.03, .06]	.52
Remote working time[a]	.04	[-.05, .13]	.35	-.01	[-.06, .04]	.71	-.01	[-.06, .03]	.58	-.01	[-.06, .03]	.59	-.01	[-.05, .04]	.84
Weekly working time[a]	-.08	[-.18, .02]	.099	.01	[-.05, .06]	.80	.01	[-.04, .07]	.64	.02	[-.03, .07]	.47	.02	[-.03, .08]	.36
Corporate tenure[a]	.06	[-.07, .19]	.39	.01	[-.06, .08]	.82	.01	[-.06, .08]	.75	.00	[-.07, .07]	.99	.02	[-.05, .08]	.62
Duration of working with leader[a]	.01	[-.10, .13]	.82	-.02	[-.08, .05]	.60	-.01	[-.07, .05]	.68	-.03	[-.09, .03]	.34	-.03	[-.09, .02]	.24
Interaction frequency with leader[a]	**.23**	[.15, .32]	<.001	**.08**	[.04, .13]	.001	**.07**	[.03, .12]	.003	**.05**	[.00, .09]	.036	.04	[.00, .09]	.065
Age[b]	-.02	[-.12, .07]	.62	**.06**	[.01, .11]	.031	**.06**	[.01, .11]	.029	**.06**	[.01, .11]	.014	**.06**	[.02, .11]	.009
Gender[b]	-.07	[-.24, .11]	.46	-.03	[-.13, .07]	.53	-.02	[-.12, .07]	.66	-.02	[-.10, .07]	.75	.00	[-.09, .09]	.97
Hierarchical level[b]	.00	[-.09, .09]	.99	.02	[-.04, .06]	.56	.02	[-.03, .07]	.49	.01	[-.04, .06]	.63	.01	[-.03, .06]	.54
Control span[b]	.05	[-.04, .14]	.26	-.01	[-.06, .04]	.64	-.01	[-.06, .04]	.67	.00	[-.04, .04]	.99	.00	[-.04, .04]	.99
Transformational leadership															
Articulating a vision				**.30**	[.22, .38]	<.001	**.27**	[.19, .36]	<.001	**.22**	[.14, .30]	<.001	**.21**	[.13, .29]	<.001
Providing an appropriate model				**.21**	[.14, .29]	<.001	**.20**	[.13, .28]	<.001	**.14**	[.07, .22]	<.001	**.15**	[.07, .23]	<.001
Fostering the acceptance of group goals				**.20**	[.12, .28]	<.001	**.20**	[.12, .27]	<.001	**.13**	[.05, .20]	.003	**.12**	[.04, .19]	.003
High performance expectations				.01	[-.04, .06]	.68	.01	[-.05, .06]	.81	.01	[-.04, .06]	.70	.02	[-.03, .07]	.48
Individualized support				**.22**	[.15, .28]	<.001	**.15**	[.07, .22]	<.001	**.09**	[.02, .16]	.015	**.09**	[.02, .16]	.013
Intellectual stimulation				**.09**	[.02, .15]	.014	**.08**	[.02, .15]	.017	.02	[-.05, .09]	.81	.02	[-.05, .09]	.53
Transactional leadership															
Contingent reward							**.13**	[.06, .20]	<.001	**.10**	[.03, .16]	.003	**.09**	[.03, .16]	.016
Instrumental leadership															
Environmental monitoring										**.15**	[.08, .22]	<.001	**.15**	[.08, .22]	<.001
Strategy formulation and implementation										-.04	[-.11, .03]	.26	-.04	[-.11, .03]	.30
Path-goal facilitation										**.12**	[.04, .19]	.003	**.13**	[.05, .20]	.001
Outcome monitoring										**.15**	[.07, .22]	<.001	**.15**	[.07, .22]	<.001
Interaction effects															
VUCA													.00	[-.05, .04]	.92
Articulating a vision x VUCA													-.01	[-.09, .07]	.75

Variables	Model F1			Model F2			Model F3			Model F4			Model F5		
	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*	β	95% CI	*p*
Providing an appropriate model x VUCA													-.01	[-.09, .06]	.74
Fostering the acceptance of group goals x VUCA													-.06	[-.14, .02]	.14
High performance expectations x VUCA													-.02	[-.06, .03]	.51
Individualized support x VUCA													-.01	[-.08, .06]	.74
Intellectual stimulation x VUCA													-.02	[-.08, .05]	.66
Contingent reward x VUCA													**-.09**	[-.15, -.02]	.016
Environmental monitoring x VUCA													.04	[-.03, .10]	.24
Strategy formulation and implementation x VUCA													.02	[-.05, .10]	.55
Path-goal facilitation x VUCA													.00	[-.08, .08]	.97
Outcome monitoring x VUCA													**.11**	[.04, .19]	.003
R^2		**.09**			**.74**			**.75**			**.78**			**.79**	
ΔR^2					**.66**			**.01**			**.03**			.01	
Adj. R^2		**.07**			**.74**			**.74**			**.77**			**.78**	
AIC		1455.34			807.97			795.59			735.54			741.49	
BIC		1514.03			891.32			883.02			839.20			892.97	

Note. n = 519. Regressions were computed using z-standardized data except for followers' and leaders' gender, which was dummy-coded (0/1 = male/female).
VUCA = volatile, uncertain, complex, and ambiguous environments.
[a]Follower-related control variables.
[b]Leader-related control variables.
Results in bold are significant at the $p \leq .05$ level.

We found evidence for incremental variance explanation of instrumental leadership beyond the original FRLM when predicting perceived leadership effectiveness in remote work contexts (see Table 3.2 and Table 3.3). At the dimensional level (RQ 2.1), the increase in variance explanation between Model D3 (including control variables and FRLM dimensions) and Model D4 (including control variables and eFRLM dimensions) was significant ($\Delta R^2 = .05$; $F\ (1, 503) = 95.03$, $p < .001$). Also, the Akaike Information Criterion (AIC; Akaike, 1987) and the Bayesian Information Criterion (BIC; Raftery, 1995) suggested Model D4 to be the best-fitting model due to its lowest AIC (789.68) and BIC (860.74) values compared to Model D1, Model D2, and Model D3. At the factor level (RQ 2.1), we also found a significant increase in variance explanation between Model F3 and Model F4 after entering the instrumental leadership factors to the control variables and FRLM factors ($\Delta R^2 = .03$, $F\ (4, 495) = 17.57$, $p < .001$). Again, Model F4 was found to fit the data best regarding AIC (735.54) and BIC (839.20) values.

Concerning the small but significant gain of explained variance (ΔR^2) of 5% and 3% from Model D3/F3 to Model D4/F4, it should be noted that the 70% and 75% of variance explanation found for Model D3/F3 (including only FRLM dimensions and factors) are both likely to be optimistically biased due to omitted variable bias caused by the absence of instrumental leadership dimensions and factors. Moreover, the shrinkages of the β-coefficients of the transformational leadership dimension ($\Delta\beta_{\text{Model D3-Model D4}} = .26$) and the transactional leadership dimension ($\Delta\beta_{\text{Model D3-Model D4}} = .09$) between Model D3 and Model D4 indicate overstated FRLM dimensions when not considering the instrumental leadership dimension in Model D3. Similarly, the shrinkages of the β-coefficients of the FRLM factors "fostering the acceptance of group goals" ($\Delta\beta_{\text{Model F3-Model F4}} = .07$), "intellectual stimulation" ($\Delta\beta_{\text{Model F3-Model F4}} = .06$), "providing an appropriate model" ($\Delta\beta_{\text{Model F3-Model F4}} = .06$), "individualized support" ($\Delta\beta_{\text{Model F3-Model F4}} = .06$), "intellectual stimulation" ($\Delta\beta_{\text{Model F3-Model F4}} = .06$), "articulating a vision" ($\Delta\beta_{\text{Model F3-Model F4}} = .05$), and "contingent reward" ($\Delta\beta_{\text{Model F3-Model F4}} = .03$) between Model F3 and Model F4 yield further evidence for overstated FRLM factors due to the absence of instrumental leadership factors in Model F3.

The unique contribution of instrumental leadership when predicting perceived leadership effectiveness was supported in supplemental analyses determining relative variable importance (see Appendix 3.A, Table 3.1A and Table 3.2A, and the detailed explanation in Appendix 3.B): Employing a variance decomposition method (Lindeman, Merenda, and Gold method, LMG; Lindeman et al., 1980) and a machine learning method (random forests; Breiman, 2001, 2002) confirmed our main findings that (a) instrumental leadership was the

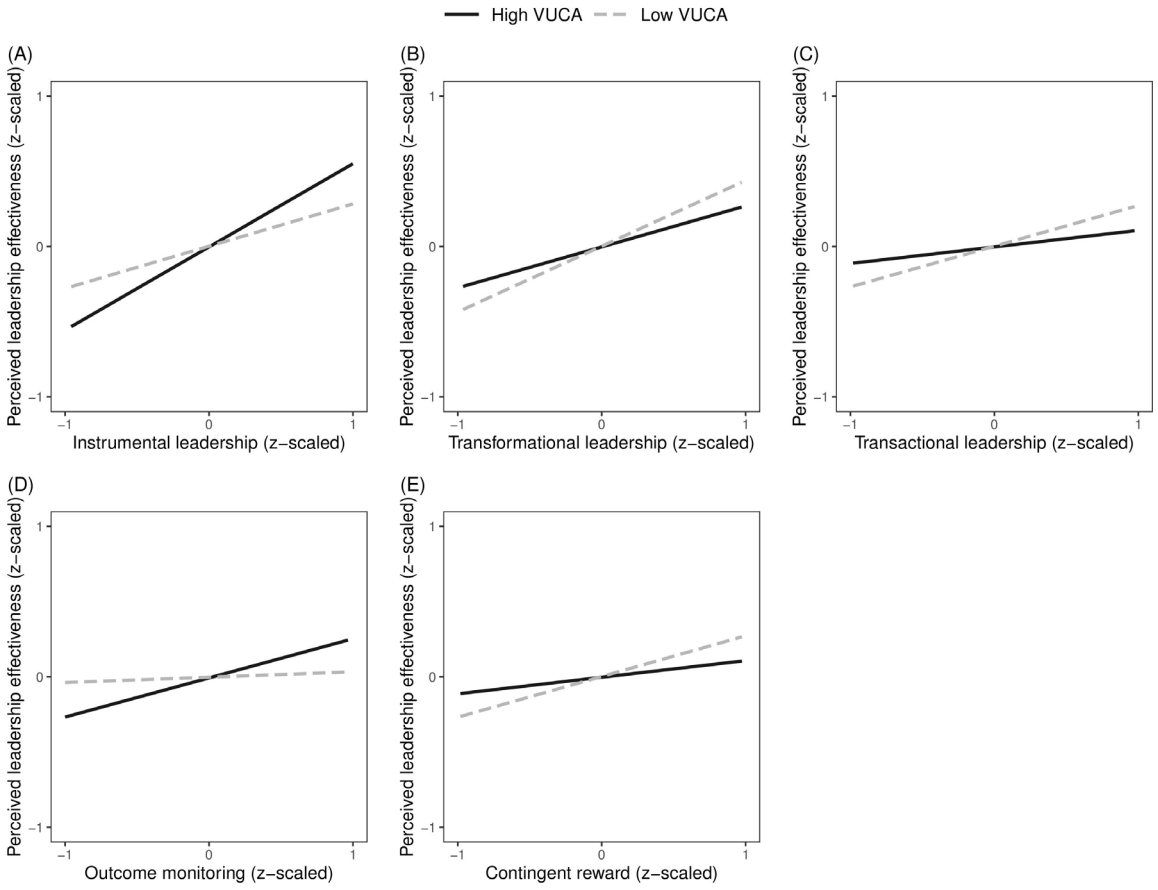
strongest predictor of perceived leadership effectiveness and (b) including instrumental leadership in the predictive model results in a substantial decrease in the variance explained by transformational-transactional leadership.

Concerning the moderation effect of perceived VUCA environments on the association between the eFRLM and leadership effectiveness at dimensional (RQ 3.1) and factor levels (RQ 3.2), a positive interaction effect indicates that the corresponding eFRLM dimension/factor is more positively associated with leadership effectiveness in environments evaluated as more VUCA. A negative interaction effect indicates that the corresponding eFRLM dimension/factor is less positively associated with leadership effectiveness in more pronounced VUCA environments. At the dimensional level (see Model D5, Table 3.2), we found a significant positive interaction effect for instrumental leadership (β = 0.14 [0.05, 0.22], p = .002) and significant negative interaction effects for transformational (β = -0.08 [-0.16, 0.00], p = .044) and transactional (β = -0.08 [-0.14, -0.02], p = .010) leadership. At the factor level (see Model F5, Table 3.3), we found a significant positive interaction effect for the instrumental leadership factor "outcome monitoring" (β = 0.11 [0.04, 0.19], p = .003) and a significant negative interaction effect for the transactional leadership factor "contingent reward" (β = -0.09 [-0.15, -0.08], p = .016). Figure 3.2 depicts the significant interaction effects at dimensional (A-C) and factor levels (D-E).

To further explore whether the eFRLM dimensions and factors were also differentially manifested in less/more-pronounced VUCA environments, we divided the sample into followers perceiving their organizational environment as low VUCA versus high VUCA. We then computed two-sample t-tests comparing the manifestation of eFRLM dimensions and factors between these groups (see Table 3.4). Using the scale center (3.50) as cut-off value, the organizational environment was perceived as low VUCA by about half the sample (n = 267, 51%) and perceived as high VUCA by the other half (n = 252, 49%). In high VUCA environments, we found a significant lower manifestation of the dimensions of transactional leadership and instrumental leadership. On the factor level, all four instrumental leadership factors, four of six transformational leadership factors ("individualized support," "providing an appropriate model," "fostering the acceptance of group goals," and "high performance expectations"), and the transactional leadership factor ("contingent reward") were significantly less manifested in high VUCA environments. The transformational leadership factor "high performance expectations" was the only eFRLM factor that was more manifested in high VUCA environments.

Figure 3.2

Significant Interaction Effects of Follower-Perceived VUCA Environments on the Association of eFRLM Dimensions (A-C) and eFRLM Factors (D-E) With Perceived Leadership Effectiveness



Note. VUCA = volatile, uncertain, complex, and ambiguous environments. "High VUCA" ("Low VUCA") refers to values one standard deviation above (below) the sample mean of follower-perceived VUCA environments.

Table 3.4

Mean Value Differences of the Implementation of eFRLM Dimensions and eFRLM Factors in Low Versus High Follower-Perceived VUCA Environments

	Low VUCA		High VUCA					
eFRLM dimensions	*M*	*SD*	*M*	*SD*	Δ_M	*t*	*df*	*p*
Transactional leadership	3.68	0.96	3.41	1.02	**-0.27**	**-3.13**	517	.002
Instrumental leadership	3.66	0.70	3.43	0.74	**-0.23**	**-3.63**	517	<.001
Transformational leadership	3.28	0.55	3.22	0.64	-0.06	-1.12	496	.26
eFRLM factors								
Individualized support	3.77	0.89	3.44	0.99	**-0.34**	**-4.07**	517	<.001
Path-goal facilitation	3.52	0.83	3.24	0.87	**-0.28**	**-3.80**	517	<.001
Outcome monitoring	3.68	0.93	3.40	0.98	**-0.28**	**-3.29**	517	.001
Contingent reward	3.68	0.96	3.41	1.02	**-0.27**	**-3.13**	517	.002
Strategy formulation and implementation	3.55	0.88	3.30	0.88	**-0.25**	**-3.20**	517	.001
Providing an appropriate model	3.36	0.82	3.19	0.95	**-0.16**	**-2.10**	494	.037
Fostering the acceptance of group goals	3.57	0.91	3.40	0.94	**-0.16**	**-2.03**	517	.042

eFRLM dimensions	Low VUCA		High VUCA					
	M	*SD*	*M*	*SD*	Δ_M	*t*	*df*	*p*
Intellectual stimulation	3.18	0.90	3.04	0.92	-0.14	-1.79	517	.074
Environmental monitoring	3.88	0.64	3.77	0.67	**-0.11**	**-1.96**	517	.050
Articulating a vision	3.29	0.80	3.21	0.90	-0.09	-1.15	517	.25
High performance expectations	3.34	0.81	3.52	0.81	**0.18**	**2.55**	517	.011

Note. VUCA = volatile, uncertain, complex, and ambiguous environments. Δ_M = mean value difference of the implementation of eFRLM leadership dimensions and eFRLM factors in low versus high-pronounced VUCA environments. The sample was divided into low (n = 267, 51%) versus high (n = 252, 49%) perceived VUCA environments using the scale center (3.50) of the variable VUCA environments as a cut-off value. eFRLM dimensions and eFRLM factors are sorted by Δ_M in ascending order.

Δ_M and t-values in bold are significant at the $p \leq .05$ level.

3.6 Discussion

The goal of this study was to gain insight into effective leadership in virtual and crisis-ridden organizational settings from the perspective of followers. To this end, we surveyed 529 followers on their perceptions of the effectiveness of established (transformational-transactional) and aspiring (instrumental) leadership dimensions and factors in remote work and VUCA environments. Our research makes several contributions to the leadership literature: We found at both dimensional (RQ 1.1) and factor levels (RQ 1.2) that instrumental leadership was perceived as strongly effective in remote work contexts, along with transformational leadership and then followed by transactional leadership. Our results also indicate that instrumental leadership explains unique variance beyond the original FRLM at both dimensional (RQ 2.1) and factor (RQ 2.2) levels. This suggests that omitted variable bias may occur when instrumental leadership is not taken into account when predicting leadership outcomes in remote work contexts. Second, our study is the first to show that associations of eFRLM dimensions (RQ 3.1) and factors (RQ 3.2) with perceived leadership effectiveness are moderated by follower-perceived VUCA environments: At the dimensional level, instrumental leadership was perceived as particularly effective in more-pronounced VUCA environments, whereas both transformational and transactional leadership were perceived as less effective. At the factor level, the instrumental leadership factor "outcome monitoring" was perceived as particularly effective in more pronounced VUCA environments, whereas the transactional leadership factor "contingent reward" was perceived as less effective in more VUCA-like environments.

3.6.1 Implications for Theory

3.6.1.1 Associations of the eFRLM Dimensions and Factors With Perceived Leadership Effectiveness in Remote Work Contexts

The present study provides initial evidence for the perceived effectiveness of instrumental leadership, transformational leadership, and transactional leadership in the context of remote work. Whereas instrumental leadership had not been studied in virtual environments, our

findings align with previous research that shows the effectiveness of transformational (Neufeld et al., 2010; Purvanova & Bono, 2009; Ramserran & Haddud, 2018) and transactional leadership (Dubinsky et al., 1995; Howell et al., 2005) in virtual environments. For instance, in line with prior studies (Kelloway et al., 2003; Shamir et al., 1994), we found charismatic factors (i.e., "articulating a vision" and "providing an appropriate model") of transformational leadership to be beneficial in remote contexts. However, some literature (Andressen et al., 2012; Eisenberg et al., 2019; Hoch & Kozlowski, 2014; Howell et al., 2005; Howell & Hall-Merenda, 1999) suggests that the effectiveness of transformational-transactional leadership vanishes with increasing leader-follower distance, which seems to contradict our findings. This discrepancy, however, may be due to changes in remote work. Whereas previous research mainly focused on leader-follower physical distance as the defining component of remote work (e.g., leader and followers working in the same versus a different city; Howell et al., 2005), our study centered on leader-follower communication via ICTs (e.g., video conferencing, instant messaging). Due to steady advancements in ICTs, the physical proximity between leaders and followers may be quite accurately simulated by now, potentially mitigating neutralizing effects of physical distance on the effectiveness of transformational-transactional leadership.

A novel contribution of our research is that we found instrumental leadership to explain unique variance in perceived leadership effectiveness during remote work beyond transformational-transactional leadership. The predictive validity for perceived leadership effectiveness held whether we examined instrumental leadership (a) on the dimensional level—where it represented the strongest predictor of leadership effectiveness—or (b) on the factor level, where three of its four factors predicted leadership effectiveness. We found that effective remote leaders displayed three key behaviors: monitoring the organization's environment ("environmental monitoring"), supporting followers by removing obstacles and allocating resources ("path-goal facilitation"), and providing performance-enhancing feedback ("outcome monitoring"). These findings generally align with previous studies that have emphasized the effectiveness of strategic and work-facilitating leadership during remote work (Bartsch et al., 2020; Krehl & Büttgen, 2022; Liao, 2017).

Finally, we found evidence for omitted variable bias when not considering instrumental leadership and its factors to predict perceived leadership effectiveness in remote work contexts. The predictive value of FRLM dimensions and factors substantially decreased and/or even lost significance after we added instrumental leadership and its factors to our predictive models. These findings align with previous research demonstrating instrumental leadership's unique variance explanation beyond FRLM dimensions and factors (Antonakis & House, 2014;

Rowold, 2014; Rowold et al., 2017) as well as distorted predictive estimates for FRLM dimensions and factors when not considering instrumental leadership (Antonakis & House, 2014; Bormann & Rowold, 2018; Rowold, 2014). In particular, our results on the relative variance importance determined via variance decomposition methods (LMG in Lindeman et al., 1980; see Appendix 3.A, Table 3.A1 and Table 3.A2, and the explanation in Appendix 3.B) are consistent with the findings of the pioneering study on instrumental leadership by Antonakis and House (2014) conducted in stationary on-site work settings: Transformational leadership's variance explanation of perceived leadership effectiveness decreased from 43% to 28% after the instrumental leadership dimension was added in Antonakis and House (2014). Similarly, in the present study, transformational leadership's variance explanation decreased from 43% to 27% after adding the instrumental leadership dimension. In both Antonakis and House (2014) and the present study, instrumental leadership accounted for a similar proportion of the variance in perceived leadership effectiveness, 28% and 29 %, respectively. Therefore, the present study underscores the methodological and theoretical raison d'être of a "fuller" (Antonakis & House, 2014, p. 748) FRLM augmenting transformational-transactional theory (Bass, 1985), namely instrumental leadership.

3.6.1.2 Moderating Role of Perceived VUCA Environments

The present study heeded calls (Antonakis & House, 2014; Hannah et al., 2009; Liden & Antonakis, 2009; Porter & McLaughlin, 2006; Wu et al., 2021) to examine the environmental boundary conditions that affect the association of leadership dimensions and factors with leadership effectiveness. In particular, VUCA environments have been moving into the spotlight of both academia (Baran & Woznyj, 2021; Bennett & Lemoine, 2014; Elkington, 2018; Giones et al., 2019; Schoemaker et al., 2018) and practice (Arkenberg, 2019; Huesmann & Khoroshylova, 2020; Kothari et al., 2021) and are likely to characterize future business environments (Luthans & Broad, 2022). The present study suggests that instrumental leadership particularly contributes to leadership effectiveness in more-pronounced VUCA environments, and this effect was mainly driven by the outcome-monitoring factor (i.e., leaders facilitate followers' work and goal achievement through corrective and performance-improving feedback). This finding aligns with preliminary research suggesting that strategic (Schoemaker et al., 2018) and especially directive/task-oriented leadership (Dynes, 1983; Kamphuis et al., 2011; Perrow, 1984) may be beneficial in volatile and crisis-ridden environments. However, in contrast to previous research stating that strategic (Boal & Schultz, 2007; Giones et al., 2019; Schaedler et al., 2022) and directive/task-oriented leadership (Stoker et al., 2019, 2022) should also be implemented more by leaders in crisis-ridden and volatile environments, we found that

instrumental leadership might actually be implemented less often in more-pronounced VUCA environments. Thus, according to the present findings, leaders seem to lack an intuitive understanding of what type of leadership is effective in times of volatility and crisis, revealing potentials for teaching effective leader behaviors in such challenging times.

In addition, we found that transformational and transactional leadership may be perceived as less effective in pronounced VUCA environments. Thereby, we found transactional leadership and also several transformational leadership factors to be less-often implemented in more VUCA-like environments, suggesting that leaders may in these regards have some intuitive understanding of less effective leadership in crisis-ridden contexts. Unsettled followers may demand less charismatic-visionary and quid pro quo leadership because an abstract vision and a simple prospect of reward may not provide sufficiently tangible guidance when the environment is complex and volatile. These findings align with previous research suggesting that transformational leadership is less effective and less implemented in extreme contexts (Geier, 2016). However, there are also findings emphasizing the effectiveness of both transformational (Bligh et al., 2004; Boehm et al., 2010; Sommer et al., 2016; Zhang et al., 2012) and transactional (Bass, 2008; Geier, 2016; Schriesheim & Murphy, 1976) leadership under extreme conditions. One possible explanation for these conflicting results may be that previous studies have not considered the full range of leadership behaviors, specifically instrumental leadership behaviors, which may have introduced omitted variable bias and overstated FRLM factors (Antonakis & House, 2014).

3.6.2 Limitations and Future Research

The present study has several limitations that provide opportunities for future research. First, the cross-sectional design of the present study is useful to identify covariates in the early stages of a nascent research field (Spector, 2019; Wang & Cheng, 2020), such as research on leadership effectiveness in remote work contexts and VUCA environments, but it does not allow for the inference of causal relations because it lacks temporal elements. Therefore, future research should apply longitudinal (e.g., daily/weekly diary studies; see Ohly et al., 2010) or (quasi-) experimental designs (e.g., laboratory/field training interventions manipulating leadership behaviors in a pre-post control group design; Avolio et al., 2009) to examine causal effects of eFRLM dimensions and factors on leadership effectiveness. Applying longitudinal designs would also help to understand how perceptions of leadership effectiveness may change over time. In particular, previous research has indicated that perceived effectiveness of leadership varies through the phases of extreme contexts, such as the preparation, response, and recovery phases (Hannah et al., 2009).

Second, our data consist solely of follower self-reports, which could have introduced common method bias (Podsakoff et al., 2012) and single-source bias, potentially causing inflated main effects of the eFRLM dimensions and factors on perceived leadership effectiveness. However, including additional controlling predictor variables in the hierarchical linear regression models should have mitigated common method bias (Siemsen et al., 2010). Despite this, common method bias cannot explain the interaction effects of follower-perceived VUCA environments on the association of eFRLM dimensions and factors with perceived leadership effectiveness. In the event of common method bias, effect sizes of interaction terms are rather underestimated and the power to identify significant interaction effects is reduced (Evans, 1985; McClelland & Judd, 1993).

Third, follower ratings of leadership effectiveness are prone to bias (Lord & Maher, 1993; Meindl et al., 1985) due to the influence of exogenous factors, such as followers' individual differences. However, follower ratings of leadership are considered more accurate than leader self-ratings and directly influence actual follower behavior (Hogan et al., 1994; Meindl, 1995; see also Podsakoff & Organ, 1986). In addition, follower ratings of leadership effectiveness converge with objective leadership effectiveness criteria (e.g., organizational unit performance; see Hogan et al., 1994). Nevertheless, future research should complement perceptual measures of leadership effectiveness with objective (e.g., financial performance) organizational measures (Hogan et al., 1994).

Fourth, we suggest the development of a psychometric test measuring the extent of an employee's perceived VUCA environment. A self-report questionnaire based on established techniques for scale construction (e.g., exploratory and confirmatory factor analysis; Worthington & Whittaker, 2006) may contribute to creating a uniform perceptual measurement of VUCA environments thus enhancing the comparability of future research. Our self-developed measure of perceived VUCA environments might be a fertile ground to do so because it draws on the most widespread VUCA framework (Bennett & Lemoine, 2014) and showed acceptable internal consistency ($\alpha = .73$).

Fifth, in light of our findings supporting the methodological and theoretical need of a "fuller" FRLM (Antonakis & House, 2014, p. 748), we recommend future research drawing on transformational-transactional leadership theory to control for instrumental leadership. Imitating Oc's (2018) call, we further encourage future research to explore additional contexts (e.g., change management processes) in which eFRLM dimensions and factors may be instrumental for leaders to effectively manage their followers.

3.6.3 Practical Implications

Leaders play a crucial role in guiding organizations and their people through uncharted and stormy waters. Instrumental leadership skills seem to be important in remote work and dynamic, crisis-ridden environments that will likely characterize future business landscapes (Luthans & Broad, 2022). However, the present findings suggest that instrumental leadership behaviors are less implemented in dynamic and crisis-ridden environments. To address this gap, companies should consider implementing training programs (Lacerenza et al., 2017) that educate organizational leaders on effective leadership, taking the specific leader-follower constellation (e.g., remote work) and organizational environment (e.g., VUCA) into account. In addition, it seems important to raise leaders' awareness of the context-dependent nature of effective leadership behaviors and to cultivate a feedback culture mirroring such behaviors, for example, by customizing 360-degree feedback instruments to constantly changing business settings (Kelloway et al., 2000; Rowold et al., 2017).

3.7 Conclusion

The COVID-19 pandemic has revealed a need for effective leadership of a geographically dispersed remote workforce in VUCA environments. The present research delved into this topic by examining the transferability of the FRLM and its more recent extension—instrumental leadership (eFRLM)—to remote and dynamic, crisis-ridden work contexts. Our findings suggest that instrumental leadership is a crucial factor impacting leadership effectiveness in remote work contexts, which may become even more important in pronounced VUCA environments. These results have practical implications for organizations seeking to effectively lead remote working employees in challenging times, and point to the potential value of training and development programs focused on educating organizational leaders on instrumental leadership skills. Overall, augmenting the FRLM with instrumental leadership appears to be a fertile ground for future research that seeks to illuminate effective leadership in nascent virtual and rapidly changing organizational contexts.

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Appendix 3.A

Table 3.1A

Supplementary Results of the Hierarchical Linear Regression Analyses Predicting Perceived Leadership Effectiveness at the eFLRM Dimensional Level

	Model D1				Model D2				Model D3				Model D4			
Variable	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF
Controls																
Age[a]	2.36	.42	.02	50.85	2.43	.41	.01	23.30	2.43	.41	.01	18.82	2.49	.40	.01	4.66
Gender[a]	1.07	.93	.00	7.85	1.09	.92	.00	3.30	1.10	.91	.00	2.85	1.11	.90	.00	0.70
Education[a]	1.27	.79	.00	22.61	1.31	.76	.00	14.54	1.32	.76	.00	10.72	1.32	.76	.00	1.98
Remote working time[a]	1.07	.93	.00	24.60	1.08	.93	.00	3.60	1.08	.93	.00	2.54	1.08	.93	.00	2.96
Weekly working time[a]	1.37	.73	.00	48.34	1.45	.69	.00	9.91	1.46	.69	.00	7.19	1.47	.68	.00	4.74
Corporate tenure[a]	2.49	.40	.00	32.12	2.53	.40	.00	14.88	2.53	.40	.00	10.93	2.55	.39	.00	3.56
Duration of working with leader[a]	1.85	.54	.00	8.99	1.88	.53	.00	22.13	1.88	.53	.00	15.50	1.89	.53	.00	2.96
Interaction frequency with leader[a]	1.06	.95	.05	24.96	1.11	.90	.01	10.87	1.13	.88	.01	8.19	1.17	.86	.01	3.53
Age[b]	1.32	.76	.00	30.52	1.34	.75	.00	10.61	1.34	.75	.00	7.68	1.36	.74	.00	4.01
Gender[b]	1.07	.94	.00	9.23	1.08	.93	.00	11.78	1.08	.93	.00	9.31	1.10	.91	.00	0.76
Hierarchical level[b]	1.20	.83	.00	22.16	1.22	.82	.00	18.80	1.23	.82	.00	14.64	1.23	.81	.00	2.77
Control span[b]	1.10	.91	.00	42.28	1.14	.88	.00	18.90	1.14	.88	.00	15.14	1.15	.87	.00	4.73
Transformational leadership					1.08	.93	.59	211.47	1.53	.66	.43	166.21	3.02	.33	.27	122.26
Transactional leadership									1.51	.66	.23	86.52	1.70	.59	.16	51.40
Instrumental leadership													3.37	.30	.29	130.23

Note. n = 519. Regressions were computed using z-standardized data except for followers' and leaders' gender, which was dummy-coded (0/1 = male/female). VIF = variance inflation factor; TOL = tolerance statistics; LMG = explained variance by a predictor variable based on the Lindeman, Merenda, and Gold method (Lindeman et al., 1980) for variance decomposition; RF = increase in node purity, which is calculated for each tree and then averaged over all trees, based on the random forest algorithm proposed by Breiman (2001, 2002) with the *ntree* parameter set at the default (500 trees).

[a] Follower-related control variables.

[b] Leader-related control variables

Table 3.2A

Supplementary Results of the Hierarchical Linear Regression Analyses Predicting Perceived Leadership Effectiveness at the eFLRM Factor Level

	Model F1				Model F2				Model F3				Model F4			
Variables	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF	VIF	TOL	LMG	RF
Controls																
Age[a]	2.36	.42	.02	50.85	2.43	.41	.01	9.07	2.43	.41	.01	7.90	2.49	.40	.01	4.66
Gender[a]	1.07	.93	.00	7.85	1.09	.92	.00	1.12	1.10	.91	.00	1.07	1.11	.90	.00	0.70
Education[a]	1.27	.79	.00	22.61	1.31	.76	.00	3.27	1.32	.76	.00	5.62	1.32	.76	.00	1.98
Remote working time[a]	1.07	.93	.00	24.60	1.09	.92	.00	5.04	1.09	.92	.00	1.17	1.10	.91	.00	2.96
Weekly working time[a]	1.37	.73	.00	48.34	1.45	.69	.00	8.43	1.46	.69	.00	3.14	1.47	.68	.00	4.74
Corporate tenure[a]	2.49	.40	.00	32.12	2.53	.40	.00	5.94	2.53	.40	.00	5.42	2.55	.39	.00	3.56
Duration of working with leader[a]	1.85	.54	.00	8.99	1.88	.53	.00	5.40	1.88	.53	.00	4.45	1.89	.53	.00	2.96
Interaction frequency with leader[a]	1.06	.95	.05	24.96	1.11	.90	.01	7.44	1.13	.88	.01	6.31	1.17	.86	.01	3.53
Age[b]	1.32	.76	.00	30.52	1.34	.75	.00	6.56	1.34	.75	.00	5.62	1.36	.74	.00	4.01
Gender[b]	1.07	.94	.00	9.23	1.08	.93	.00	1.49	1.08	.93	.00	1.17	1.10	.91	.00	0.76
Hierarchical level[b]	1.20	.83	.00	22.16	1.22	.82	.00	4.75	1.23	.82	.00	4.20	1.23	.81	.00	2.77
Control span[b]	1.10	.91	.00	42.28	1.14	.88	.00	8.19	1.14	.88	.00	7.09	1.15	.87	.00	4.73
Transformational leadership																
Articulating a vision					3.28	.31	.17	77.13	3.37	.30	.15	76.65	3.94	.25	.10	62.33
Providing an appropriate role model					3.19	.31	.16	82.77	3.21	.31	.15	75.57	3.38	.30	.09	59.75
Fostering the acceptance of group goals					3.00	.33	.16	74.54	3.00	.33	.14	67.20	3.26	.31	.09	49.77
High performance expectations					1.40	.72	.01	7.70	1.40	.71	.01	7.12	1.44	.70	.00	4.60
Individualized support					2.12	.47	.11	38.75	2.83	.35	.09	28.76	2.95	.34	.06	14.66
Intellectual stimulation					2.36	.42	.11	35.97	2.36	.42	.10	32.90	2.61	.38	.06	32.90
Transactional leadership																
Contingent reward									2.35	.43	.10	35.94	2.41	.41	.06	17.92
Instrumental leadership																
Environmental monitoring													2.73	.37	.08	27.37
Strategy formulation and implementation													2.78	.36	.05	10.14
Path-goal facilitation													3.31	.30	.08	41.33
Outcome monitoring													3.21	.31	.09	43.09

Note. n = 519. Regressions were computed using z-standardized data except for followers' and leaders' gender, which was dummy-coded (0/1 = male/female). VIF = variance inflation factor; TOL = tolerance statistics; LMG = explained variance by a predictor variable based on the Lindeman, Merenda, and Gold method (Lindeman et al., 1980) for variance decomposition; RF = increase in node purity, which is calculated for each tree and then averaged over all trees, based on the random forest algorithm proposed by Breiman (2001, 2002) with the *ntree* parameter set at the default (500 trees).

[a] Follower-related control variables.

[b] Leader-related control variables.

Appendix 3.B

Previous research found instrumental leadership to explain unique variance in leadership outcomes beyond FRLM dimensions and factors (Antonakis & House, 2014; Rowold, 2014; Rowold et al., 2017). In addition, omitting instrumental leadership factors in predictive models has previously been shown to distort the FRLM's dimension and factor estimates (Antonakis & House, 2014; Bormann & Rowold, 2018; Rowold, 2014). Given that the eFRLM dimensions and factors are not orthogonal (i.e., they are intercorrelated), the change in R^2 observed in our main hierarchical regression analyses between Model D3/F3 (including control variables and FRLM dimensions/factors) and Model D4/F4 (including control variables and eFRLM dimensions/factors) does not indicate the total actual incremental variance explained by instrumental leadership (see Antonakis & House, 2014). To further investigate the relative importance of the instrumental leadership dimensions and factors when predicting leadership effectiveness, we employed two methods for assessing the eFRLM's relative variable importance (Grömping, 2009): (a) the Lindeman, Merenda, and Gold method (LMG; Lindeman et al., 1980) for variance decomposition in multiple linear regression analyses, using the R package *relaimpo* (Grömping, 2007), and (b) the random forest (RF) machine learning algorithm for variable importance (Breiman, 2001, 2002), using the R package *randomForest* (Liaw & Wiener, 2002). Both methods are appropriate for handling intercorrelated predictors and have been applied in previous research (Bi, 2012; Grömping, 2009). The supplemental findings support our main findings, that is, (a) instrumental leadership contributes unique variance when predicting perceived leadership effectiveness beyond the FRLM and control variables and (b) there may be omitted variable bias and overstated estimates when not considering instrumental leadership in FRLM predictive models.

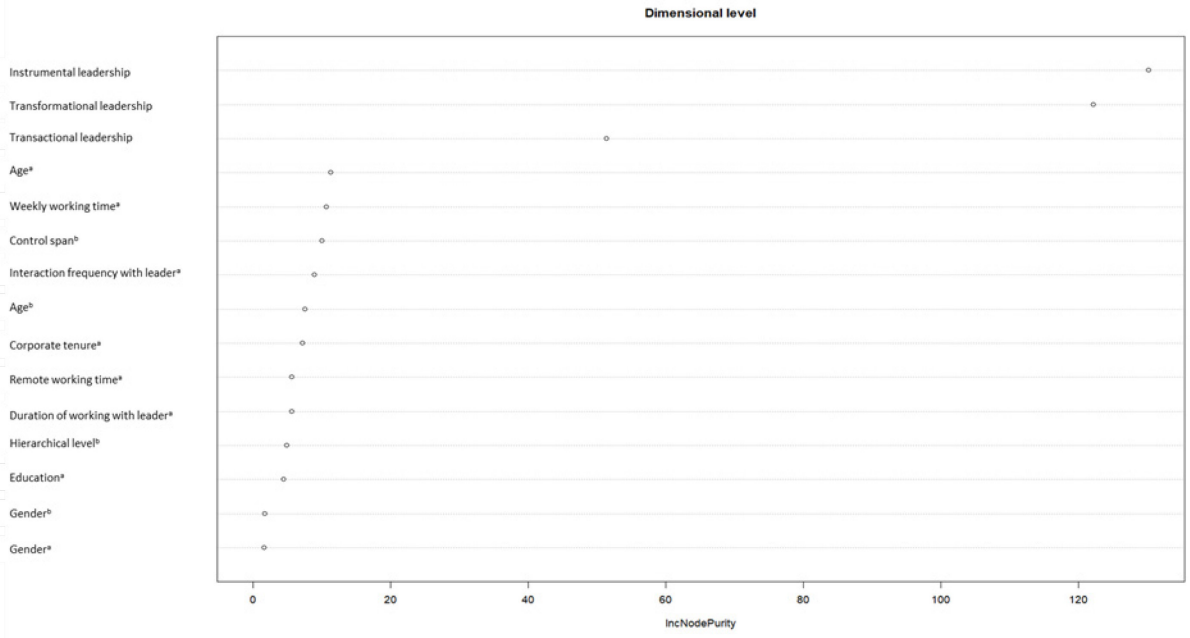
The LMG method (Lindeman et al., 1980) decomposes the variance explained (R^2) by a predictor variable considering both its direct effect and its effect in combination with other variables in the model (Johnson & Lebreton, 2004). This method estimates semi-partial coefficients (Kruskal, 1987; Liu et al., 2021) and is particularly recommended for decomposing R^2 (Grömping, 2007). When applied at the dimensional level (see Table 3.1A), the LMG method showed that the contribution of transformational leadership to the variance explained in perceived leadership effectiveness decreased from 43% (Model D3) to 27% (Model D4) after adding instrumental leadership. In comparison, instrumental leadership accounted for 29% of the actual variance explanation in Model D4, explaining more variance than transformational leadership. Our findings are consistent with the pioneering study on instrumental leadership by Antonakis and House (2014) conducted in stationary on-site work settings: Transformational

leadership's variance explanation of perceived leadership effectiveness decreased from 43% to 28% after the instrumental leadership dimension was added in Antonakis and House (2014). In the present study, transformational leadership's variance explanation decreased from 43% to 27%. In both Antonakis and House (2014) and the present study, instrumental leadership accounted for a similar proportion of the variance in perceived leadership effectiveness, 28% and 29%, respectively. Similarly, at the factor level (see Table 3.2A), the variance explanation of transformational leadership decreased substantially, with each of its corresponding six factors losing an average of 4% in R^2 after instrumental leadership factors were entered into Model F4. On average, instrumental leadership factors each contributed 7.47% to the actual variance explained in the prediction of leadership effectiveness, whereas the average contribution of transformational leadership factors was 6.63%.

The RF algorithm (Breiman, 2001, 2002) calculates the relative variance importance of predictor variables based on their contribution to the homogeneity of nodes and leaves in the modeled random forest. The importance of each predictor variable is measured by their increase in node purity (*IncNodePurity*), which is calculated for each tree and then averaged over all trees (Liaw & Wiener, 2002). An increase in node purity, as measured by the residual sum of squares, leads to a decrease in mean squared error (MSE) in regression analyses (González et al., 2015). The default number of trees (*ntree* parameter) used for computing the node purity increase was set at 500. When applied to our main hierarchical linear regression models predicting leadership effectiveness with control variables and eFRLM dimensions (Model D4; see Figure 3.1B) or factors (Model F4; see Figure 3.2B), the RF algorithm revealed that the instrumental leadership dimension was the most influential predictor in terms of increase in node purity (130.23), along with transformational leadership (122.26). Similarly, the instrumental leadership factors "outcome monitoring" (43.09) and "path-goal facilitation" (41.33) were among the top five most influential predictors in terms of increase in node purity, along with the transformational leadership factors "articulating a vision" (62.33), "providing an appropriate model" (59.75), and "fostering the acceptance of group goals" (49.77). These findings provide further support for the relative importance of instrumental leadership at both dimensional and factor levels and its predictive validity for leadership effectiveness. The corresponding values for the node purity increase for control variables and eFRLM dimensions/factors can be found in Table 3.1A and Table 3.2A, respectively.

Figure 3.1B

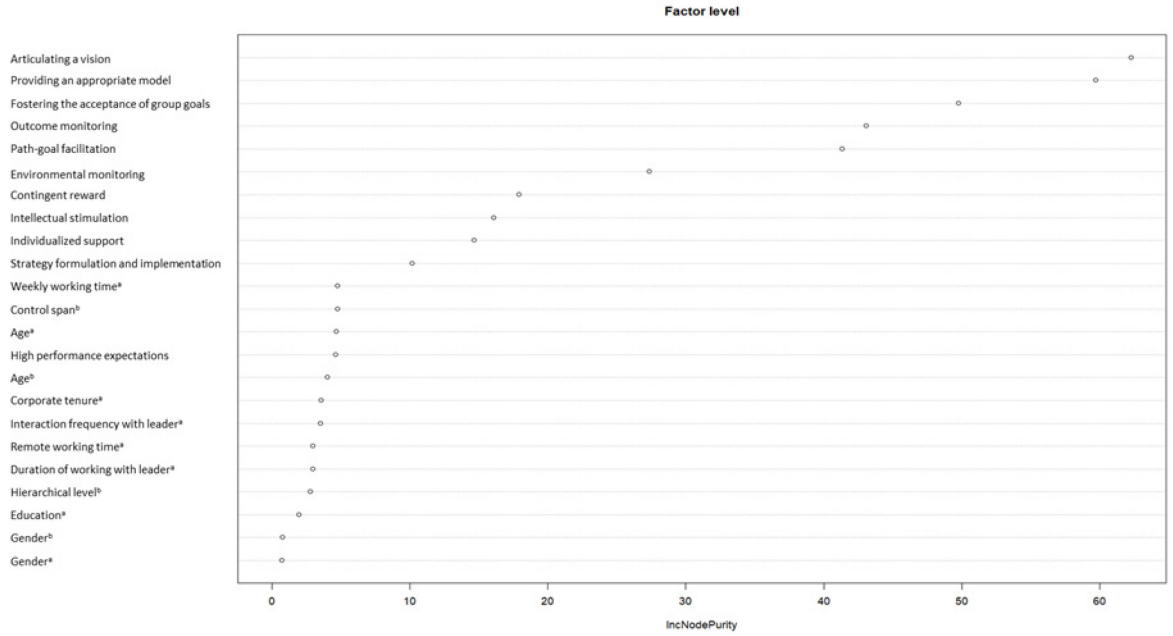
Results of the Random Forest Algorithm Predicting Perceived Leadership Effectiveness Including Control Variables and eFRLM Dimensions



Note. Gender was dummy-coded (0/1 = male/female). The relevance of each control variable and eFRLM dimension is measured in terms of the increase in node purity ("IncNodePurity").
[a] Follower-related control variables.
[b] Leader-related control variables.

Figure 3.2B

Results of the Random forest Algorithm Predicting Perceived Leadership Effectiveness Including Control Variables and eFRLM Factors



Note. Gender was Dummy-Coded (0/1 = Male/Female). The Relevance of Each Control Variable and eFRLM Factor is Measured in Terms of the Increase in Node Purity ("IncNodePurity").
[a]Follower-Related Control Variables.
[b]Leader-Related Control Variables.

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4 Rendering Consumer Behavior More Sustainable

Publication Status

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Abstract

The environmental goal to curb global greenhouse gas (GHG) emissions so as to limit global warming to well below 2 degrees Celsius above pre-industrial levels represents a tremendous challenge for humankind. While people often focus on the production side of the economy to accomplish this target, the consumption side is equally important. In this paper, we therefore focus on consumption, and discuss the prospects and obstacles to make consumption (more) sustainable. Specifically, we question how can consumers learn to act in a sustainable manner—in their purchase and recycling decisions and in their waste behavior—and how can they relinquish their environmentally harmful habits? We address these issues by integrating research from economics and psychology. Even though both disciplines have made significant progress, it is still not fully understood why individuals fail to transform their "green thinking" into "green acting" and disregard available information (e.g., eco-labels), leading to biased or erroneous consumption choices. In this way, consumption decisions are less sustainable than consumers want them to be—and than they could be. We synthesize the literature to identify sources and obstacles that make consumers deviate from sustainable consumption paths. In this regard, we identify asymmetric information, incomplete information and market failures as key economic and behavioral biases as key psychological drivers preventing consumers from making sustainable consumption decisions. In view of this, we recommend policies suitable to mitigate the identified information deficits and to counteract behavioral biases. To this end, we differentiate between consumer groups and products, which allows us to tailor policy measures to make consumers' choices more ecological.

Keywords. Sustainable consumer behavior; sustainable development goals; attitude-behavior gap; economic incentives; behavioral economics; information.

4.1 Introduction

A major driver of anthropogenic influence on Earth systems is the degradation of biophysical natural resources, the destruction of ecosystems and the decrease in biodiversity (Vitousek et al., 1997). The extent of this detrimental influence depends in complex ways on the types of resources used, on their renewability and recoverability, and on the scale of human activities relative to the carrying capacities of the ecosystems (Sulston et al., 2013). Careful resource management can be applied at different scales, ranging from economic sectors like agriculture, manufacturing, and industry, to work organizations, the consumption patterns of households and individuals, and to the resource demands of individual goods and services (Bower & Leon, 1999; Clark, 2006).

The underlying drivers of direct anthropogenic effects on the environment are human desires and needs satisfied by consumption (Michaelis & Lorek, 2004). The extent of the effects of consumption on natural resources and biodiversity may be reduced by both consuming less and consuming in a more sustainable way, the latter requiring to make the full cycle of production, distribution, final consumption, and disposal more sustainable (Polizzi di Sorrentino et al., 2016). Consumption of goods and services can be analyzed and managed at all scales throughout the consumption chain: from the effects of individual lifestyle choices and spending patterns, to the resource demands of specific goods and services, the impacts of economic sectors, to national economies and the global economy (Jackson & Michaelis, 2003). A thorough analysis of consumption patterns relates resource use to the environmental, ecological, social and economic dimensions of sustainability. In this respect, the total resources required to produce goods and services, their resource intensity and their resource productivity are all important factors for understanding the impacts of human consumption on local and global environmental conditions and integrity of the ecosystems (Girod et al., 2014).

In 2010, the International Resource Panel, hosted by the United Nations Environment Programme (UNEP), published the first global scientific assessment on the effects of consumption and production identifying priority actions for developed and developing countries (UNEP, 2010). The study found that the most critical effects are related to ecosystem health, human health and resource depletion. From a production perspective, it records that fossil-fuel combustion processes, agriculture, and fisheries have the most important impact; while from a consumption perspective, household consumption related to mobility, shelter, food, and energy-using products causes the majority of life-cycle impact of consumption.

Although the production side is equally (and perhaps even more) important compared to the consumption side (Girod et al., 2014), we shall focus on the consumption side here, and set

aside such issues as the transition towards green production, the decoupling of environmental degradation and economic growth, the production of "green" energy etc. Yet, production and consumption are by no means independent, but determine each other. For, supply and demand are equalized in market equilibrium, implying that commodities that are produced by means of unsustainable production technologies and processes or are produced under unsustainable conditions are eventually bought and consumed, and that the demands for unsustainable, yet cheap, products are willingly met by industry. Because production determines consumption, and, at the same time, consumer demand determines the goods to be produced, it is hard to isolate the two sides. Because of this interdependence it is essential that consumers become more concerned about the products they buy and consume, that is, about the underlying production processes, the required consumption of resources, the possibilities of recycling, and their pure volume of consumption. By doing so, consumers must recognize that they are able to shape sustainable markets via their purchase-related decisions.

4.2 Sustainable Development Goals

The 2030 Agenda for Sustainable Development, adopted on 25 September 2015 by all United Nations Member States, provides "a shared blueprint for peace and prosperity for people and the planet, now and into the future for all" (United Nations, 2015). It centers on 17 Sustainable Development Goals (SDGs), representing the United Nations General Assembly's harmonized set of future development targets, a collection of interlinked goals intended to be achieved by the year 2030 (United Nations, 2015). A detailed overview of the 17 SDGs is presented in Table 4.1.

Table 4.1

Sustainable Development Goals (SDGs)

Number	Goal
1	End poverty in all its forms everywhere.
2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture.
3	Ensure healthy lives and promote well-being for all at all ages.
4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5	Achieve gender equality and empower all women and girls.
6	Ensure availability and sustainable management of water and sanitation for all.
7	Ensure access to affordable, reliable, sustainable and modern energy for all.
8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
10	Reduce inequality within and among countries.
11	Make cities and human settlements inclusive, safe, resilient and sustainable.
12	Ensure sustainable consumption and production patterns.

Number	Goal
13	Take urgent action to combat climate change and its impacts.
14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development.
15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
17	Strengthen the means of implementation and revitalize the global partnership for sustainable development.

Note. Each of the 17 SDGs contains more specific targets (see United Nations, 2017, for more detail).

Among those goals, the SDG 12 "Responsible consumption and production" is particularly important from an economic perspective as it aims "to ensure sustainable consumption and production patterns". SDG 12 itself has 11 targets to be achieved by at least 2030, and progress towards those targets is measured by means of 13 indicators (United Nations, 2015):

12.1 Implement the 10-year sustainable consumption and production framework.

12.2 Sustainable management and use of natural resources.

12.3 Halve global per capita food waste.

12.4 Responsible management of chemicals and waste.

12.5 Substantially reduce waste generation.

12.6 Encourage companies to adopt sustainable practices and sustainability reporting.

12.7 Promote sustainable public procurement practices.

12.8 Promote universal understanding of sustainable lifestyles.

12.9 Support developing countries' scientific and technological capacity for sustainable consumption and production.

12.10 Develop and implement tools to monitor sustainable tourism.

12.11 Remove market distortions that encourage wasteful consumption.

Specifically, the full title of Target 12.1 is: "Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries" (United Nations, 2017, p. 16); and the full title of Target 12.c is: "Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities" (United Nations, 2017, p. 17).

Hence, the removal of market distortions that prevent the economic outcome to become sustainable—and thus ecologically and economically efficient—is a central issue of SDG 12.

We therefore take SDG 12 as a starting point, as it directly addresses sustainable production and consumption, and thus constitutes one of the core economic targets of the Agenda; or, as Guevara and Pla Julián (2019) put it: "Tackling the current patterns of consumption and production is crucial for sustainability because these are the main drivers of serious environmental and social impacts" (p. 1). In particular, we ask which market distortions, or market failures, can be identified that prevent markets from yielding efficient (in the sense of Pareto) outcomes. While a strong efficiency result is propagated by the First Welfare Theorem of economics, and the implementability of a (socially) specified allocation is postulated by the Second Welfare Theorem, actual markets apparently fail to bring about socially—and ecologically—efficient outcomes. Since the Welfare Theorems are logically sound, their lack of descriptive strength must result from violations of their prerequisites in real economies and societies. Reversely, if we can find ways to safeguard in our economies the conditions under which the Welfare Theorems hold, or if we can find policy measures to suitably compensate for those violated prerequisites, we may be sanguine to solve, or at least to mitigate, efficiency problems—and thus to turn our economies to sustainability.

4.3 Market Share of Sustainable Products

In the United States, the market share of sustainable products remains relatively low at 17.3% in 2022; however, it is worth noting that sustainability-marketed products experienced a considerably faster growth rate of 9.43% since 2017 compared to their conventional counterparts at 5.68% (Kronthal-Sacco & Whelan, 2023). Even though sustainable consumption markets across the world expanded for more than a decade (Globe Scan, 2014), sales remain marginal relative to mainstream alternatives in many markets (German Environment Agency, 2022).

Although Germany promotes sustainability (Sachs et al., 2020), the market share of sustainable products[9] remains small amounting to only 13.4% in 2020 (German Environment Agency, 2022; latest data available). Therefore, the German National Sustainable Development Strategy's target for SDG 12.1.a ("shape consumption in an environmentally and socially responsible way") to reach a 34% market share of sustainable products by 2030 (German Federal Government, 2021) seems quite optimistic and hardly achievable, as it would imply

[9] Calculations of the Federal Environmental Agency covering passenger cars, large household appliances, light bulbs and televisions (highest category of energy consumption labelling); foodstuffs (organic label); sanitary paper, detergents and cleaning agents ("Der blaue Engel" environmental label).

more than doubling the current level in less than a decade. This inadequate status in terms of sustainable consumption can also be witnessed in Germany's energy consumption and its carbon dioxide emissions at the household level[10], where both energy consumption, fluctuating around 4.000 petajoules, and emissions, stagnating in the corridor between 215 and 250 million tons of carbon dioxide, remain constant for almost two decades (German Federal Statistical Office, 2022).

In total, we observe both in parallel: a positive trend towards sustainable consumption as well as substantial scope for future progress in this direction. Hence, political action is called for as goals are determined, but not yet put to action, though. In the case of Germany, data availability leaves room for improvement, as the most recent data (both for the market share of sustainable products and for total energy consumption; see German Environment Agency, 2022) refer to the year 2020. However, the lack of more recent data poses an obstacle to the transition towards more sustainable consumption because, as we will determine, information is crucial to changing consumption patterns; similarly, the lack of timely and reliable data may jeopardize effective policy-making. Reversely, when the functional relations between consumption and the induced ecological effect are uncertain, or as long as they are not fully understood, is the value of information high, since the costs of a misled environmental policy are tremendous.

4.4 Market Failure Preventing Sustainability

From an economic perspective, a lack of sustainability of the economic outcome results from market failure. In an equilibrium of the markets for commodities and services, the aspects of sustainability are not, or not adequately, acknowledged (Bromley, 2007); the market basically ignores fundamental aspects of sustainability.—Though, it is not the market which ignores sustainability, but the economic agents who do not (fully) take into account the ecological, social and economic consequences of their behavior and their economic decisions.—As a consequence, market outcome fails to safeguard sustainability, and thus efficiency. Seyfang (2005) identifies informational barriers as a major obstacle to achieve market efficiency due to limited availability of information to consumers about "environmental and social implications of consumption decisions, or issues of credibility and consistency" (p. 295).

Efficiency, in the sense of Pareto, is an encompassing concept that respects the interests of all members of the society. Hence, under the premise that society per se is interested in

[10] Calculations of the German Federal Statistical Office (2022) covering sectors housing, transport, food, other products, and other services.

sustainability, efficiency encompasses social welfare as well as environmental and ecological targets. Yet, efficiency is only a necessary condition for an allocation to be socially optimal, that is, to constitute the socially most preferred outcome. What is best to society has to be determined by a suitably specified social welfare function that should arguably take into account the well-being of all members of the society, including the aspect of a fair distribution and fairness in general, as well as a deliberate balance of welfare of the present and future generations alike.

According to Our Common Future, usually referred to as the *Brundtland Report* (Brundtland, 1987), sustainable development is defined as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (p. 1); that is, sustainable development consists of balancing local and global efforts to meet human needs without destroying or degrading the natural environment (Robert et al., 2005). Hence, from the society's perspective, the crucial issue is to truthfully take into account the well-being of future generations and the preservation of the natural environment: to minimize negative anthropogenic impacts and to maintain the balance between ecological resilience, economic prosperity, political justice and cultural vibrancy so as to ensure a desirable planet for all species now and in the future (United Nations, 2015). Once we are willing to include these issues into our welfare criterion, or to include it as a component of our welfare function, then (some realization of) sustainability will be safeguarded whenever efficiency is reached and maintained. Clearly, this is by no means a mechanistic, automatic outcome, but requires deliberate and responsible decision-making, continuously taking into account the well-being of future generations and the preservation of the natural environment.

4.5 Types of Market Failure

Welfare economics has established two fundamental results, called the *First* and the *Second Welfare Theorem*[11], stating two strong findings: The First Theorem provides an efficiency result for competitive markets and the scope for social choice. In brevis, it says that in any economy with private goods—that is, in the absence of any type of public goods and externalities—any competitive equilibrium is Pareto efficient; as this holds for any economy, this efficiency result holds for any initial distribution of commodities, income and wealth. The Second Theorem taking the reverse view is complementary to the First: It states that, under a

[11] *First Welfare Theorem.* If consumers are non-satiated, in a private ownership economy without externalities and consisting entirely of purely private goods, any competitive equilibrium allocation is Pareto efficient. *Second Welfare Theorem.* Let the conditions of the Theorem one hold. If the technologies of all firms and the preference relations of all consumers are convex, then for every Pareto optimal allocation there is an initial allocation and a (non-zero) price vector such that the allocation can be supported by a competitive equilibrium.

set of presumptions, any Pareto efficient allocation can be implemented as a competitive equilibrium, that is, by means of an equilibrium outcome of competitive markets, if suitable transfers are made in advance (or a suitable initial allocation is chosen).[12] While the two Welfare Theorems constitute very powerful results, their limitation is that they hinge on quite demanding prerequisites, and any violation of one of those prerequisites potentially jeopardizes the respective result. So, any violation of either of the prerequisites—and for this reason any combination of violations—requires a separate analysis of the induced welfare implications, and thus of the robustness of Pareto efficiency of the market equilibrium.

Since real economies and real markets do typically not satisfy the prerequisites of the Welfare Theorems, governments are required to undertake measures suitable to establish efficiency by means of the market mechanism under these modified conditions. As we may guess, there are many real-world phenomena that violate prerequisites of the Welfare Theorems, and may thus constitute reasons for market failure; among those are externalities, non-convexities, incomplete information, incomplete markets as well as significant (or even prohibitive) transaction cost. The presence of either of them generally requires government intervention, and the simultaneous presence of multiple sources of inefficiency render suitable policies quite intricate. In general, efficiency can only be established if the number or available policy measures is at least as large as the number of the sources of market failure, where each measure is tailored to a single source.

With respect to sustainability, the most significant sources of market failure arguably are the presence of externalities, public goods, incomplete information, incomplete markets and significant transaction cost. It is therefore essential to find policy measures suitable to either eliminate or to counterbalance those reasons of market failure. This is quite a challenging task, as the reasons of market failure are quite diverse, ranging from technological phenomena, via individually rational, though socially unwelcome behavior to situations where individuals simply take wrong decisions. In the rest of the paper we explore possible policy measures to overcome those sources that take us away from sustainability.

4.6 Phenomena

Sustainable consumption comprises of the purchase of products with reduced environmental impact (e.g., detergents), the avoidance of air pollutants (e.g., anthropogenic aerosols), and the purchase of fair-traded or locally produced goods (Gilg et al., 2005). More sustainable consumption behavior falls into the scope of consumers as they decide to adopt

[12] "[W]hichever Pareto optimum we wish to decentralize […] it is possible to decentralize this allocation as a competitive equilibrium so long as the […] appropriate lump-sum transfers are made" (Laffont, 1988, p. 4).

more environmentally-friendly behavior, such as the use of organic products, clean and renewable energy sources as well as the search for goods and the use of services offered by companies with zero, or almost zero, environmental impact (Testa et al., 2021). As the literature on sustainable consumption behavior is fairly fragmented (Geiger et al., 2018), we identify emerging phenomena in the field by integrating insights from both economics and psychology.

4.6.1 Human Behavior

In the 1970s, psychology began to shift its focus towards the pressing ecological crisis. Maloney and Ward (1973) claim that environmental problems stem from "maladaptive behavior" (p. 583) exhibited by humans, emphasizing that technological solutions alone are insufficient in addressing the ecological crisis. Instead, by situating the solution within the realm of psychology, a discipline concerned with behavioral change, Maloney and Ward (1973) recognize the central role of this science in tackling environmental challenges.

4.6.1.1 Attitude-Behavior Models

Social psychology distinguishes between constructs such as individuals' attitudes and values, or intended behavior and actual behavior. *Attitude-behavior models* conceptualize the connection between attitude and behavior. Those models describe how individuals behave given their attitudes and intentions; intention represents the direct antecedent of actual behavior. For the first time, Fishbein and Ajzen (1975) state this relationship between attitude and behavior in human decision making in their *theory of reasoned action*. A derivative of this theory is the *theory of planned behavior* (Ajzen, 1991): behavior is the outcome of intention which in turn is a function of attitudes and subjective norm, the latter defined as perceived social pressure to show a specific behavior, e.g., purchasing organic vegetables (Sparks & Shepherd, 1992). Still, pro-environmental attitudes alone are not sufficient to predict a complex construct such as consumption behavior (Hargreaves et al., 2008). Ajzen (1991) added the concept of *perceived behavioral control* in his *theory of planned behavior* to further improve the predictive power of the theory of reasoned action. Perceived behavioral control accounts for behavior being not fully under consumers control. According to this concept, even when consumers possess pro-environmental attitudes and perceive the purchase of organic vegetables as socially desirable, the required price premium for organic products may prohibit them from purchasing sustainably (Sparks & Shepherd, 1992).

Social psychology discovers a weak association between pro-environmental preferences and sustainable consumption (Hargreaves et al., 2008). Consumers' environmental concerns are positively correlated with purchasing organic products (Vermeir & Verbeke, 2008). Consumers' attitudes towards organic products (e.g., vegetables or milk) are well documented;

even consumers without environmental concerns regard those products as more favorable with respect to taste, quality, safety, healthiness and their environmental impact (Vermeir & Verbeke, 2008). However, additional factors play a decisive role when it comes to sustainable consumption. Shaw and Shiu (2003) extend the traditional attitude-behavior model and introduce an ethical dimension[13] and enhance the explanatory power of their model. While Ajzen (1991) originally assumes that intended behavior is moderated by attitudes, De Pelsmacker and Janssens (2007) postulate a distinction between general attitudes (e.g., concern/interest and skepticism/lack of belief) and specific attitudes (e.g., product interest, product likeability, shopping convenience, and price acceptability). By using Belgian consumer data on fair trade products, De Pelsmacker and Jannssens (2007) show that overall knowledge and attitudes towards the fair trade issue have a considerable effect on purchase intention. Yet, their findings also indicate a moderating role of previously unexplored factors, such as (perceptions of) quality and information on fair trade purchasing behavior.

4.6.1.2 Consumer Values

Another important antecedent of sustainable consumption behavior are consumer values. These are defined as "desirable trans-situational goals, varying in importance and serving as guiding principle in a person's life or other social entity" (Schwartz, 1994, p. 21). In this sense, consumer values can be understood as guiding principles of human behavior determining which goals people pursue (Mahmoodi et al., 2021). These values, in contrast to attitudes, exhibit a higher degree of abstractness, as they are not limited to a specific behavioral context and are relatively stable over time (Schuitema & de Groot, 2015). In his *Value Theory*, Schwartz (1994) derives ten distinct types of values in order to explain sustainable behavior and decision making (see also Dietz et al., 2005).[14]

Stern et al. (1995) modified Schwartz's (1994) Value Theory and postulate that three value types are the most prevalent determinants of sustainable consumption behavior, namely egoistic, altruistic and biospheric values (Mahmoodi et al., 2021; Schuitema & de Groot, 2015; Stern & Dietz, 1994). Biospheric values can be understood as an orientation where "people judge phenomena on the basis of costs or benefits to ecosystems or the biosphere" (Stern & Dietz, 1994, p. 70). In a situation where consumers' (short term) individual interests and (long term) collective interests are incongruent, that is, a social dilemma, egoistic consumers will

[13] This dimension is measured by *ethical obligation,* defined as a person's internalized set of ethical rules that reflect his or her personal beliefs about what is right and wrong (Kurland, 1995), and by *self-identity*, defined as ethical matters becoming central to an individual's identity (Shaw & Shiu, 2003).

[14] These ten postulated value types are: power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security (Schwartz, 1994).

only cooperate if their perceived individual benefits exceed their perceived individual costs, whereas altruistic consumers also account for societies' costs and benefits. Doran and Natale (2011) find that religious consumers are more inclined to buy fair trade products as they possess higher emphatic concern. Mahmoodi et al. (2021) analyse purchases for electric products and show that values alone cannot fully explain consumer behavior. Recognizing this limitation, the authors propose the integration of strategies that leverage biases, such as consumers' loss aversion. They suggest implementing innovative tariffs that combine rewards and penalties to incentivize electricity savings. In summary, although pro-environmental attitudes and values alone do not fully predict (sustainable) consumption behavior, elucidating consumers' cognitive drivers through psychological insights is crucial (Andorfer & Liebe, 2012; Hargreaves et al., 2008).

4.6.1.3 Behavioral Economics

As behavioral economics analyses human decision making, this field has been recognized as complementary to classical economic theories (Mahmoodi et al., 2021). Consumer decision making is limited by bounded rationality and attention mosaics (Pedersen & Neergaard, 2006). The latter refers to the problem of being attentive in a situation where consumers are confronted with and overstrained by a great deal of information (Cyert & James, 1992). Specifically, cognitive anomalies in decision-making regarding sustainable products have been examined (e.g., Frederiks et al., 2015; Lee et al., 2020; Polizzi di Sorrentino et al., 2016; Schubert, 2017; Simões, 2016). Previous research (see, e.g., Frederiks et al., 2015; Polizzi di Sorrentino et al., 2016; Simões, 2016) has identified several cognitive anomalies preventing efficient outcomes in sustainable consumption behavior.[15]

In the realm of environmental policy, behavioral economics approaches have received increasing attention (Shogren et al., 2010; Thaler & Sunstein, 2010), providing an "exhaustive toolbox of strategies, so-called nudges" (Mahmoodi et al., 2021, p. 392). These nudges consist of subtle alterations in choice architecture that guide individuals toward desired outcomes without restricting their options (Thaler & Sunstein, 2010). By capitalizing on consumers' biases, well-designed nudging strategies can potentially address market failures and promote sustainable behaviors.

[15] Among those, the most notable anomalies are: temporal/spatial discounting (e.g., Hershfield et al., 2011; Newell & Siikamäki, 2014), feedback (e.g., Tiefenbeck et al., 2013; Wilson et al., 2015), status quo bias (e.g., Egebark & Ekström, 2016; Hartman et al., 1991), risk and loss aversion (Gonzales et al., 1988; Pires et al., 2004), social context and normative social influence (e.g., Alpizar et al., 2008; Goldstein et al., 2008; Nolan et al., 2008), habits/inertia (e.g., Eriksson et al., 2008; Orbell & Verplanken, 2015), environmental stimuli (e.g., Bamberg, 2006; Walker et al., 2015), information processing limits (e.g., Moisander, 2007; Pedersen & Neergaard, 2006), free-riding (Gunnthorsdottir & Rapoport, 2006), trust (Costanzo et al., 1986), and availability bias (Bekker et al., 2010; Osbaldiston & Schott, 2012).

In his *theory of warm-glow giving*, Andreoni (1990) models the emotional reward a person receives when giving to other persons. This "warm-glow" associated with gift giving represents the pleasure a person derives from behaving altruistically. Analogously, consumers may experience positive feelings when they behave in a sustainable manner. Sun and Trudel (2017) find these positive feelings that consumers experience when they recycle, thus compensating consumers for their aversion to create waste. A similar positive utility is generated through pro-social preferences (e.g., fairness in labor markets). In their laboratory experiment, Engelmann et al. (2018) show that consumers are willing to buy at higher prices when workers, in return, earn higher wages.

4.6.1.4 Inconsistencies

Although attitudes and values have been shown to play a substantial role in sustainable consumer behavior (see Testa et al., 2021 for a review), there exists a notable disparity between reported attitudes and actual behavior. Despite growing concerns among consumers regarding environmental issues, this heightened awareness does not necessarily translate into environmentally friendly consumption practices (Brach et al., 2018; Pedersen & Neergaard, 2006). In the case of Germany, a representative survey reveals consumers' sustainability concerns (Rubik et al., 2019). However, at the same time, there is evidence of a gap between attitudes and behavior, as indicated by stagnating sustainable consumption trends reported by Germany's Federal Statistical Office (2022) and Environment Agency (2022). Consequently, consumers often struggle to bridge the gap between their sustainable aspirations, encompassing attitudes and values, and their actual sustainable behaviors—a phenomenon widely recognized as the *attitude-behavior gap* or the *value-action gap* (Barr & Gilg, 2007; Schäufele & Hamm, 2018; Vermeir & Verbeke, 2008). Hamari et al. (2016) shed light on three factors contributing to this gap. Firstly, consumers engaging in sustainable consumption encounter both direct costs, such as price premiums, and coordination costs, such information processing. For instance, environmentally conscious consumers may resist paying a higher price for sustainable alternatives, like organic milk (Luchs et al., 2010). Secondly, the lack of visibility in showcasing sustainable behavior to others hinders social appreciation. Goldstein et al. (2008) demonstrate in a field experiment that individuals exhibit higher levels of sustainable behavior when they can publicly demonstrate their environmentally friendly actions. Lastly, insufficient information often hampers consumers' ability to act sustainably, as they may overlook the comprehensive life cycle costs associated with products (Kaenzig & Wüstenhagen, 2010).

The inconsistency of consumer behavior across various product or service categories poses an additional challenge to achieving more sustainable consumption patterns. McDonald

et al. (2009) interviewed 99 people in the United Kingdom who expressed concerns about mainstream supermarkets, yet continued to shop there for fast-moving consumer goods (e.g., food, beverages, and cosmetics). Interestingly, respondents displayed a discrepancy in their attitudes towards short-haul air travel, criticizing its high carbon emissions, while prioritizing more mundane factors such as flight time, price, and convenience when it came to long-haul travel. This inconsistency in behavior, as highlighted by McDonald et al. (2009), cannot be solely attributed to diverging pro-environmental attitudes or values, but also appears to be influenced by economic factors.

4.6.1.5 Barriers to Sustainable Consumption

Both personal and contextual barriers hinder consumers from engaging in sustainable behaviors despite their intentions to purchase environmentally friendly "green" products. For instance, consumers may be limited by budget constraints as conceptualized in the theory of planned behavior (Ajzen, 1991). Specifically, a lack of an intention to purchase environmentally friendly products need not to be the result of an absence of pro-environmental attitudes or of a subjective norm, but might result from the fact that consumers perceive the price premium for the environmentally friendly product as too high to be affordable (McDonald et al., 2009). Budgetary constraints may therefore partly explain the gap between attitudes and behavior. In European households, Moll et al. (2005) find a positive correlation between income and energy demand, especially for transport and recreation. Hence, the discrepancy between attitudes and behavior has two sides: Lower income impedes consumers to make sustainable purchasing decisions, whereas higher income triggers—perhaps even unintentionally—excessive consumption (income effect). This phenomenon can be observed not only at the individual level, but also at the aggregate level: while industrialized countries are prone to excessive consumption, developing countries cannot afford basic supplies such as food (Brown & Cameron, 2000).

4.6.1.6 Segmentation

The literature distinguishes three main consumer segments in terms of pro-environmental behavior (Kaenzig & Wüstenhagen, 2010):

1. Environmentally proactive *dark-green* consumers.
2. *Light-green* consumers prone to sustainable behavior if properly motivated.
3. Consumers showing no environmental concern.

Among the three consumer segments identified, only dark-green consumers demonstrate a considerable willingness to pay[16] for sustainable products. Another perspective on consumer segmentation can be found in the two-dimensional framework proposed by D'Souza (2004), which distinguishes between the cognitive dimension and the dimension of product characteristics. The cognitive dimension encompasses the presense of "environmental label information endorsed on products" (D'Souza, 2004, p. 184), such as symbols or codes, that aid consumers in recognizing sustainable products. Within this framework, D'Souza (2004) identifies four consumers types:

1. Environmentally green consumers.
2. Emerging green consumers.
3. Price sensitive green consumers.
4. Conventional consumers.

As *conventional consumers* are particularly concerned about the uncertainties associated with purchasing sustainable products (e.g., quality concerns), they are unlikely to be influenced by labels that promote their sustainable properties. *Emerging green consumers*, in contrast, value the benefits of sustainable products, but are not yet motivated to make sustainable purchases due to less meaningful labeling schemes. *Environmentally green consumers* are highly concerned about the environment, seek environmental justification for the product through labels, and thus show the highest willingness to pay for sustainable products. Finally, *price sensitive green consumers* are aware of environmental labels, but may not pay a price premium for sustainable products due to the uncertainty. This approach exemplifies how integrating insights from psychology and economics can dissolve the complexity of sustainable consumer behavior.

4.6.1.7 Sustainable Consumption Behavior (SCB)-Cube

The integration of economics and psychology in understanding sustainable consumption behavior is exemplified by the three-dimensional cube model proposed by Geiger et al. (2018): the Sustainable Consumption Behavior (SCB)-Cube incorporates the sustainability dimension (ecological, economic, and social considerations), the consumption dimension (acquisition, use, and disposal of products), and the consumption area dimension (different life areas such as food, housing, and mobility). Geiger et al. (2018) extend their basic model to account for the efficacy of different measures by adding a fourth impact-oriented dimension, which facilitates the identification of the most promising areas for behavioral change.

[16] Economists define the consumer's willingness to pay as the maximum price (*reservation price*) the consumer is willing to pay for a product.

By modifying the SCB-Cube and adding a model of sustainable creative competence, Kreuzer et al. (2019) identify relevant components of young adults' sustainable consumption behavior. While this age group prioritizes the acquisition phase, the downstream phase of usage and disposal is neglected. Also, young adults primarily consider ecological aspects and neglect social and economic aspects of sustainability. These findings illustrate the applicability of the SCB-Cube as an integrative approach that offers combinations of sustainable consumption behavior that are "both necessary and possible […] to complement and advance each other to generate scientific impetus for sustainable development" (Geiger et al., 2018, p. 29).

4.6.2 Methodological Challenges

To explore sustainable consumer behavior, different disciplines employ different research methods. In their literature review on fair trade consumption, Andorfer and Liebe (2012) examine research methods used in economics and psychology. In the studies covered in their analysis, research in psychology focuses primarily on three main concepts, that is, consumer attitudes, consumer values, and information/communication. Methodologically, these studies rely primarily on quantitative surveys and qualitative approaches, such as in-depth interviews or focus group discussions. However, a methodological disadvantage of surveys is that respondents self-report, which can distort the answers to questions (hypothetical bias). In surveys, respondents may pretend to behave in a sustainable manner, but do not behave accordingly in real life. Further methodological concerns with these studies are small and/or homogeneous samples and the complexity of human behavior (Geiger et al., 2018; Hamza et al., 2018). As a result, research conducted solely through surveys may suffer from limited external validity, diminishing its generalizability beyond the specific sample under investigation.

One method that can help to overcome the problem of hypothetical responses is experimentation. Research in economics, in contrast to psychology, relies almost exclusively on experiments to investigate consumer behavior. Given that the direct observation of consumer utility derived from goods is not feasible, it necessitates indirect measurement. One common approach is to assess the willingness to pay, which involves simulating hypothetical markets to estimate consumers' valuation of various products and attributes (Andorfer & Liebe, 2012). In laboratory experiments, researchers simulate real market conditions and inflict real (monetary) consequences on participants' decisions. This way, the actual premium that consumers are willing to pay for consuming sustainable good over non-sustainable goods can be elicited. For instance, controlled experimental studies yield evidence of rather inelastic demand for sustainable products, indicating that the price becomes increasingly less relevant to consumers:

using a hypothetical purchase task, Kaplan et al. (2018) identify the price level at which the demand turns elastic. In this study, participants were asked to report the quantity of reusable bags they would be willing to purchase at varying price points.

From a methodological point of view, controlled experiments in which individuals' willingness to pay is not induced by the experimenter, but remains *home-grown*[17]*,* should be prioritized. de-Magistris and Gracia (2016) show the advantage of experimental auctions in their study assessing consumers' willingness to pay for organic cheese in Spain. As the authors conclude, a home-grown auction offers "the advantage of simulating real markets and mitigating hypothetical […] bias because it incorporates both an incentive-compatible mechanism and real products" (de-Magistris & Gracia, 2016, p. 567).

4.6.3 Monitoring (Un-)Sustainable Consumption

Taking into account the divergence between reported attitudes and actual behavior, we take a closer look at the implications of (un-)sustainable consumption patterns. So far, research has focused on specific consumption areas (e.g., supermarket) and specific consumption phases (e.g., purchase).

4.6.3.1 Ecological Footprinting Analysis (EFA)

To gain a comprehensive understanding of individual consumption and its environmental impact, it is crucial to assess the total consumption of individuals and quantify the associated emission levels. *Ecological Footprinting Analysis* (EFA) serves as an environmental accounting metric that measures ecological overshoot resulting from individual consumption (Robèrt et al., 2002; Sutcliffe et al., 2008).[18] EFA aggregates individual consumption activities and waste components, providing a holistic measure to evaluate the environmental impact of individual lifestyles (Robèrt et al., 2002). The concept of EFA addresses two key information gaps faced by consumers: their lack of awareness regarding (a) the extent of their consumption levels, and (b) the excessive nature of their consumption in relation to the Earth's carrying capacity. EFA tackles this twofold information deficit by collecting data to calculate the ecological footprint and informing households about their individual (over-)consumption. For instance, in 2019, the average ecological footprint per capita in the United States was 7.8 global hectares (gha), while in Namibia, it was below 2.7 gha (Footprint Data Foundation et al., 2023).

[17] The term "home-grown" is used primarily in experimental economics and refers to willingness to pay "brought" to an experiment by subjects. In contrast, often values are "induced" by experimenters (i.e., telling subjects in the instructions that they have a specific willingness to pay in the experiment, e.g., are willing to pay a price of 4 for the product in question (Smith, 1976).

[18] Moro and Holzer (2020) give an extensive overview of various footprint calculators, all available on the internet.

Although EFA may not capture all environmental harm during the consumption process (e.g., toxic chemicals during production of a good; Sutcliffe et al., 2008), it serves as a valuable tool for monitoring unsustainable consumer behavior (Moore et al., 2011).

In a case study conducted in the United Kingdom (Sutcliffe et al., 2008), 18 representative households received information about their ecological footprint in five key areas of a less resource-intensive lifestyle (i.e., nourishment, transport, home energy, waste and consumer spending). Through a questionnaire, households reported their intentions and actual reductions in their ecological footprint. For nourishment, transport, home energy, and waste, all households expressed a strong intention to reduce their ecological footprint and—with the exception of one household—reported to successfully achieved reductions. However, in the category of consumer spending, only one household expressed willingness to reduce its footprint but failed to do so. The authors attribute this difficulty to its conflict with the dominant Western view of "value residing in material possession" (Sutcliffe et al., 2008, p. 567). These findings demonstrate that implementing EFA can promote more sustainable consumer behavior. By providing information on the environmental impact, consumers were motivated to make changes, such as sourcing locally produced food or opting for vehicles with lower impact. In addition, respondents agreed to switch to renewable electricity suppliers for home energy.

4.6.3.2 Life Cycle Assessment

Consumers often express a willingness to make sustainable consumption choices, but they may lack knowledge on how to achieve this goal. While the potential for environmental savings varies among products, consumers may be unaware of these differences and struggle to make their consumption more sustainable. One effective approach to addressing this information deficit is through the evaluation of greenhouse gas (GHG) emissions using life cycle assessment. This assessment method takes into account all emissions throughout the entire life cycle of a product, from resource extraction and production to transportation, use, and disposal (Girod et al., 2014; Robèrt et al., 2002). By using life cycle assessment, products can be compared based on their equivalent features and environmental impact, enabling consumers to make more informed and sustainable choices.

By conducting a life cycle assessment, Girod et al. (2014) evaluate the mitigation potential of selected consumption categories (food, shelter, mobility and goods and services), and examine the compatibility of their GHG emissions with the targeted *Representative Concentration Pathway* (RCP) 2.6 scenario, which aims to limit global warming to 2°C by

2050.[19] The study identifies RCP 2.6 compatible options within each category. In the food category, for example, choosing locally sourced vegetables and non-ruminant meats (e.g., chicken or pig) instead of those transported by air or produced in heated greenhouses can significantly reduce emissions per calorie. In the goods category, the GHG emissions are primarily influenced by energy intensity and resource extraction, making goods produced through low energy-intensive processes (e.g., wood or jute) more carbon-efficient. However, the authors acknowledge various obstacles to achieving low GHG consumption, including inconsistencies, budget constraints, and complexity, which we also identified earlier.

4.6.3.3 Green Information Systems

To obtain accurate measurements of individual sustainable consumption levels, such as those obtained through EFA or life cycle assessment, a substantial amount of data is required (Sutcliffe et al., 2008). Artificial intelligence, specifically *Green Information Systems*, can offer a solution to this challenge. Moro and Holzer (2020) introduce the tool "GreenPredict", which utilizes demographic, socio-economic, and psychological information pertaining to sustainability issues to predict sustainable consumption levels. The authors evaluate six machine learning techniques using a Swiss dataset (Swiss Household Energy Demand Survey) for mobility (e.g., transportation mode from home-work, number of short/middle distance flights) and housing (e.g., number of electric devices owned, number of showers per week) consumption categories. The study finds that broader machine learning approaches (i.e., random forest, gradient boosting trees, and multinomial logistic regression models) yield the most accurate predictions. However, the authors emphasize the importance of considering contextual and environmental factors (e.g., housing characteristics, habitual behaviors) in addition to behavioral factors to enhance the accuracy of the models.

4.6.4 Incomplete Information

Analyzing the previous phenomena, it becomes evident that individuals often struggle to translate their "green thinking" into "green acting" and disregard provided information (e.g., eco-labels)—leading to biased or erroneous consumption choices. This can be attributed to several factors. Firstly, the inefficiency of sustainable product markets and the failure of consumers to act in a fully rational manner contribute to this discrepancy (Kaenzig & Wüstenhagen, 2010). Secondly, consumers are often faced with incomplete information, which hinders their ability to make informed choices, leading to market inefficiencies. This

[19] The Copenhagen Protocol and the subsequent Cancun Agreement have garnered support from almost all countries, aiming to restrict the global average temperature increase to within 2°C compared to pre-industrial levels. Among the four RCPs presented by the Intergovernmental Panel on Climate Change, only the highly ambitious RCP 2.6 aligns with the 2°C global climate target.

information gap persists across various consumption areas, such as supermarkets and households, as well as different stages of the consumption process, including purchase and usage.

One illustrative example is the discrepancy between perceived and actual consumption (Cohen & Winn, 2007). In a study conducted by Beal et al. (2013) on 252 residential households in Australia, it was discovered that there was a significant discrepancy between the self-reported water consumption levels (measured in liters per person per day) and the actual consumption.[20] Surprisingly, the self-reported "high" water users consumed less water than both the self-reported "medium" and "low" water users. This disparity was even more pronounced when measuring water consumption in liters per household per day. The self-reported high water households consumed significantly less water compared to the self-reported medium and low water households. Interestingly, the study also revealed that when households received better comparison information about water consumption levels, such as through billing notices, the incomplete information gap was resolved, leading to a reduction in the disparity between perceived and actual consumption. This highlights the importance of providing consumers with accurate and informative data, as it enables them to make more precise assessments of their actual consumption levels and subsequently improve their consumption behaviors (Beal et al., 2013).

4.6.5 Asymmetric Information

Another phenomenon related to information arises in purchase-related environments, where consumers' lack of information also leads to inefficient market outcomes. While consumers can acquire information about product characteristics through search and experience, there remains a category of attributes known as credence attributes that cannot be fully ascertained even after consumption (see Darby & Karni, 1973; Nelson, 1970). Credence goods, such as healthcare products and physician services, inherently involve asymmetric information between the seller/producer and the buyer/consumer. This information asymmetry makes it challenging for consumers to accurately assess the value and utility of these goods (Hainmueller et al., 2015).

In the contexts of sustainable consumption, credence attributes often arise, posing challenges for consumers to assess product claims related to superior environmental

[20] To capture attitudes and behaviors related to household water consumption, Beal et al. (2013) conducted a comprehensive "Household Water Use Survey". This survey encompassed 27 multi-item questions, totaling 103 items, designed to elicit detailed information about water use, water conservation practices, as well as demographic and household composition data. In order to gauge participants' perceptions of their own water consumption levels, respondents were asked to report whether they considered their household to be a high, medium, or low water user ("Do you think that your household is a high, medium or low water user?").

performance, fair trade, absence of child labor, or cruelty-free manufacturing (Brach et al., 2018). Assessing these attributes to overcome asymmetric information can be particularly challenging for consumers, requiring significant efforts such as visiting factories or farms, which may exceed their available capacities and resources. Classical economic theory has demonstrated a "crowding out" effect, wherein products of high quality are overshadowed by low-quality alternatives due to the presence of asymmetric information (Akerlof, 1970). Given consumers' inability to verify the level of sustainability, they may be unwilling to pay a price premium for these products.

4.6.6 Approaches to Overcome Asymmetric Information

Asymmetric information presents a significant barrier to sustainable consumption, potentially resulting in the crowding out of sustainable products and detrimental effects for both the environment and consumers (Brach et al., 2018). In order to address this information imbalance, economics introduces the concept of signaling (Spence, 1973). Signaling involves better-informed agents, such as sellers, taking action to reduce the asymmetry by providing signals, such as quality seals or certifications, that help consumers make more informed choices. These signals serve as a mechanism to bridge the gap of asymmetric information and facilitate sustainable decision-making.

4.6.6.1 Eco-labeling

The credibility-signaling mechanism is based on the premise of transforming credence attributes into search attributes. For this purpose, many companies adopt third-party certification, such as eco-labeling, by submitting their products for evaluation by independent organizations (Brach et al., 2018). The effectiveness of eco-labels in influencing consumer behavior has been demonstrated across various consumption categories. For instance, a field experiment conducted in a grocery store chain in the United States by Hainmueller et al. (2015) compared the purchase of coffee carrying a fair trade label with coffee carrying a generic placebo label. The results revealed that while a 9% price increase for the lower-priced standard coffee led to a significant drop in demand of more than 30%, consumers were willing to purchase the same quantity of fair-trade coffee with an 8% price premium. Moreover, the sales of the two most popular coffee brands increased by approximately 8% when they carried a fair trade label, even with the price held constant. In another experimental study, Brach et al. (2018) found that eco-labels effectively mitigated the perception of risks and uncertainties associated with sustainable products. The authors concluded that ecolabels act as a signaling instrument to reduce these risks and positively influence consumers' intentions to purchase sustainable

products. However, it is important to note that the potential of eco-labels is contingent upon the credibility of the provided information (Brach et al., 2018).

These findings align with previous research (Darnall & Aragón-Correa, 2014; De Pelsmacker & Janssens, 2007) emphasizing the crucial role of credibility, specifically the quality of information, in the context eco-labeling. This becomes particularly significant when consumers harbor doubts about the sustainability claims of products, suspecting possible "greenwashing" tactics employed by producers (Brach et al., 2018). In addition to the signal itself and its credibility, the manner in which the information is communicated also holds importance. Providing consumers with clear, easily understandable, and readily accessible information is essential to attract them towards sustainable consumption (D'Souza et al., 2006). Ultimately, the combination of trustworthy information and effective communication can build consumer trust, encourage engagement with eco-labels, and facilitate informed decision-making in favor of sustainable consumption.

4.6.6.2 Barriers to Eco-labeling

Consumers often find themselves overwhelmed by the abundance and complexity of information regarding the environmental attributes of products, which can leave them feeling overstrained (Horne, 2009). The existence of numerous criteria within different eco-labeling schemes can further exacerbate this issue, leading to a counterproductive effect (Pedersen & Neergaard, 2006). Instead of providing clear decision guidance, consumers are faced with a lack of knowledge about product sustainability and suspicions about the credibility of eco-labels (Brach et al., 2018). A similar challenge is observed in the context of wine consumption, where "too much information and too many labels" (Szolnoki, 2013, p. 249) have resulted in consumer confusion. Therefore, there is a need for a cohesive and streamlined set of straightforward criteria that provide easily processable information to facilitate consumers' information gathering. Although the willingness to pay for eco-labeled products is influenced by various internal and external factors (e.g., attitudes and values, socio-economic background; see Pedersen & Neergaard, 2006), eco-labeling schemes still hold promise in promoting sustainable consumption behavior. However, their effectiveness may vary across different product categories, particularly those that require higher levels of consumer involvement, such as electronic devices, which demand extensive prior information processing due to their perceived importance (Brach et al., 2018).

4.6.6.3 Entrepreneurial Opportunities

Notwithstanding the standards and costs required for a fruitful implementation of eco-labels (Pedersen & Neergaard, 2006), the phenomenon of incomplete information offers

business opportunities for entrepreneurs to fill the information gap between consumers and marketers (Cohen & Winn, 2007). A notable example of such entrepreneurial efforts is TerraChoice, a Canadian-based environmental certification firm that developed the EcoLogo, one of the most widely recognized certification schemes in North America (EcoLogo, n.d.). This scheme rigorously evaluates products against comprehensive environmental criteria throughout their entire life cycle. [21]

The business potential associated with increasing consumer concern for sustainability is further evidenced by the introduction of a new reporting framework for environmental, social, and governance standards (ESGs) by the "Big Four" accounting firms (Deloitte, PwC, EY, and KPMG; see Tett, 2020). Through a comprehensive metric that assesses sustainability criteria, including GHG emissions and board diversity, these firms evaluate companies' ESG performance, providing transparency and credibility to investors and enabling consumers to hold non-compliant firms accountable by boycotting their products (Friedman, 1996).

4.6.7 Collaborative Consumption

The advancement of information and communication technologies has empowered consumers to engage in user-generated content, sharing, and collaboration, giving rise to the sharing economy.(Kaplan & Haenlein, 2010). This economic-technological phenomenon encompasses four primary categories: open source software, online collaboration, file sharing, and peer-to-peer financing (Hamari et al., 2016). Collaborative consumption, defined as peer-to-peer-based activities facilitated through community-based online services, involves obtaining, giving, or sharing access to goods and services, with the predominant mode being access to ownership through renting and lending, while others involve swapping, donating, and purchasing used goods (Hamari et al., 2016).

Despite concerns of greenwashing in the sharing economy, known as sharewashing (Hawlitschek et al., 2018), collaborative consumption holds promise for promoting more sustainable consumption practices, including the reduction of overconsumption and the extension of product life cycles through continuous maintenance services on sharing platforms (Liu & Chen, 2020). Moreover, the sharing economy fosters cross-cultural and cross-geographical cooperation among consumers, opening up new possibilities for collaboration.

[21] EcoLogo standards undergo a rigorous and transparent 12-18 month development process, certifying only the top 20% of products on the market. These standards encompass comprehensive environmental criteria throughout the product's life cycle, ensuring both environmental leadership and performance comparable to conventional alternatives. With 122 Certification Criteria Documents covering over 250 product types, EcoLogo certification addresses diverse environmental attributes for human health and environmental considerations (see EcoLogo, n.d., for more detail).

4.7 Conclusion

Anthropogenic climate change is a consequence of irresponsible production and consumption choices made without considering the global impact. These decisions neglect what economists refer to as external effects, which are the non-market consequences of individual behavior on the well-being of others. When considering environmental quality, biodiversity, and ecosystem services as public goods, the avoidance of climate change becomes a crucial aspect akin to participating in the "greatest 'public goods game' played by humans" (Milinski et al., 2006, p. 3994).

We depart from this observation and from the perception that changing human behavior towards more sustainable consumption is essential so as to reach sustainability and the Sustainable Development Goals in particular. Since, to a large extent, our economies fail to safeguard sustainable consumption decisions, our research identifies policies that help arrive at more sustainable consumption patterns. To this end, we draw on economic and psychological approaches of the literature.

First, we took an economic perspective, and asked what economic effects prevent markets from bringing about efficient allocations, which constitutes a prerequisite for sustainability. Since equilibrium market outcomes are determined by supply and demand, it is essential to look on both sides of the market to uncover the mechanisms that hinder markets from rendering efficient outcomes. The sources of an inefficient and thus from the viewpoint of the society unsatisfactory market outcome may result from consumers and firms, private and public alike, disregarding the detrimental environmental effects of their behavior.

We here focused on the consumption side, which is equally important as the production side, since it determines to a large extent the supply of goods and services. It is therefore important that consumers are aware of this and thus build a sustainable mindset that is in line with a sustainable life, in general, and with the Sustainable Development Goal 12, in particular. By doing so, consumers must realize that their consumption-related decisions shape market outcome and thus determine the environmental and ecological consequences of our economic activities. To this end, external effects need to be internalized by suitable policy measures inducing individuals to take into account the overall consequences of their decisions. We believe that, whenever available, the best way to achieve this target is to remove market distortions that prevent the economic outcome to become more sustainable. That is, we argue that the best way to make consumption "greener" is, whenever possible, to adjust, complement and enhance market mechanism so that decentralized decision making will allow meeting our sustainability targets.

Psychologists have identified individual attitudes and values as important drivers of behavior, which is in line with the empirically documented association between pro-environmental preferences and sustainable consumption behavior. However, there is a significant gap between reported attitudes and actual behavior, and the reasons for this discrepancy are multifaceted: for example, contextual as well as personal factors may prevent individuals from sustainable consumption. While changing consumer attitudes in favor of more environmental concerns helps accomplishing the first step, the apparent discrepancy between attitudes and behavior has to be removed in the second step. In order to achieve the latter, behavioral economics scholars have developed suitable measures to leverage consumers' cognitive biases, that is, feedback, risk/loss aversion, temporal/spatial discounting. All of these measures, once suitably tailored, may help arrive at more sustainable market outcomes.

The transition towards sustainable consumption requires an integrative approach utilizing insights from psychology and economics alike. Specifically, instruments tailored to specific consumer groups and the specific reasons of why consumers fail to consume in a sustainable way, seems to be most promising. Such an approach requires the integration of policy measures identified in different disciplines. For example, the SCB-Cube (Geiger et al., 2018) represents such an integrated tool using insights from economics and psychology.

We identified information as being central for arriving at sustainable consumption. The lack of information represents the most significant market failure that prevents markets from yielding sustainable outcomes. Due to a lack of information, consumers frequently behave in a non-sustainable way, even if they have pro-environmental attitudes and concerns. These informational deficits manifest in different consumption areas and in different phases of consumption: from the purchase decision to consumption and to final disposal consumers do not take into account the full life cycle of products and services. It is thus essential for public policies to overcome these informational barriers. To make consumption decisions more sustainable, the provision of relevant information turns out to be as essential as are corrective price-based policies to counter market failure.

The informational problem identified so far results from incomplete information: the consumer is not aware of information that is, in principle, available, and which could be brought to the attention of the consumer by suitable policy instruments. This situation, though, has to be differentiated from a situation of uncertainty, where the relevant information is neither available to the consumer nor to the government, but has either to be acquired by some research activity (data collection, expert interviews etc.) or becomes available in the course of time as uncertainty unfolds. In this case, environmental policies are constrained by uncertainty, and

public decisions can only become better as more information is acquired. So, there might also be, and reasonably is, an informational problem on part of the government, which may limit the efficacy of the policy measures suggested here. However, this problem brings us to the realm of the value of information for environmental policies (see, e.g., Williams et al., 2011), which is beyond the scope of this research article, though—but constitutes a fundamental issue for future research on sustainability and environmental policies.

4.8 References

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5 Beyond “Greening” the Management Curriculum: Examining the Effectiveness of an Education for Sustainability Intervention in Higher Management Education

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Abstract

Business schools must integrate sustainability into their management curricula to cultivate socially and environmentally responsible future leaders. This study examines the effectiveness of an Education for Sustainability (EfS) intervention—addressing the triple bottom line of ecological, social, and economic sustainability—among 70 management students. We employ a quasi-experimental pretest-posttest design to examine the direct effect of a “Sustainable Management” Master’s course on students’ affective learning outcomes (a) environmental concern and attitudes, (b) consciousness of sustainable consumption, and (c) pro-environmental behavior. Results show a positive direct effect of the EfS intervention on students’ pro-environmental behavior but not on their environmental concern and attitudes or consciousness of sustainable consumption. Neither students’ sustainability knowledge gain nor study engagement moderated the association between the EfS intervention and students’ affective learning outcomes. Delving deeper into students’ affective learning outcomes reveals narrower behavioral domains where the EfS intervention had a positive impact (e.g., “waste management”) and those where it had no impact (e.g., “nutrition”). Our research provides a blueprint for an effective EfS intervention for educators and practitioners seeking to cultivate sustainable behavior in future leaders and opens avenues for further research to unravel the mechanisms underlying the effectiveness of EfS interventions in management education.

Keywords. Education for sustainability, management education, triple bottom line, affective learning, pro-environmental behavior, environmental concern and attitudes, consciousness of sustainable consumption.

Open Science Statement. The data, codebook, and R-script are made transparent on the open science framework: https://t.ly/XnnS.

5.1 Introduction

Higher education institutions (HEIs), particularly business schools, play a critical role in nurturing ecologically and socially conscious future leaders, decision-makers, and entrepreneurs (Figueiró et al., 2022; Figueiró & Raufflet, 2015; Lozano, 2006; Rusinko, 2010a). This calls for a comprehensive approach to sustainability that addresses the ecological, social, and economic dimensions, moving beyond the mere integration of ecological sustainability ("greening") into management curricula (e.g., Bridges & Wilhelm, 2008; Hooey et al., 2017). *Education for Sustainability* (EfS) in management education aims to empower future leaders with the knowledge and attitudes needed to make well-informed decisions that account for ecological, social, and economic impacts (Jones et al., 2008; Sidiropoulos, 2014; Sterling, 2011), and cultivate sustainable behaviors (Zsóka et al., 2013).

For a comprehensive examination of the effectiveness of EfS interventions (e.g., stand-alone courses on sustainability; Figueiró & Raufflet, 2015), it is essential to examine their effect not only on cognitive (e.g., sustainability knowledge attainment), but particularly on affective learning outcomes (e.g., pro-environmental behavior; Chalkley, 2006; Shephard, 2008), as enduring changes in individual behavior are essential for achieving a sustainable future (Schultz & Kaiser, 2012). However, current research on the direct effects of EfS interventions on students' sustainability-related affective learning outcomes is limited, as few studies employ (quasi)-experimental research designs, standardized instruments, and appropriate samples (Brody & Ryu, 2006; Hallinger et al., 2020; Holt, 2003; Shiel et al., 2015; Sidiropoulos, 2018; Zwickle & Jones, 2018). In addition, previous research has mainly focused on ecological sustainability (Probst, 2022; Zwickle & Jones, 2018), disregarding social equity and economic prosperity. To our knowledge, no study has examined the direct effect of a longitudinal EfS intervention covering all dimensions of sustainability on management students' affective learning outcomes. Filling this research gap is crucial for developing effective EfS interventions, informing curriculum design, and providing guidance for cultivating future leaders capable of driving sustainable development forward.

Against this background, we examined the direct effect of a novel "Sustainable Management" Master's course, featuring both traditional (i.e., weekly lectures and exercises; Betihavas et al., 2016) and transformative (e.g., case studies, guest speaker; Erskine & Johnson, 2012) teaching components, on the affective learning outcomes of 70 management students enrolled at a Germany University. Our hypotheses posited a positive direct effect of the EfS intervention on students' (a) environmental attitudes and concern, (b) consciousness of sustainable consumption, and (c) pro-environmental behavior. Heeding calls for

methodological rigor in sustainability research (Corcoran et al., 2004; Fien, 2002; Redman et al., 2021; Zwickle & Jones, 2018), we employed a quasi-experimental design with pre- and post-intervention online surveys to examine the EfS intervention's direct effect longitudinally. In addition, we examined the moderating influence of students' (d) sustainability knowledge gain and (e) study engagement on the EfS intervention's effectiveness. To delve deeper and identify the underlying factors driving the direct effects of the EfS intervention, we further examined pre- and post-intervention mean value differences of the affective learning outcomes and their narrower sub-dimensions (e.g., pro-environmental behavior "waste management").

Our study found that the "Sustainable Management" Master's course had a positive direct effect on students' self-reported pro-environmental behavior, but not on their environmental concern and attitudes or their consciousness of sustainable consumption. Contrary to what we hypothesized, neither students' sustainability knowledge gain nor study engagement moderated the association between the EfS intervention and students' affective learning outcomes. The sub-dimensions of "mobility," "private energy consumption," "waste management," and "consumption choices" drove students toward more pro-environmental behavior. Furthermore, students' environmental concern and attitudes showed a significant increase in the "limits of growth" sub-dimension, while their sustainable consumption consciousness showed a significant decrease in the "voluntary simplicity" sub-dimension.

By adopting the triple bottom line approach (Elkington, 1997), our EfS intervention expands previous research's narrow focus on ecological sustainability and moves beyond the mere "greening" of management curricula, embracing the ecological, social, and economic dimensions of sustainability. Addressing the urgent need for more rigorous research on the effectiveness of EfS in management education (Sidiropoulos, 2014; Zwickle & Jones, 2018), our study yields further evidence for a divergence in the attitude-behavior association (e.g., Vermeir & Verbeke, 2006; Vicente-Molina et al., 2013). Encouragingly, our findings indicate that pro-environmental behavior among management Master's students can improve even in the absence of significant changes in their environmental concern and attitudes. To our knowledge, this study is pioneering in its examination of the moderating influences of students' sustainability knowledge gain and their study engagement on the effectiveness of EfS interventions, contributing further "outcome-focused" (Wahr & de la Harpe, 2015, p. 174) evidence. In addition, our study zoomed into the sub-dimensions of students' affective learning outcomes and identified key behavioral domains that drove their pro-environmental behavior change.

Our research has theoretical and practical implications for educators, policymakers, and practitioners, offering a blueprint for an impactful EfS intervention that cultivates pro-environmental behavior among future leaders. This way, our study opens fruitful avenues for further impact-oriented research on the underlying mechanisms driving the effectiveness of EfS interventions in management education.

5.2 Theoretical Background and Hypotheses Development

5.2.1 Education for Sustainability (EfS) in Higher Management Education

HEIs, and business schools in particular, hold a key role in advancing sustainable development by cultivating ecologically and socially responsible leaders, decision-makers, and entrepreneurs across various sectors (Figueiró et al., 2022; Figueiró & Raufflet, 2015; Lozano, 2006; Rusinko, 2010a). *Sustainability* is commonly defined as meeting the needs of the present generation without compromising the ability of future generations to meet their own needs (Brundtland, 1987, p. 292). This definition encompasses ecological integrity, social equity, and economic prosperity (Bansal & DesJardine, 2014), collectively known as the *triple bottom line* (Elkington, 1997). To fully address these dimensions, HEIs must embrace a holistic approach to sustainability that goes beyond integrating ecological integrity ("greening") into their curricula (Bridges & Wilhelm, 2008; Hooey et al., 2017). With education at the heart of HEIs' mission (Cortese, 2003), EfS places strong emphasis on equipping students with the essential knowledge and attitudes necessary to make well-informed decisions that consider their ecological, social, and economic impacts (Sidiropoulos, 2014; Sterling, 2011) and foster the development of sustainable behaviors (Zsóka et al., 2013).

The significance of incorporating sustainability into management education has been widely recognized (e.g., Audebrand, 2010; Christensen et al., 2007; Figueiró et al., 2022; Figueiró & Raufflet, 2015; Ng & Burke, 2010; Thomas, 2005) due to the role business schools hold as nurturing grounds for future business talent (Morsing, 2021). This recognition stems from the substantial impact that businesses have on environmental degradation, coupled with their potential to promote sustainability through innovative technologies (Adomßent et al., 2014; Olalla & Merino, 2019). By embracing "triple-bottom-line thinking" (Erskine & Johnson, 2012, p. 199), business schools prepare emerging future leaders to holistically consider the social, economic, and environmental impacts of their decisions, fostering the development of sustainable businesses and societies (Dzuranin et al., 2013; Erskine & Johnson, 2012; Ritter, 2006; Rusinko, 2010a, 2010b; Shriberg, 2002).

Despite the growing recognition and implementation of sustainability within business organizations (Rusinko, 2010b), the integration of sustainability into management curricula is

still at an early stage, primarily due to the numerous challenges faced by business schools (e.g., Lambrechts et al., 2013; Lozano, 2011; Lozano et al., 2013). These challenges encompass the identification of effective pedagogical approaches (Christensen et al., 2007; Roome, 2005), the necessity to challenge traditional business practices (Hind et al., 2009), and the difficulty students encounter in critically examining their assumptions and behaviors (Pavlovich et al., 2009; Springett, 2005), as well as recognizing the significance of sustainability (Erskine & Johnson, 2012), resulting in a "sustainability credibility gap" (Thomas, 2005, p. 187). Consequently, the integration of sustainability into management curricula requires significant improvement (Figueiró et al., 2022), emphasizing the pressing need for scholars to provide guidance on effective EfS interventions in higher management education that enhance student learning and, ultimately, promote sustainability practices among future business leaders.

5.2.2 Effectiveness of EfS Interventions in Higher Management Education

Effective EfS interventions extend beyond the mere knowledge transfer and attitude development, focusing on cultivating sustainable behaviors among students (Lozano, 2011; Stubbs & Schapper, 2011). Thus, to effectively promote sustainability, EfS interventions positively impact students' *cognitive* and *affective* learning outcomes (Braßler & Sprenger, 2021). Whereas cognitive learning focuses on the acquisition of knowledge and its practical application, affective learning refers to values, attitudes, and behaviors. It is commonly assumed that student learning progresses linearly (see Posch & Steiner, 2006), with cognitive learning outcomes preceding affective learning outcomes. Therefore, EfS interventions initially emphasize imparting sustainability knowledge, which encompasses topics such as resource management, corporate social responsibility, and sustainable development. Once students have acquired this knowledge, affective learning outcomes are targeted, such as the development of positive attitudes toward sustainability, including environmental concern and consciousness of sustainable consumption.

However, research has shown that the mere acquisition of sustainability knowledge and the development of positive attitudes toward sustainability do not necessarily induce pro-environmental behavioral change (Lozano, 2008). This divergence gives rise to a "knowledge-action gap" (Kollmuss & Agyeman, 2002) or an "attitude-behavior gap" (ElHaffar et al., 2020), wherein individuals fail to align their actions with their attitudes and beliefs. To effectively bridge this gap, EfS can shift students' learning experience from passive to active through the integration of more participatory teaching techniques (Figueiró & Raufflet, 2015). By providing opportunities for students to actively engage in hands-on experiences and reflective practices related to sustainability (e.g. real-world case studies; Erskine & Johnson, 2012), effective EfS

interventions empower individuals to translate their knowledge and attitudes into tangible pro-environmental actions (Barth & Rieckmann, 2015; Felgendreher & Löfgren, 2018; Figueiró & Raufflet, 2015).

Despite growing efforts to integrate sustainability into HEI curricula (e.g., Bask et al., 2020; Hallinger & Chatpinyakoop, 2019; Pauw et al., 2015), research on the effectiveness of EfS interventions remains limited (Erskine & Johnson, 2012; Grund & Brock, 2020; Hesselbarth & Schaltegger, 2014; Probst, 2022; Shiel et al., 2015; Sidiropoulos, 2018), particularly regarding their impact on students' affective learning outcomes (Pauw et al., 2015). Existing evidence suggests that exposure to EfS interventions is associated with positive changes in students' affective learning outcomes, including environmental concern, values, or attitudes (Bask et al., 2020; Cotton & Alcock, 2013; Cruz et al., 2018; Kukkonen et al., 2018; Major et al., 2017), and pro-environmental behavior (Cogut et al., 2019; Kagawa, 2007; Zsóka et al., 2013), which are crucial for promoting sustainable consumption (Álvarez-Suárez et al., 2014; Arbuthnott, 2009; Barth et al., 2014; Zsóka et al., 2013).

In summary, reviewing current EfS literature reveals significant theoretical and methodological gaps. First, despite the pressing need for sustainability integration into management curricula (e.g., Hesselbarth & Schaltegger, 2014; Veiga Ávila et al., 2018), there is a lack of research on its effectiveness (Cho et al., 2020; Craig et al., 2022; Cullen, 2017; Figueiró et al., 2022; Figueiró & Raufflet, 2015; Hallinger & Chatpinyakoop, 2019; Hesselbarth & Schaltegger, 2014; Holt, 2003). In particular, further inquiry is needed to elucidate whether EfS interventions indeed positively impact management students' affective learning outcomes, such as environmental concern and attitudes, consciousness of sustainable consumption, and pro-environmental behavior. Second, the prevalence of cross-sectional designs (Braßler & Sprenger, 2021) and the absence of standardized instruments (Probst, 2022; Sidiropoulos, 2018) and appropriate sample sizes (Hallinger et al., 2020) in existing EfS literature hinders the establishment of causal relationships between exposure to EfS interventions and students' affective learning outcomes. Third, most studies have focused primarily on the ecological dimension of sustainability while neglecting the social and economic dimensions (Probst, 2022; Zwickle & Jones, 2018), limiting the potential of management curricula to comprehensively promote sustainability. To address these gaps and advance effective sustainability integration in management curricula, this study aims to test hypotheses grounded in previous research, specifically examining the impact of EfS interventions on students' affective learning outcomes in higher management education (see Figure 5.1):

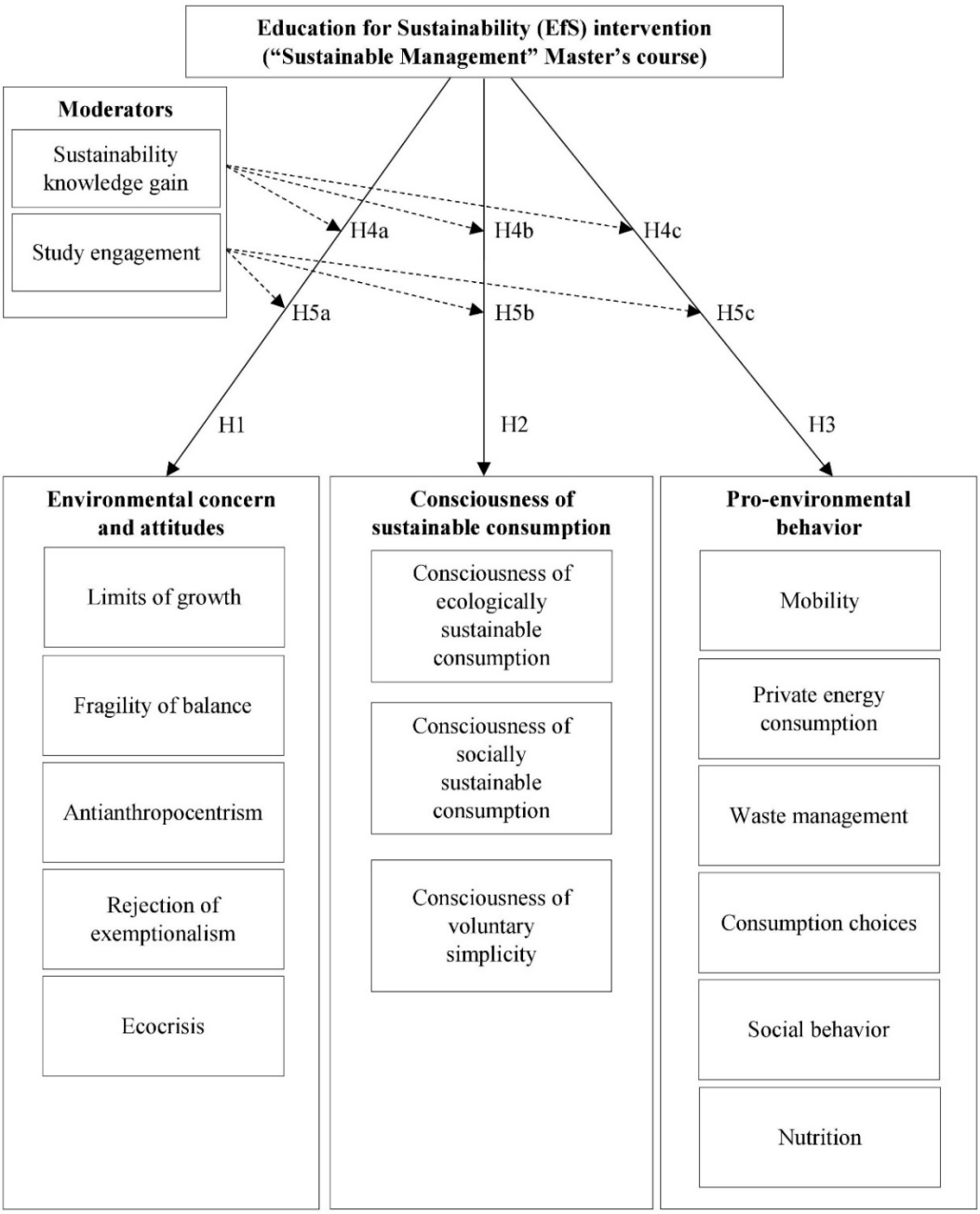
Hypothesis 1 (H1): The EfS intervention has a positive direct effect on students' environmental concern and attitudes.

Hypothesis 2 (H2): The EfS intervention has a positive direct effect on students' consciousness of sustainable consumption.

Hypothesis 3 (H3): The EfS intervention has a positive direct effect on students' pro-environmental behavior.

Figure 5.1

Conceptual Framework of The Present Study Mapping the Focal Dependent and Independent Variables and Providing an Overview of The Hypotheses



Note. The independent variable EfS intervention was dummy-coded (0 = pre-intervention, 1 = post-intervention).

5.2.3 Moderation Influences of Sustainability Knowledge Gain and Study Engagement

To gain a more comprehensive understanding of the effectiveness of EfS interventions, it is necessary to explore additional factors that may influence the association between exposure to EfS interventions and students’ affective learning outcomes. One such factor pertains to the extent to which students gain sustainability knowledge from their EfS exposure. Another important factor that was found to influence the effectiveness of EfS interventions is study engagement (Trowler, 2010; Zhang et al., 2006), which refers to the amount of time and energy students dedicate to educational activities (Kuh, 2001). Research has shown that study engagement is a critical issue in higher education and can significantly influence students’ affective learning outcomes (Leach, 2016). However, little is known about the moderating influence of both students’ sustainability-related knowledge gain and study engagement on the effectiveness of EfS interventions. Therefore, by exploring whether students’ sustainability knowledge gain and their study engagement moderate the association between the exposure to the EfS intervention and students’ affective learning outcomes, we can obtain valuable “outcome-focused” (Wahr & de la Harpe, 2015, p. 174) insights into the mechanisms through which EfS interventions can be optimized to enhance student learning.

Sustainability knowledge is widely recognized as a prerequisite for achieving affective learning outcomes through EfS interventions (Probst et al., 2019). The importance of understanding sustainability-related issues is underscored by the strong association between sustainability-related knowledge and attitudes (Bamberg & Möser, 2007; Sidiropoulos et al., 2013). However, the link between sustainability knowledge and pro-environmental behavior is still not fully understood (Kaiser & Fuhrer, 2003; Laroche et al., 2001; Zsóka et al., 2013). Research has shown that increasing sustainability knowledge may not necessarily induce behavioral changes toward sustainability (Bamberg & Möser, 2007; Kaiser & Fuhrer, 2003; Kollmuss & Agyeman, 2002; Sidiropoulos, 2014). Overall, studies focusing on affective learning outcomes (e.g., pro-environmental behavior) reported fewer positive associations to EfS exposure than those focusing on cognitive learning outcomes (e.g., sustainability knowledge). Thus, promoting pro-environmental behavior through EfS interventions appears more challenging than achieving sustainability knowledge gains (Grund & Brock, 2020). In summary, current evidence suggests that the impact of an EfS intervention on students’ affective learning outcomes is likely to be stronger when more sustainability knowledge is gained through EfS exposure. Therefore, we have formulated the following hypotheses (see Figure 5.1):

Hypothesis 4a (H4a): The direct effect of the EfS intervention on students' environmental concern and attitudes is positively moderated by students' gain in sustainability knowledge.

Hypothesis 4b (H4b): The direct effect of the EfS intervention on students' consciousness of sustainable consumption is positively moderated by students' gain in sustainability knowledge.

Hypothesis 4c (H4c): The direct effect of the EfS intervention on students' pro-environmental behavior is positively moderated by students' gain in sustainability knowledge.

Moreover, a growing body of research (e.g., Gellin, 2003; Kuh et al., 2000; Pike & Kuh, 2005) suggests that study engagement is a critical factor in achieving effective learning outcomes. Previous research (Zsóka et al., 2013) found that student interest and study engagement in sustainability-related topics positively influence the association between environmental knowledge and pro-environmental behavior. In addition, qualitative evidence has shown that EfS exposure increases study engagement and sustainability-related attitudes among management students (Sidiropoulos, 2014). Although we are not aware of explicit research investigating the moderating influence of study engagement on the effectiveness of EfS interventions, preliminary evidence cautiously suggests that the impact of an EfS intervention on affective learning outcomes may be more significant for students with higher levels of study engagement. Therefore, we propose the following hypotheses (see also Figure 5.1):

Hypothesis 5a (H5a): The direct effect of the EfS intervention on students' environmental concern and attitudes is positively moderated by students' level of study engagement.

Hypothesis 5b (H5b): The direct effect of the EfS intervention on students' consciousness of sustainable consumption is positively moderated by students' level of study engagement.

Hypothesis 5c (H5c): The direct effect of the EfS intervention on students' pro-environmental behavior is positively moderated by students' level of study engagement.

5.3 Present Study

This pre-registered[22] (https://osf.io/q5s74) study sheds light on the effectiveness of an EfS intervention in higher management education by examining the direct effect of exposure to

[22] Minor revisions were made in the present study compared to our pre-registration (https://osf.io/q5s74). These revisions encompassed both the wording and the ordering of our hypotheses. Specifically, we renamed the "provision of information" intervention to "Education for Sustainability (EfS) intervention" and changed the name of the moderator variable from "study commitment" to "study engagement". We also reversed the order of Hypotheses 2 and 3 and Hypotheses 4b/5b and 4b/5c.

a novel "Sustainable Management" Master's course on the sustainability-related affective learning outcomes of 70 management students. We hypothesize a positive direct effect of the EfS intervention on students' environmental attitudes and concern (H1), consciousness of sustainable consumption (H2), and pro-environmental behavior (H3). This way, we address theoretical and methodological gaps in current EfS research and contribute to the burgeoning field in several ways. Heeding calls (Corcoran et al., 2004; Fien, 2002; Hallinger et al., 2020; Redman et al., 2021; Zwickle & Jones, 2018) for more rigor in EfS research, we employ a quasi-experimental pretest-posttest research design (Hallinger et al., 2020) using standardized measures (Sidiropoulos, 2014) and an appropriate sample size (Hallinger et al., 2020) to draw causal inferences about the impact of the EfS intervention on students' affective learning outcomes. In addition, this study extends the narrow focus of previous EfS research on ecological sustainability and expands to encompass all dimensions of sustainability, moving beyond the mere "greening" of the management curriculum (Probst, 2022; Zwickle & Jones, 2018). Also, we add to the underexplored field by being the first to explore potential drivers and barriers that may influence the effectiveness of the EfS intervention in higher management education, through an additional examination of the moderating influences of students' sustainability knowledge gain (H4a to H4c) and study engagement (H5a to H5c). Furthermore, our in-depth analysis at the sub-dimensional level of students' affective learning outcomes uncovers the underlying factors driving the direct effects of the EfS intervention.

5.4 Method

5.4.1 Procedure and Sample

Building on previous efforts to vertically[23] integrate sustainability into management curricula (e.g., Coopey, 2003; Erskine & Johnson, 2012; Pesonen, 2003; Rusinko, 2010a, 2010b; Stead & Stead, 2010; Viswanathan, 2012; Walck, 2009), we developed a novel "Sustainable Management" Master's course at Osnabrück University in Germany for the summer semester of 2022.[24] The course was structured to provide students with a well-rounded understanding of sustainability, featuring both (A) theoretical and (B) practical components (see Figure 5.2): The theoretical components included weekly (1) lectures and (2) exercises, delivered through traditional "frontal teaching"[25] by a professor and a research associate,

[23] Vertical curriculum integration refers to the development of separate, stand-alone courses on a specific topic (see Figueiró & Raufflet, 2015).

[24] The Master's course was offered in a hybrid format during the summer semester of 2022 due to ongoing COVID-19 preventive measures: The (A) theoretical components (lecture and exercise) were delivered virtually (i.e., via voice-over recorded video lectures; Griffin et al., 2009), whereas the (B) practical components (business cases and guest speaker) were delivered face-to-face (i.e., via traditional classroom format in a lecture hall).

[25] Teacher-centered, with academics acting as experts to impart knowledge to students (Betihavas et al., 2016).

respectively. We took an interdisciplinary approach (Sibbel, 2009; Welsh & Murray, 2003), integrating sustainability-related insights from different fields (e.g. environmental science, management, economics, psychology), covering 12 sustainability-related chapters (e.g., corporate social responsibility, sustainable consumption, and circular economy; see also Figure 5.2 for more detail). This way, our Master's course expands previous EfS interventions' narrow focus on ecological sustainability and moves beyond simply "greening" the management curriculum, embracing the triple bottom line (Elkington, 1997) of ecological, social, and economic sustainability. Following the call for more participatory teaching techniques in management education (Figueiró & Raufflet, 2015), the Master's course incorporated practical[26] components based on "transformative learning" [27] (Kevany, 2007), with groups of three to four students elaborating (3) business cases and presenting them in a "flipped classroom"[28] format on three separate occasions throughout the semester. We also invited the head of sustainability of a German multinational company as a (4) guest speaker to provide students with insights on sustainability management in practice. Integrating case studies and guest speakers has previously been found to be an effective EfS approach in management education (Erskine & Johnson, 2012).

Recruitment for our study took place through online announcements (e-mail, learning management system, homepage of the Business Administration and Economics Department) at Osnabrück University before the start (4th of April 2022) of the "Sustainable Management" course. To ensure that only students who attended the Master's course during the summer semester of 2022 participated in the study, a screening question was presented: "Are you attending the Master's course 'Sustainable Management' at Osnabrück University during the summer semester of 2022?".[29] Only those who agreed were allowed to proceed to the online survey, which was voluntary and anonymous, with the right to withdraw without any

[26] Through the elaboration of business cases, we aimed to strengthen students' problem-solving, critical and creative thinking, self-learning, communication, and teamwork skills, which previous research has identified as crucial for promoting behavioral change (Dieleman & Huisingh, 2006; Steiner & Posch, 2006; Svanström et al., 2008). This way, students should develop competences that have previously been shown to be more important than the mere acquisition of knowledge (e.g., Burandt & Barth, 2010).

[27] Transformative learning refers to an educational approach that aims to shift students' learning experience from passive to active through the use of interactive teaching and learning methods (Kevany, 2007). For instance, case studies and problem-based learning encourage students to develop problem-solving and self-directed learning skills through the elaboration of real-world problems (Figueiró & Raufflet, 2015).

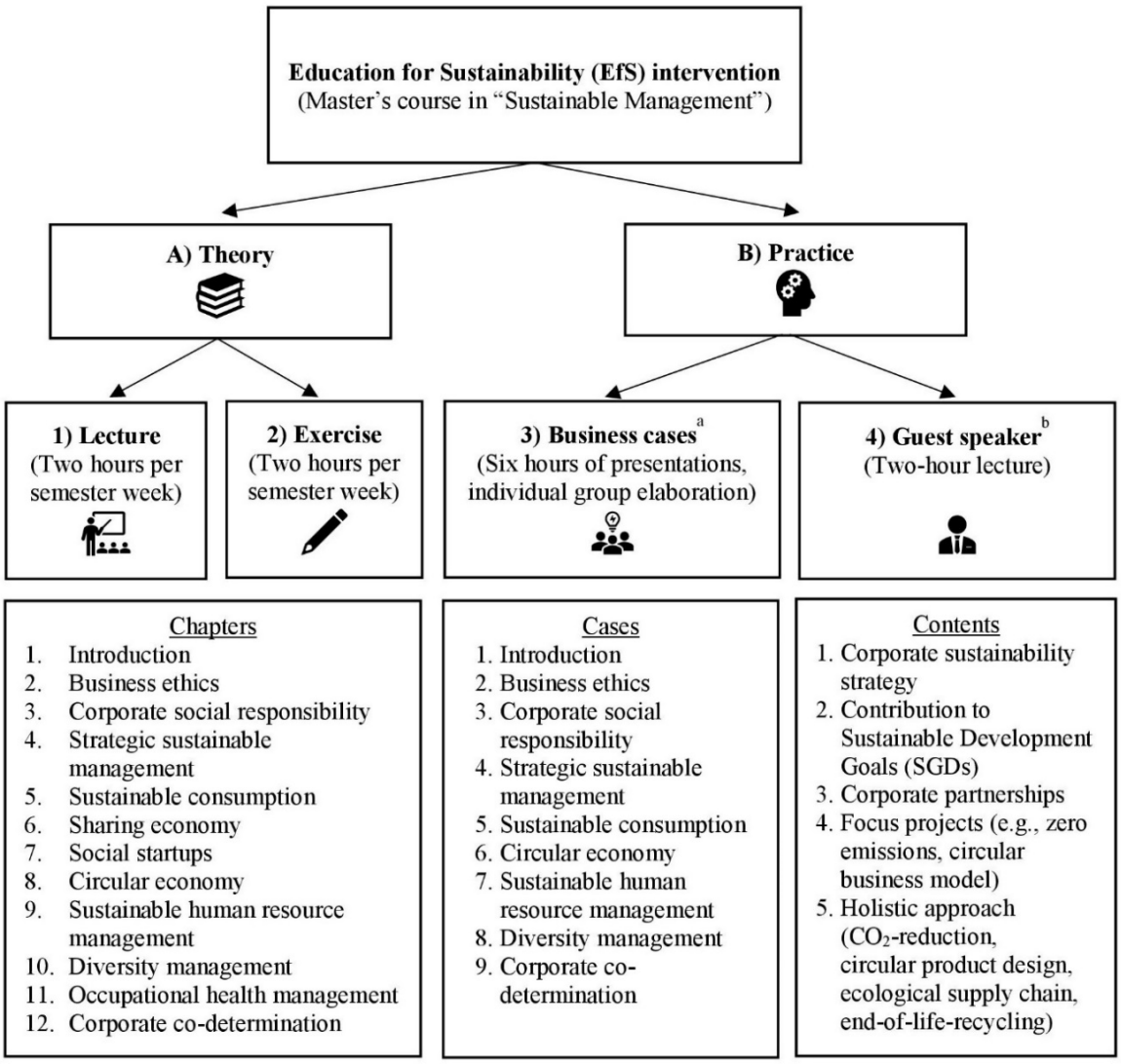
[28] Student-centered, with students governing their learning processes (Akçayır & Akçayır, 2018).

[29] To participate in the second part of the online survey, it was additionally required to confirm that one had already participated in the first part of the online survey ("Are you attending the Master's course 'Sustainable Management' at Osnabrück University during the summer semester of 2022 and have you already participated in the first part of the survey [T1] at the beginning of the summer semester 2022?").

consequences. To incentivize participation, we offered students who completed both surveys four "bonus points", which were added to their course grades.[30]

Figure 5.2

Overview of The EfS Intervention (Master's Course in "Sustainable Management")



Note. The elective Master's course "Sustainable Management" was offered in the structure shown above at Osnabrück University in Germany during the summer semester of 2022.

[a]Participation was voluntary (N = 26; 25 of whom also participated in the present study) and was rewarded with up to 10 "bonus points" to add to their course grade.

[b]Head of the sustainability department of a German multinational company with more than 6,000 employees worldwide and an annual turnover of almost €2 billion (as of 2022).

[30] A total of 120 points could be scored in the final course grading exam, and students who passed the exam (with a minimum grade of 4.0; GPA 1.0) additionally received the bonus points and were rewarded with 10 European Credit Transfer and Accumulation System (ECTS) credits.

We collected data in two waves, the first at the beginning of the summer semester (March/April 2022, t_1) and the second toward the end of the semester (June 2022, t_2). To ensure a sufficient time interval of EfS exposure between the two waves, we set a minimum of 8 weeks or 75% of the academic semester. To guarantee anonymity and match responses across both survey waves, participants generated a personal participation code at t_1 and provided it again at t_2 (Ripper et al., 2017). Before the start of the second wave at t_2, we invited participants from t_1 through e-mail[31], and sent a reminder shortly before the end of the second survey wave to encourage completion. Of the 82 students who completed the first online survey at t_1, 72 (87.80% response rate) completed the second online survey at t_2 and passed the attention check ("This is an attention check. Please click on '4' here"). After removing two participants for insufficient[32] responses, our final sample comprised 70 management students who were mostly in their third Master's semester ($M = 3.49$, $SD = 1.32$) and studying Business Administration (71.43%), Business Information Systems (17.14%) and Economics (4.29%).[33] Participants (27 female) were aged between 21 to 31 years ($M = 24.61$, $SD = 2.10$), reported an average monthly net income between €500 and €999, and mostly did not live alone ($M = 2.57$ household members, $SD = 1.2$). Pre-intervention at t_1, the average participant indicated a keen interest in sustainability ($M_{t_1} = 3.86$ of 5, $SD_{t_1} = 0.82$), self-reported a moderate sustainability knowledge ($M_{t_1} = 2.89$ of 5, $SD_{t_1} = 0.88$) but scored relatively high on an objective sustainability knowledge test (with an average of 76.39% correct answers; $M_{t_1} = 27.50$ of 36, $SD_{t_1} = 3.79$). A codebook with an overview of the survey structure and detailed information on all variables can be found at https://t.ly/XnnS.

5.4.2 Measures

Unless otherwise stated, all variables were collected at both survey waves (t_1, t_2).

5.4.2.1 Environmental Concern and Attitudes

Students' environmental concern and attitudes ($\alpha = .78$, $M_{t_1} = 4.43$, $SD_{t_1} = 0.60$) were assessed using a validated German translation (Schleyer-Lindenmann et al., 2018) of the New Ecological Paradigm (NEP, Dunlap et al., 2000), consisting of three items for each of the five sub-dimensions of *limits of growth* ($M_{t_1} = 3.51$, $SD_{t_1} = 0.86$; e.g., "We are approaching the limit of the number of people the earth can support"), *fragility of balance* ($M_{t_1} = 4.68$, $SD_{t_1} = 0.86$;

[31] In addition to the self-generated personal participation code, participants provided their personal matriculation number in order to be eligible for bonus exam points. This way, we obtained participants' university e-mail addresses for contact purposes.

[32] The removed participants discontinued their participation in the survey before providing all responses except for the control variables.

[33] We classify the participating Business Information Systems ($n = 12$) and Economics ($n = 3$) students as management students because their curriculum includes mandatory business/management courses.

e.g., "When humans interfere with nature it often produces disastrous consequences"), *antianthropocentrism* (M_{t_1} = 4.65, SD_{t_1} = 0.97; e.g., "Plants and animals have as much right as humans to exist"), *rejection of exemptionalism* (M_{t_1} = 4.14, SD_{t_1} = 0.73; e.g., "Despite our special abilities humans are still subject to the laws of nature"), and *ecocrisis* (M_{t_1} = 5.18, SD_{t_1} = 0.88; e.g., "Humans are severely abusing the environment"). Participants indicated their agreement on a 6-point Likert scale ranging from 1 (*I totally disagree*) to 6 (*I totally agree*).

5.4.2.2 Consciousness of Sustainable Consumption

Students' consciousness of sustainable consumption (α = .81, M_{t_1} = 3.84, SD_{t_1} = 0.64) were assessed using the short version of the German Consciousness of Sustainable Consumption scale (CSC, Balderjahn et al., 2013), which includes three items for each of the three sub-dimensions of *ecologically* (M_{t_1} = 3.41, SD_{t_1} = 1.01; e.g., "I buy a product only if I believe that it is made from recycled materials") and *socially* (M_{t_1} = 4.32, SD_{t_1} = 0.85; e.g., "I buy a product only if I believe that [during the manufacturing] workers' human rights are adhered to") sustainable consumption, and *voluntary simplicity* (M_{t_1} = 3.79, SD_{t_1} = 0.86; e.g., "Even if I can financially afford a product I buy a product only if I believe that I absolutely require this product"). Participants rated their agreement on a 5-point Likert scale ranging from 1 (*I totally disagree*) to 5 (*I totally agree*).

5.4.2.3 Pro-Environmental Behavior

Students' self-reported pro-environmental behavior (α = .61[34], M_{t_1} = 2.00, SD_{t_1} = 0.36) was measured using the German Short Impact Based Pro-Environmental Behavior Scale (SIBS, Geiger et al., 2019), which consists of 18 items covering five sub-dimensions for the established behavioral domains (see Kaiser, 1998) of *mobility*[35] (M_{t_1} = 2.30, SD_{t_1} = 1.17; e.g., "For my regular travel to work or to shops, I use environmentally friendly transport [bike, walking, or

[34] The Cronbach's alpha value indicates only moderate internal consistency (Taber, 2018) of the SIBS (Geiger et al., 2019), mainly due to the "car ownership/usage" items of the "mobility" sub-dimension. Missing values were imputed using the item mean (Parent, 2013). Although excluding the sub-dimension from the overall SIBS (Geiger et al., 2019) would have resulted in a nearly acceptable internal consistency (α = .68), we chose to retain the sub-dimension due to its content relevance and to capture a more comprehensive assessment of students' pro-environmental behavior.

[35] "Car ownership/usage" (M_{t_1} = 2.32, SD_{t_1} = 1.85; e.g., "I own/drive a car regularly") was measured using a combination of three items on ownership (*car* = 0, *no car* = 4), annual mileage (> 3*0,000 kilometers* = 0, *20,001 up to 30,000 kilometers* = 0, *10,001 up to 20,000 kilometers* = 0, *5,000 up to 10,000 kilometers* = 1, < *5,000 kilometers*= 1.5), and fuel type (*diesel/super* or *gasoline/E10/LPG* = 0, natural gas [CNG] = 1, electric drive = 1.5), which was then converted into an overall car use item, in which no car ownership at all (= 4) was still valued higher in terms of pro-environmental behavior than the combination of few kilometers driven (= 1.5) and a more environmentally friendly fuel type such as electric drive (= 1.5).

public transport]"), *private energy consumption*[36] (M_{t_1} = 1.96, SD_{t_1} = 0.33; e.g., "I shower instead of taking baths to save water"), *waste management* (M_{t_1} = 2.61, SD_{t_1} = 0.80; e.g., "I avoid products with excessive packaging"), *consumption choices* (M_{t_1} = 2.15, SD_{t_1} = 0.66; e.g., "I use things as long as possible instead of replacing them with a newer version"), and *social behavior* (M_{t_1} = 1.02, SD_{t_1} = 0.67; e.g., "I donate money to environmental organizations"). In addition, the SIBS (Geiger et al., 2019) accounts for the behavioral sub-dimension of *nutrition* (M_{t_1} = 2.08, SD_{t_1} = 0.66; e.g., "I eat meat for my main meals"[37]). Participants self-reported their behavior on a scale ranging from 0 (*never*) to 4 (*always*).

5.4.2.4 Sustainability Knowledge Gain

To objectively assess students' sustainability knowledge (α = .62, M_{t_1} = 27.50, SD_{t_1} = 3.79), participants completed the German Environmental Knowledge Test (EKT, Geiger et al., 2019), which consists of 36[38] single-choice questions (one correct answer and three distractors) covering the seven categories of *basic ecology* (e.g., "What causes wind?"), *climate* (e.g., "Which natural phenomenon is not attributed to global warming?"), *resources* (e.g., "For which material does recycling save the most energy in comparison to new production?"), *consumption behavior* (e.g., "Which type of transport produces the least amount of emissions per passenger and kilometer in short distance traffic?"), *society/politics* (e.g., "What is the Kyoto Protocol?"), *economy* (e.g., "What are costs due to economic activity of a company but paid by the public referred to as?"), and *environmental contamination* (e.g., "What is the main pollutant of ground water in the EU?").[39] For our statistical analyses, we calculated the difference in each student's EKT (Geiger et al., 2019) score between t_1 and t_2 indicating their gain in sustainability knowledge through exposure to the EfS intervention.

[36] Following the recommendations of the authors (Geiger et al., 2019), two items on *electricity supply* (M_{t_1} = 0.66, SD_{t_1} = 0.42; "My household obtains electricity from conventional suppliers [Eon, RWE, Vattenfall...] in the eco-tariff" and "My household obtains electricity from additional, own renewable energy source [e.g. photovoltaic system]") were combined into a 5-point scale-item (neither *living for rent* nor *own renewable energy* and neither *conventional electricity supplier in the eco-tariff* nor *pure "green" electricity supplier* = 0, either *living for rent* or *conventional electricity suppliers in the eco-tariff* = 1, either *pure* "*green" electricity supplier* or *own renewable electricity source* = 2, either *living for rent* or *conventional electricity supplier in the eco-tariff* and *pure "green" electricity supplier* or *own renewable electricity source* = 3, both *pure "green" electricity supplier* and *own renewable electricity source* = 4).

[37] This item was recoded.

[38] Following the recommendations of the authors (Geiger et al., 2019), we excluded two items with negative factor loadings ("Which form of energy counts as renewable energy?" and "International environmental experts have identified nine areas that are crucial for the stability of the entire Earth system. In which area has the stress limit already been exceeded?") from our analysis (for an overview of all items assessed, see the codebook at https://t.ly/XnnS).

[39] We consider the EKT (Geiger et al., 2019) to be suitable for a comprehensive assessment of students' overall sustainability knowledge, as it addresses the triple bottom line (Elkington, 1997) of ecological (e.g., "climate"), social (e.g., "society/politics"), and economic (e.g., "economy") sustainability.

5.4.2.5 Study Engagement

To assess students' level of study engagement with the Master's course, participants self-reported ("What is the average number of hours per week you spent on the content of the course 'Sustainable Management' [lecture and tutorial] during the summer semester of 2022?") the average weekly hours ($M = 4.10$, $SD = 2.55$) that they spent studying the course content in retrospect at t_2. This measure included pure attendance time in lectures and exercises as well as independent study time.

5.4.2.6 Control Variables

To control for relevant demographic and situational variables that have been previously associated with sustainability-related learning outcomes (e.g., Álvarez-García et al., 2019; Felgendreher & Löfgren, 2018; Lozano et al., 2015; Remington-Doucette & Musgrove, 2015; Sidiropoulos, 2014), pre-intervention at t_1 participants indicated their age, gender, monthly disposable income, number of household members, and interest in sustainability on a scale ranging from 1 (*very low*) to 5 (*very high*).

5.4.3 Analytical Approach

We employed a one-group pretest-posttest quasi-experimental research design (Hallinger et al., 2020) to draw causal inferences about the direct effect of the EfS intervention on students' environmental concern and attitudes (H1), consciousness of sustainable consumption (H2), and pro-environmental behavior (H3). To test our hypotheses H1 to H3, we used structural equation modeling (SEM; see Klem, 2000) regressing the latent constructs (a) environmental concern and attitudes, (b) consciousness of sustainable consumption, and (c) pro-environmental behavior against the dummy-coded EfS intervention ($t_1 = 0$ and $t_2 = 1$; see Figure 5.1).[40] We thereby controlled for the demographic and situational variables age, gender, monthly disposable income, number of household members, and interest in sustainability as potential predictors of environmental concern and attitudes (SEM 1), consciousness of sustainable consumption (SEM 2), and pro-environmental behavior (SEM 3). All predictor variables were standardized for the SEM analyses, except for the dummy-coded variable gender (0/1 = male/female).

To explore the moderating influences of students' sustainability knowledge gain (H4 to H4c) and study engagement (H5a to H5c) on the direct effect of the EfS intervention on the latent constructs (a) to (c), we included both moderator variables (specified as interaction terms of each latent construct (a) to (c) with the dummy-coded EfS intervention) in each of the three

[40] SEM modeling has been used in similar studies (e.g., Hüttel & Balderjahn, 2022) to draw causal inferences by regressing latent constructs against dummy-coded temporal variables ($t_1 = 0$ and $t_2 = 1$).

outlined SEMs. To examine mean value differences pre- (t_1) and post- (t_2) intervention for the latent constructs (a) to (c) and their respective narrower sub-dimensions, we computed paired-sample *t*-tests (Brogan & Kutner, 1980; whenever the corresponding data was normally distributed) and nonparametric Wilcoxon rank-sum tests (Stanek, 1988; whenever the corresponding data was not normally distributed). For all statistical analyses, we used the R program (version 4.1.0; R Core Team, 2021) and the RStudio interface (version 2022.2.1.461; RStudio Team, 2022). The R package *lavaan* (Rosseel, 2012) was used for the SEM modeling. The data and statistical code are publicly available in the online supplement at https://t.ly/XnnS.

5.5 Results

Descriptive statistics and intercorrelations between the study variables at t_1 (pre-intervention) are presented in Table 5.1.

Table 5.1

Descriptive Statistics and Intercorrelations Between the Study Variables (Pre-intervention)[a]

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Environmental concern and attitudes	4.43	0.60	-	.23	**.33**	.09	.04	-.05	.22	.00	-.02	.20
2. Consciousness of sustainable consumption	3.84	0.65		-	**.52**	-.12	-.01	-.02	**.33**	-.22	-.09	**.52**
3. Pro-environmental behavior	2.03	0.38			-	.13	-.05	.05	**.33**	-.13	-.16	**.51**
4. Sustainability knowledge	27.12	3.77				-	-.23	-.02	-.17	.18	-.02	**-.25**
5. Study engagement	4.10	2.55					-	-.03	.22	-.09	.09	-.03
6. Age	24.61	2.10						-	-.16	**.25**	-.18	.11
7. Gender	0.39	0.49							-	**-.29**	-.06	.17
8. Monthly disposable income	2.27	1.06								-	-.09	-.15
9. Household members	2.57	1.20									-	-.11
10. Interest in sustainability	3.86	0.82										-

Note. $N_{t_1/t_2} = 70$. Gender was dummy-coded (0 = male, 1= female).

[a] Except for study engagement that was assessed post-intervention at t_2.

Results in bold are significant at the $p \leq .05$ level.

Based on SEM modeling results (see Table 5.2), we found no support for H1 and H2, as there was no significant direct effect of the EfS intervention on the latent regression coefficients of students' environmental concern and attitudes (β = 0.07 [-0.10, 0.25], $p = .42$) and consciousness of sustainable consumption (β = 0.00 [-0.19, 0.20], $p = .97$). However, we found support for H3 regarding the positive significant direct effect of the EfS intervention on the latent regression coefficient of students' pro-environmental behavior (β = 0.20 [0.01, 0.49], $p = .038$). We found no support for H4a to H4c regarding the potential moderating influence of students' sustainability knowledge gain on the effect of the EfS intervention on students' environmental concern and attitudes (β = -0.01 [-0.17, 0.16], $p = .95$), consciousness of sustainable consumption (β = 0.00 [-0.17, 0.17], $p = 1.00$), and pro-environmental behavior (β = 0.03 [-0.13, 0.19], $p = .71$). Similarly, we found no support for our hypotheses H5a to H5c regarding the potential moderating influence of students' level of study engagement on the direct effect of the EfS intervention on students' environmental concern and attitudes (β = 0.01

[-0.16, 0.17], $p = .96$), consciousness of sustainable consumption (β = 0.00 [-0.17, 0.17], $p = .99$), and pro-environmental behavior (β = 0.02 [-0.15, 0.18], $p = .82$).

Table 5.2

Direct Effects of The Education for Sustainability (EfS) Intervention on Students' Affective Learning Outcomes (a) Environmental Concern and Attitudes, (b) Consciousness of Sustainable Consumption, and (c) Pro-Environmental Behavior as Well as Moderating Influences of Students' Sustainability Knowledge Gain and Study Engagement on the Direct Effect of The EfS Intervention on Students' Affective Learning Outcomes (a) to (c)

Dependent variable					Evaluation of hypotheses
	β[a]	95% CI[a]	*z*	*p*	
Environmental concern and attitudes	0.07	[-0.10, 0.25]	0.81	.42	
Age	0.01	[-0.17, 0.18]	0.06	.96	
Gender	-0.02	[-0.20, 0.16]	-0.17	.71	H1 (not supported)
Monthly disposable income	0.00	[-0.18, 0.18]	0.02	.99	
Household members	0.02	[-0.15, 0.19]	0.23	.82	
Interest in sustainability	-0.01	[-0.19, 0.16]	-0.15	.88	
Sustainability knowledge gain x EfS intervention	-0.01	[-0.17, 0.16]	-0.06	.95	H4a (not supported)
Study engagement x EfS intervention	0.01	[-0.16, 0.17]	0.06	.96	H5a (not supported)
Consciousness of sustainable consumption	0.00	[-0.19, 0.20]	0.40	.97	
Age	0.00	[-0.18, 0.18]	-0.00	1.00	
Gender	0.00	[-0.19, 0.18]	-0.01	.99	H2 (not supported)
Monthly disposable income	0.00	[-0.18, 0.18]	0.01	1.00	
Household members	0.00	[-0.17, 0.17]	0.00	1.00	
Interest in sustainability	0.00	[-0.19, 0.19]	-0.01	.99	
Sustainability knowledge gain x EfS intervention	0.00	[-0.17, 0.17]	0.00	1.00	H4b (not supported)
Study engagement x EfS intervention	0.00	[-0.17, 0.17]	0.01	.99	H5b (not supported)
Pro-environmental behavior	**0.20**	[0.01, 0.49]	2.04	.038	
Age	-0.01	[-0.18, 0.16]	-0.11	.91	
Gender	-0.05	[-0.23, 0.13]	-0.55	.59	H3 (supported)
Monthly disposable income	0.01	[-0.17, 0.19]	0.11	.91	
Household members	0.02	[-0.15, 0.19]	0.23	.82	
Interest in sustainability	-0.08	[-0.27, 0.11]	-0.85	.40	
Sustainability knowledge gain x EfS intervention	0.03	[-0.13, 0.19]	0.37	.71	H4c (not supported)
Study engagement x EfS intervention	0.02	[-0.15, 0.18]	0.23	.82	H5c (not supported)

Note. $N = 140$ ($n_{t_1} = 70$, $n_{t_2} = 70$). The independent variable EfS intervention was dummy-coded (0 = pre-intervention, 1 = post-intervention). Gender was dummy-coded (0 = male, 1= female).

[a] Results are standardized.

Results in bold are significant at the $p \leq .05$ level.

Examining the mean value differences pre- (t_1) and post- (t_2) intervention of the narrower sub-dimensions of students' affective learning outcomes (a) to (c) (see Table 5.3), we found significant mean value increases for the pro-environmental behavior sub-dimensions of "waste management" ($\Delta_M = 0.24$, $p < .001$), "private energy consumption" ($\Delta_M = 0.09$, $p = .010$), "consumption choices" ($\Delta_M = 0.12$, $p = .046$), and "mobility" ($\Delta_M = 0.11$, $p = .050$). In addition, we found a significant mean value increase in the environmental concern and attitudes sub-dimension of "limits of growth" ($\Delta_M = 0.20$, $p = .013$) and a significant mean value decrease in the consciousness of sustainable consumption sub-dimension of "voluntary simplicity" ($\Delta_M = -0.06$, $p < .001$).

Table 5.3

Pre- and Post-Intervention Mean Value Differences of Students' Affective Learning Outcomes (a) Environmental Concern and Attitudes, (b) Consciousness of Sustainable Consumption, and (c) Pro-Environmental Behavior and Their Sub-Dimensions

Variable	Pre-intervention (t_1)				Post-intervention (t_2)							
	M	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	Δ_M	*t/V*	*df*	*p*
Environmental concern and attitudes	4.43	0.60	1.87	5.53	4.50	0.54	2.07	5.60	0.07	774.50†	-	.052
Limits of growth	3.51	0.86	1.33	5.33	3.71	0.91	2.00	5.33	**0.20**	**473.50**†	-	.013
Fragility of balance	4.68	0.86	1.67	6.00	4.76	0.68	2.33	6.00	0.08	519†	-	.18
Antianthropocentrism	4.65	0.97	1.00	6.00	4.70	0.93	1.67	6.00	0.05	576.50†	-	.56
Rejection of exemptionalism	4.14	0.73	2.67	5.67	4.11	0.79	2.33	5.67	-0.05	0.35	69	.73
Ecocrisis	5.18	0.88	1.67	6.00	5.24	0.76	2.00	6.00	0.06	593†	-	.67
Consciousness of sustainable consumption	3.84	0.64	2.00	5.00	3.84	0.56	2.00	5.00	0.00	892.50†	-	.71
Ecological	3.41	1.01	1.00	5.00	3.53	0.92	1.00	5.00	0.12	461†	-	.28
Social	4.32	0.85	1.33	5.00	4.27	0.78	1.00	5.00	-0.05	410†	-	.57
Voluntary simplicity	3.79	0.86	1.67	5.00	3.73	0.77	2.00	5.00	**-0.06**	**569**†	-	<.001
Pro-environmental behavior	2.00	0.36	0.95	2.78	2.09	0.35	1.30	2.89	**0.09**	**-3.97**	69	<.001
Mobility	2.30	1.17	0.40	4.00	2.41	1.12	0.40	4.00	**0.11**	**249.50**†	-	.050
Private energy consumption	2.09	0.36	1.20	2.80	2.18	0.34	1.40	3.20	**0.09**	**461.50**†	-	.010
Waste management	2.61	0.80	0.00	4.00	2.85	0.72	0.50	4.00	**0.24**	**171**†	-	<.001
Consumption choices	2.15	0.66	0.67	3.33	2.27	0.65	1.00	3.67	**0.12**	**324.50**†	-	.046
Social behaviors	1.02	0.67	0.00	2.50	1.02	0.59	0.00	2.50	0.00	307†	-	.90
Nutrition	2.08	0.66	0.67	3.33	2.10	0.65	0.67	3.67	0.02	442.50†	-	.40

Note. $N = 140$ ($n_{t_1} = 70$, $n_{t_2} = 70$). Δ_M = mean value difference of the affective learning outcomes (a) to (c).
†Wilcoxon rank sum tests were computed whenever corresponding data were not normally distributed. Variables presented in italics are the respective sub-dimensions of the affective learning outcomes (a) to (c).
Δ_M *and t/V*-values in bold are significant at the $p \leq .05$ level.

5.6 Discussion

With this study, we sought to bridge the knowledge gap surrounding the impact of sustainability integration in management curricula on sustainability-related affective learning outcomes (Figueiró & Raufflet, 2015). We addressed previous limitations in EfS research by employing a quasi-experimental research design with standardized measures and a suitable sample (Corcoran et al., 2004; Fien, 2002; Hallinger et al., 2020; Redman et al., 2021; Zwickle & Jones, 2018) that allowed us to draw causal inferences about the EfS intervention's impact on students' affective learning outcomes. Our novel "Sustainable Management" Master's course embraced the triple bottom line of sustainability (Elkington, 1997) and went beyond the mere "greening" of management curricula. Partially confirming our hypotheses, the EfS intervention had a positive direct effect on students' self-reported pro-environmental behavior, but no direct effect on their environmental concern and attitudes or consciousness of sustainable consumption. Contrary to our hypotheses, neither students' sustainability knowledge gain nor their study engagement moderated the effectiveness of the EfS intervention in terms of its impact on students' affective learning outcomes. Zooming into the more nuanced sub-dimensions of students' affective learning outcomes, we found that the domains of "mobility," "private energy consumption," "waste management," and "consumption choices" drove the

behavioral change toward sustainability. Overall, our findings show that the "Sustainable Management" Master's course was effective in promoting pro-environmental behavior among management students. This is encouraging since lasting changes in individual behavior are essential for achieving a sustainable future (Schultz & Kaiser, 2012).

5.6.1 Implications for Theory

5.6.1.1 Direct Effect of the EfS Intervention on Students' Affective Learning Outcomes

This study offers valuable outcome-oriented insights into the effectiveness of an EfS intervention that surpasses the narrow focus on "greening" management curricula, instead embracing the holistic triple bottom line of sustainability (Elkington, 1997). Our findings demonstrate a direct positive effect of the EfS intervention on students' pro-environmental behavior, aligning with a limited body of research reporting similar results (Braßler & Sprenger, 2021; Brody & Ryu, 2006; Desrochers & Mosher, 2017; Goldman et al., 2014; Holt, 2003). However, we did not observe any direct effect of our EfS intervention on students' environmental concern and attitudes or their consciousness of sustainable consumption. A similar pattern of results was reported in a recent EfS intervention (Braßler & Sprenger, 2021) conducted beyond the realm of management education[41], showing increased pro-environmental behavior among German undergraduate students but no significant changes in their attitudes towards sustainability. These encouraging results, coupled with our findings, provide initial evidence of increased pro-environmental behavior among students, even in the absence of significant changes in their sustainability attitudes. This observed attitude-behavior divergence (e.g., Vermeir & Verbeke, 2006; Vicente-Molina et al., 2013) could be attributed to selection bias, as our management Master's students have already possessed high levels of environmental concern and attitudes ($M_{t_1} = 4.43$ out of 6; average 74% agreement) and consciousness of sustainable consumption ($M_{t_1} = 3.84$ out of 5; average 77% agreement) prior to the intervention, leaving limited room for further development (Braßler & Sprenger, 2021). Additionally, it is worth noting that the gap between attitudes and behavior appears to be narrowing, as our students showed a greater inclination to engage in pro-environmental behaviors following the EfS intervention, despite their already high levels of environmental concern and attitudes, as well as consciousness of sustainable consumption.

[41] The study's (Braßler & Sprenger, 2021) sample primarily comprised students from the fields of educational and social sciences (79.75%), with fewer participants from the natural sciences (13%) and humanities (5.8%).

5.6.1.2 Moderating Influences of Students' Sustainability Knowledge Gain and Study Engagement on the Effectiveness of the EfS Intervention

Contrary to our initial hypotheses (H4a-c and H5a-c), our findings indicate that neither the gain in students' sustainability knowledge nor their study engagement significantly moderates the effectiveness of the EfS intervention. These results match with prior research suggesting that acquiring sustainability knowledge alone does not necessarily translate into behavioral changes toward sustainability (Bamberg & Möser, 2007; Kaiser & Fuhrer, 2003; Kollmuss & Agyeman, 2002; Sidiropoulos, 2014). However, our results do not support the notion (Sidiropoulos, 2014; Zsóka et al., 2013) that study engagement positively influences student learning. Although our findings align with more recent research (Cogut et al., 2019) that also found no amplifying influence of study engagement on students' pro-environmental behavior, further investigation is necessary to determine whether study engagement impacts the effectiveness of EfS interventions. Nonetheless, these unexpected yet encouraging outcomes of our study demonstrate the effective induction of pro-environmental behavior change among management Master's students, regardless of their sustainability knowledge gain or level of study engagement. These novel findings open avenues for future research to unravel the underlying mechanisms that drive the effectiveness of EfS interventions in management education.

5.6.1.3 Pre- and Post-Intervention Mean Value Differences of Students' Affective Learning Outcomes and Their Sub-Dimensions

In addition, our study delved into the sub-dimensions of students' affective learning outcomes and identified key behavioral domains that drove their pro-environmental behavior change. Specifically, behavior related to "mobility," "private energy consumption," "waste management," and "consumption choices" played a crucial role in steering students toward sustainable action. These findings align with previous research (Kagawa, 2007) that classified comparable behaviors requiring modest adjustments to current lifestyles as "light green", including recycling, conserving energy and water, and choosing organic, fair trade, and healthy products. Similar shifts toward waste reduction and sustainable transportation modes have been observed among US students (Cogut et al., 2019), underscoring the effectiveness of addressing these behavioral domains in EfS interventions.

Moreover, our in-depth analysis at the sub-dimensional level suggests that future business leaders are increasingly questioning the belief in unlimited economic growth (Sabata, 1995), as evidenced by a significant increase in students' concerns and attitudes towards the "limits of growth" sub-dimension. This demonstrates that our EfS intervention has effectively addressed

previous challenges faced by HEIs (see Hind et al., 2009; Pavlovich et al., 2009; Springett, 2005), as students appear more inclined to recognize the constraints of traditional business practices and reflect on their own environmental behavior after the intervention. Notably, we further observed a decline in students’ consciousness of sustainable consumption sub-dimension of “voluntary simplicity”. While this finding may seem paradoxical at first glance, previous research (e.g., Balderjahn et al., 2013; Iwata, 2006) has argued that sustainable consumption behaviors can indeed coexist with a less frugal and constrained lifestyle. Hence, our students may be shifting toward “light green” consumption practices without sacrificing personal comfort. However, further investigation is warranted to understand the underlying causes and implications of this shift in sustainable consumption consciousness, particularly for future sustainability education programs.

5.6.2 Implications for Practice

Our study uncovers practical implications of EfS interventions that extend beyond academia to educational and organizational contexts. Firstly, our—in terms of induced pro-environmental behavior change—effective Master’s course expands the narrow focus on ecological sustainability and advocates for the triple bottom line approach (Elkington, 1997), encouraging business schools and HEIs to enrich their curricula by integrating ecological integrity, social equity, and economic prosperity. Secondly, despite students’ already high levels of environmental concern and attitudes, the EfS intervention shows promising signs of narrowing the attitude-behavior gap, with increased engagement in pro-environmental behaviors. Lastly, the effectiveness of our EfS intervention in promoting “light green” behaviors highlights their value in driving sustainable practices through minor lifestyle adjustments. Applied to organizational contexts, the implementation of sustainability-related training courses and workshops (e.g., Armstrong & Sadler-Smith, 2017; Haugh & Talwar, 2010) may be particularly valuable in fostering sustainable behaviors among employees with existing sustainable attitudes and consciousness, leading to positive environmental outcomes and reducing the ecological footprint of organizations.

5.6.3 Limitations and Future Research

Although our findings are encouraging, it is important to acknowledge their limitations. First, the use of a one-group pretest-posttest research design allowed us to establish causal relationships regarding the direct effect of our EfS intervention on students’ affective learning outcomes. However, this quasi-experimental design (Hallinger et al., 2020) has limitations in providing counterfactual inferences, such as understanding what would have occurred if the students had not been exposed to the Master’s course (see Campbell & Cook, 1979; Shadish et

al., 2002; Torgerson, 2008). Additionally, the design is susceptible to confounding variables, including history, maturation, test effects, and regression to the mean (Marsden & Torgerson, 2012). To overcome these limitations, future research should employ “gold standard” experimental designs (Cook & Payne, 2001) that randomly assigns participants to a treatment group (exposed to the EfS intervention) and a control group (not exposed to the EfS intervention).

Second, the generalizability of the present study’s findings may be subject to certain limitations. Educational interventions are inherently constrained by the characteristics of the student population and the potential presence of confounding factors within the sample (Tolmie et al., 2011). In this study, the sample consisted exclusively of Master’s students in management from a single German university, who may share similar academic and sociodemographic backgrounds that might not fully represent the wider student population in Germany or beyond. Although we acknowledge the limitations of self-reported behavior (e.g., intention-behavior gap, social desirability bias; see Chao & Lam, 2011) it is worth noting that meta-analytical evidence (Kormos & Gifford, 2014) indicates a convergence between self-reported and objective pro-environmental behavior (r = .46). Nonetheless, we recommend future research to additionally incorporate objective and other-rated measures of pro-environmental behavior. Furthermore, the COVID-19 pandemic necessitated the virtual delivery of the theoretical components (lecture and exercise course) of our “Sustainable Management” Master’s course, which may affect the transferability of the findings to traditional face-to-face teaching contexts. To enhance the external validity of the results and illuminate the effectiveness of EfS interventions in diverse educational contexts, future research could address these limitations by replicating the study on a larger scale, in cross-national settings, and under traditional face-to-face conditions (e.g., in lecture halls).

Third, it is important to consider the potential impact of self-selection bias introduced by our sampling method, as students who chose to participate in our “Sustainable Management” Master’s course may have already possessed positive attitudes and strong interest in sustainability (Braßler & Sprenger, 2021). However, we recognize that longitudinal studies offer a valuable approach to mitigating concerns related to self-selection bias and further confounding factors. By leveraging the temporal structure of the data, longitudinal designs effectively minimize the potential threat of reverse causation (Carbonaro & Maloney, 2019), enhancing our understanding of the causal relationships between the EfS intervention and students’ affective learning outcomes.

Fourth, the academic community lacks consensus regarding the use of established instruments to measure students' affective learning outcomes in EfS research, primarily due to diverse theoretical perspectives (Braßler & Sprenger, 2021; Sidiropoulos, 2018). In our study, we addressed this challenge by employing the NEP (Dunlap et al., 2000), CSC (Balderjahn et al., 2013), and SIBS (Geiger et al., 2019) measures, most of which have been previously validated and most of which showed acceptable internal consistency in our analysis. Although our assessed affective learning outcomes cover the triple bottom line of sustainability (Elkington, 1997), it is important to acknowledge that the focus of our study remains on the ecological dimension through the operationalization of the NEP (Dunlap et al., 2000), with limited coverage of the social and economic dimensions through this measure. To advance our understanding of "triple-bottom-line thinking" (Erskine & Johnson, 2012, p. 199) in terms of students' affective learning outcomes, we encourage future EfS research to build upon our initial efforts and incorporate other established instruments that offer a more comprehensive assessment of affective learning within the social and economic dimensions of sustainability.

Fifth, whereas attendance at lectures and exercises can offer a preliminary indication of students' study engagement, it may not fully capture the depth of their active involvement in the EfS intervention. To provide a more comprehensive understanding of the role of study engagement in the effectiveness of EfS interventions, it would be beneficial for future research to consider additional measures. For instance, assessing the extent of students' engagement beyond attending lectures and exercises, such as their involvement in supplementary readings, independent study, or participation in sustainability-related projects, would offer a more nuanced evaluation of their affective participation and commitment to the subject matter.

Lastly, although our "Sustainable Management" Master's course included transformative learning components (case studies and a guest speaker) to provide students with self-directed learning opportunities and practical experience through real-world sustainability business cases (Dieleman & Huisingh, 2006; Steiner & Posch, 2006; Svanström et al., 2008), the specific impact of these components on students' affective learning outcomes could not be determined in our study. Previous qualitative EfS research (e.g., Oxenswärdh & Persson-Fischier, 2020) has utilized similar problem-solving tasks for real-world issues and reported promising results in terms of student learning. To deepen our understanding of "what works" (Redman et al., 2021, p. 128) in terms of EfS effectiveness, we suggest that future research employ (quasi-) experimental research designs (Hallinger et al., 2020) to shed light on the nuanced effects of innovative teaching formats on students' affective learning outcomes. This way, business schools can enrich their management curricula with the most effective teaching methods,

equipping students with the knowledge, attitudes, and lasting behaviors necessary to become effective sustainability leaders in their future careers.

5.7 Conclusion

Our study adds to the burgeoning field of EfS by addressing the knowledge gap concerning the integration of sustainability in management curricula and its impact on students’ learning outcomes. Through the use of a quasi-experimental research design, we examine the direct effects of an EfS intervention on the sustainability-related affective learning outcomes of management Master’s students. This way, our research takes an outcome-oriented approach to sustainability education that embraces the triple bottom line, moving beyond the “greening” of the management curriculum. By providing a blueprint for curriculum design, implementation, and evaluation of an effective EfS intervention in management education, we take a crucial step toward cultivating responsible leaders who can effectively balance the interests of the environment, society, and the economy. This way, our study provides fertile ground for further outcome-oriented research aimed at unraveling the underlying mechanisms of effective EfS interventions, enhancing sustainability learning in higher management education.

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