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I-Shuo Chen*

The Relationship Between Personal Resources and Work Engagement and the Mediating Role of Home Resources/Demands**

Abstract

Personal resources have been widely investigated in studies on work engagement. They have been mainly viewed as affected by individuals' situated environments and as the most proximal predictor of work engagement. Unlike those studies, we aimed to investigate whether personal resources can be crafted by individuals and whether there are mechanisms embedded in the relationship between personal resources and work engagement. Using a diary study conducted over seven consecutive days with 70 individuals who were either married or living with a partner and who were considering and subsequently underwent cosmetic surgery on their pelvic region during the survey period (n = 490 observations), we investigated differences in the individuals' personal resources (i.e., self-efficacy, self-esteem, and optimism) pre- and postsurgery. We further investigated the relationship between individuals' personal resources after surgery and their work engagement by using home elements (i.e., home resources and home demands) as mediators. The proposed hypotheses are underpinned by the conservation of resources theory (COR theory) and are empirically supported. We claim that individuals' personal resources can be crafted outside the work environment (i.e., nonwork environment) and that such personal resources contribute to work engagement by motivating individuals to develop a nonwork environment (e.g., home) that allows them to successfully control and influence their work environment by increasing/decreasing home resources/demands.

Keywords: personal resources, work engagement, self-efficacy, self-esteem, optimism, cosmetic surgery, home
(JEL: I12, I31, M1)

Introduction

The importance of work engagement has led scholars to extensively explore how work engagement may be affected by work engagement (e.g., Mazzetti et al., 2023). Work engagement is a positive, fulfilling, work-related state of mind that is categorised by vigour, dedication, and absorption (Schaufeli & Bakker, 2004).

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Although much has been done during recent years (e.g., Mazzetti et al., 2023), the role of personal resources in work engagement is not sufficiently clear in the literature. *Personal resources* (e.g., self-esteem, optimism, and self-efficacy; Xanthopoulou et al., 2007) represent positive self-evaluations that are linked to resilience and that reflect individuals' sense of ability to successfully control and affect their environment (Hobfoll et al., 2003). Below, we articulate two issues that may have prevented us from fully understanding the role of personal resources in work engagement.

First, personal resources are viewed to be affected by individuals' living domains (Ten Brummelhuis & Bakker, 2012). This passive view has drawn our attention because individuals may not always be passively affected by their situated environments; rather, they may play an active role in dealing with the environment (Chen & Fellenz, 2020; Chen, 2020). The issue may be traced back to 2007 when the role of those resources in work engagement was explored by being considered a mediator, and job influences were found to affect work engagement via those resources (Xanthopoulou et al., 2007). More than ten years later, in 2023, the developed body of knowledge of personal resources remains the same, although those resources were concluded to benefit the acquisition of resources at work (Bakker et al., 2023). In this light, we aim to investigate whether personal resources may be actively crafted by individuals themselves.

Second, personal resources have been widely concluded to be the most proximal predictor of work engagement (Chen, 2022; Schaufeli & Taris, 2014; Xanthopoulou et al., 2007). In addition to the fact that such conclusions may also be dated back to 2007, as previously addressed, much of the empirical evidence has been based on the work context (e.g., Bakker & Van Wingerden, 2021). However, it is unclear whether and how personal resources crafted in a nonwork domain may affect work engagement. Addressing this insufficiency in the literature is crucial because individuals may craft and mobilise resources in a cross-domain manner (Chen & Fellenz, 2020). Overlooking the cross-domain effect of personal resources on work engagement may limit the understanding of the dynamics of work engagement from the perspective of personal resources.

Home is adopted to represent the nonwork domain in this research, as the impact of individuals' home lives on their work lives has been extensively documented and was concluded to be the most influential nonwork domain affecting employees' work (e.g., Chen & Fellenz, 2020). It conceptually incorporates a broader range of individuals' private activities, interactions, and relationships, which encompass the traditional nuclear family, nonblood relationships, and many other facets of individuals' private lives in which they are involved on nearly a daily basis (Chen & Fellenz, 2020; Ten et al., 2012). We argue that personal resources crafted in a nonwork domain may not directly affect individuals at work, as they do not share the same characteristics; instead, they may initially affect their nonwork

lives. Based on the conservation of resources theory (Hobfoll, 1998), we propose that personal resources crafted in the nonwork domain may enable individuals to address home demands and motivate them to shape home resources, thereby enabling them to have sufficient resources to use at work. *Home demands* are the various aspects of the home that need ongoing physical or mental effort, whereas *home resources* are similar aspects that benefit goal achievement, decrease home demands, help individuals personally grow and develop, and increase available physiological and psychological resources (Chen & Fellenz, 2020). Our investigation hence contributes to the work-home interface literature in that existing work-family theories have been developed from the perspective of individual passiveness (e.g., work-family enrichment and conflict; Greenhaus & Beutell, 1985; Greenhaus & Powell, 2006).

This study has novel practical implications. We studied individuals undergoing cosmetic surgery on their pelvic region, as such surgery is relatively new in the industry, and the potential proactivity of this category of individuals in their living domains has yet to be extensively investigated in either the work engagement or body image literature since the surgery outcome is normally invisible publicly. Cosmetic surgery is a medically optional (or elective) procedure that is typically performed on parts of the body with the purpose of improving the appearance of a specific physical attribute (Haiken, 1997). Most individuals who elect to undergo cosmetic surgery procedures appear to be psychologically healthy (Honigman et al., 2004). Changes in external physical appearance lead to improvements in psychological well-being, as indicated by improvements in self-confidence and self-esteem (i.e., personal resources; Abdo et al., 2023; Mokhtari et al., 2021; Shah-Desai et al., 2023; Yoon & Kim, 2020).

Similarly, cosmetic surgery has been investigated in the literature on body image (e.g., Wu et al., 2022). While cosmetic surgery has been found to improve individuals' personal resources in their private lives (e.g., personal resources), relatively few studies have investigated whether and how such improvements in personal resources may contribute in a cross-domain manner to supporting individuals' work. This issue is particularly relevant to and essential for cosmetic surgery on body parts that are not publicly visible (e.g., pelvic region), considering that such surgery is costly and that individuals may look for value-added consequences other than physical appearance change. Therefore, we are interested in exploring whether individuals who have undergone cosmetic surgery on their pelvic region experience an increase in their personal resources that contributes to work engagement through the impact on their nonwork environment (e.g., home). This research has timely practical implications for clinics/centres/hospitals that perform such surgeries, and its interdisciplinary findings contribute to the literature on work engagement, the work-home interface, and body image.

Literature Review and Hypotheses

Conservation of Resources (COR) Theory

In this study, we adopted COR theory as the theoretical underpinning for our hypotheses. The core of the theory specifies that it is human nature to protect, maintain, and further acquire resources (Hobfoll, 1998). The initial definition of resources in the theory was so general that almost everything individuals value a resource (e.g., energy and objects; Halbesleben et al., 2014). It was further redefined by researchers as anything that is valued by individuals and benefits their goal achievement (Halbesleben et al., 2014). There are several propositions within COR theory (Hobfoll, 1998). Specifically, to gain resources, protect from resource loss, or recover from actual loss of resources, resource investment is needed. With more resources, individuals are better positioned for future resource acquisition (Hobfoll, 1998). However, with fewer resources, individuals become more vulnerable to future resource loss and may tend to conserve their remaining resources (Hobfoll, 1998).

The Dynamics of Personal Resources: Cosmetic Surgery as a Case

In this research, we focus on three specific personal resources—self-efficacy, self-esteem, and optimism—since they fundamentally constitute individuals' resilience, which has been further conceptualised as a unitary construct that plays a decisive role in individuals' functioning (Lamont et al., 2019). *Self-efficacy* is an individual's sense of belief in their ability to engage in a specific action that is required to reach a desired outcome (Luszczynska & Schwarzer, 2005). *Self-esteem* represents individuals' overall/global evaluations of self-worth or self-value (Awick et al., 2016). *Optimism* represents individuals' beliefs that they will experience good outcomes in life, which then intrinsically motivates them to take action and resolve difficulties (Aspinwall & Taylor, 1997; Millstein et al., 2019).

Ample empirical and clinical studies document that individuals, both male and female, across all age ranges are concerned with their physical appearance (e.g., Hazzard et al., 2022) and that physical appearance seems to have a certain impact on individuals' psychological states (e.g., Soulliard et al., 2019), such as self-efficacy (e.g., Ouyang et al., 2020), self-esteem (e.g., Holzer et al., 2020), and optimism (e.g., Schou et al., 2005). For example, in a study involving 696 female college students, Oh (2003) revealed significant correlations between concern about physical appearance and both self-efficacy and self-esteem. After surveying 161 women newly diagnosed with breast cancer and 949 healthy women, Schou et al. (2005) concluded that concern with physical appearance is correlated with optimism. Furthermore, in a survey involving 211 men and 226 women (aged 18–86 years), Davison and McCabe (2005) found that concern with physical appearance predicts individuals' self-esteem for all age groups. In an analysis of related studies, Schwartz and Brownell (2004) showed that concern with physical appearance affects individ-

uals' self-efficacy. A study by You et al. (2016) with 3,658 Korean adolescents demonstrated that concern with physical appearance has a strong effect on self-esteem. Based on a survey of 603 college students, Cash et al. (2004) found that concern with physical appearance is a predictor of optimism. Furthermore, existing studies have indicated that individuals seeking cosmetic surgery have obvious physical and psychological expectations for the outcome of the procedure (e.g., Di Gesto et al., 2022; Honigman et al., 2004). In other words, those individuals may need additional personal resources, and any change in physical appearance due to cosmetic surgery may conceivably affect the level of an individual's resources.

Based on COR theory and empirical evidence, we argue that individuals' personal resources, such as self-efficacy, self-esteem, and optimism, can be affected by the outcome of cosmetic surgery procedures, as such procedures involve changes in the physical appearance of the body part (e.g., pelvic region) undergoing surgery. Consequently, individuals' personal resources may be crafted in the nonwork domain (e.g., in cosmetic surgery clinics/centres/hospitals). Thus, we posit that individuals who elect to undergo cosmetic surgery on their pelvic region experience significantly different levels of personal resources (e.g., self-efficacy, self-esteem, and optimism) before and after the cosmetic surgery procedure. Based on the above, we propose the following hypothesis.

Hypothesis 1 (H1): Individuals' personal resources are significantly different before and after a cosmetic surgery procedure on the pelvic region.

Personal Resources and Work Engagement

Work engagement is categorised by three factors: vigour, dedication, and absorption. *Vigour* is "high levels of energy and mental resilience while working, willingness to invest effort in work, and persistence in the face of difficulties"; *dedication* reflects "a strong psychological involvement in employees' work, combined with a strong identification with their work and encompassed feelings of significance, enthusiasm, inspiration, pride, and challenge"; and *absorption* represents "being happily engrossed in work, whereby time passes quickly and one has difficulties detaching". Existing studies claim that vigour and dedication are the primary components of work engagement (e.g., Chen & Fellenz, 2020).

Based on COR theory (Hobfoll, 1998), we claim that personal resources positively predict work engagement. Personal resources enable individuals to have resources available to engage in their work. Indeed, existing studies have shown that personal resources are the most influential predictor of work engagement (e.g., Chen, 2022; Mazzetti et al., 2023; Schaufeli & Taris, 2014). Other studies have also revealed ample supportive findings for the positive effect of these three personal resources on work engagement (e.g., Acosta-Gonzaga, 2023; Nagoji & Mackasare, 2023; Wang & Dapat, 2023). Based on the above, we propose the following hypothesis.

Hypothesis 2 (H2): Controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before a cosmetic surgery procedure, individuals' personal resources after the cosmetic surgery procedure are positively associated with their work engagement.

Personal Resources, Home Demands, and Home Resources

Considering COR theory (Hobfoll, 1998), we posit that personal resources contribute to increasing home resources and facilitating the reduction of home demands. Existing studies have also revealed that with personal resources such as self-efficacy, individuals tend to believe that they can effectively address problems in their situated domain, perceive self-control, and are flexible, thereby being intrinsically motivated to take action and commit to such decisions (Airila et al., 2014; Mastenbroek et al., 2014). It is thus conceivable that personal resources enable individuals to have resources available to proactively explore ways to address home demands. Empirical studies have also shown that self-efficacy benefits the reduction of perceived family stress (e.g., Smoktunowicz & Cieślak, 2017). Similarly, these resources motivate individuals to craft more resources in the home domain since they have sufficient resources to invest in obtaining further resources for disposal (Chen & Fellenz, 2020).

Empirical studies have revealed that self-esteem benefits family performance (e.g., Li et al., 2022), implying that self-esteem enables individuals to deal with resources and demands in the home domain. Indeed, self-esteem influences how individuals think, feel, perceive, or even behave (Brando-Garrido et al., 2020). Individuals with self-esteem are confident in their ability to face challenges and are intrinsically motivated to maximise their successes (Rose, 2021). Hence, when encountering demands at home, individuals may trust their capability and be intrinsically motivated to address and resolve those demands. In addition, these individuals are likely intrinsically motivated to maximise successes in their home roles (e.g., endeavouring to be the best partner), which in turn contributes to creating a home environment that optimises their home resources.

Other studies have shown that optimism enables individuals to manage home-life stressors and increases their resources in the home domain (e.g., mental resources; Reizer et al., 2022). Indeed, individuals with optimism have faith/expectations of success when they confront difficulties or challenges, and such faith/expectation does not have to be supported by actual capability (e.g., Avey et al., 2008). In this light, when individuals with optimism encounter demands at home, they are likely to believe that they can successfully address those demands and thus be willing to take practical action to do so (Avey et al., 2008). Similarly, those individuals will also intend to realise a positive life in the future (Reker, 1997), thereby being intrinsically motivated to obtain other resources for their use in their living domains

(e.g., social resources; Taylor et al., 2012). In light of the above, we propose the following hypotheses.

Hypothesis 3 (H3): Controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before a cosmetic surgery procedure and personal resources after the cosmetic surgery procedure are positively associated with home resources.

Hypothesis 4 (H4): Controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before a cosmetic surgery procedure and personal resources after the cosmetic surgery procedure are negatively associated with home demands.

Moderating Role of Home Influences

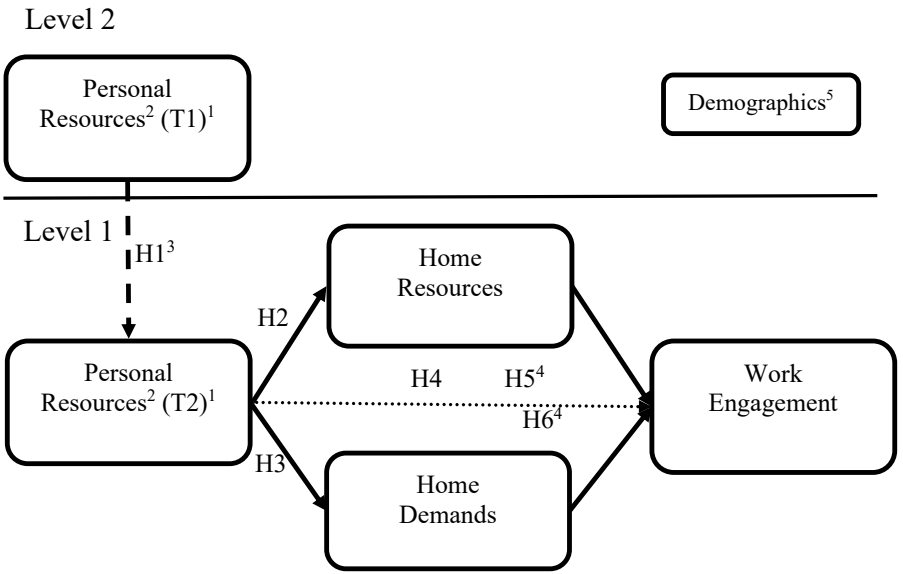
To date, no known studies have investigated whether and how personal resources crafted in a nonwork domain influence work engagement. Considering COR theory (Hobfoll, 1998), we posit that home elements (i.e., home demands and home resources) serve as mediators of the relationships between personal resources (e.g., self-efficacy, self-esteem, and optimism) and work engagement. Specifically, personal resources enable individuals to have sufficient resources to deal with home demands and invest in gaining more resources in the home domain, thereby enabling those individuals to have resources available to engage in their work.

Individuals transit across multiple living domains, such as the work and home domains, almost daily, and they mobilise their available resources in a cross-disciplinary manner when they see fit (Chen & Fellenz, 2020; Chen, 2020; Clark, 2000). Existing studies based on COR theory propose that individuals are strategic in how they determine the investment and use of their available resources from one domain to another (Halbesleben et al., 2014). When resources in one domain (e.g., home) are useful in another domain, such as the work domain, they may decide to use those resources in the latter domain (Halbesleben et al., 2014). However, home demands deplete individuals' available resources. According to COR theory (Hobfoll, 1998), individuals may tend to conserve their remaining resources by reducing their level of engagement at work due to home demands. A recent study also revealed the beneficial role of home resources and the detrimental role of home demands in work engagement (Chen, 2024). Therefore, we develop the following hypotheses. Based on the proposed hypotheses, the conceptual model is provided in Figure 1.

Hypothesis 5 (H5): Controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before a cosmetic surgery procedure, individuals' home resources mediate the relationship between personal resources after the cosmetic surgery procedure and work engagement.

Hypothesis 6 (H6): Controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before a cosmetic surgery procedure, individuals' home demands mediate the relationship between personal resources after the cosmetic surgery procedure and work engagement.

Figure 1. The Conceptual Model



Note. [1] T1 = pre-cosmetic surgery procedure; T2 = post-cosmetic surgery procedure.
[2] Personal resources include self-efficacy, self-esteem, and optimism.
[3] The bold dotted line represents the first hypothesis, in which personal resources at T1 and T2 are treated as if they are at the same level during the analysis. Personal resources at T1 will be treated as a higher-level factor and as a control variable for the subsequent examinations of the hypotheses.
[4] The thin dotted line represents the two partial mediating hypotheses (i.e., H5 and H6).
[5] Demographics include age, sex, marital status, and occupation.

Methodology

Participants and Procedure

The sample employed in the present research consisted of individuals who were undergoing cosmetic surgery on their pelvic region (body parts that are not publicly visible) in various cosmetic clinics/centres in China, as well as the partners of these individuals. The types of cosmetic surgery procedures included in our sample were mainly aimed at enhancing aesthetic appearance rather than dealing with motor impairments such as hip surgery. As part of the standard operating procedure, cosmetic surgeons typically explain the specific, relevant surgical details to (poten-

tial) individuals who are considering having cosmetic surgery on a particular body part(s) that they want to improve but who have not yet made a final decision. Surgeons also inquire about whether (potential) individuals require additional time to decide, typically a week after the surgical details are explained. Finally, surgeons schedule a date to perform the surgery, generally at the end of the period, for further consideration, and this appointment can be cancelled at any time. Upon completing a surgery, cosmetic surgeons immediately and strictly schedule an appointment with the individual to remove stitches/change dressings before the individual returns home, typically one or two weeks after the surgery. Notably, the survey has been proven not to require the individuals to stay home until they are fully recovered; rather, individuals are able to go to work the next day since the wound is small (B. G. Aesthetic & R. F. Laser Center, 2015).

In light of the above, the survey comprised two phases. For the first phase (i.e., before the cosmetic surgery procedure), we employed convenience sampling in the cosmetic clinics/centres with verbal permission from the manager. The (potential) individuals and their partners each received a set of daily questionnaires designed to evaluate the (potential) individuals' personal resources (T1 in the hypothetical model) and to collect the (potential) individual's demographic information on the date on which he or she met with a surgeon for a consultation about the surgery. The participants were encouraged to complete the questionnaires daily during the period for further consideration (i.e., 7 days) and to return the completed sets of questionnaires on the date assigned for the surgery only if the (potential) individual decided to have and showed up for the surgery. During this phase, both the (potential) individuals and their partners separately evaluated the (potential) individuals' personal resources. In the subsequent analysis, each individual's personal resources are represented by the average of the individual's self-evaluation and his or her partner's evaluation.

The second phase (i.e., after the cosmetic surgery procedure) included the participants who decided to have the surgery, came in for the surgery on the appointed date and returned their and their partners' completed daily questionnaires for the 7-day period on the date of the surgery. These individuals and their partners received an identical set of daily questionnaires to evaluate the individuals' personal resources (T2 in the hypothetical model) for an additional 7 days after the surgery. The participants were encouraged to complete the survey using the same method that they used during the previous week. The individuals' partners also received two additional sets of daily questionnaires that were designed to evaluate home resources, home demands, and individuals' work engagement. The individuals' partners were encouraged to complete the questionnaires after work and after home interactions (e.g., chatting). The individuals were encouraged to return their completed questionnaires and their partners' completed questionnaires during the first appointment to remove stitches/change dressings. The survey was completely

voluntary, and a small research code was included at the bottom of the questionnaires for matching purposes.

In this research, we used quantitative and emotional home demands to operationalise home demands. The rationale for adopting both demands was that they have been widely shown to jeopardise individuals' mental and physical energies at home (e.g., Dibaji et al., 2017; Kesselring et al., 2001; Li et al., 2013). They have also been viewed to conceptually mirror quantitative and emotional job demands (Peeters et al., 2005). Similarly, we used home social support and home autonomy to operationalise home resources. The rationale for adopting both social support and autonomy was that they had been found to support individuals' motivations in their living domains, such as the work and home domains (e.g., Bakker et al., 2007; Demerouti, 2012; Demerouti et al., 2020).

In total, 258 pairs of participants were invited to participate at multiple time points, and 101 agreed to participate (for a response rate of 39%). At the end of the first phase, 84 pairs of participants submitted questionnaires and were included in the second phase (response rate of 83%). At the end of the second phase, 70 pairs of participants submitted questionnaires and were included in the analysis (response rate of 82%). The overall response rate was 68% for the 101 initial pairs of participants. Of the 70 individuals included in the analysis, 45 (64.3%) were male, and 25 (35.7%) were female. Most of the individuals were between 31 and 40 years old (37.1%) or between 41 and 50 years old (27.1%). An equal proportion of the individuals were between 21 and 30 years of age and 51 years of age or older (n = 10, 14.3%). Only 5 of the individuals were aged >20 years or younger (7.1%). Forty-five (64.3%) of the individuals were married, while 25 (35.7%) were not married (couple). Of the individuals, 25 reported an occupation in business (35.7%), 20 did not identify an occupation (i.e., others) (28.6%), 12 were in service occupations (17.1%), 11 were manufacturing occupations (15.7%), and only two reported industrial occupations (2.9%).

Measures

The survey items used in this research are summarised in the appendix. The *personal resources* that were measured included self-efficacy, self-esteem, and optimism. *Self-efficacy* was evaluated using the general self-efficacy scale (Schwarzer & Jerusalem, 1995). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "If I am in trouble, I can usually think of a solution" to "Today, when I was in trouble, I usually thought of a solution". For the items that the individuals' partners completed, we replaced "I" with "my partner" or "he or she" for each item. For example, we revised the original item to "Today, when my partner was in trouble, he or she usually thought of a solution". All the measurement items were scored using a 5-point Likert scale

ranging from 1 (*not at all true*) to 5 *(exactly true)*, and the scale exhibited high reliability (averaged α_{T1} =.82; averaged α_{T2} =.86).

Self-esteem was measured using the Rosenberg self-esteem scale (RSE; Rosenberg, 1979). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "I take a positive attitude toward myself" to "Today, I took a positive attitude toward myself". For the items completed by the individuals' partners, we replaced "I" with "my partner", "he or she", or "him/herself" for each item. For example, we revised the original item to "Today, my partner took a positive attitude toward him/herself". All the measurement items were scored using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and the scale exhibited high reliability (averaged α_{T1} =.84; averaged α_{T2} =.89).

Optimism was evaluated using the revised life orientation test (Revised LOT; Scheier et al., 1994). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "In uncertain times, I usually expect the best" to "Today, in uncertain times, I usually expected the best". For each item completed by the individuals' partners, we replaced "I" with "my partner". For example, we revised the original item to "Today, in uncertain times, my partner usually expected the best". All the measurement items were scored using a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and the scale exhibited high reliability (averaged α_{T1} =.85; averaged α_{T2} =.86).

The *home demands* measured included quantitative home demands and emotional home demands. *Quantitative home demands* were evaluated using the scale developed by Montgomery et al. (2003). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "Do you find that you are busy at home?" to "Was your partner busy at home today?" All the measurement items were scored using a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*), and the scale exhibited high reliability (averaged α =.86). *Emotional home demands* were measured using the scale developed by the authors for quantitative home demands. To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "How often do emotional issues arise at home?" to "How often did emotional issues arise at home for your partner today?" All the measurement items were scored using a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*), and the scale exhibited high reliability (averaged α =.83).

The *home resources* that were measured included home social support and home autonomy. *Home social support* was assessed using the scale developed by Peeters et al. (1995). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "My colleague/manager pays attention to my feelings and problems" to "Today, I paid attention to my partner's feelings and problems". All the measurement items were scored using a 5-point

scale ranging from 1 (*never*) to 5 (*always*), and the scale exhibited high reliability (averaged α =.88). *Home autonomy* was measured using the scale developed by Bakker et al. (2004). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item "Do you have control over how your work is carried out?" to "Did your partner have control over how home duties were carried out today?" All the measurement items were scored using a 5-point scale ranging from 1 (*never*) to 5 (*always*), and the scale exhibited high reliability (averaged α =.85).

Work engagement was appraised using the daily version of the Utrecht Work Engagement Scale (UWES) (Breevaart et al., 2012), which contains three dimensions (i.e., vigour, dedication, and absorption). *Vigor* was evaluated using three items (e.g., At my work, I feel that I am bursting with energy). *Dedication* was also measured using three items (e.g., I am enthusiastic about my job). Absorption was excluded from this study because it was found to be an irrelevant aspect of engagement after 30 in-depth interviews were conducted by Schaufeli et al. (2001). Additionally, many existing studies have suggested excluding the *absorption* subscale when evaluating work engagement (e.g., González-Romá et al., 2006). To adapt the scale for use in this research, we revised the items where necessary. For example, we revised the original item for daily *vigour* from "Today, I felt that I was bursting with energy" to "Today, my partner felt that he or she was bursting with energy". All the measurement items were scored using a 5-point scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*), and the scale exhibited high reliability (averaged α =.87).

The *control variables* were sex, age, marital status, and occupation. These variables were included because previous studies have demonstrated that they impact the evaluation of work engagement (e.g., Heller & Watson, 2005; Seppälä et al., 2009). These control variables were applied to minimise any potential bias resulting from demographic differences in the predictor and outcome variables.

Data Analysis and Results

Preliminary Analyses

Because of the nature of this study, the data in this research were multilevel, with repeated daily measurements nested within individuals. This led to a 2-level model in which repeated measurements were at the first level (N = 490 observations), and the individual respondents were at the second level (N = 70 participants). Maas and Hox (2005) claimed that the minimal sample size at the second level should be 30 cases to perform robust estimations of fixed effects in multilevel modelling, suggesting that the sample size of the present study at the second level (n = 70) was favourable for the estimations. Optimal design software (Spybrook et al., 2008) was used to analyse the statistical power of the 2-level model. The results revealed a value exceeding.80, suggesting appropriate statistical power for the analysis. We

used HLM software to test the proposed hypotheses. Variables at the first level were centred on the respective person mean, whereas variables at the second level were centred on the sample mean (Xanthopoulou et al., 2008).

The intraclass correlation coefficient (ρ) based on the intercept-only model supported the adoption of multilevel modelling in this research. The results indicated that the multilevel structure of the data must be considered (daily self-efficacy: ρ =.13; thereby, 87% of the variation contributes to within-person variations; daily self-esteem: ρ =.07; thereby, 93% of the variation contributes to within-person variations; daily optimism: ρ =.08; thereby, 92% of the variation contributes to within-person variations; daily home social support: ρ =.22; thereby, 78% of the variation contributes to within-person variations; daily home autonomy: ρ =.12; thereby, 88% of the variation contributes to within-person variations; daily quantitative home demands: ρ =.18; thereby, 82% of the variation contributes to within-person variations; emotional home demands: ρ =.17; thereby, 83% of the variation contributes to within-person variations; and daily work engagement: ρ =.27; thereby, 73% of the variation contributes to within-person variations).

Table 1. Pearson Correlation Analysis Results for All Measures

Variables	*Mean (sd)*	1	2	3	4	5	6	7	8	9	10
PEFB	2.64 (.62)	-									
PSEB	2.32 (.92)	.61**	-								
POPB	2.81 (.71)	.18**	.36**	-							
PEFA	3.29 (.72)	-.17**	-.14**	.01	-						
PSEA	3.22 (.77)	-.04	.11*	.01	.54**	-					
POPA	3.23 (.75)	-.18**	-.04	-.08	.47**	.59**	-				
PRHR1	3.30 (1.06)	-.21**	-.03	-.05	.16**	.27**	.36**	-			
PRHR2	3.37 (1.02)	-.14*	-.10*	-.17**	.29**	.33**	.36**	.49**	-		
PRHD1	2.85 (.88)	.05	-.02	.10*	-.13**	-.13**	-.13**	-.18**	-.09*	-	
PRHD2	2.87 (.95)	.14**	-10*	.04	-.26**	-.17**	-.10*	-.14**	-.17**	.39**	-
PRWE	3.31 (1.16)	-.17**	-.04	-.08	.20**	.32**	.31**	.33**	.42**	-.29**	-.23**

***Note*. *: p <.05; **: p <.01 (n = 490 observations, n = 70 participants).**

The means, standard deviations, and correlations between the measures are summarised in Table 1. We also conducted independent sample *t-tests* for the individuals' and their partners' ratings of the individuals' personal resources pre- and post-surgery to examine whether there were differences between these ratings. The results (as noted in Table 2) revealed that before surgery, individuals' and their partners' ratings of two personal resources (daily self-esteem, t = 6.92, p <.001; daily

optimism, t = 11.39, p <.001) were significantly different. Only the individuals' and their partners' ratings of daily self-efficacy were not significantly different (t = -.134, p <.001). The results suggest that it is more appropriate to assess individuals' personal resources in subsequent analyses by using the average of individuals and their partners' evaluations than by relying only on individuals' self-reported data, as the former contributes to reducing any potential biases in the research results caused by self-reports. After surgery, although the ratings of two personal resources (i.e., daily self-efficacy, t = -.70, p >.05; daily optimism, t = -1.12, p >.05) were not significantly different, the individuals' and their partners' ratings of daily self-esteem remained significantly different (t = -6.85, p <.001). These results also support the notion that assessing individuals' personal resources based on the average of their and their partners' evaluations is more appropriate for subsequent analysis than relying solely on individuals' self-reported evaluations.

Table 2. Independent Sample t Tests for Patients' and Their Partners' Ratings of Patients' Personal Resources

Respondents	*N*	Personal Resources		Independent Sample *t* Test	
		Mean	*sd*	*F*	*t*
		Daily Self-Efficacy (Presurgery)			
Patients	490	2.60	.87	1.48	-.134
Partners	490	2.68	.85		
		Daily Self-Esteem (Presurgery)			
Patients	490	2.55	.94	5.78	6.92***
Partners	490	2.09	1.10		
		Daily Optimism (Presurgery)			
Patients	490	3.14	.87	11.14	11.39***
Partners	490	2.49	.92		
		Daily Self-Efficacy (Postsurgery)			
Patients	490	3.27	.87	5.88	-.70
Partners	490	3.31	.94		
		Daily Self-Esteem (Postsurgery)			
Patients	490	3.01	.93	34.11	-6.85***
Partners	490	3.43	1.02		
		Daily Optimism (Postsurgery)			
	490	.93		.01	-1.12
	490	.89			

Note. ***: p <.001 (N = 490 observations, N = 70 participants).

PEFB = Patient's daily self-efficacy (presurgery); PSEB = Patient's daily self-esteem (presurgery); POPB = Patient's daily optimism (presurgery); PEFA = Patient's daily self-efficacy (postsurgery); PSEA = Patient's daily self-esteem (postsurgery); POPA = Patient's daily optimism (postsurgery); PRHR1 = Partner-rated home social support for the patient; PRHD2 = Partner-rated home autonomy for the patient; PRHD1 =

Partner-rated daily quantitative home demands for the patient; PRHD2 = Partner-rated daily emotional home demands for the patient; and PRWE = Partner-rated daily work engagement for the patient.

Hypothesis Testing

The first hypothesis states that there is a significant difference in individuals' personal resources (e.g., self-efficacy, self-esteem, and optimism) before and after undergoing a cosmetic surgery procedure on their pelvic region. The results (as summarised in Table 3), which are based on paired-sample *t-tests*, support Hypothesis 1 since all the personal resources were significantly different before and after the cosmetic surgery procedure (daily self-efficacy: t = -13.98, p <.001; daily self-esteem: t = -17.67, p <.001; and daily optimism: t = -8.59, p <.001). Additionally, individuals' personal resources were significantly higher after surgery than before surgery.

Table 3. Paired-Sample t Tests for Daily Personal Resources (Pre- and Post-Surgery)

Personal Resources (Pre – Postsurgery)	*N*	Paired-Sample *t-Test*			
		Mean	*sd.*	*t*	Confidence Interval (95%) (Lower, Upper)
Patients' Daily Self-Efficacy (Pre – Postsurgery)	490	-.65	1.02	-13.98***	(-.74, -.56)
Patients' Daily Self-Esteem (Pre – Postsurgery)	490	-.90	1.13	-17.67***	(-.90, -.80)
Patients' Daily Optimism (Pre – Postsurgery)	490	-.41	1.07	-8.59***	(-.51, -.32)

Note. ***: p <.001 (N = 490 observations, N = 70 participants).

The second hypothesis states that when controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before the cosmetic surgery procedure, individuals' personal resources after the cosmetic surgery procedure are positively associated with work engagement. The results support Hypothesis 2 since, after controlling for sex, age, marital status, occupation, and personal resources before the cosmetic surgery procedure, personal resources after the cosmetic surgery procedure were positively associated with daily work engagement (daily self-efficacy: t = 1.12, p <.05; daily self-esteem: t = 2.83, p <.01; and daily optimism: t = 3.43, p <.001; see Table 8, Model 2). Model 2 fit the data best, as the value for the variance (*-2 LL* = 1499.37; see Table 8) was significantly lower than that in the previous models.

The third hypothesis posits that when controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before the cosmetic surgery procedure, individuals' personal resources after the cosmetic surgery procedure are positively associated with home resources. The results support Hypothesis 3 since, after controlling for sex, age, marital status, occupation, and personal resources before the cosmetic surgery procedure, personal resources after the cosmetic surgery procedure

were positively associated with home social support (daily self-efficacy: t = 1.33, p <.05; daily self-esteem: t = 1.60, p <.05; and daily optimism: t = 4.67, p <.001; see Table 4, Model 2); and home autonomy (daily self-efficacy: t = 1.59, p <.05; daily self-esteem: t = 2.79, p <.01; and daily optimism: t = 4.47, p <.001; see Table 5, Model 2). For each home resource, Model 2 fit the data best, as the value for the variance (home social support: *-2 LL* = 1413.59; see Table 4; home autonomy: *-2 LL* = 1334.99; see Table 5) was significantly lower than that in the previous models.

Table 4. Multilevel Estimates for Models Predicting Home Resources (Home Social Support): Personal Resources as Predictors

Model	Null			1			2		
Variables	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	3.30	.04	75.50***	3.30	.04	81.42***	3.30	.04	81.42***
Sex				-.19	.09	-2.19*	-.20	.09	-2.19*
Age				-.05	.05	-1.14	-.05	.05	-1.14
Marital Status				.01	.08	.03	.01	.08	.03
Occupation				.02	.02	.90	.02	.02	.90
Daily Self-efficacy (Pre)				-.11	.26	-.42	-.11	.26	-.42
Daily Self-esteem (Pre)				-.09	.18	-.52	-.09	.18	-.52
Daily Optimism (Pre)				.01	.18	.02	.01	.18	.02
Daily Self-efficacy (Post)							.10	.07	1.33*
Daily Self-esteem (Post)							.15	.09	1.60*
Daily Optimism (Post)							.51	.11	4.67***
		X^2			X^2			X^2	
Level 1 (Daily) Variance	.14			.14			.14		
Level 2 (General) Variance	.04	57.41*		.04	49.46*		.03	56.38***	
-2 LL		1458.14			1471.64			1413.59	
Δ-2 LL					13.51			58.05**	

Note. *: p <.05; **: p <.01; ***: p <.001 (n = 490 observations, N = 70 participants).
Pre: Presurgery; Post: Postsurgery.
Model 2 presents the direct impact of the independent variable on the mediator (Step 1/ Baron & Kenny, 1986).

Table 5. Multilevel Estimates for Models Predicting Home Resources (Home Autonomy): Personal Resources as Predictors

Model	Null			1			2		
Variables	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	3.37	.06	59.57***	3.37	.05	63.10***	3.37	.05	63.10***
Sex				-.09	.11	-.81	-.09	.11	-.81
Age				-.07	.07	-1.11	-.07	.07	-1.11
Marital Status				-.11	.11	-1.01	-.11	.11	-1.01
Occupation				.06	.03	1.74	.06	.03	1.74
Daily Self-efficacy (Pre)				.15	.32	.47	.15	.32	.47
Daily Self-esteem (Pre)				-.29	.22	-1.31	-.29	.22	-1.31
Daily Optimism (Pre)				.08	.28	.30	.08	.28	.30
Daily Self-efficacy (Post)							.11	.07	1.59*
Daily Self-esteem (Post)							.21	.08	2.79**
Daily Optimism (Post)							.37	.08	4.47***
		X^2			X^2			X^2	
Level 1 (Daily) Variance	.75			.75			.69		
Level 2 (General) Variance	.10	114.42***		.09	101.97***		.09	125.85***	
-2 LL		1405.90			1417.66			1334.99	
Δ-2 LL					11.75			82.66***	

Note. *: p <.05; **: p <.01; ***: p <.001 (n = 490 observations, N = 70 participants).
Pre: Presurgery; Post: Postsurgery.
Model 2 presents the direct impact of the independent variable on the mediator (Step 1/ Baron & Kenny, 1986).

The fourth hypothesis states that when controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before the cosmetic surgery procedure, individuals' personal resources after the cosmetic surgery procedure are negatively associated with home demands. The results support Hypothesis 4 since, after controlling for sex, age, marital status, occupation, and personal resources before the cosmetic surgery procedure, personal resources after the cosmetic surgery procedure were negatively associated with quantitative home demands (daily self-efficacy: t = -.77, p <.05; daily self-esteem: t = -.73, p <.05; and daily optimism: t = -1.32, p <.05; see Table 6, Model 2); and emotional home demands (daily self-efficacy: t = -2.62, p <.01; daily self-esteem: t = -1.29, p <.05; and daily optimism: t = -1.07, p <.05; see Table 7, Model 2). For each home demand, Model 2 fit the data best, as the value for the variance (quantitative home demands: *-2 LL* = 1231.57; Table 6;

emotional home demands: *-2 LL* = 1322.52; Table 7) was significantly lower than that in the previous models.

Table 6. Multilevel Estimates for Models Predicting Home Demands (Quantitative Home Demands): Personal Resources as Predictors

Model	Null			1			2		
Variables	Estimate	*SE*	*T*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	2.85	.04	72.40***	2.85	.04	76.13***	2.85	.04	76.13***
Sex				.05	.07	.77	.05	.07	.77
Age				.01	.04	.24	.01	.04	.24
Marital Status				-.06	.07	-.95	-.06	.07	-.95
Occupation				.04	.02	1.78	.04	.02	1.78
Daily Self-efficacy (Pre)				.20	.20	1.02	.20	.20	1.02
Daily Self-esteem (Pre)				-.10	.14	-.72	-.10	.14	-.72
Daily Optimism (Pre)				.22	.17	1.30	.22	.17	1.30
Daily Self-efficacy (Post)							-.05	.07	-.77*
Daily Self-esteem (Post)							-.05	.07	-.73*
Daily Optimism (Post)							-.10	.08	-1.32*
		X^2			X^2			X^2	
Level 1 (Daily) Variance	.68			.68			.59		
Level 2 (General) Variance	.15	68.74*		.15	62.130		.13	62.757**	
-2 LL		1267.26			1285.00			1231.57	
Δ-2 LL					17.73			53.43***	

Note. *: p <.05; **: p <.01; ***: p <.001 (n = 490 observations, N = 70 participants).
Pre: Presurgery; Post: Postsurgery.
Model 2 presents the direct impact of the independent variable on the mediator (Step 1/ Baron & Kenny, 1986).

Table 7. Multilevel Estimates for Models Predicting Home Demands (Emotional Home Demands): Personal Resources as *Predictors*

Model	Null			1			2		
Variables	Estimate	*SE*	*T*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	2.87	.05	54.75***	2.87	.05	63.59***	2.87	.05	63.59***
Sex				-.24	.10	-2.38*	-.24	.10	-2.38*
Age				-.02	.04	-.55	-.02	.04	-.55
Marital Status				.02	.10	.21	.02	.10	.21
Occupation				.01	.03	.36	.01	.03	.36
Daily Self-efficacy (Pre)				.13	.37	.34	.13	.37	.34
Daily Self-esteem (Pre)				.30	.23	1.31	.30	.23	1.31
Daily Optimism (Pre)				.02	.20	.08	.02	.20	.08
Daily Self-efficacy (Post)							-.24	.10	-2.62**
Daily Self-esteem (Post)							-.12	.09	-1.29*
Daily Optimism (Post)							-.10	.08	-1.07*
		X^2			X^2			X^2	
Level 1 (Daily) Variance	.74			.74			.70		
Level 2 (General) Variance	.15	112.60***		.15	83.46*		.14	88.19*	
-2 LL		1338.70			1340.09			1322.52	
Δ-2 LL					1.38			17.57*	

Note. *: p <.05; **: p <.01; ***: p <.001 (n = 490 observations, N = 70 participants).
Pre: Presurgery; Post: Postsurgery.
Model 2 presents the direct impact of the independent variable on the mediator (Step 1/ Baron & Kenny, 1986).

Table 8. Multilevel Estimates for Models Predicting Daily Work Engagement: Personal Resources as Predictors and Home Resources (and Home Demands) as Mediators

Model	Null			1			2			3 (Home Resources as the mediator)			3 (Home Demands as the mediator)		
Variables	Estimate	*SE*	*t*	Estimate	*SE*	*T*	Estimate	*SE*	*t*	Estimate	*SE*	*t*	Estimate	*SE*	*t*
Intercept	3.31	.06	55.90***	3.31	.06	58.48***	3.31	.06	58.48***	3.31	.06	58.48***	3.31	.06	58.48***
Sex				-.19	.12	-1.54	-.19	.12	-1.54	-.19	.12	-1.54	-.19	.12	-1.54
Age				-.01	.05	-.13	-.01	.05	-.13	-.01	.05	-.13	-.01	.05	-.13
Marital Status				.01	.13	.02	.01	.13	.02	.01	.13	.02	.01	.13	.02
Occupation				.01	.04	.06	.01	.04	.06	.01	.04	.06	.01	.04	.06
Daily Self-efficacy (Pre)				-.39	.31	-1.24	-.39	.31	-1.24	-.39	.31	-1.24	-.39	.31	-1.24
Daily Self-esteem (Pre)				.09	.20	.43	.09	.20	.43	.09	.20	.43	.09	.20	.43
Daily Optimism (Pre)				-.16	.29	-.54	-.16	.29	-.54	-.16	.29	-.54	-.16	.29	-.54
Daily Self-efficacy (Post)							.12	.10	1.12*	.13	.10	1.31	.06	.11	.54
Daily Self-esteem (Post)							.29	.10	2.83**	.21	.10	2.06*	.26	.10	2.64
Daily Optimism (Post)							.34	.10	3.43***	.16	.10	1.68	.31	.09	3.45
Home Social Support										.13	.05	2.58*			
Home Autonomy										.29	.06	4.45***			
Quantitative Home Demands													-.26	.07	-3.56***
Emotional Home Demands													-.13	.07	-1.81*
		χ^2			χ^2			χ^2			χ^2			χ^2	
Level 1 (Daily) Variance	1.29			1.29			1.13			1.03			1.05		
Level 2 (General) Variance	.47	93.45*		.45	85.37*		.41	97.14**		.38	106.73***		.39	105.02***	
-2 LL		1536.42			1549.06			1499.37			1466.04			1472.44	
Δ-2 LL					12.64			49.68**			33.33**			26.93*	

Note. **: p <.01; ***: p <.001 (n = 490 observations, n = 70 participants).
Pre: Presurgery; Post: Postsurgery.
Model 2 presents the direct impact of the independent variable on the dependent variable (Step 2/Baron & Kenny, 1986). Model 3 (with home resources as the mediator) and Model 3 (with home demands as the mediator) present the impact of the independent variable and mediator, respectively, on the dependent variable (Step 3/Baron & Kenny, 1986).

The fifth hypothesis states that when controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before the cosmetic surgery procedure, individuals' home resources partially mediate the relationship between postsurgery personal resources and work engagement. Baron and Kenny's (1986) 3 steps for examining mediation were used in this regard. First, the independent variable (i.e., personal resources postsurgery) must be related to the dependent variable (i.e., daily work engagement). Second, the independent variable (i.e., personal resources postsurgery) must be related to the mediator (i.e., home resources). Third, the first relationship must become nonsignificant (full mediation) or must be significantly weakened (partial mediation) after the mediator is entered into the model. The first condition was met by Hypothesis 4. The second condition was met by Hypothesis 2. The results support the third condition for Hypothesis 4 since, after controlling for sex, age, marital status, occupation, and personal resources before surgery and after entering home resources into the model (see Table 8, Model 3 for home resources), the original significant positive relationships between postsurgery personal resources and daily work engagement were either nonsignificant or significantly weakened. Specifically, the relationships between daily work engagement and both daily self-efficacy (t = 1.31, p >.05) and daily optimism (t = 1.68, p >.05) became nonsignificant after the mediator (i.e., home resources) was included. The relationship between daily self-esteem and daily work engagement (t = 2.06, p <.05) was significantly weakened after the mediator (i.e., home resources) was included. Model 3 for home resources fit the data best, as the value for the variance (*-2 LL* = 1466.04; see Table 8) was significantly lower than that in the previous models. Based on 1,000 bootstrap samples and 95% confidence intervals (CIs), the bootstrapping results support the indirect effect of each home resource on the relationships between postsurgery personal resources and daily work engagement. Specifically, for daily self-efficacy, the indirect effects of home social support/home autonomy reveal CIs between.02/.09 [LL95CI] and.09/.22 [UL95CI]. For daily self-esteem, the CIs were between.02/.09 [LL95CI] and.11/.21 [UL95CI], while for daily optimism, the CIs were between.02/.11 [LL95CI] and.13/.24 [UL95CI]. Overall, the results support Hypothesis 5.

The sixth hypothesis states that when controlling for personal resources (e.g., self-efficacy, self-esteem, and optimism) before the cosmetic surgery procedure, individuals' home demands partially mediate the relationship between postsurgery personal resources and work engagement. The same approach was adopted for Hypothesis 5 for Hypothesis 6. The first condition was met by Hypothesis 4, and the second condition was met by Hypothesis 3. The results support the third condition for Hypothesis 6 since, after controlling for sex, age, marital status, occupation, and presurgery personal resources and after entering home demands into the model (see Table 8, Model 3 for home demands), all the original significant positive relationships between postsurgery personal resources and daily work engagement were nonsignificant (daily self-efficacy: t =.54, p >.05; daily self-esteem: t = 2.64, p

>.05; and daily optimism: $t = 3.45$, $p > .05$). Model 3 for home demands fit the data best, as the value for the variance (*-2 LL* = 1472.44; see Table 8) was significantly lower than that in the previous models. The bootstrapping results also support the indirect effect of each home demand on the relationships between postsurgery personal resources and daily work engagement. Specifically, for daily self-efficacy, the indirect effects of quantitative home demands/emotional home demands reveal CIs between.02/.01 [LL95CI] and.10/.09 [UL95CI]. For daily self-esteem, the CIs were between.02/.01 [LL95CI] and.09/.07 [UL95CI], and for daily optimism, the CIs were between.02/.01 [LL95CI] and.10/.06 [UL95CI]. Overall, the results support Hypothesis 6.

Discussion on Findings

The aim of this research was to investigate whether personal resources can be crafted in a nonwork domain and whether such crafted personal resources can, in turn, influence work engagement by influencing demands and resources in the nonwork domain. Thus, by studying a group of individuals who underwent cosmetic surgery on their pelvic region, we empirically compared their personal resources before and after the cosmetic surgery procedure. Furthermore, by using the term "home" to represent the nonwork environment, we empirically examined the relationship between individuals' personal resources after cosmetic surgery and their work engagement by using home elements (e.g., home demands and home resources) as mediators. This research contributes to the literature on work engagement, work-home, and body image in several ways.

Research Contributions

The results of this study reveal that personal resources before a cosmetic surgery procedure differ from those after the cosmetic surgery procedure. In other words, personal resources can be crafted by individuals themselves in nonwork environments (e.g., in cosmetic clinics/centres). This finding provides new insight that individuals play a more proactive role in shaping their personal resources, in addition to being passively affected by the situated environment, as found by existing studies (e.g., Ten Brummelhuis & Bakker, 2012). Our study of the ability of individuals to access personal resources after cosmetic surgery on the pelvic region also supports the existing findings about the differences in psychological expectations before and after surgery (e.g., Di Gesto et al., 2022; Honigman et al., 2004). However, our findings are novel since we extend these findings by providing evidence that individuals who seek cosmetic surgery on their pelvic region, which is not publicly visible, have psychological expectations regarding the outcome of the surgical procedure and that changes in the physical appearance of these body parts affect their personal resources (e.g., self-efficacy, self-esteem, and optimism). Hence, we contribute to the literature on body image.

Our results also show that personal resources after a cosmetic surgery procedure increase home resources and decrease home demands, thereby supporting COR theory (Hobfoll, 1998). This finding also challenges the conventional view concerning individuals' passiveness, as it demonstrates how crafted personal resources may improve individuals' proactivity by addressing demands and shaping resources in the home domain. Additionally, issues related to cosmetic surgery have been associated mainly with individuals' mental states and personal resources (e.g., Căiță et al., 2023; Koc & Ayyildiz, 2023). Our findings extend the existing knowledge of cosmetic surgery by revealing how such surgery contributes to individuals' proactivity in the home domain, thereby contributing to the literature on body image by bridging it to family studies. Similarly, as far as we are aware, very few, if any, family studies have attempted to investigate the role of the outcome of improved body image in individuals' proactivity at home. Our study thus opens a budding debate from the resources perspective in this regard for future scholarly discussions.

The results of this study also reveal that home elements (i.e., home resources and home demands) mediate the relationship between personal resources after a cosmetic surgery procedure and work engagement. This finding provides new insights into the linkage between personal resources and work engagement by indicating that personal resources may not be the most proximal factor/predictor of work engagement; rather, there are mechanisms embedded in the link that channel the impact of personal resources on work engagement. In this research, we demonstrate that crafted personal resources in the nonwork domain affect work engagement by enabling individuals to minimise home demands and shape home resources, thereby eventually benefiting them from having resources available to engage in work. Our findings are novel in that we did not evaluate personal resources in the work domain, as most of the existing studies on the same or similar issues have done (Xanthopoulou et al., 2007). Instead, we measured these factors in the nonwork domain and investigated how they impact work engagement, which echoes the importance of considering individuals' private lives when studying the issue of work engagement (Chen, 2024). These findings, therefore, extend the existing understanding of the association between personal resources and work engagement from the cross-domain perspective, thereby contributing to the literature on work engagement.

Research Limitations and Future Research Directions

Some limitations should be noted. First, although the sample size of this study exceeds the suggested number (30 cases for level 2) according to Maas and Hox's (2005) rule of thumb for performing robust estimations of fixed effects in multilevel modelling and although the results obtained from the optimal design software exhibit appropriate statistical power for analysis, we suggest that future studies reexamine this study's research framework using larger samples. Second, we adopted home as representative of the nonwork environment in this research. However,

the nonwork environment is not limited to the home. According to Katz and Kahn (1978), individuals are involved in multiple social systems. Existing studies also propose numerous non-work environments in which individuals are frequently involved when they are not at work (e.g., churches, clubs, leisure activities, and other social communities; (Allis & O'Driscoll, 2008; Chen, 2020; Crittenden, 2023; Culvin, 2023; Pondé & Santana, 2000)). Future research should investigate different non-work environments and the influences derived from those environments to reexamine the research framework used in this study.

Third, we did not empirically investigate how the respondents felt about the outcome of their cosmetic surgery procedures. This may result in concerns regarding the contribution of the cosmetic surgery procedure (i.e., the nonwork environment) to improving personal resources. Specifically, one may argue that the cosmetic surgery procedure *per se* may not contribute to the improvement of personal resources; instead, there may be other daily influences at work (in the second stage of the survey) that we did not investigate. However, if that were the case, we would not have been able to identify the mediations of home elements, which are nonwork based, on the relationships between personal resources and work engagement.

Fourth, Bolger et al. (2003) claimed that little is known about the influences of a diary design on participants' responses. In this research, the respondents completed the questionnaires multiple times. Such an approach may lead to a habitual effect. In other words, the respondents may have completed the survey in a habitual way after a few days. However, if that were the case in the present study, we would not have been able to identify significant within-person fluctuations in the focal measures (Tims et al., 2011). Consequently, habitual effects are important to consider in diary research. However, any influences derived from this effect appear to have been limited and do not appear to have substantially influenced the study results.

Fifth, the sample of this study is somewhat specific, as it involves individuals who have undergone cosmetic surgery on the pelvic region. This specificity raises potential concerns about the generalizability of the findings to the broader population. Individuals who choose to undergo such surgery may possess unique characteristics or motivations that do not necessarily reflect those of the average person undergoing cosmetic surgery. Additionally, there may be concerns about potential self-selection bias, as individuals who elect cosmetic surgery may differ in psychological traits, socioeconomic status, or other demographic variables compared to those who do not (Sarwer et al., 2004; Honigman & Castle, 2006). In light of these concerns, we suggest that future research test our proposed model with more diverse samples, including various types of cosmetic surgery and a wider range of demographic groups, to better determine the extent to which our results can be generalised. Furthermore, we recommend that future research conduct longitudinal studies that

track individuals before and after different types of cosmetic procedures. This approach may offer more robust evidence supporting the broader applicability of our findings (von Soest et al., 2011).

Sixth, the post-surgery observation period in this research is relatively short. While it is understandable that individuals experience improved personal resources after a successful procedure, it is crucial to consider the long-term sustainability of those resources and their impact on our focal measures. Existing studies on body positivity and well-being have revealed that the benefits of cosmetic procedures may not address underlying issues and thus may diminish over time (e.g., Sarwer et al., 2005; Cash et al., 2002). In other words, individuals may initially experience an improvement in personal resources following cosmetic surgery. However, without addressing underlying psychological factors, it is possible that these improvements may normalise and potentially decline over time. Therefore, we suggest that future research include longer follow-up periods to test the endurance of the observed effects and investigate whether the impact of improved personal resources on work engagement is maintained over the long term.

Finally, one may be concerned with the accuracy of partner-rated work engagement since work engagement is a working state of mind that should be rated by the respondents themselves. However, existing studies have shown that third-person ratings of work engagement may be more accurate than self-ratings, as they help prevent the inflation of the rated outcome that may occur as a result of self-reports and have been encouraged for academic use (Xu et al., 2020). However, given that existing studies have considered managers and coworkers as the third person for ratings (Xu et al., 2020), it is not clear whether partner ratings support the same conclusions. Although our approach is novel and the results are in line with COR theory (Hobfoll, 1998), future research should retest our proposed model by using managers, coworkers, or both for third-person evaluations of respondents' work engagement.

Practical Implications

We provide practical implications for clinics/centres/hospitals that offer these types of cosmetic procedures. Currently, cosmetic surgery is a popular avenue that many people pursue to make themselves beautiful both outside (i.e., physically pretty/good-looking) and inside (i.e., increased psychological well-being). Although existing studies have provided many practical implications regarding cosmetic surgery for individuals (e.g., Abdo et al., 2023; Mokhtari et al., 2021; Shah-Desai et al., 2023; Yoon & Kim, 2020), most, if not all, of those studies are based on evidence related to surgery on body parts that are typically publicly visible. Little attention has been given to cosmetic surgery on body parts that are not publicly visible (e.g., the pelvic region); hence, the practical implications of surgery on these types of body parts are unclear for both cosmetic surgeons and individuals.

We revealed that cosmetic surgery in the pelvic region contributes to increasing individuals' personal resources, such as self-efficacy, self-esteem, and optimism. In addition, an increase in personal resources motivates individuals to manage their home life more effectively by reducing home demands and/or shaping home resources, which in turn allows them to have higher levels of work engagement. We suggest that during the initial consultation stage, cosmetic surgeons inform potential individuals who are considering cosmetic surgery on the pelvic region but who have not yet made a final decision about how the outcome of the surgery may psychologically contribute to both their home and work lives through improved personal resources, in addition to explaining the specific surgical details. Specifically, cosmetic surgeons may inform individuals of the improved self-efficacy, self-esteem, and optimism that surgery can produce, which may support them in taking proactive actions to address home demands and increase home resources such as those studied in this research, thereby enabling them to better engage in work. Doing so will benefit cosmetic surgeons by more effectively motivating potential individuals to make a final decision about the surgery than by explaining only the specific surgical details. Moreover, individuals can gain a better understanding of the value of such cosmetic procedures in terms of contributing to their home and work lives by increasing their personal resources, in addition to improving the physical appearance of the body part targeted for surgery.

Conclusion

In this research, we investigated 1) whether personal resources are crafted in a nonwork domain and 2) whether there are mechanisms that channel the effect of improved personal resources on work engagement. Underpinned by COR theory, we demonstrated that personal resources can be crafted in private life and that these personal resources contribute to work engagement in a cross-domain manner through the home domain by increasing home resources and decreasing home demands. Our research findings demonstrated that personal resources may not always be the proximal factor of work engagement, which has been widely claimed by studies on work engagement. Our study provides a new direction for future scholars to explore further the association between personal resources and work engagement. Additionally, we present practical implications for clinics/centres/hospitals that offer these surgical procedures by providing cosmetic surgeons with evidence that they can use to motivate potential individuals to reach a decision about surgery. Surgeons can inform potential patients of the value of this type of cosmetic surgery for their home and work life (i.e., feeling more personal resources, enabling them to deal with home influences, thereby contributing to their work engagement), in addition to the benefit derived from altering the physical appearance of the body part undergoing surgery.

Appendix

Daily Self-efficacy

Please respond to the following statements about yourself (/your partner) today:

1. Today, I could always manage to solve difficult problems when I tried hard enough.
2. Today, when someone opposed me, I could find the means and ways to get what I want.
3. Today, it was easy for me to stick to my aims and accomplish my goals.
4. Today, I was confident that I could deal efficiently with unexpected events.
5. Today, thanks to my resourcefulness, I knew how to handle unforeseen situations.
6. Today, I could solve most problems when I invested the necessary effort.
7. Today, I could remain calm when facing difficulties because I could rely on my coping abilities.
8. Today, when I was confronted with a problem, I could usually find several solutions.
9. Today, when I was in trouble, I could usually think of a solution.
10. Today, I could usually handle whatever came my way.

*For the version for the respondents' partner, we replaced "I" with "my partner" or "he or she" for each item where needed.

Daily Self-esteem

Please respond to the following statements about yourself (/your partner) today:

1. Today, on the whole, I was satisfied with myself.
2. Today, at times I thought I was no good at all.
3. Today, I felt that I had a number of good qualities.
4. Today, I was able to do things as well as most other people.
5. Today, I felt I did not have much to be proud of.
6. Today, I certainly felt useless at times.
7. Today, I felt that I'm a person of worth, at least on an equal plane with others.
8. Today, I wished I could have more respect for myself.
9. Today, all in all, I was inclined to feel that I was a failure.
10. Today, I took a positive attitude toward myself.

*For the version for the respondents' partner, we replaced "I" with "my partner" or "he or she" for each item where needed.

Daily Optimism

Please respond to the following statements about yourself (/your partner) today:

1. Today, in uncertain times, I usually expected the best.
2. Today, it was easy for me to relax.
3. Today, if something could have gone wrong for me, it did.
4. Today, I was always optimistic about my future.
5. Today, I enjoyed my friends a lot.
6. Today, It was important for me to keep busy.
7. Today, I hardly ever expected things to go my way.
8. Today, I didn't get upset too easily.
9. Today, I rarely counted on good things happening to me.
10. Today, overall, I expected more good things to happen to me than bad.

*For the version for the respondents' partner, we replaced "I" with "my partner" or "he or she" for each item where needed.

Daily Work Engagement

Please respond to the following statements about yourself (/your partner) today:

1. Today, my partner felt bursting with energy.
2. Today, my partner felt strong and vigorous at his or her job.
3. Today, when my partner got up this morning, he or she felt like going to work.
4. Today, my partner was enthusiastic about his or her job.
5. Today, my partner's job inspired my partner.
6. Today, my partner was proud of the work that he or she does.

Daily Quantitative Home Demands

Please respond to the following statements for your partner:

1. Was your partner busy at home today?
2. Did your partner have to do many things in a hurry when he or she was at home today?
3. Did your partner have to carry out many tasks at home today?

Daily Emotional Home Demands

Please respond to the following statements for your partner:

1. How often did emotional issues arise at home for your partner today?
2. How often did your partner's housework confront him or her with things that touched him or her personally today?
3. How often did your partner become frustrated about things concerning his or her home life today?

Daily Home Social Support

Please respond to the following statements about you for your partner:

1. Today, I paid attention to my partner's feelings and problems.
2. Today, when necessary, I helped my partner with a certain home task.
3. Today, when necessary, I gave my partner advice on how to handle things at home.
4. Today, I showed that I appreciate the way my partner did his or her home duties.

Daily Home Autonomy

Please respond to the following statements for your partner:

1. Today, my partner could decide him or herself how he or she would execute his or her work.
2. Today, at home, my partner had the freedom to decide how he or she did his or her work.
3. Today, my partner's home duty allowed him or her to make many decisions on his or her own.

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How Algorithmic Direction Affects Work Autonomy Within Varying Control Configurations: A Fuzzy-Set Qualitative Comparative Analysis**

Abstract

Employers are increasingly using algorithmic directions to instruct employees. Algorithmic direction controls work through instructions and recommendations based on algorithms, either substituting or complementing traditional control mechanisms, such as formal input and output control or informal clan control. However, it is unclear how the combination of algorithmic direction and other control mechanisms influences employees' perceived work autonomy. This empirical study analyses which combinations of algorithmic direction and other control mechanisms ensure employees continue to perceive work autonomy. A fuzzy-set qualitative comparative analysis was applied to a linked employer-employee dataset of 559 employees in large German workplaces. Results suggest that control configurations that combine algorithmic direction and informal clan control through personal interaction with supervisors or colleagues facilitate method autonomy, provided that organisations refrain from algorithmic monitoring and devaluation of prior skills. To ensure criteria autonomy, employees should also get to develop new skills and interact personally with both supervisors and colleagues.

Keywords: algorithmic control, algorithmic monitoring, configurational perspective, fsQCA, work autonomy
(JEL: M12, M54, J81, O33)

Introduction

Based on rapid technological advances, algorithmic direction has become prevalent in many industries and constitutes a new form of control through which organisations aim to efficiently align employee behaviour and performance (Baiocco et al., 2022; Kellogg et al., 2020). Being an integral part of algorithmic management, organisations use software programs to automatically generate algorithmic direction that provides work instructions, suggestions or further information to employees (Lee et al., 2015; Leicht-Deobald et al., 2019; Wood et al., 2019). Therefore, the algorithmic direction is expected to influence employees' work autonomy, i.e., the

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degree of freedom that employees perceive in deciding how to perform tasks and what work goals to accomplish (Breaugh, 1985; Humphrey et al., 2007). Work autonomy is a key job characteristic that relates to job quality because it is positively associated with employee motivation, well-being, and performance (Backhaus & Steidelmüller, 2021; Gallie, 2012; Muecke & Iseke, 2019). Employees strive for control over their work, which makes them feel needed, and work autonomy is a valuable job characteristic (Hattrup et al., 2020). If employees perceive algorithmic direction as limiting their work autonomy, they are likely to resist the new technology; however, if they feel empowered by algorithmic direction, they are more likely to embrace it (Blazejewski & Walter, 2018; Kellogg et al., 2020; Ruiner & Klumpp, 2022).

Yet, there has been little cross-industry research so far examining how employees in traditional employment perceive algorithmic direction as it relates to their work autonomy (Baiocco et al., 2022; Gagné et al., 2022). In particular, empirical evidence regarding how algorithmic direction influences the degree to which employees perceive work autonomy remains inconclusive (Bader & Kaiser, 2017; Meijerink & Bondarouk, 2023; Noponen et al., 2023; Ruiner & Klumpp, 2022). Some researchers suggest that algorithmic direction may foster work autonomy, as digital technologies support employees' ability to make complex decisions and enhance their flexibility (Ahlstrom et al., 2020; Grønsund & Aanestad, 2020; Nurski & Hoffmann, 2022). However, work organisations typically implement algorithmic management in ways that undermine employees' work autonomy by standardising, deskilling, and decomposing jobs, resulting in digital Taylorism (Gagné et al., 2022; Noponen et al., 2023). Using a dataset of employees working in traditional employment, Gensler and Abendroth (2021) show that employees perceive significantly less work autonomy when they receive algorithmic direction every day compared to employees who never receive algorithmic direction.

In this paper, we seek to find out how algorithmic direction is implemented as part of an organisation's control system (Cardinal et al., 2017; Duggan et al., 2020; Kalleberg & Reve, 1993) and which implementation is associated with high levels of work autonomy. The concept of a control system denotes that algorithmic direction co-occurs with other control mechanisms, resulting in specific control configurations (Cardinal et al., 2010; Lebas & Weigenstein, 1986; Sitkin et al., 2020). Research on organisational control has identified four different prototypical control mechanisms: input, behavioural, outcome and clan control (Ouchi, 1979; Sihag & Rijsdijk, 2019; Sitkin et al., 2020). These control mechanisms can be formal or informal (Kreutzer et al., 2016). In addition to algorithmic direction as a form of formal behavioural control, we consider algorithmic monitoring as a formal output control mechanism and changes in skill requirements (i.e., the devaluation of prior skills and the need to acquire new skills) as input control. We also consider personal interaction with supervisors and colleagues as indicators of informal clan control (Cardinal et al., 2010; Kirsch, 1996; Turner & Makhija, 2006).

In order to study how algorithmic direction is combined with these control practices and how they jointly influence employees' perceived work autonomy, we analyse a sample of 559 employees in large German workplaces who receive daily algorithmic direction, using fuzzy-set Qualitative Comparative Analysis (fsQCA; Misangyi et al., 2017; Park et al., 2017; Ragin, 2008). The method allows us to explore how different control mechanisms combine for employees to experience work autonomy. It also accounts for the fact that multiple combinations of control mechanisms may be associated with work autonomy. Thus, fsQCA shows which control mechanisms are relevant for employees to experience work autonomy, and it indicates whether control mechanisms are complementary or substitutive in explaining work autonomy.

In sum, we seek to make three contributions to the literature on algorithmic management in work organisations. First, we add to the sparse knowledge of the algorithmic management of traditional work. This study covers algorithmic direction as applied in conventional jobs from both public and private sectors across different industries, while prior research has largely investigated platform-based work (H. Huang, 2023; Parent-Rocheleau & Parker, 2022; Wood, 2021). Furthermore, most studies to date have analysed whether or not algorithmic direction has been applied, but little is known about how algorithmic direction is implemented in conventional work settings. We seek to provide a more nuanced understanding of algorithmic management by studying the implementation of algorithmic direction as part of organisational control systems following recent calls (Noponen et al., 2023; Parker & Grote, 2022a, 2022b).

Second, we contribute to organisational theory by applying a configurational approach to better understand how algorithmic direction influences employees' perceptions (Cardinal et al., 2017; Sihag & Rijsdijk, 2019; Sitkin et al., 2020). We argue that configurations of control mechanisms rather than individual control practices influence employee perceptions. So far, scholars have rarely applied a configurational approach when studying the digitalisation of work (for recent exceptions, see Lyngstadaas & Berg, 2022; Meier et al., 2023), but it promises to enrich knowledge about algorithmic management and its implications for work autonomy (Monteiro & Adler, 2022; Parker & Grote, 2022a; Schafheitle et al., 2020). Prior research has often assumed that formal behavioural and output control practices, such as algorithmic direction and monitoring, restrict work autonomy, while informal clan control, such as personal interaction with supervisors and peers, has been characterised as empowering (Cardinal et al., 2018; Sitkin et al., 2020). Yet, empirical evidence indicates that these assumptions may be overly simplistic (Adler & Borys, 1996; Monteiro & Adler, 2022). Instead, researchers have suggested that employee perceptions are influenced by the interaction of several controls (Cardinal et al., 2018; Long & Sitkin, 2018; Sihag & Rijsdijk, 2019). Therefore, we argue that it depends on the configuration of control practices and whether employees experience work autonomy. Even though we find that employees receiving

algorithmic direction tend to experience less work autonomy, we identify specific combinations of algorithmic direction with other control mechanisms that are associated with high levels of work autonomy, using fsQCA as a configurational method.

Third, we contribute to research on work autonomy by distinguishing between method autonomy and criteria autonomy to explore whether they require distinct control configurations to occur. Method autonomy describes the latitude of employees to decide how to execute their work, while criteria autonomy refers to the extent to which employees can select or change criteria to assess work outcomes closely linked to previously set work objectives (Breaugh, 1985). We focus on method and criteria autonomy because they are most likely influenced by algorithmic direction (Ruiner & Klumpp, 2022; Schafheitle et al., 2020). Method autonomy and criteria autonomy differ in their impact on employee attitudes, well-being, and performance (Humphrey et al., 2007; Muecke & Iseke, 2019). Yet prior research has not considered that algorithmic management may influence method and criteria autonomy in distinct ways (Möhlmann & Zalmanson, 2017; Noponen et al., 2023). Therefore, this study refines our understanding of work autonomy in a context that is subject to significant changes in work autonomy due to the digital transformation of work (De Spiegelaere et al., 2016; Schafheitle et al., 2020).

Overall, the findings promise to advance the discussion on how to implement algorithmic direction without compromising work autonomy and, eventually, employee motivation and well-being, thus helping organisations preserve job quality in light of the digital transformation of work.

Literature Review

Organisations exercise control to ensure that work processes are coordinated so that organisations meet their objectives (Cardinal et al., 2010; Ouchi, 1979). Organisational control systems consist of various control mechanisms that serve to direct, evaluate, and discipline employees (Cardinal et al., 2018; Edwards, 1979; Ouchi, 1979). Control mechanisms are any individual formal (i.e., written institutional rules, job descriptions, skill requirements, and work instructions) and informal (i.e., values, norms, beliefs, and information on organisational priorities) control procedures that organisations apply to control the input, behaviour, or output parts of the labour process (Cardinal et al., 2010; Ouchi, 1979; Schafheitle et al., 2020). To exercise formal input control, work organisations define skill requirements for performing a job (Cardinal et al., 2018; Schafheitle et al., 2020). Formal mechanisms focusing on behaviour control intend to control how employees perform work, while formal output control aims at measuring and assessing whether and to what extent a work target has been achieved (Cardinal et al., 2010; Ouchi, 1979). In contrast, clan control is informal in nature, relying on face-to-face interactions

among employees, supervisors, and peers to foster collaboration and the adoption of shared work values (Cardinal et al., 2018; Eisenhardt, 1985; Ouchi, 1979). Supervisors and peers shape and monitor employee behaviour through frequent personal interaction (M.-P. Huang et al., 2005; Huber & Gärtner, 2018; Kirsch et al., 2010).

Algorithmic direction serves as a formal behaviour control mechanism by providing work instructions and recommendations to direct employees and guide them in making work-related decisions (Kellogg et al., 2020; Lee et al., 2015; Wood, 2021). Algorithms link, consider and evaluate large amounts of data about organisational processes, personnel, capacities, priorities, supply and demands in order to efficiently solve work-related problems and support complex decisions, such as those related to recruitment (Leicht-Deobald et al., 2019), loan approvals (Terry et al., 2022), and logistics (Delfanti, 2021). Employees receive algorithmic direction on how to perform tasks via computer programs, apps, tablets or wearables in the form of suggestions or direct orders (Elliott & Long, 2016; Ruiner & Klumpp, 2022).

Organisations can implement algorithmic direction as a formal behaviour control mechanism, along with other forms of organisational control, thereby creating distinct control systems. The digital transformation of work may imply that organisations use algorithmic monitoring as a formal output control mechanism in addition to algorithmic direction. Algorithmic monitoring relies on sensors, cameras, and further input devices (e.g., keyboards or touchscreens) to automatically gather, store and evaluate data on work processes and outcomes (European Commission [EC] & Ball, 2021). Based on these large amounts of data, algorithms monitor work processes and evaluate work outcomes (Parent-Rocheleau & Parker, 2022). Organisations use algorithmic monitoring to compare work outcomes with standards and automatically adjust organisational resources and work targets or sanction and reward employees (EC & Ball, 2021).

Additionally, algorithmic direction may be associated with a shift in formal input control, as previously necessary skills become obsolete or employees must develop new skills (Delfanti, 2021; Grønsund & Aanestad, 2020; Johansson et al., 2017). Skill requirements serve as an input control mechanism because they define what skills and abilities organisations consider relevant and are willing to reward (Cardinal et al., 2017; Schafheitle et al., 2020). Organisations may devalue some skills because, for example, technology replaces human skills (H. Huang, 2023). On the other hand, organisations that use algorithmic direction can also redesign jobs to include novel or more complex tasks that require employees to develop new skills (Meijerink & Bondarouk, 2023; Noponen et al., 2023).

Finally, organisations using algorithmic direction may also rely on personal interaction with supervisors or peers as informal clan control to direct and monitor employees. Even though algorithmic direction may replace managerial functions, such as directing and coordinating work (Kellogg et al., 2020; Schwarzmüller et al.,

2018), supervisors are still essential in the context of platform-based work (Cram & Wiener, 2020; Ruiner & Klumpp, 2022) and in conventional work settings (Elliott & Long, 2016). Similarly, while employees may increasingly interact with sociotechnical systems, colleagues are still likely to influence how their peers act and perform work (De Jong et al., 2014; Elliott & Long, 2016). Through frequent personal interactions, supervisors control employees by giving directions, motivating employees to achieve organisational goals and providing feedback (Cardinal et al., 2018; Kreutzer et al., 2016). Likewise, personal interaction with peers helps to instil shared values, norms and perspectives and fosters coordination and collaboration (Walter et al., 2021).

To date, little is known about how organisations combine algorithmic direction with algorithmic monitoring, changing skill requirements and personal interactions with supervisors and peers. Therefore, we seek to explore organisational control systems entailing algorithmic direction.

Algorithmic Direction and Work Autonomy: A Configurational Perspective

Employees may perceive organisational control as coercive, thereby limiting work autonomy, or as enabling, i.e., facilitating work autonomy (Adler & Borys, 1996; Crowley, 2012). Similarly, the autonomy-control paradox suggests that algorithmic control can simultaneously enhance and restrict work autonomy (Bader & Kaiser, 2017; Ruiner & Klumpp, 2022). Accordingly, the association between algorithmic direction and perceived work autonomy remains ambiguous. Some studies indicate that algorithmic direction supports work autonomy (Meijerink & Bondarouk, 2023; Ruiner & Klumpp, 2022; Wood et al., 2019), while others show that algorithmic direction undermines work autonomy (Delfanti, 2021; Kinowska & Sienkiewicz, 2023; Nurski & Hoffmann, 2022; Wood, 2021). In a cross-sectional study on employees in traditional jobs, Gensler and Abendroth (2021) find that employees who receive algorithmic direction daily perceive significantly less work autonomy than employees who receive no algorithmic direction.

Yet research shows that it is inadequate to characterise individual control mechanisms as either coercive or enabling (Sitkin et al., 2020). Therefore, we argue that employees' perceptions of algorithmic direction can vary greatly, depending on how algorithmic direction is combined with algorithmic monitoring, changing skill requirements and personal interactions with supervisors and peers. Thereby, we follow a configurational approach that has gained a lot of attention in organisation theory (Furnari et al., 2021; Park et al., 2017). The configurational approach emphasises that specific combinations of conditions (i.e., a configuration) jointly produce an outcome of interest and that different configurations may lead to the same outcome (Fiss et al., 2013; Misangyi et al., 2017; Ragin, 2008). Recent research on organisational control suggests studying organisational control as configurations of control practices that jointly influence employee perceptions (Parker & Grote,

2022b; Sitkin et al., 2020). The configurational perspective takes into account the multifaceted nature of organisational control, providing a more nuanced picture of the complex control systems in organisations (Cardinal et al., 2017).

Employees perceive configurations of control mechanisms, i.e., control systems, as coercive or enabling, thus affecting their work autonomy (Adler & Borys, 1996; Crowley, 2012). As control systems differ in their emphasis on controlling behaviour, output and/or input (Cardinal et al., 2018), they provide more or less discretion for employees to decide how to work (method autonomy) and what to focus on (criteria autonomy). For example, control systems with a strong emphasis on controlling employee behaviour permit less method autonomy than control systems focusing on controlling the output. Control systems emphasising both formal behaviour and formal output control tend to be perceived as more coercive than control systems that rely on input control or informal clan control (Cram & Wiener, 2020; Meijerink & Bondarouk, 2023; Schafheitle et al., 2020; Wesche & Sonderegger, 2019).

Output Control: Algorithmic Monitoring

If algorithms are not only used to direct employees but also to monitor their work performance and outcomes, thereby combining formal behaviour and output control, then employees are expected to have less work autonomy. Algorithmic monitoring enables the continuous, invasive, immediate, and extensive capturing and evaluation of work performance (EC & Ball, 2021), including information on employees' tacit knowledge, actions, thoughts, feelings, physiology, relationships and reputation (Ravid et al., 2020), as well as their movements and location within and beyond work establishments (Elliott & Long, 2016; H. Huang, 2023). Some employees perceive quick and specific feedback as helpful, particularly insofar as it can encourage them to learn and acquire new skills (Tomczak et al., 2018). However, if algorithmic monitoring complements algorithmic direction, employees have little room to evaluate their own performance and revise it accordingly. Moreover, giving employees immediate feedback on their performance creates an atmosphere in which they feel as if they are constantly being judged or even disciplined. Hence, the combination of algorithmic direction and monitoring likely restricts work autonomy because it impedes independent thinking and increases the pressure on employees to act in 'anticipatory conformity' (Zuboff, 1988) with the work organisation.

Input Control: Devaluation of Prior Skills and New Skill Requirements

Skills are important for work autonomy because employees draw upon their skills and knowledge to address problems and cope with job demands. The more employees understand their work context, procedures, and how to achieve work goals, the better their ability to take control and work autonomously (Wu et al., 2015).

Therefore, changing skill requirements as formal input control in combination with algorithmic direction is expected to influence employees' perceived work autonomy (Cardinal et al., 2010).

If algorithmic direction is implemented in a way that renders prior skills obsolete, employees tend to experience less work autonomy, as this implies that jobs become more standardised and underutilise employees' prior skills (Noponen et al., 2023). This is particularly likely if algorithmic direction is combined with algorithmic monitoring and a devaluation of prior skills. Yet if prior skills remain valued, employees may view algorithmic direction as a tool that complements their skills or as guidance to base their decisions on, thereby increasing work autonomy (Noponen et al., 2023; Schildt, 2017).

Algorithmic direction may also be associated with the need for employees to learn new skills (Grønsund & Aanestad, 2020), with ambiguous effects on perceived work autonomy. On the one hand, employees may perceive a mismatch between their current skills and the skills required to understand, interpret and cope with algorithmic direction, thereby threatening their self-efficacy and leading them to perceive less work autonomy (Grønsund & Aanestad, 2020). On the contrary, the need to develop skills due to the implementation of algorithmic direction may also imply that jobs become more challenging and complex, thereby enhancing work autonomy. Receiving augmented information on work processes by algorithmic direction serves to reduce information asymmetries and may enable new forms of coordination and self-directed teamwork (Hirsch-Kreinsen, 2016; Schildt, 2017), resulting in employees gaining decision-making competencies (Wood et al., 2019).

Informal Clan Control: Personal Interaction with Supervisors and Peers

In general, employees consider good communication and relationships with supervisors and colleagues to be important work characteristics (Hattrup et al., 2020). Algorithmic direction can complement or substitute personal interactions with supervisors and peers as informal mechanisms of clan control. If algorithmic direction is used to give employees instructions, information and feedback, it is reasonable to assume that the role of human managers shifts accordingly (Jarrahi et al., 2021; Wesche & Sonderegger, 2019). Current research on algorithmic direction suggests that supervisors increasingly take on the role of an advisor and interpreter of algorithmically generated decisions (Ruiner & Klumpp, 2022; Terry et al., 2022). Moreover, algorithmic direction cannot replace the strengths of human managers, such as insight into human nature, instinctive feelings, or the ability to appreciate employees' performance and motivate them when necessary. This is why supervisors have proven essential in supporting employees' work autonomy (Jungert et al., 2021). Supervisors who frequently communicate with employees may mitigate potential problems employees face when working with algorithmic direction, thereby reducing insecurity and strain (Cram & Wiener, 2020; Kreutzer

et al., 2016). In general, respectful and supportive leadership is positively correlated with employee decision autonomy (Backhaus & Steidelmüller, 2021). Therefore, employees working in algorithmic directions may perceive frequent personal interaction with supervisors as supportive, creating leeway for them to decide how to work or what to work on. Yet, informal control through supervisors may add to the strain-enhancing effects of algorithmic direction, for example, if employees perceive the personal interaction with supervisors as coercive rather than supportive.

Similarly, the interaction with co-workers serves as a clan control mechanism by creating cohesion and structuring work processes through team organisation and peer supervision owing to task interdependence (Hodson, 2008; Loughry, 2010). Employees exchange information, support one another, and show appreciation and motivation, thus countervailing the potentially negative effects of algorithmic direction. Hence, joint action and increased cooperation of colleagues can mitigate the counterproductive effects of algorithmic direction and help employees conserve work autonomy (Kellogg et al., 2020; Lammi, 2021). However, case studies show that close integration into social relationships with colleagues, joined by algorithmic direction and monitoring, evokes competitive work behaviour due to the chance to evaluate behaviour and performance in real time (Elliott & Long, 2016; Payne, 2018). Therefore, close personal interaction with colleagues may also curtail employees' work autonomy. Following these considerations, for the control system in which algorithmic direction is present, it is possible that clan control by supervisors and peers results in restricting *or* enabling work autonomy.

In sum, we assume that the effect of algorithmic direction on work autonomy depends on how it is implemented in joint interaction with other formal and informal control mechanisms. So far, little is known about these configurations or the joint effects of the various control systems in which algorithmic direction as behavioural control is implemented. Therefore, we use an exploratory approach to identify configurations of control systems, including algorithmic direction, that allow for high levels of work autonomy.

Methodology

Sample

This study analysed the third wave of a linked employer-employee panel dataset (LEEP-B3[1]) of employees of large-scale work organisations (i.e., 500 or more employees) in Germany. Work organisations were from both the public and non-public sectors, as well as from various industries. Data were collected between April 2018 and January 2019 and based on administrative data from the German Federal Employment Agency provided by the Research Institute for Employment Research (IAB) and a survey conducted by Bielefeld University, Germany (Diewald et al.,

1 https://doi.org/10.4119/unibi/sfb882.2014.12.

2014; Marx et al., 2020; Peters et al., 2020). Employers were drawn from a random sample based on all work organisations with 500 or more employees in Germany operating at the time of reporting. Interviewed employees were randomly selected from the population of all employees of the employer sample who were born in 1960 or later and were subject to social insurance contributions (Marx et al., 2020; Peters et al., 2020). The complete sample of the third wave comprised 6,287 cases from 160 different work organisations. The sample used for the present analyses comprised 559 cases.[2] Namely, those who worked under algorithmic direction daily or several times a day for which other relevant information was available.

Method

To examine which combinations of organisational control mechanisms lead to high work autonomy for algorithmically directed employees, this study applied fsQCA (Ragin, 2008). Although this approach is popular in organisation and management science (Greckhamer et al., 2018; Lyngstadaas & Berg, 2022), it has rarely been applied in research on job design (for exceptions, see Kalleberg & Vaisey, 2005; Ong & Johnson, 2023). FsQCA allows researchers to analyse 'multiple conjunctural causation' (Rihoux, 2006). Holding that combinations of conditions—rather than one condition alone—are related to an outcome, 'conjunctural causation' implies that algorithmic direction may be linked to high work autonomy (only) if it is combined with other specific work conditions. 'Multiple' causation or equifinality refers to the idea that more than one of these combinations of conditions may serve as a causal path to an outcome. This implies that several configurations of control mechanisms may lead to work autonomy if algorithmic direction is applied.

The fsQCA approach expresses causal links in set-theoretic language. First, the conditions and outcomes are calibrated into set membership values ranging from 0 (the observation is fully out of the set) to 1 (the observation is fully in the set), with a crossover point at which a case is either in or out of the set (Ragin, 2008). Second, the intermediate set membership values for all cases are defined by applying the log odds method (Ragin, 2008). Third, based on the membership values, fsQCA implements algorithms that explore how the membership of cases in causal conditions is linked to membership in the outcome.

This study defined a frequency threshold (Greckhamer et al., 2018) whereby only configurations with at least five cases were considered for further analysis. In doing so, 96.6 % of all the cases were retained. The remaining cases below the frequency threshold are classified as logical remainders. To analyse sufficiency, fsQCA assesses

2 Of 6,287 cases, 85.7 % gave consent to have their data to be linked to administrative data relevant for the analyses, and they still worked for the same company of which the sample was drawn and were currently employed. Of the remaining 5,387 cases, 10.7 % worked with algorithmic direction daily. A share of 2.8 % of the remaining 575 cases were not included due to missing information.

configurations displaying the outcome based on consistency scores, with high consistency scores inferring that a configuration almost always leads to the outcome (Ragin, 2008). Following recent recommendations (Greckhamer et al., 2018), this study applied a minimum raw consistency score of. 80 and a minimum PRI consistency[3] (i.e., proportional reduction in inconsistency) score of .60 for method autonomy and .51 for criteria autonomy. Configurations with consistency scores below the cut-off values were not considered sufficient. Combinations of causal conditions found to be sufficient were then subjected to the truth table algorithm, thereby reducing the number of expressions needed to describe the sufficient combinations of conditions (Ragin, 2008). All analyses were conducted using the statistics program R and applying the 'SetMethods' (Oana et al., 2021) and 'QCA' (Duşa, 2019) packages.

Measures and Calibration

Outcomes: Method and Criteria Autonomy

The outcomes of work autonomy were measured according to Breaugh (1985). Respondents rated each autonomy dimension on a Likert scale ranging from 1 to 5 in terms of how much autonomy they perceive (see Appendix Table A1 for details on the measurements of the outcomes and conditions). Both method autonomy and criteria autonomy were calibrated using the logic behind the five-point Likert scales as external criteria (Fiss et al., 2013). Accordingly, a score of 1 corresponded to fully out of the respective set (set membership value of 0), while a score of 5 corresponded to fully in the respective set (set membership value of 1). The thresholds for the crossover points of each work autonomy dimension set corresponded to their respective mean levels in the member sets of employees who were not members of the algorithm direction set. This study opted for this route because its primary objective was to identify control systems compensating for possible forms of implementation of algorithmic directions that restrict work autonomy. A score of 3.9 marked the point of maximum indifference about the set membership of method autonomy (set membership score of .5), and a score of 3.1 marked the point of maximum indifference to criteria autonomy.

Conditions

Following the underlying theoretical assumptions of the original five-point Likert scales, algorithmic monitoring was calibrated using 1 and 5 as anchors and 3.1 as crossover point. Clan control in the form of personal interaction with colleagues was considered high (set membership value of 1) if employees communicated

3 To ensure that the identified solutions are consistent despite the PRI consistency levels being below .75, this study included robustness checks analysing the negation of the outcome (see Table A2 in the appendix). The results of the negation analyses confirmed the consistency of the relevant solutions.

several times a day (score 5) and low (set membership value of 0) if employees communicated rarely or never (score 2.1). A value of 4.1 (daily communication) marked the crossover point. Clan control in the form of personal interaction with supervisors occurred less frequently, as indicated by a mean of 3.54 (s.d. 1.07) compared to a mean of 4.57 (s.d. 0.70) for personal interaction with colleagues. To account for these distinct communication patterns, a value of 3.1 (weekly communication) was chosen as the crossover point for personal interaction with the supervisor. Formal input control in the form of changes in skill requirements was represented by two original crisp sets, which differ between 0 and 1. The 'need to learn new skills' and 'a devaluation of prior skills in the course of the digital transformation' were calibrated by 0 for a full non-membership of the respective set, .51 as POI[4], and 1 for full membership. Table 1 presents descriptive statistics, the calibration of all sets and the share of cases that experience both algorithmic direction and the respective control mechanism.

Table 1. Descriptive Statistics, Calibration and Co-occurrence with Algorithmic Direction

Control Mechanisms			Mean/ %	St. Dev.	Qualitative Anchors			Combined with Algorithmic Direction in x % of Cases
					Full Non-Membership	Point of Indifference	Full Membership	
Formal	Output Control	Algorithmic Monitoring	3.90	1.38	1	3.1	5	69 %
	Input Control	Devaluation of Prior Skills	15.03	-	0	.51	1	15 %
		Need for New Skills	66.91	-	0	.51	1	67 %
Informal	Clan Control	Personal Interaction with Supervisor	3.54	1.07	1	3.1	5	51 %
		Personal Interaction with Colleagues	4.57	0.70	1	4.1	5	66 %
Work Autonomy								
		Method Autonomy	3.57	1.28	1	3.9	5	
		Criteria Autonomy	2.78	1.23	1	3.1	5	

Note. Descriptive statistics and calibrated fuzzy sets of the sample of employees receiving algorithmic direction daily.
N = 559; corresponds to 9 % of the raw data sample (N = 6,287) of LEEP-B3 data 2018/19, wave 3.

Results

Prevalence of Control Systems, Including Algorithmic Direction

About 10 % of employees in the secondary data sample (N = 5,387) reported receiving algorithmic directions at least daily. Most of them (69 %) indicated that al-

4 For technical reasons, the point of indifference is set at.51 instead of.50.

gorithmic direction was combined with algorithmic monitoring, implying that algorithms are frequently used to combine formal behaviour and output control. In 15 % of the cases, algorithmic direction was associated with a devaluation of prior skills, while 67 % of employees receiving algorithmic direction reported that they had to learn new skills. About half of the employees (51 %) indicated that they had daily personal interactions with their supervisor, and 67 % reported that they closely interacted with their colleagues in addition to receiving algorithmic direction.

As expected, control systems varied considerably, indicating that organisations implement algorithmic directions in various ways. The most common control system in our sample, representing 18 % of the cases, entailed a combination of algorithmic direction with algorithmic monitoring, upskilling (i.e., no devaluation of prior skills but a need to learn new skills) and informal clan control (i.e., personal interaction with both supervisors and peers). Another 18 % of the cases pertained to control systems that included algorithmic direction and monitoring, upskilling and no frequent personal interaction with supervisors. These control systems were associated with low levels of method and criteria autonomy. Overall, about 25 % of algorithmically directed employees reported experiencing method autonomy. Only 7 % of the algorithmically directed employees indicated to have criteria autonomy.

Sufficient Combinations of Control Mechanisms for Method and Criteria Autonomy

For each dimension of work autonomy, this study conducted a separate fsQCA to identify organisational control configurations that result in method or criteria autonomy. Control configurations are intermediate solutions that take the presented theoretical considerations and empirical evidence into account. The results of the sufficiency analyses are depicted in Table 2.

Six of the 32 possible configurations are consistently associated with method autonomy (cf. Table A3), while the other 26 configurations are not. The six configurations can be summarised, resulting in three solution paths sufficient to explain method autonomy (cf. Table 2). In addition to the joint absence of a devaluation of prior skills and algorithmic monitoring, there should be no need to learn new skills (M1; CONS:.801; COV: 21.4 %), or there should be additional personal supervisor interaction (M2; CONS:.835; COV: 34.3 %) or close personal interaction with colleagues (M3; CONS:.798; COV: 36.8 %). Together, all configurations sufficient for method autonomy had a consistency rate of .776 and covered 39.0 % of the cases (cf. Table 2).

Table 2. Results of Sufficiency Analyses

Control Mechanisms Combined with Algorithmic Direction	Method Autonomy			Criteria Autonomy
	M1	M2	M3	C1
Algorithmic Monitoring	×	×	×	×
Devaluation of Prior Skills	×	×	×	×
New Skills Required	×			■
Personal Interaction with Supervisor		■		■
Personal Interaction with Colleagues			■	■
Mean Autonomy	*3.82*	*3.84*	*3.92*	*3.27*
n *(% of Cases with Algorithmic Direction)*	61 *(11 %)*	76 *(14 %)*	108 *(19 %)*	37 *(7 %)*
Raw Consistency	.801	.835	.798	.848
PRI Consistency	.550	.624	.590	.536
Raw Coverage	.214	.343	.368	.284
Unique Coverage	.008	.009	.019	
Overall Solution Consistency		.776		-
Overall Solution Coverage		.390		-

Note. The results table shows three solution paths for method autonomy and one solution path for criteria autonomy. ■ = Condition must be present; × = Condition must be absent; [] = Condition may be absent or present.
Source: LEEP-B3 data 2018/19, wave 3; own calculation.

As it was more difficult to explain how employees achieved criteria autonomy than method autonomy, this study instituted a lower PRI cut-off in order to obtain any solution with a positive outcome. The truth table analysis (cf. Table A4) for criteria autonomy suggested only one configuration that met the criteria of a minimum consistency score of .80 and a PRI score of .51. Sufficiency analyses suggested that, in addition to no devaluation of prior skills and no algorithmic monitoring, employees with algorithmic direction should experience the need to learn new skills, personal interaction with supervisors and peers in order to experience criteria autonomy (C1: CONS: .848; COV: 28.4 %). Thus, requirements to perceive criteria autonomy under algorithmic direction were high because all workplace conditions investigated were part of the only solution path.

Discussion

This study investigated which systems of organisational control, including algorithmic direction, result in employees perceiving work autonomy. The digital transformation of work has led to the implementation of algorithmic direction in work organisations, which has raised concerns about employees' work autonomy (Gagné et al., 2022; Möhlmann & Zalmanson, 2017). However, there has been limited research on the co-occurrence of algorithmic direction and varying control mechanisms, which form control systems that differ in their impact on work autonomy

(for an exception, see Ruiner & Klumpp, 2022). Therefore, this study follows a configurational approach (Cardinal et al., 2017; Furnari et al., 2021; Misangyi et al., 2017; Ong & Johnson, 2023). The aim of this study was to enhance our understanding of how work organisations implement algorithmic direction as part of their control system (Cardinal et al., 2017) and which implementation results in high levels of work autonomy.

The analyses suggest that the configuration of control mechanisms determines whether employees experience work autonomy when organisations use algorithmic direction. These results are in line with the assumption that it is the configuration of multiple control mechanisms that influences how employees perceive work autonomy (Cardinal et al., 2018; Long & Sitkin, 2018; Sihag & Rijsdijk, 2019). Thus, the study's findings provide a better understanding of how distinct control systems including algorithmic direction influence employees' perceptions of work autonomy.

By applying fsQCA as a configurational method, our findings help to understand previous inconsistent findings by showing that the combination of algorithmic direction with other control mechanisms determines whether employees experience work autonomy. Furthermore, the results indicate that algorithmic direction does not undermine employees' work autonomy per se. In fact, the results suggest that when algorithmic direction is not combined with other formal output control in the form of algorithmic monitoring and changes in skill utilisation, employees still perceive high levels of work autonomy. In line with this finding, Delfanti (2021) assumes that when skills become obsolete, perceived competence may decrease, making employees even more dependent on algorithmic direction on how to perform work. However, in contrast to formal control, informal controls can partly offset the constraints on work autonomy that may arise from algorithmic direction. Informal control in the form of leadership correlates with higher decision autonomy. This finding is consistent with the overall appreciation of employees for beneficial mutual interaction and feedback from supervisors. (Hattrup et al., 2020). Moreover, employees may seek the assistance of supervisors and colleagues to manage or work around algorithmic direction, which helps them improve their work autonomy and achieve their work goals (Kellogg et al., 2020; Petrakaki & Kornelakis, 2016). These results imply that the opportunity to consult supervisors for suggestions, interpretations or negotiation is crucial for attaining method autonomy when algorithms are used to control work, confirming previous findings (Cram & Wiener, 2020; Ruiner & Klumpp, 2022; Terry et al., 2022).

Prior research indicates that informal clan control exerted by colleagues promotes competitive behaviour in workplaces utilising algorithmic management, limiting employees' ability to choose how to work (Elliott & Long, 2016; Payne, 2018). Our findings suggest that organisations can limit negative consequences of informal peer control in case of employees receiving algorithmic direction by refraining from

combining algorithmic direction with algorithmic monitoring and a devaluation of prior skills.

Our research has practical implications for the implementation of algorithmic management in work organisations. It is important for employees to have work autonomy as it allows them to stay alert and train and develop their skills. Therefore, organisations should pay attention to different control configurations involving algorithmic direction and their specific implications for different dimensions of work autonomy. Yet, none of the control mechanisms studied can compensate for the limitations on work autonomy caused by formal output control through algorithmic monitoring and formal input control by devaluing prior skills. As algorithmic monitoring is typically important in algorithmic management, previous research suggests it is important to provide employees with access to and control over their monitoring. When implementing algorithmic direction and algorithmic monitoring in work procedures, it is advisable to do so in a transparent and controllable way so that employees can maintain their autonomy.

There are several limitations of this study that should be considered in future research. While the fsQCA of large German workplaces provides new insights into the configuration of different implementations of algorithmic direction and how they relate to work autonomy, analyses of smaller workplaces or workplaces in other countries could produce different results. In addition, further investigations considering group differences between different sectors or occupational status groups may provide additional knowledge that work organisations could consider when planning to implement algorithmic direction.

Conclusion

This study makes several contributions to the understanding of how algorithmic direction is related to employees' work autonomy. It is one of the first studies to focus on how conventional workplaces implement algorithmic direction as part of their control system. The study is based on a representative dataset of 559 employees working in large German organisations. The findings indicate that algorithmic direction is implemented in various distinct ways in traditional workplaces. We found that a significant share of control systems exhibits features of digital Taylorism (Noponen et al., 2023), often as a combination of algorithmic direction and algorithmic monitoring or, less commonly, as a combination of algorithmic direction and employee deskilling.

Other configurations show characteristics of digital empowerment (Cardinal et al., 2018; Sitkin et al., 2020), as algorithmic direction is combined with an upskilling of employees or close personal interactions with supervisors and peers. The findings also indicate that algorithmic direction does not replace informal clan control but rather complements personal interactions with supervisors and peers in most cases. Additionally, the results suggest that a combination of algorithmic direction and

informal clan control through personal interaction with supervisors or colleagues allows for high levels of method autonomy if organisations avoid algorithmic monitoring and devaluing prior skills.

Moreover, the study shows that granting method autonomy can be achieved through a wider range of control configurations that incorporate algorithmic direction, as opposed to enabling criteria autonomy. Employees experience criteria autonomy only in those control systems that avoid algorithmic monitoring and a devaluation of employees' prior skills but require them to develop new skills *and* provide informal controls through personal interaction with supervisors *and* colleagues. The requirements for criteria autonomy are higher than for method autonomy, making it more difficult for organisations that use algorithmic direction to preserve criteria autonomy. Furthermore, if algorithmic direction does not require employee retraining for new skills, then employees may have method autonomy, but this configuration precludes criteria autonomy.

Overall, the results suggest that algorithmic direction does not necessarily lead to digital Taylorism, where employees are restricted in their work autonomy *per se*. Algorithmic direction can be used as a control mechanism while still allowing employees to perceive method and criteria autonomy. The configurational perspective highlights that employees' perception of work autonomy depends on the configuration of algorithmic direction with other control mechanisms.

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Appendix

Table A1. Original Measurement and Scales of the Outcomes and Conditions

	Original Item/Question	Original Scales				
Outcomes		Completely Applicable				Completely Unapplicable
		1	2	3	4	5
Method Autonomy	I am allowed to decide how to go about getting my job done.	❒	❒	❒	❒	❒
Criteria Autonomy	I am able to define my job objectives.	❒	❒	❒	❒	❒
Conditions		Completely Applicable				Completely Unapplicable
Algorithmic Monitoring	Information or data about my operations are automatically stored; for example, via an app, machines or a computer program.	1	2	3	4	5
		❒	❒	❒	❒	❒
		Yes			No	
		1			2	
New Skills Required	In the last three years, additional qualifications were required because of changes in my work in the course of digitalisation.	❒			❒	
Devaluation of Prior Skills	In the last three years, my professional expertise has become less important in the course of digitalisation.	❒			❒	
		Several times per day	Daily	Weekly	Rarely	Never
		1	2	3	4	5
Personal Interaction with Supervisor	How often do you communicate/interact face to face with your supervisor about your work?	❒	❒	❒	❒	❒
Personal Interaction with Colleagues	How often do you communicate face to face with your colleagues about your work?	❒	❒	❒	❒	❒

Table A2. Necessary Analyses

Autonomy Dimension	Method Autonomy			Criteria Autonomy		
Conditions	Cons. Nec	Cov. Nec	RoN	Cons. Nec	Cov. Nec	RoN
AM	.772	.571	.494	.791	.492	.452
DOWNG	.209	.587	.914	.211	.498	.898
UPG	.696	.556	.545	.709	.476	.504
IS	.772	.653	.643	.824	.586	.601
IC	.876	.599	.438	.896	.515	.392
~AM	.421	.742	.902	.455	.675	.880
~DOWNG	.887	.567	.344	.903	.486	.307
~UPG	.400	.600	.824	.405	.510	.793
~IS	.507	.688	.837	.532	.606	.803
~IC	.333	.729	.922	.348	.640	.899

Note. '~' denotes the negation of a condition. 'AM' = Algorithmic Monitoring, 'DOWNG' = Devaluation of Prior Skills, 'UPG' = New Skills Required, 'IS' = Interaction with Supervisor, 'IC' = Interaction with Colleagues; 'Cons. Nec.' = Consistency Parameter of Necessity; 'Cov. Nec' = Coverage Parameter of Necessity; 'RoN' = Relevance of Necessity.

Table A3. Truth Table Analysis of Method Autonomy

#	AM	DOWNG	UPG	IS	IC	Outcome	n	Incl	PRI
7	0	0	1	1	0	1	14	.956	.708
1	0	0	0	0	0	1	15	.954	.665
6	0	0	1	0	1	1	25	.948	.775
2	0	0	0	0	1	1	21	.919	.664
4	0	0	0	1	1	1	25	.885	.646
8	0	0	1	1	1	1	37	.869	.627
13	0	1	1	0	0	0	8	.957	.403
5	0	0	1	0	0	0	16	.946	.590
25	1	1	0	0	0	0	6	.946	.173
29	1	1	1	0	0	0	13	.931	.575
19	1	0	0	1	0	0	11	.924	.580
31	1	1	1	1	0	0	5	.922	.436
17	1	0	0	0	0	0	23	.888	.507
28	1	1	0	1	1	0	7	.877	.249
23	1	0	1	1	0	0	24	.865	.510
18	1	0	0	0	1	0	24	.842	.537
32	1	1	1	1	1	0	14	.829	.462
30	1	1	1	0	1	0	16	.824	.398
21	1	0	1	0	0	0	47	.820	.406
22	1	0	1	0	1	0	52	.777	.453
20	1	0	0	1	1	0	39	.764	.505
24	1	0	1	1	1	0	98	.720	.494
9	0	1	0	0	0	?	1	1	1
11	0	1	0	1	0	?	1	.991	0
27	1	1	0	1	0	?	1	.988	.697
3	0	0	0	1	0	?	4	.972	.678
10	0	1	0	0	1	?	2	.970	.034
15	0	1	1	1	0	?	1	.962	.194
12	0	1	0	1	1	?	1	.956	0
14	0	1	1	0	1	?	2	947	.381
16	0	1	1	1	1	?	2	.942	.291
26	1	1	0	0	1	?	4	.923	.311

Note. 'incl' = Parameter of Fit Consistency/ Inclusion Score; 'PRI' = Proportional Reduction in Inconsistency; 'AM' = Algorithmic Monitoring, 'DOWNG' = Devaluation of Prior Skills, 'UPG' = New Skills Required, 'IS' = Interaction with Supervisor, 'IC' = Interaction with Colleagues.

Table A4. Truth Table Analysis of Criteria Autonomy

#	AM	DOWNG	UPG	IS	IC	Outcome	n	incl	PRI
8	0	0	1	1	1	1	37	.848	.536
7	0	0	1	1	0	0	14	.939	.485
13	0	1	1	0	0	0	8	.932	.132
1	0	0	0	0	0	0	15	.929	.449
25	1	1	0	0	0	0	6	.919	0
5	0	0	1	0	0	0	16	.917	.367
29	1	1	1	0	0	0	13	.906	.335
2	0	0	0	0	1	0	21	.901	.473
31	1	1	1	1	0	0	5	.901	.255
19	1	0	0	1	0	0	11	.897	.437
6	0	0	1	0	1	0	25	.888	.491
4	0	0	0	1	1	0	25	.864	.449
17	1	0	0	0	0	0	23	.841	.336
28	1	1	0	1	1	0	7	.828	0
18	1	0	0	0	1	0	24	.820	.432
23	1	0	1	1	0	0	24	.819	.339
32	1	1	1	1	1	0	14	.814	.388
30	1	1	1	0	1	0	16	.793	.193
21	1	0	1	0	0	0	47	.781	.250
22	1	0	1	0	1	0	52	.734	.317
20	1	0	0	1	1	0	39	.716	.383
24	1	0	1	1	1	0	98	.641	.352
3	0	0	0	1	0	?	4	.991	.866
11	0	1	0	1	0	?	1	.983	0
9	0	1	0	0	0	?	1	.982	0
15	0	1	1	1	0	?	1	.961	0
27	1	1	0	1	0	?	1	.957	0
10	0	1	0	0	1	?	2	.953	0
12	0	1	0	1	1	?	1	.951	0
16	0	1	1	1	1	?	2	.950	.173
14	0	1	1	0	1	?	2	.910	.082
26	1	1	0	0	1	?	4	.862	0

Note. 'incl' = Parameter of Fit Consistency/ Inclusion Score; 'PRI' = Proportional Reduction in Inconsistency; 'AM' = Algorithmic Monitoring, 'DOWNG' = Devaluation of Prior Skills, 'UPG' = New Skills Required, 'IS' = Interaction with Supervisor, 'IC' = Interaction with Colleagues.

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Determinants of Work Loneliness in Hybrid Work: A Comparison Study Between Newcomers and More Experienced Employees*

Abstract

Remote and hybrid work became common practices due to the global COVID-19 pandemic. However, they entail a risk of work loneliness, which raises the question of newcomers' socialisation to work communities. This study explores whether the social context of hybrid work is perceived differently by employees who entered the organisation during or after the pandemic and their more experienced employees and if elements of the social context of hybrid work function as antecedents for work loneliness differently among these two groups. This research is based on data (N=1641) on hybrid workers from a large technology industry company collected in December 2022. Our results show that new employees experienced higher work loneliness than experienced employees. Informal communication with supervisors and colleagues and social support from colleagues (and particularly among new employees from the supervisor) were associated with lower levels of work loneliness. Our study provides empirical evidence concerning the antecedents of work loneliness and introduces the contingency factor as an additional element to the work loneliness process model. This study also contributes to organisational socialisation literature by being the first to compare newcomers and experienced employees in the post-pandemic hybrid work context.

Keywords: work loneliness, organisational newcomers, hybrid work, social support, communication
(JEL: C12, C30, I00, M54)

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Introduction

The massive shift towards remote and hybrid work in recent years has changed how work communities collaborate and coordinate their work (Jämsen et al., 2022; Mirowska & Bakici, 2023). Social practices within organisations that have adopted remote and hybrid working models have changed (Jebsen et al., 2022). For instance, meetings and communication between people are typically performed in online settings, while face-to-face encounters in offices have diminished drastically (Mirowska & Bakici, 2023). Remote and hybrid work increase the risk of asynchronous presence, both in a virtual working place and physically in the office, causing challenges for dynamics between team members (Brown et al., 2020). Thus, remote and hybrid work may be a situational boundary condition which has been found to increase the risk of work-related loneliness characterised by feelings of an unmet need for belonging at work (Wright & Silard, 2021; Yang et al., 2022). Perceptions of loneliness increase stress-provoking attentiveness to potential social threats and thus impair physiological functioning (Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010), and this is likely to have adverse effects on employees in terms of individual well-being and performance (Ozcelik & Barsade, 2018; Wright, 2005; Wright & Silard, 2021). The sense of not belonging may be particularly strong for new employees who do not have existing networks in the workplace (Cooper et al., 2021), especially if they have joined a work community in which remote and hybrid work is common (Jopling et al., 2023). However, whether new employees in remote and hybrid settings experience more loneliness at work than their more experienced counterparts has not been examined, and therefore, in this study, we focus on work loneliness in remote and hybrid work among newcomers and more experienced employees.

Hybrid work is a combination of working remotely (i.e. from home or some other location not designated by the employer) and from the office (Carrasco-Garrido et al., 2023). In remote and hybrid work, workplace social interactions and communication have become reliant on information and communication technology (ICT), which in turn has resulted in a decline in informal and spontaneous communication (Jämsen et al., 2022; Mirowska & Bakici, 2023; Standaert et al., 2022), and limited the ability to understand the social dynamics of the group (see Karl et al., 2022). It has also been suggested that changes in communication during remote work hinder the maintenance of social interactions and increase employees' subjective feelings of loneliness at work (Jämsen et al., 2022; Yang et al., 2022).

Furthermore, there is evidence suggesting that extensive remote work has a negative impact on social support from the supervisor (e.g. Sardeshmukh et al., 2012) and might also result in reduced social support from colleagues (George et al., 2022; Wang et al., 2021). This is unfortunate, as social support — gaining practical help and appreciation from supervisors and colleagues — is beneficial, especially in the context of hybrid work (Knight et al., 2022). Research shows that organi-

sational social support (which encompasses support from supervisors, peers, and the organisation) is associated with reduced feelings of loneliness (Bentley et al., 2016; Patterer et al., 2023; Wright et al., 2006) also in hybrid work (Knight et al., 2022). These shifts in modern working life are relevant for all employees engaged in dispersed work communities involving remote work and can significantly impact the experiences of new employees when they first join an organisation. Newcomers undergo a socialisation process wherein they acquire the necessary skills and behaviours needed to understand their roles and become integrated into the organisation (e.g. Bauer et al., 2007). The level and quality of communication and interactions between newcomers and more experienced members of the organisation facilitate newcomers' relationship-building and their integration into their work groups (Kammeyer-Mueller & Wanberg, 2003; Wang et al., 2015). Research also indicates that the social support received from supervisors and colleagues fosters adjustment (Nelson & Quick, 1991) and contributes to the sense of belonging in the organisation and work community (Morrison, 2002). Thus, as remote and hybrid work models challenge interpersonal communication and may reduce the availability of social support within organisations, risk factors for work loneliness may emerge and particularly impact new employees. Nevertheless, research on work loneliness and its underlying causes in the context of remote and hybrid work remains scarce (Wright & Silard, 2021), and empirical studies comparing the experience of newcomers with those of more experienced employees are rare.

The aim of this study is twofold: First, we explore whether the social context of remote and hybrid work (i.e. the amount of internal communication, informal non-work related communication with supervisors, informal non-work related communication with colleagues, social support from supervisors, and social support from colleagues) is perceived differently by employees who have entered the organisation after the COVID-19 pandemic started (newcomers) and more experienced employees. Second, we study the relationship between elements of the social context of remote and hybrid work and work loneliness. Furthermore, we study if the elements of the social context function differently as antecedents for work loneliness among newcomers and more experienced employees. Therefore, this study contributes to two distinct research domains of work loneliness and the socialisation of newcomers in organisations, with a particular focus on the context of remote and hybrid work.

Work Loneliness Among Newcomers and Experienced Employees

Defining Loneliness

Loneliness is a distressing feeling that is caused by the perception of inadequate levels of social relationships (Hawkley & Cacioppo, 2010; Peplau & Perlman, 1982). Particularly, the quality rather than the quantity of social relations is crucial regarding loneliness (Hawkley & Cacioppo, 2010), and loneliness can be experienced in

different domains of life, such as in work. However, it is important to distinguish loneliness from being alone and simply having a low level of social relations. Being alone is often only momentary and usually voluntary (i.e. being in solitude), which is described as a rather positive experience as it is seen as refreshing, offers freedom, and facilitates creativity (Long & Averill, 2003; Wright, 2005). Small social networks and infrequent contacts can indeed be a risk factor for loneliness, but this kind of objective social isolation has been consistently proven to have only a modest correlation with loneliness (Holt-Lunstad et al., 2015; Tanskanen & Anttila, 2016).

Strong empirical evidence connects loneliness with perceived stress (Christiansen et al., 2016; Hawkley & Cacioppo, 2010; Laustsen et al., 2023). The regulatory loop model of loneliness (Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010) states that lonely individuals feel unsafe, which provokes a stressful hypervigilance towards social threats and causes maladaptive cognitive bias regarding social interaction. This self-reinforcing loop of loneliness may also provoke feelings of hostility, pessimism, and low self-esteem (Hawkley & Cacioppo, 2010) and activate biological stress responses (Cacioppo et al., 2003; Cacioppo & Cacioppo, 2014; Doane & Adam, 2010). Thus, loneliness may have several negative outcomes affecting the experiences of working life and is thus worthy of further study, although, in this study, we do not examine the possible outcomes of (work) loneliness.

Work Loneliness

Belonging is one of the basic psychological needs of human beings, and it does not disappear even during the working day (Baumeister & Leary, 1995; Ryan & Deci, 2017). Belonging to a work community often satisfies many of people's social needs, and work may provide an opportunity for social relationships that are perhaps not otherwise available (Wright, 2005). However, unmet social needs at work can generate feelings of work loneliness (Wright & Silard, 2021). According to Wright and Silard's (2021) theoretical model of loneliness at work, every employee differs from each other regarding both their *desired* and *actual* levels of social relationships at work. Accordingly, a discrepancy where an employee desires more and better-quality relationships at work than they are actually experiencing is called a relational deficiency, which can trigger a distressing emotional response – i.e. a feeling of loneliness. Wright and Silard (2021) define loneliness at work as the psychological pain of perceived relational deficiencies in the workplace.

In organisations, new employees (i.e. newcomers in organisations) are usually referred to as organisational outsiders and experienced employees as organisational insiders. The transformation to become an effective insider happens via a socialisation process, when newcomers learn their organisational roles and become integrated into the work group and organisation (Bauer et al., 2007; for a review, see Allen et al., 2017). Organisational socialisation is a learning and adjustment process for a

newcomer, involving the development of a wide range of knowledge regarding the role, task, and organisational politics and norms, and also familiarising themselves and building relationships with a new social group (Cooper-Thomas & Anderson, 2006; see also Ashforth et al., 2007). Newcomers' socialisation processes are shaped and facilitated by the interplay between the newcomer's own proactive behaviours and the information and social support they gain from coworkers and supervisors (Cooper et al., 2021; Cooper-Thomas et al., 2014; Harris et al., 2020; Saks & Gruman, 2018; see also Harris et al., 2022). However, it is very likely that newcomers' desires and expectations for social relationships at work, as well as the realities they face, do not match up for some period of time. There is some evidence that longer organisational tenure can be related to lower loneliness at work (Anand & Mishra, 2021; Van Zoonen & Sivunen, 2022), although correlations between tenure and work loneliness have mainly been reported as nonsignificant (e.g. Ozcelik & Barsade, 2018; Patterer et al., 2023). It must be noticed that a correlation between tenure (a continuous variable of the years an employee has worked in the organisation) and work loneliness does not provide adequate evidence regarding the differences in the levels of work loneliness between new and experienced employees. However, this indicates that newcomers may be at a higher risk of work loneliness than employees who have already established their roles and places in the work community and developed mutual relationships (Sias, 2005). Nonetheless, while establishing high-quality relationships with organisational insiders might be more difficult and yet highly essential for effective socialisation in a virtual context (Gruman & Saks, 2018, pp. 125–126), extant literature has extended little focus on factors that can sustain the onboarding process of newcomers in remote or hybrid work contexts (Mazzei et al., 2023).

Only one report (Jopling et al., 2023) was found that provides empirical results comparing new and experienced employees' work loneliness after the COVID-19 pandemic, indicating that loneliness at work was higher among employees who had changed jobs during the Covid-19 pandemic compared to their more experienced counterparts (Jopling et al., 2023). However, that study design included employees from many different kinds of jobs and did not provide information specifically about newcomers and experienced employees in a remote and hybrid work context, so our study addresses this knowledge gap.

Whereas newcomers may experience higher work loneliness than more experienced employees, there may also be differences in the possible antecedents for it, as well as how they are related to work loneliness. Therefore, we continue our literature review by examining the possible antecedents for work loneliness, and their differences among newcomers and experienced employees.

Antecedents of Work Loneliness for New and More Experienced Employees

Antecedents of Work Loneliness

Different types of *antecedents of work loneliness* have been theoretically identified, although empirical studies have mainly studied the outcomes of work loneliness (Becker et al., 2022; Ozcelik & Barsade, 2018), and research focusing on its antecedents is still very rare (Spilker & Breaugh, 2021; Wright & Silard, 2021). The social contexts of the work, such as communication, information-sharing, collaboration practices, the availability of social support from supervisors or colleagues, the quality of leadership, and overall the felt quality of work-related relationships are likely to influence the experiences of work loneliness (Wright, 2009; Wright & Silard, 2021). Work-related relationships are developed through communication, and particularly non-work-related and other informal communication is crucial in this process (Fay & Kline, 2011; Horan et al., 2021; Koch & Denner, 2022; Sias & Cahill, 1998; Wilson et al., 2008). Thus, in addition to the formal and work-related interactions between work community members, informal non-work-related communication with colleagues and supervisors (i.e. talking or chatting about things which are unrelated to work) is also likely to be linked to the experience of work loneliness. For example, frequent communication with a supervisor has been connected with lower levels of work loneliness (Arslan et al., 2020). Furthermore, informal communication is connected with the interpersonal dimension of communication satisfaction (Kandlousi et al., 2010), and satisfaction with communication at work has been seen to be connected with lower levels of worker loneliness (Bowers et al., 2022).

Social support from colleagues and supervisors refers to their willingness to help with work tasks if needed, being available if problems emerge and showing appreciation for one's contribution at work (see e.g. Wännström et al., 2009). Experiencing these kinds of behaviours strengthens the sense of belonging and diminishes feelings of isolation at work. Social support from the supervisor and colleagues has also been connected with lower levels of loneliness at work (Patterer et al., 2023; Wright et al., 2006). Social support seems to be especially relevant in hybrid work, with colleagues' support protecting from loneliness even more than support gained from the supervisor (Knight et al., 2022). Therefore, in this particular study, our indicators for the social context of the work are the amount of internal communication, informal non-work-related communication with supervisors, informal non-work related communication with colleagues, social support from supervisors, and social support from colleagues.

Antecedents of Work Loneliness – Are They Perceived Differently by Newcomers and Experienced Employees?

Next, we briefly discuss the possible differences in the amount of internal communication and informal communication that occurs between a newcomer and his/her

supervisor and colleagues, as well as the social support gained from supervisors and colleagues. After that, we focus on the possible differences in how these antecedents can be related to work loneliness among newcomers and experienced employees.

Newcomers desire a feeling of identification and interpersonal belonging in the new social context (Bauer et al., 2007; Cooper et al., 2021; see also Ellis et al., 2015), and this triggers their relationship-building and information-seeking strategies (Ashford & Black, 1996; Sluss et al., 2012). Entering a new job and team can be a highly stressful situation that causes uncertainties for newcomers, who thus seek information and feedback to reduce such feelings (Ashford & Black, 1996; Bauer et al., 2007; Saks & Gruman, 2018). A lot of information is also usually provided for newcomers via formal induction and orientation (Antonacopoulou & Güttel, 2010). Therefore, it is likely that newcomers are more often involved in formal communication than experienced employees. Moreover, unlike newcomers, experienced employees (both supervisors and newcomers' colleagues) have had time to develop relationships, social ties (Sias, 2005), and even friendships at work (Horan et al., 2021), and therefore their involvement in informal communication may be higher compared to newcomers, although there is some empirical evidence (Koch & Denner, 2022) that the seniority of an employee is not related to the amount of informal communication. At the entry stage, a prime source of response and feedback for newcomers is their supervisor (Li et al., 2011). When a newcomer enters a new job, they typically receive lots of social support from the supervisor, and although the intensity of supervisor support diminishes over time (Jokisaari & Nurmi, 2009; Kammeyer-Mueller et al., 2013), it is likely that the social support gained from a supervisor is of a higher level compared to that of experienced employees. However, the social support gained from colleagues may emerge differently because colleagues do not typically have such formal roles in relation to newcomers as those of a supervisor (e.g. Cooper-Thomas, 2009), and this type of support may become stronger over time. Therefore, it is likely that the perception of social support from colleagues is higher among experienced employees than with newcomers.

Are Antecedents of Work Loneliness Different for Newcomers and Experienced Employees?

Frequent and formal communication opportunities between newcomers and experienced employees are not only important for gaining information, but they also provide possibilities to get to know other people better and build meaningful relationships (Batistič & Kaše, 2022; Saks & Gruman, 2018; Wang et al., 2015), as well as helping to reduce newcomers' uncertainties about being accepted by others (Chou & Chang, 2016). In addition, opportunities to share information and ideas with insiders as a newcomer can give a sense of full organisational membership and foster workplace network development (Jokisaari & Vuori, 2014; Rollag, 2004). Appropriate information and feedback exchange from workgroup

members provides opportunities for newcomers to connect with others (Ellis et al., 2017; Li et al., 2011; Rajamäki & Mikkola, 2019), and therefore, the amount of internal communication may be more important for newcomers than for experienced employees in relation to work loneliness.

Informal exchanges with experienced employees play an essential role for newcomers in the development of affective bonding (Lapointe et al., 2014) and foster experience and confirmation of membership in the organisation (Morrison, 2002). It has been addressed that newcomers' proactivity in relationship-building (Li et al., 2019; Zhao et al., 2023) and the positive responses to those initiatives from experienced employees (Li et al., 2011; Zheng et al., 2021) facilitate their social bonding and integration into the work community (Sluss et al., 2012). Therefore, it is likely that informal communication with supervisors and colleagues is more important for newcomers regarding work loneliness than it is for experienced employees.

Furthermore, social support from supervisors (see Lee, 2023 for a review) and co-workers help newcomers to engage with the new role and group (Korte & Lin, 2013; Zhou et al., 2021) and encourage newcomers to take the initiative to build interpersonal connections (Kammeyer-Mueller et al., 2011). Social support and satisfying work relationships offer newcomers a sense of belonging within the organisation and also a confirmation of their membership in the work community (Morrison, 2002; Nelson & Quick, 1991). In turn, erosion, reluctance or scarcity of social support and rejective behaviour from insiders are linked with a decreased experience of social acceptance and uncertainty of equal membership (Cooper et al., 2021; Kammeyer-Mueller et al., 2013; see also for a review Rink et al., 2013). The virtue of social support from insiders affects the newcomer's experience of social acceptance, such as feeling comfortable around co-workers and being accepted as one of them (Ellis et al., 2015; Gardner et al., 2022; Morrison, 1993). Perceived co-worker support is found to be especially important for the newcomer's experience of social acceptance compared to more experienced employees (Gardner et al., 2022). Therefore, it is likely that both types of social support gained either from the supervisor or colleagues are more important for new employees compared to their experienced counterparts.

Work Loneliness in Remote and Hybrid Work Among New and Experienced Employees

Starting as a new employee in a digital environment is different compared to a traditional in-presence working environment, in which most of the previous studies on work loneliness have been conducted. Newcomer socialisation in a virtual environment may pose challenges to learning the new social context, which can subsequently impair an individual's affective commitment and social integration and so make it more difficult for newcomers to establish high-quality relationships with insiders that also involve informal elements (Gruman & Saks, 2018). In

remote work, newcomers feel particular uncertainty about relationship building and need to go the extra mile to proactively develop social ties (Woo et al., 2022).

The increase in remote work means that members of work communities or teams do not share a physical context (e.g. a common office) very often, and thus, communication and collaboration mainly happen via ICT-mediated channels. ICT-mediated communication is challenging and has been described as less satisfying and of a lower quality compared to face-to-face interaction (Jämsen et al., 2022; Sias et al., 2012; Šmite et al., 2023; Wang et al., 2021). For example, it has been found that during the COVID-19 pandemic, remote employees' synchronous communication decreased, and their asynchronous communication increased, and this trend hindered the maintenance of social interactions at work (Yang et al., 2022). High-intensity remote work also brings challenges in seeking advice from others (Wu et al., 2023). Moreover, meetings are nowadays mostly virtual, and it has been reported that videoconferencing limits participants' abilities to understand the social dynamics of the group (see Karl et al., 2022). It has also been found that whereas social interaction comes naturally in face-to-face interaction, it requires a sense of co-location in online meetings, which is a condition that is not always easy to create (Standaert et al., 2022). However, even though remote communication has its drawbacks, it can allow employees to develop and maintain meaningful work-related relationships in a remote work context. For instance, the high frequency of digitally mediated communication has been found to be connected with higher quality interpersonal relationships (Nurmi & Hinds, 2020) and a lower level of perceived social isolation at work (i.e. work loneliness) (Van Zoonen & Sivunen, 2022).

The heavy reliance on ICT for social interactions at work has led to a lack of informal communication, such as the reduction in opportunities for informal feedback and interaction, and other occasions for informal exchanges, such as celebrating achievements and social outings (Jämsen et al., 2022; Mirowska & Bakici, 2023). Even though informal communication between organisation members seems to be a challenge in remote work context (Šmite et al., 2023), it is argued that it might be even more important in remote as opposed to onsite work (Fay, 2011), and it is generally suggested that organisations should provide opportunities for informal communication in remote work in order to promote better quality work relationships (Knight et al., 2022; Van Zoonen & Sivunen, 2022). Thus, it is not surprising that remote workers' satisfaction with their informal communication has, for example, been connected with their liking the colleagues they interacted with the most (Fay & Kline, 2011).

Social support gained from different sources in the organisation (and especially from supervisors and colleagues) plays an important role in remote employees' experiences at work. For instance, Men et al. (2022) studied employees during the pandemic, and their sample mainly consisted of people working from home. They

found the supervisor's praise for work achievements and their clear advice with tasks to be essential for establishing and maintaining trust (Men et al., 2022), which is a building block for all relationships and may be linked to experiences of work loneliness. These concepts are closely related to how we approach supervisor support in this study. In addition, the role of supervisors has been noted as being especially crucial in a remote context in starting and ensuring the adjustment process in the domains of role, social acceptance and work relationships and in providing support and information for newcomers that ease the process in these domains (Ellis et al., 2019; Kim, 2022; Mazzei et al., 2023). A further study conducted during the pandemic highlighted the importance of social support gained from colleagues and showed that it was an important predictor for remote employees' well-being (Straus et al., 2023). Moreover, it has also been found that in remote work, organisational social support (consisting of support gained from supervisors, peers, and the organisation) was related to lower feelings of social isolation (Bentley et al., 2016), and the study of Wang et al. (2021) indicated a negative association between social support and loneliness in remote work. All in all, characteristics of remote and hybrid work, such as the increased reliance on ICT-mediated communication, less time spent in a shared physical place, and a lack of incidental encounters with the supervisor and colleagues, should be acknowledged as situational boundary conditions for the feeling of work loneliness.

In light of the above, the aims of this study are to explore, first, whether the social context of remote and hybrid work (i.e. the amount of internal communication, informal non-work related communication with supervisors, informal non-work related communication with colleagues, social support from supervisors, and social support from colleagues) is perceived differently by employees who have entered the organisation after the COVID-19 pandemic started (newcomers) and more experienced employees. Second, we study the relationship between elements of the social context of remote and hybrid work and work loneliness. Furthermore, we examine whether these elements of the social context function differently as antecedents of work loneliness among newcomers and more experienced employees (see Figure 1).

Hypothesis 1: *Compared to more experienced employees, new employees experience higher levels of a) work loneliness, b) internal communication, and c) social support from supervisors, and lower levels of d) informal non-work related communication with supervisors, e) informal non-work related communication with colleagues, and f) social support from colleagues.*

Hypothesis 2: *The amount of internal communication is negatively associated with a) loneliness at work and b) particularly among new employees.*

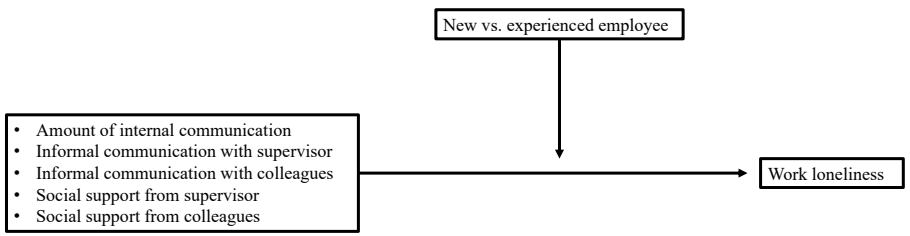
Hypothesis 3: *Informal non-work related communication with colleagues is associated with a) loneliness at work and b) particularly among new employees.*

Hypothesis 4: *Informal non-work related communication with supervisors is associated with a) loneliness at work and b) particularly among new employees.*

Hypothesis 5: *Social support from colleagues is associated with a) loneliness at work and b) particularly among new employees.*

Hypothesis 6: *Social support from supervisors is associated with a) loneliness at work and b) particularly among new employees.*

Figure 1. Relationships Between Study Constructs



Methods

Sample

The cross-sectional data for this research consists of a large sample (N=1641) of hybrid workers from 11 business units within a large multinational company (MNC) operating in Finland. This MNC represents the technology industry, particularly the energy business industry. This is a very important sector for economies globally and in Finland, and employees in this sector are essential assets for their employers. A large share of the company's employees undertakes expert work, and most of their tasks can be performed remotely. Conducting research concerning remote and hybrid employees' experiences in this context provides valuable insights into how to develop and maintain a decent working life in a changing and turbulent business environment. Furthermore, this particular company was very interested in the possibility of gaining information about their employees, which formed an important reason to collect data from their business units. Also, some other companies operating in the same sector were invited to participate, but for internal reasons, they did not accept the invitation.

The sample was collected via an online questionnaire in December 2022 with a response rate of 49%. The link to the questionnaire was distributed to the employees via email. Participation in the survey was optional and voluntary, and employees

could respond to the questionnaire during their working hours. The employer was not provided with information about which employees had or had not responded to the questionnaire. The questionnaire itself was created by the research team, and company representatives from HR departments were able to comment and make suggestions regarding the questionnaire format. Additionally, we obtained demographic background information from the company's personnel register, which improved the validity of the data. Information about the combination of register and questionnaire data was provided to employees at the start of the questionnaire via a link to the research project's privacy notice, as required by the EU General Data Protection Regulation. The amount of missing data was low, as only 62 (4%) respondents had missing values in the study variables. The complete responses (n = 1579) were used in all of the descriptive analyses.

Demographically, the sample mostly consisted of men (n=1196, 76%), and the mean age of respondents was 44.8 years with a standard deviation (SD) of 10.3. The mean amount of remote work was 56.1% (SD = 27.2) of the total working time. Most of the respondents (n=1317, 83%) were experienced employees, and almost a fifth (n=262, 17%) were new employees who started working during the COVID-19 pandemic. The respondents were coded (0 = experienced employee, 1 = new employee) based on their employment contract start date, and those who had worked at the company for two years or less were considered as new employees.

Measures

Work loneliness was measured with a five-item scale which has been extensively validated in two different Finnish samples (Kemppinen & Tanskanen, 2023). The participants rated five items (e.g., "I feel left out in this organization.") on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α score was 0.86 which indicated a good internal consistency for this measure.

The *amount of internal communication* was measured as the percentage of internal communication (e.g. with colleagues, supervisor, and back office) of the total working time. *Informal non-work-related communication with supervisors* was assessed with two items: "How often do you talk or chat about things which are unrelated to work?" a) face-to-face and b) remotely. Participants evaluated these two items with an eight-point scale (1 = Never, 2 = Less than monthly, 3 = Monthly, 4 = Multiple times during a month, 5 = Weekly, 6 = Multiple times during a week, 7 = Daily, 8 = Multiple times during a day). *Informal non-work-related communication with colleagues* was measured with the same items and the same scale. The overall non-work-related communication scores were calculated as the maximum value of either item score (e.g. an employee with item values 4 and 3 would get an overall score of 4). *Social support from supervisors* and *social support from colleagues* were measured with separate three-item scales from the QPS-Nordic questionnaire (Wännström

et al., 2009). A sample item for the social support from the supervisor scale is "If needed, can you get support and help with your work from your immediate supervisor?" and a sample item for the social support from the colleagues scale is "If needed, can you get support and help with your work from your coworkers?". Participants responded to these items on a five-point scale ranging from 1 (Very rarely or never) to 5 (All the time or almost all the time). The Cronbach's α scores for supervisor support and colleague support were 0.83 and 0.83, respectively. Both of these values indicated a good internal consistency of the scales.

Control variables included sex, age, team size, the amount of remote work, the amount of working alone, job autonomy, and quantitative job demands. Sex, age, and team size were retrieved from the company register. *Sex* was coded as 0 = male, 1 = female, *age* was measured in years, and *team size* was calculated as the number of team members under the same supervisor. The *amount of remote work* was measured as the percentage of time spent remote working from the total working time, and similarly, the *amount of working alone* was measured as the percentage of time spent working alone from the total working time. These ratios were evaluated by the employees. *Job autonomy* was measured with a six-item scale based on the Nova-Weba questionnaire (Houtman et al., 1994). Participants rated the six items (e.g. "I am my own boss when it comes to organising my workload.") on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α score was 0.84, which indicated a good internal consistency in this sample. *Quantitative job demands* were measured with a four-item scale from the QPS-Nordic questionnaire (Wännström et al., 2009). Participants evaluated the four items (e.g. "Is it necessary to work at a rapid pace?") with a five-point scale ranging from 1 (Not at all or little) to 5 (Very often or almost all the time). The Cronbach's α score was 0.85, which indicated good internal consistency in this sample.

Analytical Strategy and Statistical Methods

The total number of rows containing missing data was low (n = 62, 4%). Listwise deletion (LD) was used for respondents with missing values (n=33) in the grouping variable (experienced or new employee), as the contract starting date was not recorded for external contract employees. As the remaining amount of missing data was very low, LD was also utilised for the rest of the respondents with missing values (n=29), assuming that the missingness was occurring completely at random. The complete cases of respondents (n = 1579) were used in the subsequent analyses.

In order to test our first hypothesis, age-adjusted regression analyses with a new versus experienced employee dummy variable as a predictor were conducted. To test the other hypotheses concerning the differences in predictors of work loneliness between experienced and new employees, multiple-group analysis (MGA) was used to estimate separate linear regression models for experienced and new employees.

The differences between the experienced employee and the new employee estimates were tested with the Wald chi-square test by setting the parameter values as equal between experienced and new employees. A robust maximum likelihood estimator (MLR) was used to estimate the models. Descriptive and regression analyses were performed with R (version 4.3.1; R Core Team, 2023), and the multiple-group analysis was conducted with Mplus (version 8.6; Muthén & Muthén, 1998–2017). In MGA, several possible confounders were adjusted as it is likely that, for example, demographics, remote work, the amount of working alone, job autonomy, and quantitative demands have an effect on both work loneliness and its examined antecedents (Knight et al., 2022; Wright, 2005; Wright & Silard, 2021).

Results

A descriptive analysis of the stratified sample (see Table 1) indicated that the overall level of work loneliness was low in both groups but slightly higher among new employees (mean = 1.91) compared to experienced employees (mean = 1.72). The levels of supervisor and colleague social support and informal communication with them were high among new and experienced employees. New employees were younger (mean = 35.93) compared to experienced employees (mean = 46.58), and there were more women among new employees (36%) compared to experienced employees (22%). Newcomers also reported slightly higher amounts of working alone than experienced employees (55% vs. 52%). Regarding team size, autonomy, quantitative job demands and the amount of remote work, there were no differences between new and experienced employees.

Table 2 presents correlations among study variables stratified to new and experienced employees. Whole sample correlations and descriptive statistics are presented in Table 5 (provided in the Appendix). As presented in Table 2, correlations between work loneliness and the other study variables indicated that social support from supervisors and colleagues and informal communication with them were negatively and similarly correlated with work loneliness among both new and experienced employees. In addition, the amount of working alone (r =.13) was significantly correlated with work loneliness among new employees, while among experienced employees, age (r = -.09), autonomy (r = -.17) and the amount of internal communication (r = -.06) were negatively correlated with work loneliness, and quantitative demands (r =.11) positively correlated with work loneliness.

Table 1. Stratified Means, Standard Deviations, and Comparison Tests Between Experienced and New Employees

Variable	$Mean_{exp}$	SD_{exp}	$Mean_{new}$	SD_{new}	Test statistic[b]	p	Effect Size[d]
(1) Sex[a]	0.22	0.41	0.36	0.48	20.87	<.001	0.12
(2) Age	46.58	9.56	35.93	9.41	16.51	<.001	−1.12
(3) Team size	10.27	7.24	10.84	6.87	−1.26	.207	0.10
(4) Autonomy	3.79	0.70	3.79	0.76	−0.04	.966	0.00
(5) Quantitative demands	3.11	0.94	2.98	1.07	1.83[c]	.068	−0.12
(6) Amount of remote work	56.27	26.84	55.18	28.97	0.59	.553	−0.05
(7) Amount of working alone	52.36	21.92	55.84	22.68	−2.33	.020	0.14
(8) Amount of internal communication	35.75	19.56	35.04	19.65	0.36	.592	−0.04
(9) Informal communication with supervisor	4.33	1.48	4.22	1.51	1.12	.262	−0.08
(10) Informal communication with colleagues	5.66	1.33	5.51	1.48	1.53[c]	.128	−0.11
(11) Social support from supervisor	4.24	0.72	4.37	0.71	−2.65	.008	0.18
(12) Social support from colleagues	4.22	0.66	4.25	0.66	−0.72	.470	0.05
(13) Work loneliness	1.72	0.74	1.91	0.82	−3.77	<.001	0.26

Note: n = 1317 for experienced employees and n = 262 for new employees. [a] 0 = male, 1 = female. [b] Test statistics are T-test statistics t(1577) for continuous variables and chi-square statistic chi(1) for sex. [c] Welch T-test was used as variances could not be assumed to be equal. [d] Effect sizes are Cohen's d for continuous variables and Phi for sex.

Table 2. Stratified Correlations of Experienced and New Employees

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Sex[a]	1	–.03	–.09	–.03	–.04	.11	–.11	.07	–.10	–.07	–.02	.06	.08
(2) Age	.04	1	–.12	–.05	.12	.00	–.09	.07	.03	–.06	–.04	–.10	–.06
(3) Team size	–.11***	.01	1	.11	–.08	.10	.01	–.03	–.16*	.11	–.04	–.05	–.00
(4) Autonomy	.01	.01	.00	1	–.41***	.13*	.13*	–.08	.08	.15*	.25***	.24***	–.04
(5) Quantitative demands	.01	–.02	–.01	–.36***	1	–.05	–.30***	.18**	–.05	–.02	–.25***	–.28***	.07
(6) Amount of remote work	.07*	.00	.01	.11***	–.06*	1	.07	–.08	–.21***	–.30***	–.03	–.05	.04
(7) Amount of working alone	–.05	.05	.07*	.15***	–.27***	.12***	1	–.28***	–.16*	–.02	.01	.07	.13*
(8) Amount of internal communication	.13***	–.04	–.01	–.07*	.19***	–.15***	–.52***	1	.10	.04	–.03	.00	.02
(9) Informal communication with supervisor	–.01	–.07*	–.16***	.02	.02	–.19***	–.12***	.10***	1	.46***	.32***	.15*	–.27***
(10) Informal communication with colleagues	–.05	–.10***	–.00	–.01	.04	–.18***	–.08**	.07**	.48***	1	.19**	.25***	–.25***
(11) Social support from supervisor	.01	–.05	–.01	.23***	–.16***	–.01	.02	.03	.26***	.07*	1	.48***	–.44***
(12) Social support from colleagues	.05	–.02	.03	.23***	–.14***	.03	.06*	–.01	.15***	.18***	.55***	1	–.42***
(13) Work loneliness	.01	–.09**	–.01	–.17***	.11***	.02	.02	–.06*	–.20***	–.19***	–.39***	–.49***	1

Note: Correlations for experienced employees are presented below the diagonal and for new employees above the diagonal. * p <.05, ** p <.01, *** p <.001.

Hypotheses 1a-f were tested with age-adjusted regression analyses (Table 3), which revealed that new employees experienced more work loneliness (b = 0.12, p <.05) than experienced employees, as was suggested in H1a. In addition, new employees communicated informally with colleagues less (b = -0.27, p <.01) than experienced employees, which supported H1e. There were no other significant differences between new and experienced employees, and therefore, hypotheses H1b (new employees experience higher levels of internal communication), H1c (new employees have more social support from supervisors), H1d (new employees have less informal communication with supervisors), and H1f (new employees experience lower levels of social support from colleagues) were not supported by the data. However, it should be noted that the mean amount of social support from the supervisor was significantly (p =.008) higher among new employees (mean = 4.37) compared to experienced employees (mean = 4.24) (see Table 1), but adjusting the age of respondents in regression analysis created no significant difference.

Table 3. Unstandardized Beta Coefficients, Standard Errors, and 95% Confidence Intervals for Comparisons Between New and Experienced Employees

Variable	B	SE	95% CI
Work loneliness (H1a)	0.12*	0.06	(0.01, 0.23)
Amount of internal communication (H1b)	– 1.02	1.42	(– 3.81, 1.76)
Social support from supervisor (H1c)	0.09	0.05	(– 0.01, 0.19)
Informal communication with supervisor (H1d)	– 0.19	0.11	(– 0.40, 0.02)
Informal communication with colleagues (H1e)	– 0.27**	0.10	(– 0.47, – 0.07)
Social support from colleagues (H1f)	0.01	0.05	(– 0.08, 0.10)

Note: All models were tested separately with the control variable included. New employees were coded as 1 and experienced employees as 0. * p <.05, ** p <.01, *** p <.001.

The results of the multigroup analysis (see Table 4) revealed associations between work loneliness and the predictors within the experienced employee and the new employee groups. Hypothesis (H2a) was not supported because the amount of internal communication was not negatively and significantly related to work loneliness among experienced employees (β_{exp} = – 0.05, p >.05) or new employees (β_{new} = 0.07, p >.05). Even though the parameter values of the amount of internal communication differed significantly (β_{exp} = – 0.05; β_{new} = 0.07; p =.05) between experienced and new employees, the amount of internal communication was not significantly associated with work loneliness in the within-group investigations. Therefore, hypothesis (H2b) was also not supported.

Hypothesis (H3a) was supported because informal non-work-related communication with colleagues was negatively and significantly related to work loneliness of both the experienced employees (β_{exp} = – 0.09, p <.01) and the new employees (β_{new} = – 0.11, p <.05). The standardised regression coefficients did not differ between the groups (β_{exp} = – 0.09; β_{new} = – 0.11; p =.69), and therefore, hypothesis (H3b) was not supported. Hypothesis (H4a) was partially supported as informal

non-work-related communication with the supervisor was negatively associated with the work loneliness of experienced employees (β_{exp} = – 0.06, p <.05) but not with the work loneliness of new employees (β_{new} = – 0.08, p >.05). This observed within-group difference in statistical significance of the parameters, however, was likely to be due to the loss of statistical power in the new employee group as the group's size was much smaller. Additionally, the standardised regression coefficients between groups were not significantly different (β_{exp} = – 0.06, β_{new} = – 0.08, p =.80). Because of this result, hypothesis (H4b) was not supported by the data.

Hypothesis (H5a) was supported because the social support from colleagues was negatively and significantly associated with work loneliness of both the experienced (β_{exp} = – 0.36, p <.001) and the new employees (β_{new} = – 0.31, p <.001). Similarly, hypothesis (H6a) was supported because the social support from the supervisor was negatively and significantly associated with work loneliness of both the experienced (β_{exp} = – 0.16, p <.001) and new employees (β_{exp} = – 0.29, p <.001). Hypotheses H5b and H6b were not supported by the comparison results, and there were no differences in standardised regression coefficients between experienced and new employees regarding social support from the supervisor (β_{exp} = – 0.16, β_{new} = – 0.29, p =.11) or social support from colleagues (β_{exp} = – 0.36, β_{new} = – 0.31, p =.48).

Some differences were observed in the within-group associations of the control variables. Among experienced employees, age (β_{exp} = – 0.12, p <.001) was negatively related to work loneliness, but the coefficients were not significantly different compared to new employees (β_{exp} = – 0.12, β_{new} = – 0.09, p =.62). Among new employees, job autonomy (β_{new} = 0.12, p <.05) and the amount of working alone (β_{new} = 0.15, p <.01) were positively related to work loneliness. Other control variables, such as the amount of remote work, were not related to work loneliness in either group. Compared to experienced employees, the difference between the standardised regression coefficients of job autonomy was significant (β_{exp} = – 0.04; β_{new} = 0.12; p =.01), and the difference between the coefficients of the amount of working alone was almost significant (β_{exp} = 0.04; β_{new} = 0.15; p =.06). However, other standardised regression coefficients did not differ between experienced and new employees.

Table 4. Standardized Regression Coefficients, Standard Errors, 95% Confidence Intervals, and Wald Difference Test Results for Predictors of Work Loneliness Between Experienced and New Employees

Predictors	Experienced employees			New employees			Wald test[a]	
	β	SE	95% CI	β	SE	95% CI	W	p
Intercept	6.87***	0.29	(6.31, 7.42)	6.11***	0.60	(4.93, 7.28)	1.32	.25
Sex[b]	0.03	0.03	(– 0.02, 0.08)	0.09	0.05	(– 0.01, 0.19)	1.12	.29
Age	– 0.12***	0.02	(– 0.16, – 0.07)	– 0.09	0.05	(– 0.19, 0.01)	0.24	.62
Team size	– 0.01	0.02	(– 0.06, 0.03)	– 0.04	0.05	(– 0.13, 0.05)	0.29	.59
Autonomy	– 0.04	0.03	(– 0.10, 0.01)	0.12*	0.06	(0.01, 0.24)	6.51	.01
Quantitative demands	0.04	0.03	(– 0.01, 0.10)	– 0.01	0.06	(– 0.13, 0.11)	0.61	.43
Amount of remote work	– 0.01	0.02	(– 0.06, 0.04)	– 0.06	0.05	(– 0.16, 0.04)	0.79	.37
Amount of working alone	0.04	0.03	(– 0.03, 0.09)	0.15**	0.05	(0.05, 0.26)	3.60	.06
Amount of internal communication (H2)	– 0.05	0.03	(– 0.10, 0.01)	0.07	0.05	(– 0.03, 0.17)	4.00	.05
Informal communication with supervisor (H3)	– 0.06*	0.03	(– 0.12, – 0.01)	– 0.08	0.06	(– 0.20, 0.04)	0.07	.80
Informal communication with colleagues (H4)	– 0.09**	0.03	(– 0.14, – 0.03)	– 0.11*	0.06	(– 0.22, – 0.00)	0.16	.69
Social support from supervisor (H5)	– 0.16***	0.03	(– 0.23, – 0.10)	– 0.29***	0.07	(– 0.42, – 0.16)	2.50	.11
Social support from colleagues (H6)	– 0.36***	0.03	(– 0.43, – 0.30)	– 0.31***	0.07	(– 0.44, – 0.18)	0.51	.48

Note. [a] df = 1 in all Wald tests. [b] 0 = male, 1 = female. β = standardized regression coefficient, SE = standard error, CI = confidence interval, W = Wald chi-square test statistic. * p <.05, ** p <.01, *** p <.001.

These results suggest that an increase in informal communication with a supervisor or colleagues and an increase in social support from either of them was associated with a decrease in work loneliness among experienced employees. Similar to experienced employees, an increase in informal communication with colleagues and an increase in social support from either the supervisor or colleagues was associated with a decrease in the work loneliness of new employees. Most of the observed within-group associations with work loneliness were not significantly different between new and experienced employees. The tested model explained 29.6% of the variation in the work loneliness of experienced employees and 33.3% of the variation in the work loneliness of new employees.

In an additional analysis, work loneliness was analysed using a sample combining both new and experienced employees. The results (see Table 6 in the Appendix) indicated that informal communication with a supervisor (β = -0.07, p <.01) and colleagues (β = -0.09, p <.001) had minor negative effects on work loneliness, whereas the effects of social support from a supervisor (β = -0.19, p <.001) and particularly from colleagues (β = -0.35, p <.001) were strongly negative.

Discussion

This study aims to increase the understanding of work loneliness and explain how communication and social support between and from different organisational actors are related to the experiences of work loneliness in the context of remote and hybrid work. We also add knowledge about the socialisation of newcomers in organisations in which employees work partly in the office and partly in a remote mode. Our study provides both theoretical and managerial implications.

Theoretical Contribution

First, we contribute to the knowledge about antecedents of work loneliness, specifically in remote and hybrid work contexts. Even though the amount of work on loneliness literature has increased in recent years, it is still sparse. Specifically, only a few studies (Becker et al., 2022) have examined loneliness at work in a remote/hybrid context, and despite theoretical advances, the empirical research on the antecedents of work loneliness is still insufficient (Spilker & Breaugh, 2021; Wright & Silard, 2021). Previous research has, however, identified a low level of social support from supervisors and, particularly, from colleagues as a predictor of loneliness at work (Knight et al., 2022; Patterer et al., 2023; Wright et al., 2006). Low levels of social support from supervisors and colleagues were the most important predictors of work loneliness in this study as well. In addition to social support, we present the frequency of informal non-work-related communication with supervisors and colleagues as a new predictor of work loneliness to supplement the extant process model of work loneliness (Wright & Silard, 2021). However, the overall amount of internal communication was not associated with work loneliness, supporting the notion that regarding loneliness, it is indeed the quality rather than the quantity of relationships and communication that matters (Hawkley & Cacioppo, 2010; Wright & Silard, 2021).

As another theoretical contribution to work loneliness, we introduced a contingency component into the existing process model of work loneliness of Wright and Silard (2021). Thus, we hypothesised that the antecedents of work loneliness are not universal, and the set of antecedents and their strength can vary depending on contextual factors or in different groups. Specifically, we examined the relationships between antecedents and work loneliness within new and more experienced employees, and we suggest future studies to focus on other contingency variables as well, for instance, to examine if the work loneliness process is different for supervisors and subordinates, or if the diversity of the team (e.g. in terms of cultural diversity or diversity based on the age of employees) would be influential. Moreover, we suggest how the division of the time between working remotely and in the office (i.e. hybrid work) is organised and what the adopted practices are are situational boundary conditions for work loneliness and worth studying in a more detailed manner in the future.

Second, we contribute to the field of *newcomer socialisation* by comparing the perceptions about the social context of remote and hybrid work between employees who have entered the organisation during and after the COVID-19 pandemic in terms of newcomers and experienced employees. We found that work loneliness is higher among newcomers compared to their more experienced counterparts who have worked in the organisation for a longer time. Our results are aligned with earlier evidence (Anand & Mishra, 2021) that the shorter the organisational tenure is, the stronger the work loneliness. In addition, we also confirm that those who started as newcomers during the COVID-19 pandemic are likely to suffer from work loneliness more than their colleagues with longer organisational tenure (Jopling et al., 2023). Our study adds to the previous knowledge by focusing on the context of remote and hybrid work and confirming that the same trend exists. However, in the study by Joplin et al. (2023), the intensity of remote work itself was not found to be a risk factor for work loneliness, and our findings are aligned, although adding to earlier knowledge by showing that it was not a risk factor for either newcomers or experienced employees. Consequently, we are not able to confirm that the amount of remote work itself impairs newcomers' socialisation in their work community (in particular, increasing their work loneliness), although the virtual work context has been suggested to pose a challenge for them (Gruman & Saks, 2018; Woo et al., 2022). In addition, there is evidence (Mergener & Trübner, 2022) that social relationships, in particular, the working atmosphere with colleagues and the supervisor, affect employee's decisions about whether to work remotely or in the office. Therefore, it is also conceivable that the quality of social relationships determines the extent of remote work. Future studies should dig deeper into this phenomenon and, for instance, compare newcomers' and experienced employees' work loneliness between teams or groups that mainly or totally work remotely and ones that mainly or totally work in the same physical place. Also, a more detailed understanding of the length of stay in the organisation is needed (e.g., by dividing employees into better-differentiated groups rather than just newcomers and experienced employees). In addition, future studies could also study the differences between organisational newcomers who are just starting their careers and those changing jobs and who already have experience in other organisations. Moreover, longitudinal study designs are needed to explore the causality between the amount of remote work and the quality of the social work environment and also whether this functions similarly for newcomers and more experienced employees.

Furthermore, it seems that there were surprisingly few differences in the other social context factors of the work environment between newcomers and experienced employees, as only the frequency of informal communication with colleagues was lower for new employees. It is understandable that experienced employees have had more time to develop deeper relationships with colleagues (Horan et al., 2021; Sias, 2005) that likely include informal elements. However, it seems that our participants were not involved in informal communication very often, and on average,

people communicated informally with their colleagues once a week and even more rarely with their supervisor. Remote work was common in our sample, and thus, communication was likely to be largely ICT-mediated. Earlier literature has found that ICT-mediated communication is challenging and perceived as being of lower quality compared to face-to-face interaction (Jämsen et al., 2022; Sias et al., 2012; Šmite et al., 2023; Wang et al., 2021). Our findings may even indicate that remote and hybrid work specifically placed new employees in a situation where they did not have many possibilities for spontaneous discussions or occasions for informal exchanges (Jämsen et al., 2022; Mirowska & Bakici, 2023; Standaert et al., 2022). Moreover, we expected newcomers to differ from experienced employees regarding the amount of available social support either from supervisors or colleagues, but this was not supported in the age-adjusted analysis. Even though experienced employees can have more developed support networks, new employees are likely to need and receive more support, which balances the difference. Moreover, there is also a possibility that more experienced employees who witnessed the shift during the pandemic might experience a greater sense of losing social support than those who never went through a comparable experience or have no earlier experiences as a reference. Future studies that aim to study the amount and quality of communication in remote and hybrid work should adopt different methods, for instance, diary studies, meeting recordings, and longitudinal study designs, to follow the development of newcomer communication practices over time. Moreover, a more detailed investigation of how remote and hybrid work contexts affect expectations for social relationships and their fulfilment in different phases of employment would be useful and help shed more light on the process of socialisation in the modern world of work.

Turning the focus to the relationships between our antecedents and work loneliness, we found that the amount of internal communication was not related to work loneliness for either newcomers or experienced employees. There was no statistically significant difference between the groups in regard to the importance of factors of informal communication with supervisors and colleagues, as well as the social support from supervisors and colleagues. However, the standardised estimate for the effect of supervisor social support on work loneliness was substantially bigger for new employees (β=-0.29) compared to more experienced colleagues (β=-0.16), but the estimates did not differ significantly due to a larger standard error in the new employee estimate that is likely caused by a smaller sample size.

It is also worth mentioning that for new employees, support from both the supervisor and colleagues was an equally strong predictor of low levels of loneliness at work. Among experienced employees, support from colleagues had a remarkably stronger association with work loneliness compared to supervisor support. It is already known that social support protects employees from work loneliness (Bentley et al., 2016; Wang et al., 2021), but our study is the first to show how the source of social support differs among new and experienced employees in the hybrid work

context. In sum, we suggest that informal communication in the organisation is a protective factor from work loneliness for all employees, whereas the importance of the source of social support may differ depending on the status of being an 'outsider' or an 'insider'. For newcomers (outsiders), all available support is valuable and needed, whereas, for experienced employees (insiders), social needs at work become satisfied mainly through the support they gain from their peers.

In addition, our results indicate that high job autonomy and working alone can increase feelings of work loneliness among new employees, whereas, among experienced employees, they were not associated with work loneliness. The result relating to working alone is not surprising as, for example, collaborative work has been connected with lower work loneliness (Abelsen et al., 2023). But previous research has also associated job autonomy negatively with work loneliness (e.g. Wang et al., 2021). Accordingly, high autonomy could be detrimental for newcomers as high autonomy means high independence, which can particularly isolate new employees from social resources (Harris et al., 2022). Thus, while autonomy can further lead to self-sufficiency and independence, co-working, learning, getting feedback, and interdependency would be more beneficial for newcomers.

Strengths and Weaknesses

The sample of this study was collected from one MNC and its 11 business units, which involves advantages and disadvantages. First, expert work done in this technology industry company represents typical information work that can be carried out at least partially remotely, and therefore, the findings of this study are likely to be relevant for other organisations that have high-tech expert employees working in a remote or hybrid mode. Second, our case MNC had certain HR practices and processes that were relevant for all of our participants, although business units had high autonomy, for instance, in how the share of remote and office work was organised in each unit. Thus, even though the HR practices especially relevant for our study (i.e. those related to hybrid work) were not uniform in all of the studied units, in the future, data from several companies with different HR practices related to hybrid work should be studied in this regard.

Moreover, a comparative study requires a large sample size, and even though the sample of this study was big and there were 262 newcomers in the sample, in some cases, the power of the analysis remained restricted. Therefore, even bigger sample sizes in future studies would enhance the statistical power in analysis and enable a comparison of different newcomer groups, such as those who had just started working versus those with a little more experience or those starting in a senior versus an entry-level position. This study is based on cross-sectional data, and future studies would benefit from adopting a longitudinal research design, which could be utilised to confirm causal relationships between predictors and work loneliness and exclude possible reverse causalities. That would also allow for the

testing of possible causalities between different variables considered as antecedents for work loneliness in this study, such as the amount of remote work and the quality of the social work environment (Mergener & Trübner, 2022).

Another weakness of the study is the use of self-assessed measurements, which runs a risk of common method bias (Podsakoff et al., 2003). The potential for bias was mitigated by purposeful elements of questionnaire planning (e.g. reverse items, random item arrangement, proximal separation of themes, different scale anchors and numbers of scale points) and emphasising anonymity (Podsakoff et al., 2003). Only employees themselves can estimate their levels of work loneliness, but more objective measures of communication and social support could be utilised in future studies. For instance, data collected from emails, calendars, instant messages, or video/audio calls may provide possibilities for this purpose (e.g., Yang et al., 2022). That said, examining several different possible work loneliness predictors among new and experienced employees can be seen as a strength of the study (Koch & Denner, 2022), and furthermore, we distinguished supervisors and colleagues as different sources of social support and companions in informal communication.

Practical Implications

This study has significant practical relevance for both newcomers and experienced employees, as well as human resource management professionals. In order to protect all members of organisations from work loneliness, employees themselves should pay attention to how they interact with each other in the remote and hybrid work context. Supervisors or team leaders should ensure that meetings (online, face-to-face or hybrid) also involve elements that encourage informal communication between employees. Informal communication comes most naturally in face-to-face encounters and may be challenged by remote and hybrid work (Šmite et al., 2023; Wu et al., 2023; Yang et al., 2022). So, working in the employer's facilities instead of the home office could provide more possibilities for natural interaction. However, going to the office is not necessarily an infallible solution for meeting coworkers face-to-face, as other team members may not be there, and common practices to enhance a synchronous presence in the shared physical space of team members are required.

Providing help and being available for others when needed, in other words, 'giving social support to other members of the organisation' (Kammeyer-Mueller & Wanberg, 2003), is important in fostering the perception of belonging. Therefore, we suggest that regularly sharing information about each team member's skills and knowledge may help other members understand what kind of issues each person can help with and thus advance the realisation of social support between peers. In order to have access to various sources of social support, onboarding programs for remote and hybrid employees should involve appointed contacts with different actors in the organisation, the creation of practices that match newcomers with

mentors and 'buddies', more informal points of contact, and organised events aimed at building networks within the workplace.

Supervisors' should remember that their role is particularly important for newcomers, and therefore, we suggest that, especially in the remote and hybrid work context, the supervisor should be in frequent contact with newcomers in order to provide the possibility for them to ask for help and support, and also to create a space for informal communication. In addition, we recommend that newcomers' first tasks are planned in a way that allows them to collaborate with colleagues and not be left to work alone with too much autonomy.

Conclusion

The primary objective of the current study was to address a gap in existing scholarly knowledge concerning how newcomers and more experienced employees perceive working in remote and hybrid contexts. We examined whether the social context of remote and hybrid work is perceived differently by employees who had entered the organisation during or after the pandemic and more experienced employees and if elements of the social context of remote and hybrid work function differently as antecedents for work loneliness among these two groups. We show that new employees experienced higher work loneliness than experienced employees. Informal communication with supervisors and colleagues and social support from colleagues (and particularly among new employees from the supervisor) were associated with lower levels of work loneliness. We suggest that the application of the contingency approach to work loneliness has much to offer for research investigating its antecedents and outcomes. Studying newcomers and experienced employees in remote and hybrid work contributes to research on newcomer socialisation, and social and team dynamics in the post-pandemic hybrid work context.

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Appendix

Table 5. Means, Standard Deviations, and Correlations of Overall Combined Sample

Variable	Mean	SD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) Sex[a]	0.24	0.43	1												
(2) Age	44.81	10.33	−.02	1											
(3) Team size	10.36	6.04	−.10***	−.03	1										
(4) Autonomy	3.79	0.71	.00	.00	.03	1									
(5) Quantitative demands	3.08	0.97	−.02	.03	−.02	−.37***	1								
(6) Amount of remote work	56.09	27.21	.07**	.01	.03	.12***	−.06*	1							
(7) Amount of working alone	52.94	22.09	−.05*	.00	.06*	.15***	−.28***	.11***	1						
(8) Amount of internal communication	35.63	19.58	.12***	−.02	−.01	−.07**	.19***	−.14***	−.48***	1					
(9) Informal communication with supervisor	4.31	1.49	−.03	−.04	−.16***	.03	.00	−.19***	−.13***	.10***	1				
(10) Informal communication with colleagues	5.64	1.36	−.06*	−.07**	.02	.02	.03	−.21***	−.07**	.07**	.48***	1			
(11) Social support from supervisor	4.26	0.72	.01	−.07**	−.01	.23***	−.18***	−.01	.02	.02	.27***	.08***	1		
(12) Social support from colleagues	4.23	0.66	.05*	−.03	.01	.23***	−.16***	.01	.06*	−.01	.15***	.19***	.53***	1	
(13) New employees[b]	0.17	0.37	.12***	−.38***	.04	.00	−.05*	−.01	.06*	−.01	−.03	−.04	.07**	.02	1
(14) Work loneliness	1.75	0.76	.03	−.11***	−.01	−.15***	.10***	.02	.05	−.04	−.22***	−.20***	−.39***	−.47***	.09***

Note. [a] 0 = male, 1 = female. [b] 0 = experienced employees, 1 = new employees. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 6. Standardized Beta Coefficients, Standard Errors, and 95% Confidence Intervals for Overall Combined Model

Variable	β	SE	95% CI
Intercept	6.64***	0.26	(6.14, 7.14)
Sex[a]	0.04	0.02	(– 0.00, 0.09)
Age	– 0.13***	0.02	(– 0.17, – 0.08)
Team size	– 0.02	0.02	(– 0.06, 0.02)
Autonomy	– 0.02	0.02	(– 0.06, 0.03)
Quantitative demands	0.03	0.03	(– 0.02, 0.08)
Amount of remote work	– 0.01	0.02	(– 0.06, 0.03)
Amount of working alone	0.06*	0.03	(0.01, 0.12)
Amount of internal communication	– 0.02	0.02	(– 0.10, 0.01)
Informal communication with supervisor	– 0.07**	0.03	(– 0.12, – 0.02)
Informal communication with colleagues	– 0.09***	0.03	(– 0.14, – 0.04)
Social support from supervisor	– 0.19***	0.03	(– 0.25, – 0.13)
Social support from colleagues	– 0.35***	0.03	(– 0.40, – 0.29)
New employees[b]	0.05*	0.03	(0.00, 0.10)

Note. [a] 0 = male, 1 = female. [b] 0 = Experienced employee, 1 = New employee. β = standardized regression coefficient, SE = standard error, CI = confidence interval. * p <.05, ** p <.01, *** p <.001.

Marta Nosková, Martin Januška*

Performing Managerial Functions During the COVID-19 Crisis: A Systematic Literature Review**

Abstract

Managing businesses during COVID-19 was challenging, mainly due to constant changes. Managers' experiences gained from these crises should be shared so that they can be more prepared in case it happens again. The aim of this article is to research current literature to find out what changes in the performance of managerial functions were observed during the COVID-19 crisis. A systematic literature review was performed in the Web of Science (WoS) database to summarise findings on this topic. Eventually, only 18 publications were analysed (which indicated a significant research gap). Most of the identified changes were related to the function of leading (e.g., the need to motivate and communicate more clearly and support employees to adapt to remote working). In organising, managers faced problems regarding the shortage of employees, constant reorganisation, and the issues accompanying remote working. Planning in the COVID era was very challenging, but not many research papers dealt with it, same as with controlling. When writing this article, no publication (on WoS) directly studied the changes in management functions due to the COVID-19 crisis. This article bridges the identified research gap by summarising the changes identified from the existing research and suggests the necessity of the research in this area.

Keywords: COVID, COVID-19, managerial functions, management
(JEL: H12, M10, M16)

Introduction

On March 11, 2020, the World Health Organization declared a global pandemic due to COVID-19. At that time, many countries had already taken measures to mitigate the spread of this disease, for example, closing schools and universities, transitioning to distance learning (Navickienė, 2021), recommending remote working whenever it is was possible, and no visitors in hospitals and social care facilities, regulations to wear face masks in public, etc. Due to these measures, as well as due to the sickness itself, many things in many areas of life have changed.

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The COVID-19 situation negatively influenced many sectors of the global economy. In almost all sectors, supply chains and company sales were affected, which caused liquidity problems (Soluk, 2022). Many sectors temporarily lost their clients (due to the restrictions) and had to focus on their survival. The most influenced sectors were, for example, the sports sector and its entrepreneurship (Ratten, 2020), tourism (Utkarsh & Sigala, 2021), food service (Messabia et al., 2022), as well as culture or air transportation (Kraus et al., 2020). Due to this situation, many companies in these sectors (as well as others) were forced to search for new opportunities because their regular market collapsed, and they started to work on projects that previously were not part of their portfolio (Soluk, 2022).

Even in sectors that were affected less significantly, changes in many areas of business processes have occurred. Many organisations were forced to adopt virtual working (Gentilin & Madrigal, 2021), hybrid working, or working from the office under different conditions (Ayoko et al., 2021).

In the working environment, the most often identified change (e.g., Almazrouei & Zacca, 2022; Hartmann & Lussier, 2020) was the greater use of technologies due to remote working (for example, sending emails, online meetings, etc.) Thus, this situation led to an acceleration of digitalisation (Cervinka & Novak, 2022; Soluk, 2022) or onlinezation of organisations (Blagov & Anand, 2022), which helped them to remain competitive during the COVID era and could help them also in the future. On the other hand, it has led to a greater need to secure data and communication to protect against cyber-attacks (Hartmann & Lussier, 2020).

All the changes during the COVID era influenced employees, who were exposed to much stress, affecting their mental health (Koch & Schermuly, 2021). The same applied to managers or business owners (in this paper, these two groups will be called "managers"), who suddenly had to deal with a unique crisis and had to adapt to rapid changes and adopt innovative practices (Zaoui et al., 2021). Initially, they responded to the situation by strengthening centralised decision-making (Schleper et al., 2021) and shifting toward short-term survival instead of long-term planning (Soluk, 2022).

As Hartmann and Lussier (2020) stated, due to COVID-19, some knowledge, skills, and abilities had to change because some were more important and some were less. Also, many had to learn how to manage a crisis and its different phases, even those managing small, for example, family firms (Boers & Henschel, 2022 explored this issue). Thus, there is no question that the abilities and skills of managers were severely tested, and the way managers performed their managerial functions has changed.

Contemporary literature recognises four managerial functions. These functions are planning, organising, leading, and controlling (an overview of management functions used in college textbooks can be found in Mcnamara (2009), where it is

visible that the "four function view" clearly prevails). Planning can be defined as setting goals and establishing strategies and plans for achieving those goals (Robbins & Coulter, 2021). Organising involves assigning tasks to individuals or groups to achieve these goals (Certo & Certo, 2019). Leading is about guiding and inspiring people toward achieving goals; it includes "motivating and communicating with employees, individually and in groups (Bateman & Konopaske, 2022, p. 12). Furthermore, controlling can be defined as evaluating how well an organisation has achieved its goals (together with implementing corrective actions if needed) (Jones & George, 2017). Correctly performing these functions is necessary to maintain a high organisational performance. Thus, the environmental change that influences their performance can severely affect organisational existence. Therefore, it is essential to identify and study the changes in performing managerial functions due to COVID and their possible consequences on organisational functioning. The COVID situation represents the period in which almost every factor of the business environment was affected (e.g., macro-environment, sector, competitors, and the organisation itself). Managers had to react and adapt to the situation. They had to perform their functions in a business environment that changed daily and do their best to achieve the organisation´s goals. The question is, what managerial function was affected the most and whether some changes have been preserved also in the post-COVID era.

This paper aims to research current literature to find out what changes in the performance of managerial functions were observed during the COVID-19 crisis. Specifically, this paper aims to answer the research questions stated in the following chapter. For this purpose, a systematic literature review (SLR) was performed in the WoS database to summarise findings on this topic (at the time of preparation, no such analysis was published). This paper aims to find out the current state of the art to know whether there is a need to study this issue further empirically.

The remainder of the paper is organised as follows: the research methodology is presented with the research question and keywords. Then, the review results are presented, and the relevant papers are described together with their findings. The discussion and conclusion follow.

Research Methodology

To answer the research questions, it was decided to perform SLR. Generally, literature reviews can be divided into two categories: the traditional literature survey (TLS) and the systematic literature review (SLR). TLS can be subjective because it does not provide criteria for selecting the papers or their quantity (Ah-mad et al., 2020). On the other hand, SRL involves selection, searching, critical appraising, synthesising, and summary of specific questions (Cook et al., 1997). It is "a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyse

data from the studies that are included in the review" (Moher et al., 2009, p. 1). According to Tranfield et al. (2003, p. 220) "the aim of systematic review is to provide collective insights through theoretical synthesis into fields and sub-fields".

In this paper, the SLR procedure is based on Baltazar et al. (2023) and Tomašević et al. (2021, p. 1005) and follows four stages:

- question formulation,
- keyword search and article sourcing,
- screening the articles for quality and relevance
- and full-text analysis.

In more detail, it was first necessary to state the research questions examining the studied changes. Then, the right keywords were determined, and the database was selected. Subsequently, the articles were screened for quality and relevance and then analysed. In the last step, the findings were synthesised, and conclusions were made.

Research Question Formulation

As the first step, the formulation of specific research questions was performed. These questions will be answered by examination of the research selected in SLR.

- RQ1: What types of managerial functions are the most often researched in the context of COVID-induced changes?
- RQ2: According to the research, was it easier or harder to perform examined managerial functions in the COVID era?
- RQ3: According to the research, will the identified change be applied in the post-COVID era?
- RQ4: In the examined research, is attention also paid to the online environment and its impacts on management?

Keywords and Article Sourcing

The WoS database was used to perform SLR. The time horizon was not limited in advance; however, logically (due to the combination of keywords, see Table 1), it turned out that no research was done before 2019. Title, abstract, keywords, and keywords plus were searched to find the selected keywords. The appropriate WoS Category was selected to examine only papers dealing with management. Only papers in English were searched. Also, there was no limitation regarding the publication type (conference proceedings were allowed) to ensure full topic coverage.

Table 1. Article Sourcing Protocol

Database	**WoS**
Year of Publication	No restriction
Search Field	Topic (title, abstract, author keywords, and keywords plus)
Combination of keywords	"covid" AND "change" AND "management"
WoS Category	Management
Date of search	5. 1. 2023
Criteria for article inclusion	Written in the English language

Screening the Articles for Quality and Relevance

By implementing this article sourcing protocol, 211 publications were found. It included three editorial materials with no additional value to this research. Thus, they were discarded. Then, the abstracts were read to screen the articles for relevance. As relevant were considered the publications whose abstracts contained keywords. At this point, it was clear that due to the selection of the keywords, many publications that were not relevant were found. However, authors did not have any other option to find the desired articles because if the keywords were more specific, for example, “management functions”, “planning”, and “leading”, etc. in the context of “COVID” and “change”, almost no results were found. The possibility of selecting only “COVID” and the name of some functions seemed at first like a solution, but this led to an even more significant number of irrelevant articles even within the WoS category “Management” (approx. 500 papers containing topics such as organising hospital care during COVID, planning the travelling, teaching during COVID etc.). As this research aimed to identify COVID-induced changes in the performance of the functions, it was eventually decided that using the keywords in Table 1 would be the best way to achieve the paper's aim. The rule for screening the publications was established as follows: include only the publications that in the title or abstract dealt with changes in management during the COVID era in the context of its functions (planning, organising, leading, and controlling; but they did not have to be mentioned directly). For that reason, many publications that dealt solely with change management, crisis management, and knowledge management were excluded because these publications were aimed to study these specific types of management without any connection to managerial functions, also due to the selection of keywords (and the fact, that WoS searches also within Keywords Plus which are less relevant), few publications about nurses dealing with COVID on the front line or workers in hotels were found. These types of publications had to be discarded because they did not deal with managerial function even distantly. In the end, 47 publications were relevant to the topic and were analysed further.

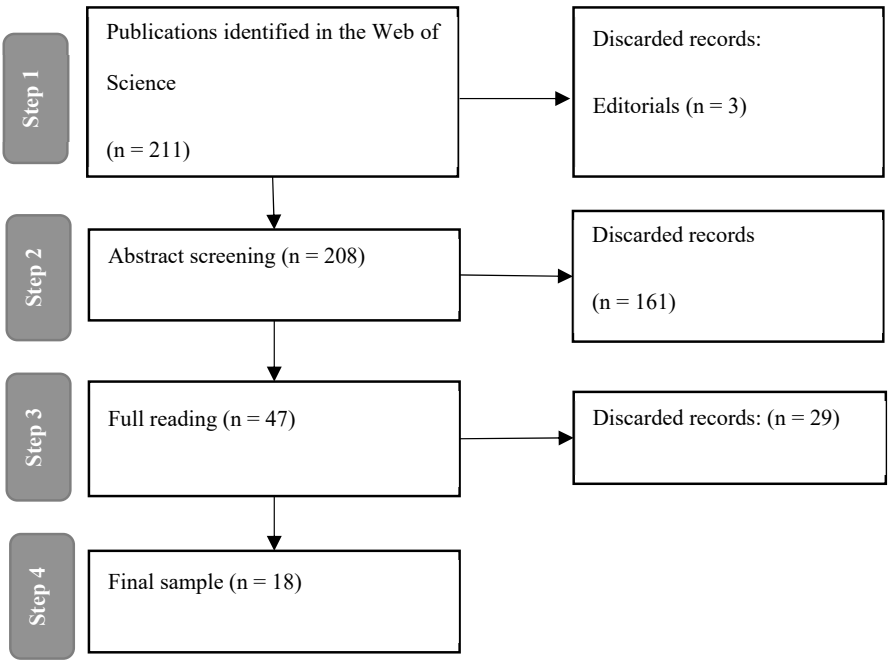
Analysing the Publications

The 47 publications were thoroughly examined in order to answer the research questions. An Excel sheet was used to note the answers to each question in each publication. It was examined whether the publication is a case study/survey, theoretical, etc., what managerial function it deals with, if it was easier/more complicated to perform the function, will the change be preserved, and whether the attention is also paid to the online environment and its impacts on management. Also, the year of the publication and its citations were subjected to analysis. Thus, qualitative and quantitative approaches to SLR were selected.

The 47 papers were thoroughly read, and it was found that no publication directly aimed to study the changes in the performance of managerial functions. Papers dealt with many management-related topics; however, they rarely dealt with expressly stated management functions (except for leading). Thus, to include the paper in this analysis, it was sufficient that there was a description of the specific activity of management and its changes due to the COVID situation, which related to at least one managerial function. Further, the papers were categorised according to the identified functions (in some cases, more than one). Identifying these functions was sometimes tricky because multiple management functions are often performed simultaneously and cannot be separated. However, the authors used their experiences and examples from college textbooks (e.g., Jones & George, 2017) to identify these functions correctly.

At this point, it was found that although abstract screening was used to categorise the papers according to the managerial function, it dealt with none in several cases. Thus, many more papers had to be discarded in this process because they did not deal with anything that was at least distantly connected to any managerial function. In the end, only 18 papers were analysed. In these 18 papers, the answers to all research questions were searched for. The whole SLR procedure is visualised in Figure 1.

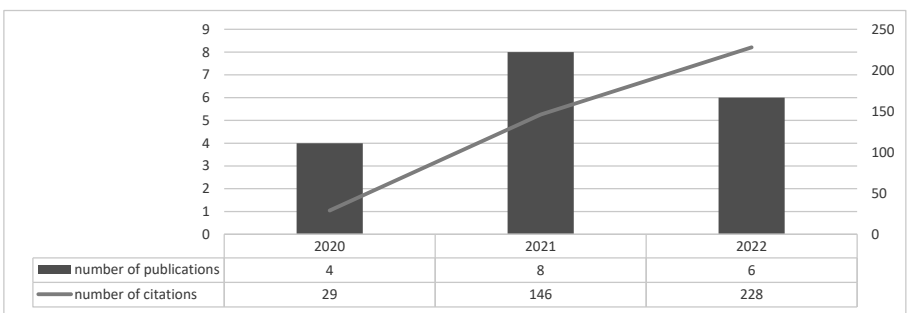
Figure 1. Procedure of SLR



Characteristics of the Selected Sample

An overview of the development of the number of contributions in individual years and the number of citations of existing publications in individual years can be seen in Figure 2. As expected, no publications were found before 220 (as the COVID-19 disease started to spread at the end of 2019). It is visible that the topic is fascinating because only 18 articles altogether had 403 citations (it should be added that half of them had solely one article).

Figure 2. Number of Publications and Their Citations Over the Years



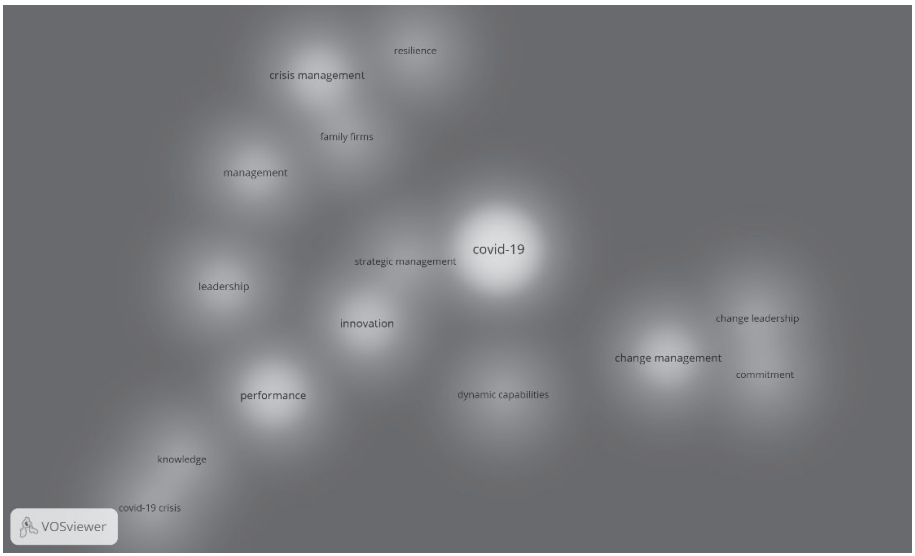
In the final selection, there is only one proceeding paper and one review article; the rest are journal articles. Primarily, these research papers are based on surveys (in 15 cases); one is a case study, a literature review, and a theoretical paper. As to the type of managers (their focus) surveyed or studied in publications, see Table 2. Most often, the publications did not specify the type of management (only, for example, stated that they surveyed managers of businesses in some geographical area); the second largest group is business owners (for example, family business owners, restaurant owners, etc.) and then public sector managers, HR managers, and project managers. Other measures (such as publications per country) were irrelevant to this research.

Table 2. Type of Surveyed/Studied Managers

Types of managers	Number of articles
Not specified	5
Business owners	4
Public sector managers	2
HR managers	2
Project managers	2
Sales managers	1

Eventually, the analysis of the co-occurrence of keywords was made using VOSviewer. The full counting method was used, and the minimum number of keyword occurrences was selected as 2. This led to only identifying 15 keywords (out of 143 appearances). The results are shown in Figure 3. It is visible that the most often used keyword was "COVID-19" (11 times), followed by "performance" (5 times), "crisis management," "innovation" and "change management" (4 times). The results show a diverse focus of the analysed publications, which probably resulted from the universality of management.

Figure 3. Density Visualisation of Keywords



Results of the Literature Review

This chapter presents the results of the analysis to answer the research questions. Each sub-chapter presents publications that are related to the studied topics.

Changes in Performing Managerial Functions (RQ1)

To answer the RQ1, the publications in Table 3 were sorted according to the type of managerial function that they were, at least indirectly, dealing with (see the last column). In the same category, the publications were sorted according to the year and alphabetical order of the names. It is visible that except for one publication that marginally deals with change in planning and the second that deals with change in organising, leading is the most often solely researched function (in 7 cases). The rest (9) are publications that mention or directly study the change in more than one managerial function.

Table 3. Overview of Analysed Publications

Name of the publication	Citation	Managerial function
Organisations' Resources and External Shocks: Exploring Digital Innovation in Family Firms	(Soluk, 2022)	Planning
The influence of COVID-19 pandemic on digital transformation process and strategic management in SMEs in the Czech Republic	(Cervinka & Novak, 2022)	
Guiding employees through the COVID-19 pandemic: An exploration of the impact of transparent communication and change appraisals)	(Yue & Walden, 2022)	
Management research contributions to the COVID-19: A bibliometric review and analysis of the contributions from the Journal of Management & Organization	(Ayoko et al., 2021)	
Managing the crisis: How COVID-19 demands interact with agile project management in predicting employee exhaustion	(Koch & Schermuly, 2021)	Leading
Change leadership at local self-government in the context of COVID-19: The case study of Lithuanian municipal administration	(Racaite-Samusiene et al., 2021)	
Pandemic-induced knowledge gaps in operations and supply chain management: COVID-19's impacts on retailing	(Schleper et al., 2021)	
Leading change in response to COVID-19	(Amis & Janz, 2020)	
Managing restaurants during the COVID-19 crisis: Innovating to survive and prosper	(Messabia et al., 2022)	Organising
The impact of COVID-19 on management decision-making: The case within Australian organizations	(Almazrouei & Zacca, 2022)	
COVID-19 and people management: The view of human resource managers	(Gonçalves et al., 2021)	
Entrepreneurial ecosystems during COVID-19: The survival of small businesses using dynamic capabilities	(Rashid & Ratten, 2021)	
Considerations in the use of work-from-home (WFH) for post-pandemic planning and management	(Manko, 2021)	
Challenges and priorities in talent management during the global pandemic caused by COVID-19	(Tomcikova et al., 2021)	Mixed
Consumer purchasing behaviour towards strategic innovation management practices in Morocco during COVID-19 health crisis	(Zaoui et al., 2021)	
Challenges of project management during the COVID-19 Crisis	(Dănilă & Adam, 2020)	
Managing the sales force through the unexpected exogenous COVID-19 crisis	(Hartmann & Lussier, 2020)	
The economics of COVID-19: Initial empirical evidence on how family firms in five European countries cope with the corona crisis	(Kraus et al., 2020)	

When the papers from the "mixed" category were considered, the most often identified function was leading (dealt with altogether in 15 papers), organising (9), planning (5), and controlling (1). The following paragraphs will introduce the identified changes in performing managerial functions and the existing research.

As defined by Jones and George (2017), leading means that managers energise and enable the organisation´s members to achieve organisational goals (e.g., they try to motivate people, communicate with them, persuade them, etc.)

The newest research that dealt at least distantly with leading during COVID-19 was done by Almazrouei and Zacca (2022), Cervinka and Novak (2022), and Yue and Walden (2022). Almazrouei and Zacca (2022) investigated the influence of the COVID-19 pandemic on decision-making approaches among 55 Australian managers and identified some common approaches regarding leading: managers tried to stay strong to cope with the situation, they provided necessary training and support for their employees and tried to align with company policy. Cervinka and Novak (2022) conducted structured interviews with 8 Czech managers, leaders, and workers to assess the influence of the COVID-19 pandemic on strategic management and the digital transformation process. They identified that COVID-19 caused negative as well as positive effects on leading. It accelerated processes and communication with employees; however, it also caused a decrease in employees' motivation, loss of morale, and resignation, which had to be dealt with by managers. Yue and Walden (2022) were dealing with communication during COVID-19. They surveyed 414 full-time US employees, which revealed that transparent internal communication from management is positively related to employees' challenge appraisal of the change.

Ayoko et al. (2021) performed a bibliometric review of the management papers from 1995 to 2020 to make recommendations on managing organisations during the COVID-19 crisis and organisational change. Their findings were mainly related to the leading function of management (for example, for a leader, it was essential to have skills in working virtually). Gonçalves et al. (2021) based their research on a survey of 136 HR managers in Portugal to describe the changes in HR management due to
COVID-19. Main changes related to leading were identified in training, induction and onboarding, and communication. Manko (2021) based his research on a survey of 158 managers (from various types of organisations and geographical areas) focused on adopting remote work. He identified that "communication and access to information are critical areas for management to address when employees work from home (Manko, 2021, p. 131)". He also revealed that some managers had problems keeping people on task (31 %) or dealing with crises or urgencies (28 %).

Koch and Schermuly (2021) proved that project work during the COVID-19 disease era fosters feelings of emotional exhaustion because of the accumulation of unfinished tasks. They imply that agile project management could serve as "job resource buffering the impact of COVID-19 demands on unfinished tasks" (Koch & Schermuly, 2021, p. 1278). Racaite-Samusiene et al. (2021) examined the change in leadership in Lithuanian municipal administration during the COVID-19 pandemic. They found that these managers were able to inspire, influence, motivate,

and encourage the followers to learn constantly and work in a team, resolve problems, and flexibly react to current issues. Leadership was also the subject of research by Schleper et al. (2021), who stressed the importance of leaders' emotional intelligence and empathic capabilities during COVID-19. Rashid and Ratten (2021) mentioned the necessity of motivating people during the COVID-19 situation. They revealed that some managers of small businesses tried to motivate employees using online platforms (Facebook, WhatsApp) and encouraged people to share their daily lives.

Similarly, Kraus et al. (2020), in their survey, identified the changes in communication due to COVID-19. Companies had to use several types of communication (e.g., Whatsapp messaging, information blog, podcast, service hotline, or daily newsletters written by the CEO) because not all the employees had their email or access to the intranet.

Hartmann and Lussier (2020) identified specific changes in people, tasks, technology, and structure related to leading function (for example, taking care of employees' physical and mental health and allowing people immediate training to gain some necessary knowledge and skills).

The oldest research dealing with leading was done by Amis and Janz (2020), who suggest that there should be a change in response to COVID-19 to a "people-centred approach" instead of seeing people who work in organisations as being more than simply “human resources.”

Organising can be defined as “structuring working relationships so organisational members interact and cooperate to achieve organisational goals” (Jones & George, 2017, p. 10). In analysed papers, some changes in the organisation were identified.

Almazrouei and Zacca (2022) pointed out that often, the work system had to be adjusted to allow work from home. Messabia et al. (2022) examined the experiences of restaurant owners during the COVID-19 crisis using semi-structured interviews. They found out that these managers had to deal with a lot of stress, financial and liquidity problems, problems with closures and re-openings, and a shortage of employees. Thus, mainly with organising aspects.

In HR management (survey based on 136 HR managers from Portugal), the main changes related to organising were identified in the organisation of work, recruitment, and selection (Gonçalves et al., 2021).

Based on 20 interviews with Pakistani entrepreneurs, Rashid and Ratten (2021) aimed to examine how small types of enterprises were affected by the COVID-19 situation. One finding was that businesses started moving towards a more agile business model to react better to the situation. Also, they revealed that businesses had to adapt to online buying and selling, which sometimes demanded the restructuralization of some departments (for example, marketing).

Tomcikova et al. (2021) partially examined organising when in their survey (n=137 HR managers), "more than half of the respondents agree that the impact of the pandemic leads to changes in the way the company is managed and organized" (Tomcikova et al., 2021, p. 98). Also, according to their research, most companies (70%) did not recruit employees during the COVID-19 pandemic.

Kraus et al. (2020) interviewed 27 top managers or responsible areas managers of family businesses in 5 European countries during the spring of 2020 to find out how these businesses were affected by the COVID-19 situation. Regarding organising, most of these firms implemented remote work, supported their employees with the technology necessary for their work, and closed social meeting places (cafeterias) or discouraged them from meeting each other.

Also, rearranging scheduled tasks was identified as one of the changes due to COVID-19 (Hartmann & Lussier, 2020).

Planning, thus identifying and selecting organisational goals and courses of action (Jones & George, 2017), was probably the most affected because no one knew what would happen (what restrictions would be applied, how long the situation would last, etc.) This is partly confirmed by Manko (2021), who revealed that some managers (26% out of 158 asked) had problems making or implementing new plans. That is why organisations should have action plans planned before some similar situation happens to be able to respond quickly (Tomcikova et al., 2021).

Soluk (2022) based the research on 112 interviews with managers of family firms and revealed that, usually, family businesses are intensely focused on their long-term perspective. However, due to the COVID-19 situation, they shifted towards survival in the short term.

The least studied was the controlling function, which evaluates the level of achieving organisational goals and taking corrective actions if necessary (Jones & George, 2017).

In this context, only Almazrouei and Zacca (2022) mention that managers had to adapt their management style to be able to monitor employees remotely. They also identified that managers experienced lower levels of KPIs achievement and performance.

Additionally, few research papers dealt with topics related to management functions that could not be categorised individually.

Zaoui et al. (2021) dealt with the impacts of strategic innovation management during the COVID-19 pandemic on consumer purchasing behaviour. Although this paper is not directly related to specific managerial functions, it cannot be omitted because it deals with strategic innovation management initiatives that contain processes related at least to planning, leading, and organising. For example, their research revealed that 89% of respondents (n=57 managers of Moroccan

companies) adopted new digital capabilities and technologies, 81% introduced a new product or service or improved an existing one, and 74% adopted Customer and Supplier Relationships practices. All these changes were applied during the COVID-19 pandemic, and most were directly accelerated by it.

Dănilă and Adam (2020) based their research on documentation analysis and interviews with five project managers. The research is primarily focused on the influence of the COVID-19 situation on the decision-making of project managers. However, some changes in the four managerial functions can also be identified. For example, managers faced decisions regarding people working on projects (leading and organising) or urgent need for a strategy to finish the projects (planning).

Difficulties in the Performance of Examined Managerial Functions (RQ2)

The COVID era was demanding and challenging and negatively affected the management of organisations (Hartmann & Lussier, 2020; Tomcikova et al., 2021). Managers' workload increased (working hours were not counted, phone calls had to be done, etc.) (Racaite-Samusiene et al., 2021). They had to face "higher pressure, higher costs and lack of ability to change" (Cervinka & Novak, 2022, p. 6), time pressure (Schleper et al., 2021), lots of decisions (Dănilă & Adam, 2020), and also management style was influenced due to the necessity to work, manage and monitor employees remotely (Almazrouei & Zacca, 2022).

Similarly, Messabia et al. (2022), who surveyed restaurant owners, stated that "stress" was the most often mentioned experience regarding COVID-19. Also, they had to deal with the shortage of employees, financial difficulties, and adapting to the changes (ensuring that customers wear masks, maintaining social distancing, increasing the use of food delivery services, etc.).

Kraus et al. (2020), for example, identified that communication in larger family firms was more difficult than in smaller ones, especially in the need to reach all employees or internal stakeholders.

Also, some managers had difficulties contacting their authorities, receiving late or ambiguous recommendations (Dănilă & Adam, 2020), or accessing the correct information necessary for their remote work (Manko, 2021). The author also mentions that half of the surveyed managers stated that remote working distracted them from work, and they face problems in leading people, planning, or dealing with emergencies.

Rashid and Ratten (2021) mention that many small businesses had to lay off many jobs because they could not pay employees. Consequently, managers had to work longer shifts to cover the orders. In addition, the shift from a long-term perspective to a short-term perspective (in the case of planning) revealed by Soluk (2022) was challenging because managers had to solve many problems at the moment.

Regarding RQ2, 12 publications stated that performing managerial functions was more complicated; the rest of the analysed publications did not deal with it.

Maintaining Identified Changes (RQ3)

Only changes identified as partly permanent were related to the greater use of technologies and their impacts on management. As Gonçalves et al. (2021) stated, it is expected that in the post-pandemic future, the main changes will be related to technology (for example, teleworking, homework, communication and leadership of remote workers). Also, Cervinka and Novak (2022) mention that digitalisation was accelerated due to the COVID-19 situation, which is the change organisations will benefit from even after COVID-19.

Thus, regarding RQ3, it is visible that almost no publications were dealing with this topic, simply because many of them were written at the beginning (2020) or at least during the COVID era. The only change that affects management and could be maintained in the post-COVID era is the greater use of technology that was implemented due to the necessity of remote working. However, this only applies to companies where remote working is possible.

Movement Into an Online Environment and Its Impacts on Management (RQ4)

Due to COVID, many people had to work remotely, which led to greater use of technology. Employees and managers sent and received emails more often, sold products virtually, met people over a video communication platform or used social media more often (Hartmann & Lussier, 2020, p. 103). Technology helps managers in the way they manage their employees, especially in communication (Almazrouei & Zacca, 2022). However, they had problems keeping people on task (Manko, 2021). Also, managers had to deal with problems regarding the rapid change in buyers' behaviour when everyone requested the possibility to shop online (Schleper et al., 2021) or to be able to interact with their clients online (Zaoui et al., 2021).

Ayoko et al. (2021) also discussed online work in their bibliometric review. They stated that for a leader, it was essential to have skills in working virtually because the hybridisation of work multiplied due to the crisis.

As Tomcikova et al. (2021) mentioned, the COVID-19 pandemic caused changes in work and shifts towards virtual teams and working from home. Cervinka and Novak (2022) identified that COVID accelerated digitalisation and onlinesation. However, IT managers were very stressed when making these changes very quickly.

Also, not all organisations were able to move to the online environment. The employees who worked with specific infrastructure or sectors (production, hospitality) were usually not allowed to work from home (Kraus et al., 2020). The most typical

examples are restaurant owners (studied, for example, by Messabia et al., 2022) who cannot manage their companies online.

While many organisations reported problems with quick adaptation to remote working, some organisations or projects adapted to online activities very fast and without difficulties (Dănilă & Adam, 2020), and some were happy about it because their revenues increased (Rashid & Ratten, 2021).

Also, Gonçalves et al. (2021) stated that many technological changes will likely appear in the post-COVID future (see previous section).

Regarding RQ4, 12 publications deal with remote working or technology use and its impact on management. Although it was seen as a quick change, many enterprises can benefit from it.

Discussion

No publication aimed to study the changes in managerial function performance directly. Most of the analysed publications focused on some functional unit of the enterprise (for example, HR, sales, supply chains, etc.) and the changes in its management due to COVID. The publication was categorised accordingly based on whether these changes were related to any managerial function. The most often researched function in the context of COVID-induced changes (RQ1) is leading. In terms of this function, the problems with the motivation of employees and the role of management when dealing with it were identified seven times (Cervinka & Novak, 2022; Hartmann & Lussier, 2020; Koch & Schermuly, 2021; Manko, 2021; Racaite-Samusiene et al., 2021; Rashid & Ratten, 2021; Schleper et al., 2021). Then, the change in communication was identified five times. It was necessary to communicate more often (Cervinka & Novak, 2022) or to use online platforms (Kraus et al., 2020; Rashid & Ratten, 2021) and to allow employees to access necessary information (Manko, 2021). It was also found that transparent internal communication helped employees accept a change (Yue & Walden, 2022). Further, remote working was often mentioned as a challenge (in 4 cases). Managers had to have skills in working virtually (Ayoko et al., 2021). The same skills were necessary for employees. Thus, employee training and support changes were also identified (Almazrouei & Zacca, 2022; Gonçalves et al., 2021; Hartmann & Lussier, 2020).

Regarding organising, some identified changes were related to employees; for example, there was a shortage of employees (Messabia et al., 2022), changes in recruitment and selection (Gonçalves et al., 2021), or even no hiring of new employees during COVID-19 (Tomcikova et al., 2021). Additionally, some changes in work organisation (Gonçalves et al., 2021) or in processes that emerged, for example, from the need to buy and sell online (Rashid & Ratten, 2021) as well as to work remotely (Almazrouei & Zacca, 2022; Kraus et al., 2020) were identified. Also, managers had to be able to react quickly to immediate changes in the business

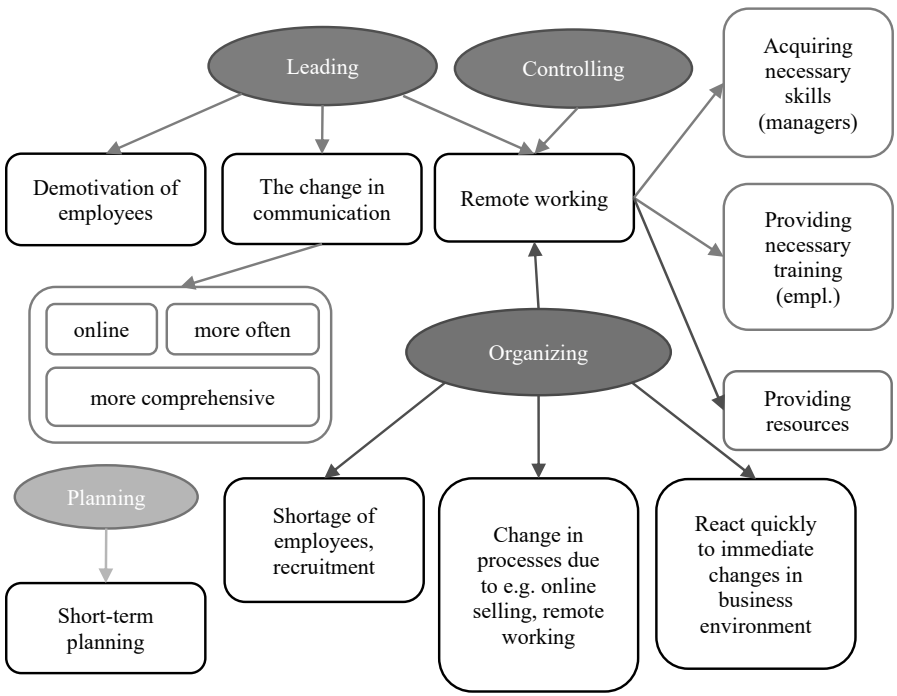
environment, for example, to deal with constant closures and openings (Messabia et al., 2022), and thus be able to rearrange scheduled tasks (Hartmann & Lussier, 2020). Managers had to secure the necessary resources (IT support, technology, etc.) to allow remote work – and often very quickly.

Planning, making or implementing new plans was an issue for many organisations (Manko, 2021). One significant change in planning was identified; instead of joint long-term planning, organisations had to deal with an immediate crisis, which led to a shift to short-term planning (Soluk, 2022) or an urgent need for a strategy on how to finish on time (Dănilă & Adam, 2020).

Regarding controlling function, Almazrouei and Zacca (2022) mentioned that managers had to adapt to remote controlling of their employees.

For better clarity, the identified changes in the performance of managerial functions are shown in Figure 4.

Figure 4. Identified Changes in the Performance of Managerial Functions Due Covid-19 Situation



The colours of the arrows show which function the identified change is related to. It is worth noting that remote working affected three functions at once. Also, the figure indicates how changes in one function can indirectly affect other functions

(for example, although the change in communication was mainly caused by the effort to lead more effectively in the COVID era, it had to be organised somehow). These relationships were not drawn up because as the functions generally relate closely, this figure would become confusing (for example, short plans need to be organised, led, and controlled). Thus, only changes that were identified in order to answer RQ1 were drawn up.

The difficulties in performing managerial functions (RQ2) most often resulted from a sudden lack of funds (Cervinka & Novak, 2022; Messabia et al., 2022), which unfortunately led to layoffs (Rashid & Ratten, 2021). Also, the sudden increase in workload (Racaite-Samusiene et al., 2021), which led to the necessity to work longer shifts (Rashid & Ratten, 2021), was not helping the situation. Some managers report problems with managing and monitoring employees remotely (Almazrouei & Zacca, 2022), communicating with them (Kraus et al., 2020), or with their authorities (Dănilă & Adam, 2020). Dealing with many problems at the moment (Soluk, 2022), as well as solving the situations mentioned above, resulted in higher pressure and stress (Cervinka & Novak, 2022; Messabia et al., 2022), which made it challenging to perform managerial functions correctly.

Caused by the unique crisis, these identified changes were relatively temporary and originated as a reaction to the crisis (RQ3). However, one change that will probably endure (at least partly) in the COVID era is the higher level of technology use. It was found that the positive fact of the COVID-19 situation was an acceleration of digitalisation (Cervinka & Novak, 2022); thus, it positively affected organisations where they planned to implement and use technology. However, this will probably not last in organisations that use technology only to communicate online instead of onsite.

That one, partly sustainable change, was also the topic of RQ4. Movement into an online environment was mentioned or studied in many research papers. It was identified that there were two reasons for this movement: to reach the organisation's employees (in case of remote working) and to reach its customers (in case of prohibition of on-site sales). People were sending and receiving more emails, meeting people over video (Hartmann & Lussier, 2020), working virtually (Ayoko et al., 2021), creating virtual teams (Cervinka & Novak, 2022) or using social media (Hartmann & Lussier, 2020; Rashid & Ratten, 2021). Managers re-quested to have the possibility to sell online (Hartmann & Lussier, 2020; Schleper et al., 2021) and to be able to interact with their clients online (Zaoui et al., 2021). These rapid changes brought problems not only to employees and managers who had to adapt to these changes but also to IT managers who had to make it happen (Cervinka & Novak, 2022). On the other hand, for some organisations, it meant also an increase in revenues (Rashid & Ratten, 2021)

Conclusions

This paper presents the results of SLR and focuses on the changes in the performance of managerial functions due to COVID-19. Special attention is also paid to one expected change – a movement to the online environment and its effects on management. It was revealed that most of the changes were related to the function of leading, for example, the need to motivate, communicate more clearly, provide all necessary information to employees, and support them to adapt to remote working. In organising, managers faced problems regarding the shortage of employees, constant reorganisation, and the issues accompanying remote working. Planning in the COVID era was very challenging, but not many research papers dealt with it, same as with controlling.

This paper has interesting findings from which researchers and practitioners (managers) could benefit. As to managers, the paper brings several findings that could be used to prepare them for a possible similar future situation. At first, this research helps to reveal the functions and related competencies that could be trained in advance to deal with similar situations better. As most changes affect leadership, managers are recommended to be more trained in motivating people and effective communication. Also, all functions were influenced by the fact that many issues had to be dealt with online/remotely. Thus, more preparedness to do managerial work remotely is necessary. This paper also confirms that performing these functions was very difficult (managers had to face more work, higher pressure, and difficult decisions, and they had to be able to adapt to the new circumstances almost daily); thus, for example, training in change management, decision-making, or how to handle stressful situations is recommended. Also, this paper identified one significant change that could prevail in the post-pandemic world and be seen as positive: acceleration of digitalisation and greater use of technologies. Thus, on the one hand, managers nowadays need to be able to see technology as a good assistant that could help them in their work; however, on the other hand, they need to know the problems (for example, managing people virtually) or even the dangers (threat of data leaks, hacker attack etc) associated with it. Thus, some related training and precautionary measures are recommended.

Also, as the general aim of this study was to find whether there is a need for further research on this topic, it benefits the researchers. Since this article describes the identified research gap (a relatively low number of identified papers dealing with this topic), its findings may be a good inspiration and starting point for future empirical research. Also, it can serve as a good theory base because it summarises the changes identified from the existing research. Thus, other researchers can pay attention to how to fill the already identified research gap instead of a long process of identifying and justifying their research. As future research, qualitative and quantitative studies that would purposely identify the changes management had to face (divided into categories according to managerial functions) can be recommended

to follow, as well as the studies that researched the level of preservation of these changes in the post-COVID era. Regarding the first type, the research needs to be done urgently. In most countries, COVID-related restrictions have ended, management is no longer affected by these changes, and managers will soon forget the experiences from the COVID era (because people tend to forget bad things). The second type of research is not so urgent, and it could be interesting to see what was preserved in the long term.

The following are the standard limitations related to systematic literature reviews. The first limitation of the study is its focus on publications indexed only on the WoS and within the category of Management. Although this was necessary to limit the number of publications, it is possible that some relevant articles were omitted. In future research, other databases such as Scopus or Google Scholar could bring more numerous results. The second limitation is that the analysis of publications is subjective. Thus, some papers could have been omitted during the screening process even though they should have been part of the analysis. In this type of research, it is advisable that the screening is done by more than two people independently (in this case, it was done by both authors). However, the impact of this error would not be significant because even in these 18 identified publications, some changes have been repeated.

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Stress and Quits Among Intimidated Scientists: Management Failures and Paradoxes of Support**

Abstract

Through a major international survey of scientists, we investigated the stress effects on scientists who experience work-related intimidation and harassment, from whom they sought support, how useful support was, and whose support mattered for stress and quits. Using a theoretical framework that was an adaptation of the job demands-resources model, we found that different forms of intimidation affected stress and quits in different ways. Intimidated scientists sought support from both internal and external sources. The most supportive groups they consulted were often outsiders. Support had a major impact on stress and quitting. While stress itself increased quits, support was much more important, especially from senior management. Internal and external support worked very differently on quits. We finish with observations about management and HR functions within universities and other research organisations.

Keywords: intimidation, harassment, stress, science, scientists, support
(JEL: I2, I23)

Introduction

The harassment and intimidation of scientists have been a growing concern in recent years. On the one hand, extensive research literature has developed about workplace harassment and 'bullying' of employees (e.g. Branch et al., 2012; McDonald, 2012). The old, unreflexive norm of the white-male-god-scientist (Burke et al., 2017) is meeting the #Metoo movement head-on. On the other hand, far less attention has been directed to the intimidation of specialist occupations such as scientists. Yet intimidation, for example, from lobbyists, interest groups or corporations, has implications for both the scientist and science. It has global implications for the progress of knowledge: advances can be ignored, hidden, or not made in the first place. This can lead to bad public policy nationally and has global

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ramifications. Participation in scientific careers is already a major problem (Lyons & Quinn, 2015), and intimidation of scientists (Dunlap & McCright, 2015; Halpern & Mann, 2015) exacerbates this. Scientists may avoid research areas that are highly sensitive (Miller, 2003; Wolfson et al., 2015). This is all of concern, not just because of the public interest in having an effective, vocal scientific workforce (Hardert, 2001; Miller, 2003), which might just help in saving the planet, but also because of evidence of harassment in the sector (Strachan et al., 2012; Penner, 2015; Clancy et al., 2014; Skinner et al., 2015).

While estimates of the prevalence of what is often called harassment vary in a range of 5–20%, it is potentially destructive and miserable for affected workers (Rittenmeyer et al., 2012), adversely influencing retention, burnout, and job satisfaction (Deery et al., 2011), diversity and performance (Hunt et al., 2015), including scientific performance (Corrales et al, 2015). We cannot ignore what intimidation may mean for the progression of science (Kozlowski et al., 2022).

In this paper, we look broadly at issues of intimidation, going beyond sexual harassment — which is not to downplay its importance (Aji et al., 2024; Burke et al., 2017) — to all forms of intimidation affecting scientists, taking into account the relevance of some ideas that emerge from the study of personal harassment and bullying (Branch at al., 2013) to the scientific community at large. Our core research question is this: for scientists, what are the relationships between intimidation, stress, and job quits? This encompasses a series of sub-questions:

1. What are the effects, in terms of stress and quits, on scientists who experience work-related intimidation and harassment?
2. From whom do intimidated scientists seek support?
3. How useful is support?
4. Whose support matters for stress and quits?

We investigate this through a major global survey of scientists specifically designed to interrogate the experiences of harassment for scientists. The analysis tells us a lot about management in research organisations, particularly its failures in some key areas, and about the paradoxes of support. Some types of support, we will see, have very different effects on what might intuitively be thought of as closely related outcome variables.

Relevant Literature

Before detailing our methodology, we outline the relevant literature, starting with the distinction between intimidation (the term we use) and harassment (the term more commonly appearing in the literature). We then briefly touch on some studies on the effects of intimidation before considering the relevant theoretical studies relating to social support theory, social capital theory and job demand-resources

(JD-R) theory, and finally outlining our specific theoretical perspective, which in effect integrates those various theories but also adds some matters specific to this study.

Intimidation vs Harassment

In this study, we use the term 'intimidation' rather than 'harassment' for two reasons. First, harassment is usually defined in the literature as something that needs to be repeated (Dollard et al., 2009; Brodsky, 1976). We are also interested in 'one-off' incidents, which may still be stressful for the target (Grimes at al., 2020), because a one-off incident of sufficient strength may be enough to change the behaviour of a target in the way intended by the perpetrator. Second, harassment implies conscious agency on the part of the perpetrator, which we do not assume: although intent will frequently be there, sometimes a target may feel intimidated even if that is not the objective of the perpetrator. Most surveys (of which this is one) cannot read the mind of the perpetrator, but the key thing is how the target feels.

The Internal/External Distinction

It could be considered that the type of abuse we are looking at comes down to two sources of intimidation: external (perhaps a lobby group wanting to suppress particular ideas or an individual trying to force a change in scientists' behaviour) or internal (a colleague, supervisor or student) who seeks the elimination of competition or sexual gratification. Typically, studies (Marsh at al., 2004) have treated internal and external intimidation as conceptually unrelated phenomena that have been considered from different perspectives.

However, several European studies (Giaccone & Nunzio, 2015 identified twelve) applied an internal/external perpetrator distinction to surveys of workplace harassment, sometimes (but only in a minority of cases) restricted to consideration of violence or, at the other extreme, hassling and teasing. It is a very useful distinction for thinking about not only the sources of intimidation but also the factors that ameliorate its effects.

That said, for a broader analysis of intimidation, the neat internal/external conceptual distinction may not be quite so simple. Intimidation from within the organisation may be in response to, or even in anticipation of, the needs of outside interests, real or perceived. It may be perceived by the target as the 'organisation' against the scientist (even if the perpetrator is not acting consistent with policy), as opposed to an individual who might be harassing them.

So, it is probably better to conceive of three types of intimidation: external organisational intimidation (where the immediate perpetrator is outside the organisation), internal organisational intimidation (where the immediate perpetrator is inside and

may be doing it in anticipation of or in response to external factors, or entirely for internal purposes); and personal harassment (predominantly, but not exclusively, internal). A common thread is the likely effects on targets, ranging from defiance to ignoring and retreat, which might include states of fear or silence (e.g. Rittenmeyer et al. 2012) and stress. Similarities also include the potential effects on science: diminishing its capacity to develop and grow and contribute to public debate, something research organisations are meant to be concerned about.

In this paper, the internal/external distinction is also important in terms of the nature and effects of support. That is, we take into account whether support available to an intimidated scientist is internal or external to the organisation and explain the significance in terms of job demands and resources (JD-R) theory, which we discuss in more detail below. We also take into account the extent to which the outcome variable relates to the scientist's internal vs. external positioning. The two outcome variables under discussion here are: first, stress responses (largely involuntary and not measured by reference to whether the scientist is inside or outside the organisation) and second, exit behaviour, that is, whether the scientist remains in or leaves their job. These last are measured by various internal/external indicators (are the scientists still inside or now outside their former job with the organisation?). We will return to this matter later.

Effects of Intimidation

Job quitting may be a response to intimidation of scientists, one that concerns the organisations for which they work — that is, the universities, government agencies or other research organisations. There is evidence that women who self-report harassment are more likely to leave their jobs for a lower-paying one elsewhere (Folke & Rickne, 2022). A study by the Australian Human Rights Commission found that 17 per cent of victims of sexual harassment who made a formal complaint ended up quitting their jobs (Australian Human Rights Commission, 2020). In the US, 'over time, fully 52% of highly qualified females working for SET companies quit their jobs, driven out by hostile work environments and extreme job pressures' (Hewlett et al., 2008). Such responses reflect the low power of workers in the capitalist workplace (Jessop, 2010), and particularly the low power of women (Federici, 2020), such that exit for many is the only viable option. According to some analyses, 'the objective of sexual harassment is not necessarily the pursuit of sex, but rather intimidation and the satisfaction of power needs' (de Haas & Timmerman, 2010; Pryor et al., 1995). While many theories of power at work (such as the Marxist theories cited above) are built around businesses with profit as the goal, a similar argument (about intimidation and power) might be applied to research organisations with the goal of monetisable research outcomes and where many scientists work.

Theoretical approaches

What might influence this stress and quitting behaviour? The literature suggests that the impact of intimidation can be lessened by the power of support networks that benefit the affected employees (Ashida & Heaney, 2008, 872; Heaney & Isreal, 2002, 199). People without networks have low resources and, hence, low power. Using Social Support Theory (as discussed by Sarason & Sarason 1985), support is the key theoretical concept when trying to explain what influences an individual to undertake bad or even criminal behaviour. This means that the more social support an individual has, or the stronger the individual's social network is, the less likely that this person will engage in crime or other harmful behaviours. In general, social networks and social support are beneficial to health, including in male-dominated workplaces (which many scientific workplaces are) (Lee et al., 2014; Battams et al., 2014), and various interventions are proposed to strengthen these support networks (Isreal 1982; McLeroy et al., 2001) or are favoured by corporations (Scully, 2009). Baumeister & Leary (1995) argued that people can be partly protected from stress and have improved coping skills through the presence of others who provide support and assistance. Underlying this is an intrinsic drive for connections and social relationships. From limited studies, support networks appear relevant to the impact of personal harassment (Mueller et al., 2001; Chamberlain et al., 2008).

Related to social support theory is *social capital theory*, which explains the importance of using social connections and social relations to achieve (or not be able to achieve) goals. As social integration within organisations affects sexual harassment, and supportive co-workers provide some protection against some (milder) forms of sexual harassment; we would expect networks to play an important role in whether intimidation occurs (Mueller et al., 2001; Chamberlain et al., 2008). *Organisational support theory* suggests employees form a general perception concerning the extent to which their organisation values their contributions and cares about their well-being. This involves the critical role of bystanders (not just people who witness harassment but also those with whom the victim may subsequently discuss the issue, whether or not through their regular social networks). This is analysed in detail by several authors (e.g. D'Cruz & Noronha, 2011; Omari & Paull, 2012; McDonald, 2012) and points to the importance of support, not only from the abused target's colleagues, family and friends but also the institutional support that is potentially provided by the supervisor, senior management and HR. The role of management is potentially important, not just because of where scientists might fit in the managed hierarchy but also because of their role in providing (or not providing) support.

JD-R Theory, as suggested by Bakker & Demerouti (2007), is another theoretical angle showing how "job demands and resources have unique and multiplicative effects on job stress and motivation". The theory also proposes to reverse causal effects, whereby associated stresses mean that "burned-out employees may create

more job demands overtime for themselves, [whereas] engaged workers… mobilise their job resources to stay engaged". This theory could be popular with management looking to get better long-term benefits from their employees.

Crucially for our analysis, JD-R theory allows for social support to be one of the resources that employees can draw upon to reduce stress as the demands of the job intensify. High job demands, such as pressures with a physical, psychological, or organisational origin, may run down employees' resources (mental and physical) and thereby lead to health problems (Demerouti et al., 2001). The adverse effects of high job demands can, in turn, be ameliorated by support from colleagues and supervisors, which is seen as a job resource (Bakker et al., 2003b). This may have consequences in employment behaviour: for example, a study of return-to-work outcomes after injury found that social connectedness was higher amongst employees who had returned to work than it was amongst those who had not (Watt et al., 2015).

A Theoretical Model

Our approach is to locate the processes investigated here within an expanded JD-R framework that incorporates ideas from social support theory. We treat intimidation as a job 'demand' in that it is something that arises in the process of a scientist doing their work and would not have occurred if they had not been working in that organisation. The more intensive that intimidation is, the more demanding it is. Feeling stressed is a physiological and psychological response to the stressor that is intimidation, with high-level demands causing bodily reactions manifest in stress (Bakker et al., 2006). So, the more intensive intimidation is, the greater the stress response will be, if other things are equal.

Other things are not equal, however. The 'support' that the scientist can access is a 'resource', but the extent to which it is a useful resource for the purpose of dealing with the 'demand' caused by intimidation will depend on several factors. The first is whether that support is perceived as beneficial: whether the worker feels that it has helped them or not. That may seem, on the surface, to be self-evident, but it needs to be explicitly stated here.

The second factor is whether that support comes from within or outside the organization. If the problem comes from the scientist's engagement with the organization (employment), then the beneficial impact of support may be shaped by whether support also comes from internal or external sources. If support comes from within the organization, it might help resolve the problem, and ease the adverse response.

Yet, we cannot assume that the effect would work the same for all types of responses. Physiological or psychological responses, which may be relatively involuntary, may vary less than discretionary responses, such as whether the scientist remains working in the organisation, which has a direct link to the organisation itself.

This, then, is the third factor in determining the impact of a support resource: the outcome variable itself.

Indeed, it is plausible that the location of support could interact very differently with the perceived degree of support when explanations are sought for different types of outcomes. With involuntary outcomes, such as perceptions of stress, external support might just be weaker than internal support in reducing adverse effects. Thus, perceived stress might be lower when the scientist receives good support from either internal or external sources. With discretionary employment decisions, however, the sign of the effect could feasibly disappear or even change. This is because external support is not a resource for a beneficial behavioural response that deals with a problem internal to the organisation (i.e. work). Indeed, good external support combined with poor internal support could persuade a scientist that they are better off leaving the organisation. Thus, exit rates could conceivably be even higher where the scientist received high external support than if they received low external support, even though the reverse would be expected (that is, exit rates would be lower) where internal support was higher than where it was low.

In short, we propose five factors that will determine the relationship between intimidation and adverse outcomes for the scientists themselves. Two concerns are the intimidation itself (the 'job demand'), the intensity of the intimidation, and the source (internal or external). Two concerns are the support (the 'job resource'), how beneficial it is perceived to be (a variant of the 'intensity' concept), and the source (internal or external). The final factor concerns the outcome itself, in particular, the extent to which it is involuntary or discretionary and relates to the internal/external positioning of the scientist.

Methodology

The main data were collected through an anonymous online survey of international scientists. We focused on three main fields of science, recruited and categorised as either high or low risk in terms of the nature of their disciplinary topic, the potential risk to a scientist's reputation and the extent to which they could be viewed as politically sensitive or non-sensitive. They were Climate Science (high risk, being politically controversial, with attacks coming from the 'right'), Food and Plant Science, e.g., agronomists, biologists, genomics, etc. (also high risk, due to being politically controversial, but with attacks coming from some 'left' and 'green' groups) and scientists in astronomy (low risk, as it is politically non-controversial, outside of fringe religious groups).

The project was funded by the Australian Research Council and designed with the assistance of an international advisory board. Potential participants were recruited through a search of the ISI Web of Science database, a method previously used successfully by Cook et al. (2013). We applied keyword phrases in either the title, author keywords or abstract of the paper to identify the specific science cohorts

published between 2012-2018. This method obtained 90467 unique author emails. Survey invitations were distributed from August to December 2020. Several problems arose using this method. We obtained what looked like automatic replies from over 20% (n=20190) stating that the invitation email had been blocked or was not received. We targeted specific disciplinary groups through our search terms, but it turned out that half of the respondents self-identified as being from other STEMM disciplines or HASS researchers, emphasising the cross-disciplinary nature of the target topics. This meant the potential survey population who received the survey invitation and two reminders was 70277, though they were not exclusively employed in the three areas mentioned above — rather, they had *published* in one of those three areas. In total, 2675 scientists responded to the survey, but 589 (22%) did not answer the focal questions about intimidation and were dropped for this analysis. The remaining 2086 (78%) who responded to the focal questions designed to elicit intimidation or intimidation incidents and their consequences are the sample for this paper.

Among these 2086 international scientists, 1403 (67.3 %) were males, 499 were females (23.9%), and 184 (8.8%) did not provide their gender. Some 41% had experienced intimidation in the past five years. The sample represented a response rate of 2.9% of our potential international scientific community. To date, it is the largest study of international scientists on the topic of intimidation or harassment. It included 118 Climate scientists (6%), 401 (19%) in food and plant science, and 448 (21%) in astronomy research. As mentioned, despite using search terms to target specific cohorts, a considerable proportion of the scientists who participated self-identified from other disciplines; 1114 (54%) were from other STEMM or humanities and social sciences disciplines.

We examined nine forms of intimidation. The online survey was designed specifically for the study, taking about 30-60 minutes to complete depending on the length of responses given. It was administered using Lime software. The invitation emails were not linked to responses to ensure respondent anonymity and confidentiality and were consistent with ethical standards for human participants as required by the funding body.

Challenges in Estimating Intimidation

Studies in this area typically measure harassment either by asking respondents to say whether they were harassed ('self-labelling') or to confirm various incidents on a list that the researchers subsequently define as harassment (a 'behavioural experience inventory') (Nielsen et al., 2016). We used the latter. We did not consider the self-labelling approach to be useful for this project, as words like 'intimidation' convey different meanings to different people, whereas descriptions of specific events have more commonly shared meanings. Nine items were developed specifically for the context of scientific knowledge production and communication of evidence and

concerning aspects of bullying related to the science sector, with one item being more general to allow responders to provide information on any other relevant incidents. Respondents could check all items they had experienced in the past five years since 2015. A series of questions tapped the nature of the incident (or the one most significant for them) designed to identify who was involved, the motives (if known), how long the intimidation lasted, what the consequences were to the scientists in terms of their research work including perceptions of career and health and wellbeing consequences. In the tables and figures below, the potential responses to the behavioural experience inventory are abbreviated; the full wording is shown in Table 1.

Table 1. Short Form and Full Wording of Response Options Regarding Form of Intimidation

Short form	Full form
Complaint	[Q24_1 A complaint about you to someone in the organization]
Adverse information	[Q24_2 Dissemination or publication of adverse information about you]
Online abuse	[Q24_3 Online abuse]
Property damage	[Q24_4 Damage to property relating to you or your work]
Pressure to redirect	[Q24_6 Unwelcome pressure to redirect your work in ways that you did not feel were appropriate]
Instructed not to talk	[Q24_7 Being instructed to talk about, or not to talk about, your work or the work of others in your area in a way that could hide, obscure or mislead about that work]
Budget or contract cuts	[Q24_8 Actual or threatened cuts to budgets or termination or non-renewal of budgets or contracts for reasons not arising from scientific merit]
General other unwelcome behaviour	[Q24_9 Unwelcome behaviour with the intention or effect of making you feel intimidated or harassed]
Sexual harassment	[Q24_5 Unwelcome or inappropriate behaviour of a sexual nature]

Question wording: The next set of questions asks about situations and events in connection with your work. Please indicate which, if any, of the following have occurred to you in connection with your work since 1 January 2015, regardless of whether you were working for a different organization at the time *(multiple responses possible)*

In our sample, some 850 respondents — about two-fifths of our sample — reported having experienced an intimidation event. We do not claim that this represents the incidence of intimidation in the population of scientists as a whole, as the survey method could have encouraged those who had experienced one more than those who had not completed the survey, especially given the high workload of the target audience. However, bearing this bias in mind and the fact that there was nothing in the sampling process to encourage particular types of intimidated scientists to respond differentially, we do treat the sample as being sufficiently representative of *intimidated scientists* and large enough to warrant statistical analysis.

After identifying the main incident that was most serious for them, respondents were asked about the extent, if any, to which they experienced a range of concerns relating to career health and well-being (one of which was stress).

Dependent Variables

Our two main dependent variables were stress and job exit. To measure job exit, the numerator in the labour turnover equation, we asked respondents whether the incident had led to them leaving their jobs. To measure stress, we used an item from a series that assessed respondents' worry and concerns relating to work, personal and mental health aspects following intimidation. The lead question asked, 'To what extent, if any, did the event make you…' and one of the items was 'feel stressed'. Response options comprised a 5-point scale (1=never, 2=rarely, 3=some of the time, 4=often, 5=a lot of the time). In reporting the results in the text below, we treat "often" and "a lot of the time" as a single category. Our analyses were performed in SPSS version 27.

We also considered using more extensive multi-item indexes based on all nine of the items in that series and undertook various tests. However, an extensive recent study by Matthews et al. (2022) found that many single-item indexes performed as well as, or better than, equivalent multi-item indexes and listed 'subjective stress' as a single-item measure that had 'very good validity'. The particular item they tested was a general measure ('Do you find your job stressful?'), whereas we used one referring to a specific incident (did the event make you…feel stressed?). Nonetheless, after undertaking various tests, we opted for our simple single-item index measuring stress over a multi-item alternative due to its ease of understanding, the fact it did not perform any worse in relation to the variables we examined than the main multi-item index we tested, and that in comparisons with one variable (gender), the single-item index actually showed more variation against gender than the multi-item index.

In examining the effects of various intimidation events, we are conscious of the fact that this is a cross-sectional study and so cannot incontrovertibly prove cause and effect over time. Thus, while we can compare such measures as whether respondents who have been intimidated show lower or higher career satisfaction than those who have not been intimidated, we place more reliance on self-reporting of the effects of events on people ('Did the event make you feel…more stressed?' or '…worry about your future career?'). Self-reporting is not without limitations, and we point in the conclusions to ways of addressing this weakness.

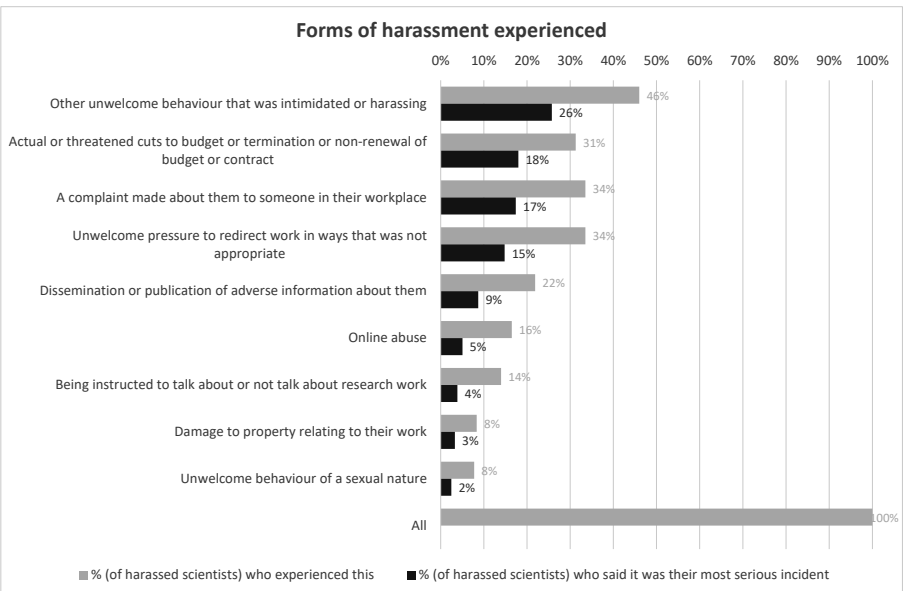
Forms and Relationships of Intimidation

Amongst intimidated scientists, the most common form of intimidation was a type of personal intimidation, 'other unwelcome behaviour that was intimidating or harassing'. (Responses to our follow-up questions confirmed that this was mostly

internal intimidation that would be classed as 'personal'.) This was the last option of the nine presented to respondents. Some 46 per cent of intimidated scientists reported this, about 1½ times the next most common form. For 26 per cent, it was the most serious incident (Figure 1). No single form of intimidation dominated this category, but the most common, in order, were 'persistent criticism', 'verbal abuse', 'gossip or false or malicious rumours', 'exclusion from workplace activities', 'ridicule', 'exclusion from other work-related networks', 'offensive messages' and 'sabotage'.

Behind this general 'other unwelcome behaviour' category, the next most common forms of intimidation were, in order, actual or threatened cuts to budgets or contracts, a complaint to someone in the organization, pressure to redirect work, dissemination of adverse information, online abuse, being instructed not to talk about research, property damage, and unwelcome behaviour of a sexual nature.

Figure 1. Forms of Harassment Experienced



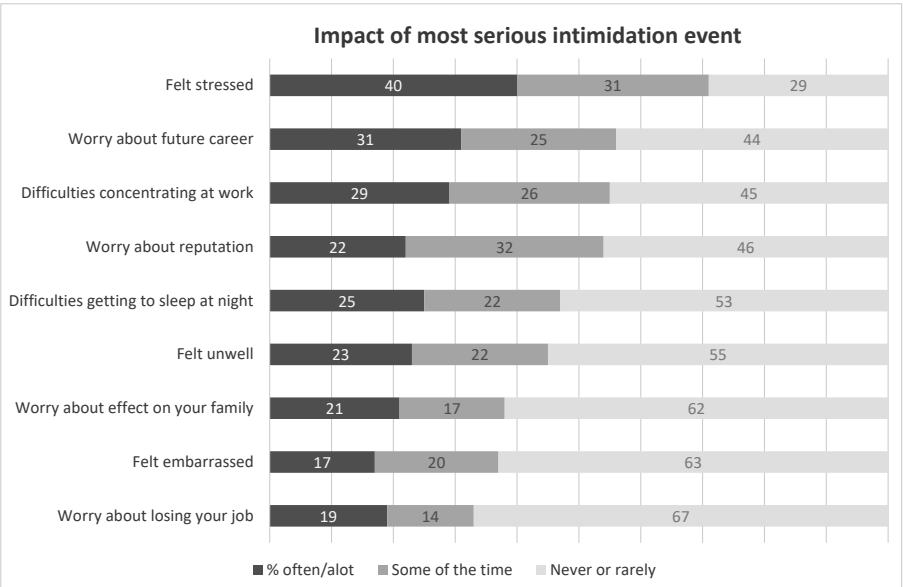
Population: Intimidated scientists

Stress and Other Effects

Amongst scientists who had experienced an incident, over seven-tenths felt some stress as a result of the incident (Figure 2), including four-tenths who stated they were stressed often. Nearly a third had been unable to concentrate at work often, and nearly a half sometimes or often had difficulty getting to sleep. Almost a third

of the scientists were often concerned about their future careers, and a third had some concerns about losing their jobs following the intimidation.

Figure 2. Impact of Most Serious Intimidation Events



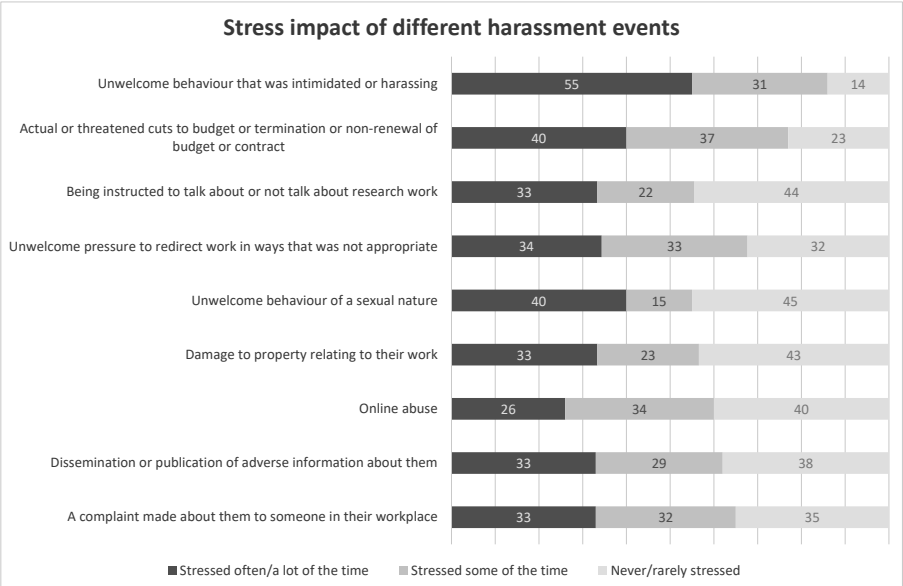
Population: Intimidated scientists

Consistent with our adaptation of JD-R theory, stress was greater for those who reported that intimidating actions were perpetrated by persons within the workplace than external to their workplace. For example, half of scientists who experienced internal intimidation were stressed often by this experience, compared to a third of scientists whose main incident was motivated by an external perpetrator.

Different events led to different stress responses (Figure 3). On this, the worst event was, again, general 'other' unwelcome behaviour that was intimidating or harassing. Amongst those who nominated this as the most serious event, well over half said that they were often stressed as a result. In total, six-sevenths of people who nominated this said they were sometimes or often stressed by it.

The items with the next most frequent 'often stressed' responses were budget or contract cuts and sexual harassment. Interestingly, sexual harassment also had the least frequent 'sometimes stressed' response and the most common 'not at all stressed' response. The number of such approaches — in terms of our model, its intensity — mattered a lot. If there was only one category of sexual harassment, then stress was lower than if there were more. The impact of online abuse on stress appeared the weakest, at least if it was on its own.

Figure 3. Stress Impact of Different Harassment Events



While the form of intimidation mattered, what appeared stronger was the cumulative breadth of it. When a respondent indicated only one form of intimidation, just 26 per cent said they were often stressed as a result of that incident. However, when they recorded two forms of intimidation, 42 per cent said they were often stressed by the most serious incident, and when they recorded three or more forms, 60 per cent said they were often stressed. When we look within the general 'other' category, the proportion often stressed when they experienced one category (say, verbal abuse or ridicule) was 31 per cent, but the proportion often stressed with two categories was 56 per cent, with three or four, it was 65 per cent, while 85 per cent of those unfortunate individuals who recorded five or more categories (n=72) said they were often stressed. Likewise, 48 per cent of people who recorded one category of sexual harassment were often stressed by their most serious incident, but 80 per cent of people who recorded three or more categories of sexual harassment were often stressed. If intimidation was intended to put the targets under stress, then the more forms it took, and hence the more cumulative and reinforcing it was, the more effective it also was.

Sources of Support

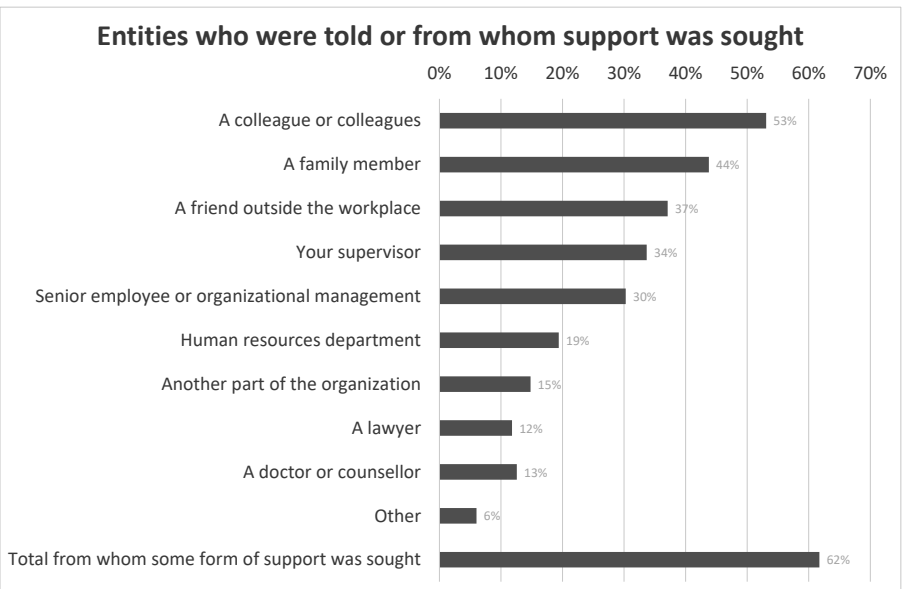
Following Organizational Support Theory (Murry et al., 2001; Alrawadieh et al., 2023), the literature tells us that support is important in explaining the targets' experience of, and even exposure to, intimidation. Just over half of the intimidated

scientists in the sample sought some help, or at least spoke to someone, about their most serious incident. Figure 4 tells us from which 'groups' they sought support or spoke with regarding the most serious incident.

The group most commonly consulted was inside the organization: it was the scientist's colleagues, who were consulted by over half intimidated respondents. The two next most commonly consulted groups, though, were both outside the organisation: family and friends. After that came several others within the organisation: the respondents' supervisors, senior management (both being consulted by about a third of intimidated respondents), then the human resource (HR) department (one in five), and another (unspecified) part of the organisation (one in six). The least commonly consulted were two externals: a lawyer and a doctor or a counsellor (about one in eight in each case).

Some 38 per cent consulted or sought support from no one. Less than a third (28 per cent) did nothing (even on their own) following the incident. Only 17 per cent took formal action (that is, reported the incident or made a complaint).

Figure 4. Entities Who Were Told or From Whom Support Was Sought



The more stressed a scientist was, the more likely they were to seek support. Amongst those who said that they were never or rarely stressed by the most serious incident, only 48 per cent sought support from anyone, but the proportion who sought support was 58 per cent amongst those who were sometimes stressed and 77 per cent amongst those who were often stressed. Those who were stressed often or a lot tended to reach out to a broader support network (on average, about four

groups or individuals), whereas those who were rarely stressed from their incident reached out to only 1.5 groups on average.

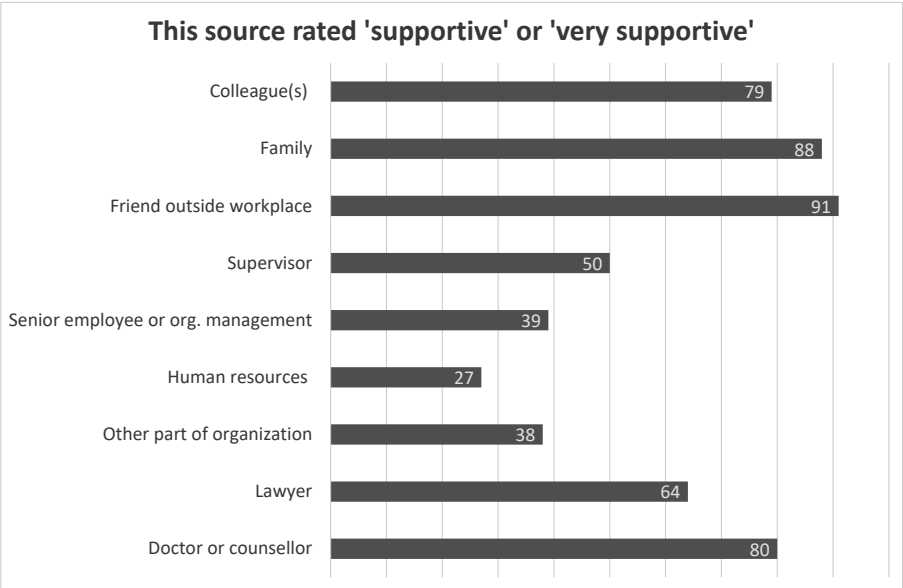
We found that the more stressed (single item) a scientist was, the more likely they sought support from management (54 per cent who were stressed often or a lot of the time sought support from management, compared to 43 per cent who were stressed some of the time and only 29 per cent who were not that stressed at all about the incident). However, among those who sought support from management, the scientists who were highly stressed and worried about job loss were the least satisfied with the support they received. Only 33 per cent were satisfied, with two-thirds stating that management was not supportive, useless or made things worse.

The level of stress was also related to the entity from whom support was sought. Amongst those who sought support from a doctor or counsellor, 77 per cent were often stressed. In addition, 65 per cent of those who sought support from a lawyer were often stressed. So, the two entities sought out disproportionately by the most stressed were two external entities. But these professionals were least commonly sought by anyone. (To put it colloquially, you had to be pretty desperate to talk to a doctor, a counsellor or a lawyer.) Within the organisation, the entity associated with the most stressed scientists was the HR department, but now we start to bump into questions of reverse causality: to what extent was this because people only sought HR out because they were more stressed, and to what extent were they more stressed because they had spoken to HR? Although we cannot answer that definitively, it is plausible that both are true, as the data below suggest.

The Usefulness of Support

We asked about how supportive the various entities intimidated scientists who were consulted. There were very large differences in the efficacy of support from different groups (Figure 5). At the top was a group which was mostly, but not entirely, outside the workplace: a friend (91 per cent were rated as 'supportive' or 'very supportive'), family (88 per cent), doctor or counsellor (80 per cent), colleague (79 per cent), and, somewhat below those, lawyer (64 per cent). In the middle was the respondent's supervisor (50 per cent).

Figure 5: The Source Rated 'Supportive' or 'Very Supportive'



The worst performance was shown by the HR department (something also noted elsewhere, e.g. Gutek & Koss (1993)). Only 27 per cent of those who consulted them found them supportive. We add that 39 per cent found HR 'useless' and 19 per cent said they 'actively made things worse'. This was almost twice as many as the next-ranked entity for 'actively made things worse', which was the respondent's supervisor (10 per cent), followed by senior management (8 per cent).

The more complex the intimidation, the worse the performance by HR. When respondents recorded only one form of intimidation, 40 per cent rated HR as supportive concerning the most serious incident, 40 per cent as useless, and 7 per cent said it actively made things worse. However, when respondents recorded three or more forms of intimidation, a mere 21 per cent found HR supportive concerning the most serious incident, 41 per cent useless, and 32 per cent said it actively made things worse.

Aside from HR, the two other worst performers in terms of the proportion rated 'supportive' or 'very supportive' were another part of the organisation (38 per cent) and senior management (39 per cent). The latter, however, were consulted twice as often as the former (Figure 4), so the poor performance of senior management was much more important than the poor performance of other parts of the organisation.

Like with HR, the more complex things were, the less helpful senior management was. When respondents recorded only one form of intimidation, 51 per cent rated

senior management as supportive, 29 per cent as useless, and 7 per cent said it actively made things worse. However, when respondents recorded three or more forms of intimidation, a mere 11 per cent found senior management supportive, 28 per cent useless, and 30 per cent said it actively made things worse.

Broadly speaking, we found three clusters of support sources. One group comprised entities who were not consulted often and who did not perform well when their support was sought. These were all entities that had a formal role within the organisation: senior management, HR, and 'other' parts of the organisation. A second group comprised entities who were consulted often after intimidation occurred and whose support was mostly considered very positively. These were mostly external entities with 'informal' roles: friends, family and colleagues. While colleagues were normally employed by the organisation, they had no presumed formal role in terms of the management of intimidation, and targeted scientists would presumably choose to consult those whom they considered their closest friends within the organisation. The third cluster comprised those entities that were demonstrably outside the organisation but had a formal role: lawyers, doctors, and counsellors. They were consulted relatively infrequently and by those often most stressed but were nonetheless generally given high ratings for supportiveness.

One group, supervisors, sat in a unique intermediate position, both in terms of the frequency with which they were consulted (more often than other formal parts of the organisation, but less than informal external or collegial sources of support) and the quality of support they were seen to offer (better than the rest of the organisation, and again less supportive than informal external or collegial sources of support).

The Effectiveness of Support and the Relationship to Stress and Quits

How much did it matter whether an entity was supportive or not? And did it matter whether they were internal or external to the organisation?

Support and Stress

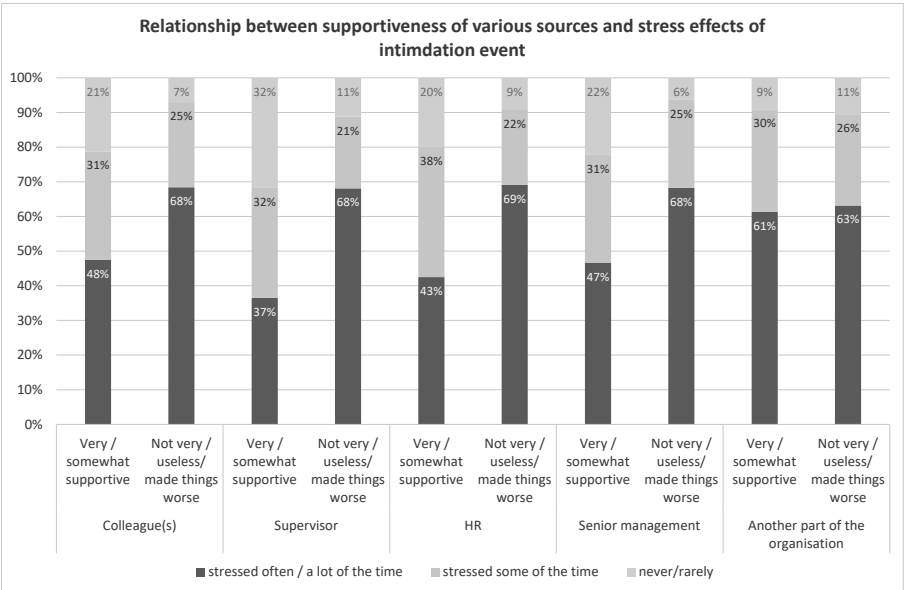
There were several entities whose support made a real difference to the stress experienced by intimidated scientists (Figure 6). If senior management was supportive, just 47 per cent of intimidated scientists were often stressed. But if senior management was unsupportive ('not very supportive', 'useless' or 'actively made things worse'), some 68 per cent of intimidated scientists were stressed, a difference of 20 percentage points. Broadly similar effects were apparent for most of the other frequently consulted groups: a 22-percentage point difference for support from family members, a 20-percentage point difference for colleagues, a 26-percentage point difference for HR, a 27-percentage point difference for external friends, and a substantial 31 percentage point difference for the scientist's supervisor. For the

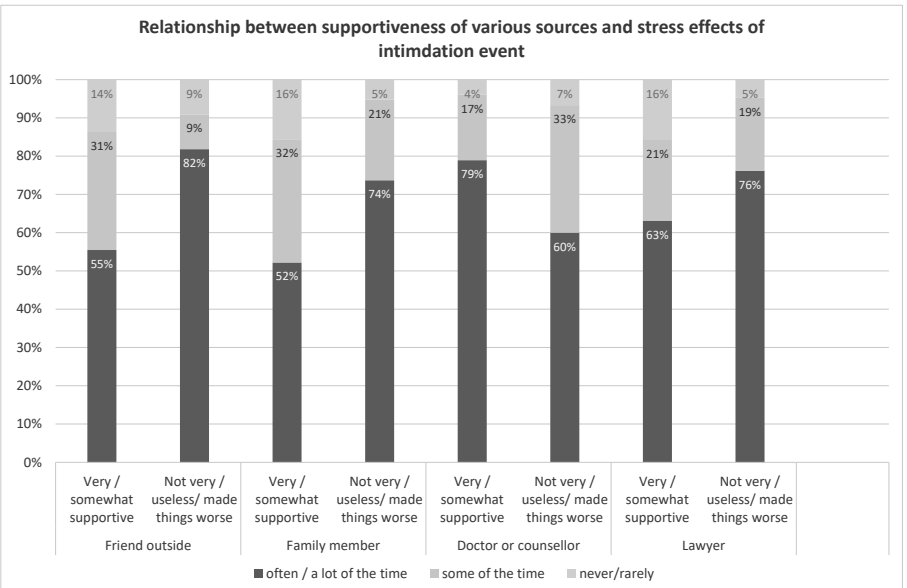
remaining support groups, who were the least frequently consulted, the differences were smaller.

For the more commonly consulted support groups — the ones that mattered — greater support meant less stress. The most important finding was that regarding senior management, as senior management was frequently consulted but infrequently supportive. HR had a bigger impact on those who consulted it, and it performed much worse than senior management, but fewer consulted HR than consulted senior management, so its poor performance was not as important as senior management's.

What helped intimidated scientists' stress levels more, though, was that they often consulted external supports like family and friends. Those groups were normally very supportive, and support from those groups was linked to a substantial difference in the stress those scientists experienced. Similarly, within the organisation, scientists' colleagues were most frequently consulted; they were normally supportive, and their support was associated with lower stress among targets.

Figure 6. Relationship Between Supportiveness of Various Sources and Stress Effects of Intimidation Events





Support and Quits

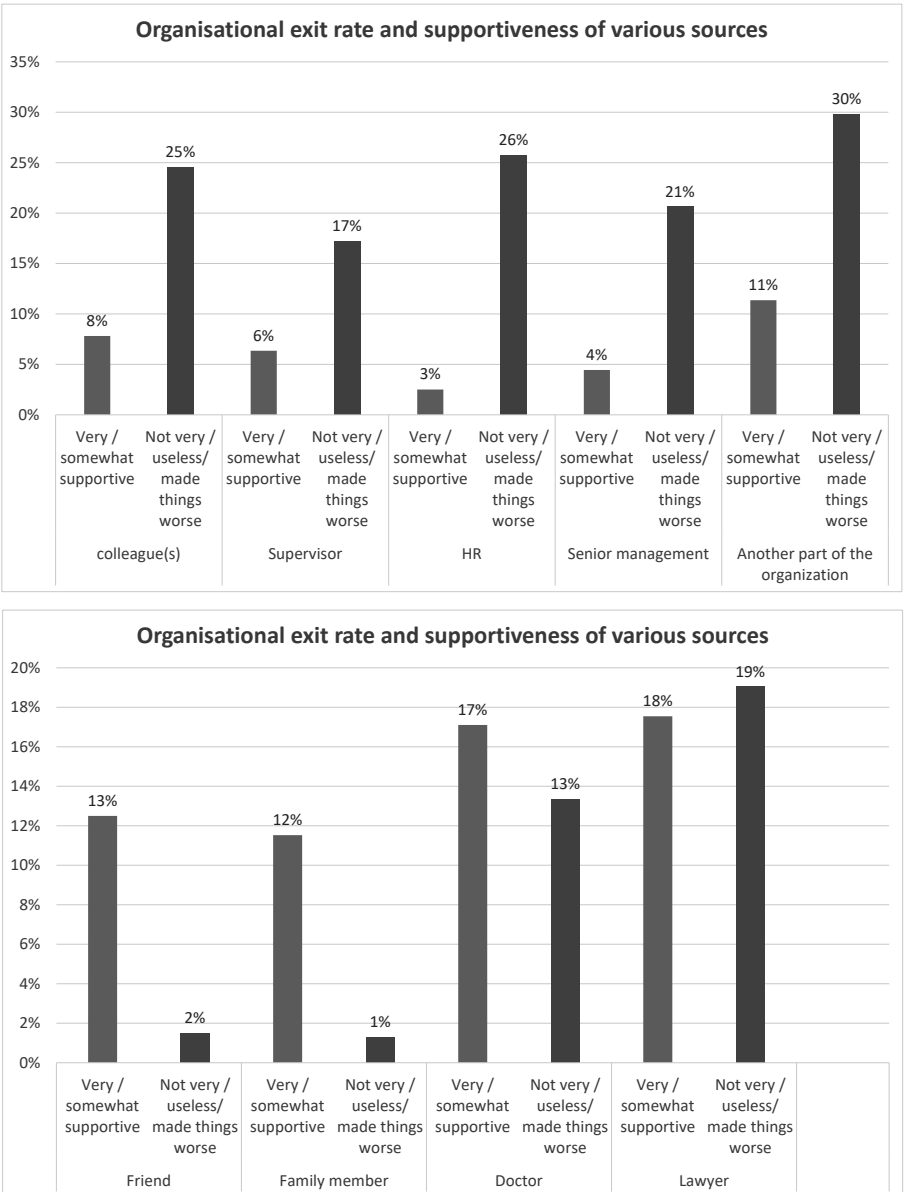
Did the same patterns exist between support and quits? It would be reasonable to expect one, as there was a strong relationship between stress and quitting. Only 4 per cent of intimidated scientists who rarely or never felt stress as a result of their most serious incident quit their job because of it. Yet 18 per cent of intimidated scientists who often felt stress did quit.

Some of the relationships we saw previously with stress also applied to quits. The quit rate was 8 per cent among those who experienced one form of intimidation, 10 per cent among those who experienced two and 15 per cent among those who experienced three. However, the relationship with forms of intimidation was a bit different. Quits were highest, not amongst those who experienced personal intimidation, but amongst those who experienced some forms of organisational intimidation: instructions not to talk (20 per cent), budget or contract cuts (18 per cent) and pressure to redirect (16 per cent) all had higher quit rates than sexual harassment (11 per cent) and general other unwelcome behaviour (14 per cent).

Figure 7 replicates Figure 6 but with the exit rate in place of stress. We can see the major effects of support on quit rates. Support from senior management, HR, the supervisor, another part of the organization and colleagues all have a substantial lowering effect on the quit rate, cutting it by between 62 per cent (another part of the organization) and 90 per cent (HR). Indeed, the effect of support from within the organisation on the quit rate is greater than the impact on stress.

Moreover, the effect of managerial support appears considerably greater than the impact of stress. If management was supportive (N=90), the exit rate was at 4-5 per cent regardless of whether stress was frequent or not. If management was unsupportive (that is, 'not very supportive', 'useless' or 'actively made things worse') (N=126), the exit rate was 18 to 22 per cent, depending on whether stress was frequent or not. If these key functions of senior management and HR are failing scientists, then that is a key resource that they are unable to access in the face of the demands placed on them by intimidation events.

Figure 7. Organisational Exit Rate and Supportiveness of Various Sources



But it is a very different story for external sources of support. If the intimidated scientist has a supportive friend, their probability of quitting is 7 times *greater* than if the friend is not supportive. If a family member is supportive, they are 8 times

more likely to leave. If a doctor or counsellor is supportive, they are 28 per cent more likely to leave. Only if the lawyer is supportive are they less likely to leave, and that is by a tiny (and non-significant) 8 per cent.

To an intimidated scientist, support from external colleagues, friends or family tells them that they are right and that the grass is indeed greener on the outside. Realising that there is a viable alternative to staying in a negative environment reduces their stress and increases their incentive to leave. Support from outside the organisation might be a resource intimidated scientists can draw upon, but the mere fact of it alerting them to the existence of a viable alternative seems pretty important.

The incentive is even stronger when the intimidated scientist faces unsupportive management but a supportive outside network. Amongst scientists who reported both a very supportive external friend and unsupportive senior management (N=56), the exit rate was as high as 30 per cent. With a very supportive friend and an unsupportive HR (N=37), the exit rate was 38 per cent.

Discussion

The findings of this study provide important insights into the complex power dynamics of intimidation and harassment experienced by scientists and how various theoretical perspectives can help explain the actions of employees and managers. We found that common forms of intimidation could be personal harassment or internal or external organisational intimidation. Experiencing intimidation led to significant stress for the affected scientists. Responses of the people affected targeted range from defiance to ignoring – or retreat, which might include states of fear or silence and stress. Those who experienced intimidation "often" or "a lot of the time" reported higher levels of stress. Intimidated scientists sought support from various sources, including colleagues, supervisors, and management. However, the support they received was not always seen as useful in mitigating the negative impacts of the intimidation. The study found that the source of support mattered – support from supervisors and management was more effective at reducing stress and preventing job quits compared to support from colleagues or other sources. We explained how various theoretical frameworks can help explain the dynamics of intimidation, stress, and job quits among scientists. These explanations provide pathways for management action and insights for those affected.

Second, when scientists are intimidated, they may seek support from both internal and external sources. They commonly speak to friends, family and colleagues, as well as to their supervisor. For intimidated scientists, the most supportive groups they consulted were often outsiders: families and friends. Colleagues were also seen as supporters. Senior management was not.

These findings align well with social capital theory in explaining the importance of social connections and social relations for support (Mueller et al., 2001; Chamberlain et al., 2008). However, the type of social capital matters. If there is an increased risk of workplace bullying when organisations fail at developing social capital (Pihl et al., 2017), social support from outside the organisation may compensate for that yet draw people away.

Third, the findings on stress and quits can be explained in the context of organisational support theory and our adaptation of the JD-R model (D'Cruz & Noronha, 2011) Bakker & Demerouti, 2007). Support from within the organisation, particularly from senior management, played a critical role in mitigating the negative impacts of intimidation on scientists. However, lack of support from these internal sources was associated with higher levels of stress and increased likelihood of job quits among the affected scientists. On a substantial minority of occasions, victims sought support from HR or other parts of the organisation to little avail. This underscores the importance of organisations providing adequate upper management support and resources to help scientists cope with intimidation – particularly in light of HR not being much use to victims. Different forms of intimidation affect stress and quits in different ways, but the more a scientist experiences these incidents, the greater the stress effect and the greater the quit effect. While stress itself increased quits, support was much more important. If management was supportive and intimidated, scientists would mostly stay in their jobs. If management was unsupportive, a much higher proportion of them would leave. These findings highlight the critical role of organisational support from senior management and HR in mitigating the negative impacts of intimidation and reinforce the responsibility of scientific institutions to create and maintain a supportive institutional environment.

Good support empowers individual scientists within the organisation, reduces stress and subsequently reduces quits. However, external support works very differently. This reduces stress and increases quits, presumably because it shows the benefits to scientists of leaving the organisation. If a scientist's friends and family are supportive and senior management is unsupportive, the temptation to leave becomes immense. The failure of internal management support is reinforced by the paradox of external support that reduces stress but increases the likelihood of exit. If internal support increases the power of intimidated scientists to mobilise resources within the organisation in their favour, external support increases the external resources that can draw them to leave.

We can say that the old saying rings true in this data: 'HR is not your friend'. HR was the least supportive of all the groups that intimidated scientists turned to and often made things worse rather than better for them. The only positive thing that could be said about senior management in this regard is that they were not HR and were, therefore, better than HR in providing support. Senior managers behave as if they have no idea how to provide support and fail to provide direction to HR on

how they should support their scientific workers. Until they do, these organisations will encounter increasing difficulties with a distressed and departing workforce.

This is happening in the context of the management of universities and other research organisations failing in their duties to reduce the incidence or effects of harassment and intimidation. We agree with the argument that the neoliberal reforms serve to restrict the ability of individual academics to maintain the traditional public good mission of universities and erode the traditional values of academic freedom and independence (Hil and Lyons, 2017).

Conclusion

Overall, the findings support our adaptation of the JD-R theory, implying that there are five factors that determine the relationship between intimidation and adverse outcomes for the scientists themselves. Two concern the intimidation itself (the 'job demand'): the intensity of the intimidation; and the source (internal or external). Of those, the intensity of intimidation appeared more important than the form of it. More intense intimidation led to more stress.

Two other factors concern the support (the 'job resource'): how beneficial it is perceived to be (a variant of the 'intensity' concept) and the source (internal or external). When those from whom the intimidated scientists sought support actually gave good support, stress was lower. This occurred regardless of whether the source of support was internal or external, though the size of the effect varied.

However, when looking at exits, the pattern was more complex. If internal sources were highly supportive, exit rates were low. However, if external sources were highly supportive, exit rates would be higher. So, the outcome variable itself mattered; it was the fifth factor influencing outcomes. Stress is a largely involuntary outcome of a difficult situation. Leaving an organisation is a discretionary act, and if external sources are offering support that internal sources are not, then it makes sense for many intimidated scientists to leave.

Future research on the analysis of intimidation could make use of longitudinal techniques to overcome the limitations of the cross-sectional used here. Research on the policy side could consider how organisations could do better in creating an environment less likely to promote intimidation, better able to support scientists who experience intimidation, and crucially with better equipped and trained supervisors capable of effectively dealing with these problems when they are not the source of them themselves. Just as HR is not the scientists' friend, neither is their supervisor likely to be, but they at least know the person, have some sort of personal relationship with them, and have some level of power within the organisation. Can they be equipped to represent the scientist's interests to senior management rather than represent senior management's interests to the scientist?

Meanwhile, the implications of this research are profound. What organisations do about the intimidation of scientists is crucial, and clearly, many are not doing enough. It is reasonable to conclude that significant numbers of researchers experience intimidation, in many cases as pressure to redirect their research or reduce their efforts to communicate findings. In an era where scientific research is often the basis of public policy, we should be concerned about the extent of intimidation of scientists and the consequences of less informed policy choices. Further research on this problem could usefully include a more detailed exploration of the impacts of intimidation in areas of science critical to current policy debates, such as climate research and studies of alternative responses to pandemics. While some populist politicians have accused scientists of exaggerating the risks of climate change, this research shows it is much more likely that intimidation has led to scientists being reluctant to speak out or even to abandon science entirely.

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APPENDIX A: SINGLE-ITEM MEASURES VERSUS A MULTI-ITEM INDEX MEASURING STRESS

Our two main dependent variables are stress and job exit. Job exit, the numerator in the labour turnover equation, was simple to measure: we asked respondents whether the incident had led to them leaving their jobs.

Stress was more complex, and we faced a choice of using a single-item measure specifically framed in terms of stress or a multi-item index. To assess the negative personal effects of the most serious incident, scientists were asked nine questions

that assessed their worry and concerns relating to work, personal and mental health aspects following intimidation. The leader question asked, 'To what extent, if any, did the event make you': 'worry about your reputation', 'worry about your future career', 'worry about losing your job', 'worry about the effect on your family', 'have difficulty concentrating at work', 'have difficulty sleeping at night', 'feel stressed', 'feel unwell', 'feel embarrassed'. The response options for each item comprised a 5-point scale (1=never, 2=rarely, 3=some of the time, 4=often, 5=a lot of the time). Our analyses were performed in SPSS version 27. A preliminary analysis using the original scoring (1 to 5) showed the nine items were all significantly correlated (table A1). Feeling stressed was more closely correlated with concentration, sleep, and unwell (r=.75,.75,.72 respectively), as is typical of stress instruments. By contrast, the stress item with the worry about future career or job loss items were not as strongly correlated (.58,.49) but correlated higher together (.67), as might be expected, but also suggesting distinct aspects across the 9 items.

Table A1. Correlations Between Single Item Stress and Worry Items

	Mean	1	2	3	4	5	6	7	8
1. Worry about reputation	2.54								
2. Worry about future career	2.69	.60							
3. Worry about losing your job	2.09	.49	.67						
4. Effect on family	2.22	.46	.60	.67					
5. Difficulty concentrating	2.67	.55	.59	.51	.57				
6. Difficulty sleeping	2.44	.51	.54	.53	.58	.78			
7. Feeling embarrassed	2.17	.54	.43	.37	.40	.54	.53		
8. Feeling stressed	3.15	.51	.58	.49	.55	.76	.75	.54	
9. Feeling unwell	2.40	.48	.55	.47	.56	.70	.71	.56	.72

To capture the variance of the stress and worry items into a smaller set of variables, a principal component analysis (PCA), an exploratory technique, was used to examine the structure of these items. Our criteria to assess the suitability of the nine items for PCA were reached: the sample size to item ratio was high (720 responses for nine items). Skew and kurtosis did not exceed.20 for any of the items. A KMO measuring sampling adequacy was high (.915), and Bartlett's test of sphericity suggested the correlation matrix was appropriate for analysis (chi-square = 4371.99, p=.000). An oblimin rotation due to correlation between items and along with a graphical scree test the output suggested two factors explaining 71 per cent of the variance in total. For the first factor, which we called 'psychological injury' (62.1 per cent), items were feeling embarrassed, stressed, unwell, difficulty concentrating, difficulty sleeping, feeling embarrassed and worry about reputation (loadings.874,.841,.831,.800,.792, 562, respectively). The second factor, which we named 'vulnerability', explained that 9.7% of the items were worrying about job loss, the effect on family, and worry about future careers with loadings.968,.770,.737, respectively.

However, face validity for a multi-item index is difficult to interpret. A lot of the details contained in the components get lost. A single-item construct is easy to understand as its meaning is self-explanatory; the weakness with a single-item measure arises in people's tendency to answer questions erratically. One hopes that, with a multi-item index, that erraticism will wash out.

So, we compared the analytic usefulness of the multi-item index ('psychological injury') with the single-item measure ('stress'), which at heart are meant to measure the same thing. They showed similar patterns across relationships with several other variables that we looked at. However, we found that the single-item index was more powerful for undertaking gender comparisons. We wanted to see if either could detect gender differences in the effects of certain intimidation events on stress/psychological injury. So, we used a t-test to compare the average gender difference in scores on the 5-point scale of the single-item stress measure and on the 30-point scale of the multi-item index for each of the nine main types of intimidation events. At the conventional 5 per cent level of significance, the single-item stress index showed gender differences (women being more affected than men) in the impact of online abuse and being instructed not to talk. The multi-item index did not detect these differences. At the 10 per cent level, the single-item index also detected a gender difference in the effect of property damage, which the multi-item index did not. For six of the nine forms of intimidation, the t-score on the single-item index was higher than that on the multi-item index. In light of this, and in the absence of contrary results with other variables suggesting significantly better performance for the multi-item index, we use the easier-to-understand, single-item measure of stress throughout the rest of this paper.