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# Relationships between ICT Use for Task and Social Functions, Work Characteristics, and Employee Task Proficiency and Job Satisfaction: Does Age Matter?

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**Abstract:** Digitalization and demographic change represent two megatrends that impact organizations and workplaces around the globe. Rapid developments in information and communication technology (ICT) are fundamentally changing the ways in which work is conducted. At the same time, workforces are becoming increasingly older and age diverse. Integrating the model of workplace ICT use and work design with socioemotional selectivity theory from the lifespan development literature, we investigate employee age as a moderator of the indirect and total effects of ICT use for task and social functions on self-rated task proficiency and job satisfaction. As potential mediators, we focus on three job-related resources: job autonomy, team cohesion, and task significance. Data were collected from 1761 employees at three measurement points across two months. The results showed that ICT use for task and social functions were not significantly associated with job autonomy, team cohesion, task significance, task proficiency, and job satisfaction, while controlling for baseline levels of these mediator and outcome variables. Job autonomy was negatively related to task proficiency, and team cohesion was positively related, whereas both job autonomy and team cohesion were positively related to job satisfaction. Contrary to expectations, age did not moderate the indirect and total effects of ICT use for task and social functions on task proficiency and job satisfaction. We discuss the implications of our findings for future research and practice regarding ICT use and age in the work context.

**Keywords:** information and communication technology; ICT; work design; age

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**Citation:** Dietz, C.; Bauermann, P.; Zacher, H. Relationships between ICT Use for Task and Social Functions, Work Characteristics, and Employee Task Proficiency and Job Satisfaction: Does Age Matter? *Merits* **2022**, *2*, 224–240. https://doi.org/10.3390/merits2030016

Academic Editor: Luis Miguel Ciravegna Fonseca

Received: 13 July 2022
Accepted: 25 August 2022
Published: 30 August 2022

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Digitalization and demographic change are two global megatrends with significant implications for societies, organizations, and individual employees. Digital transformation has enabled organizations to create new and to improve existing products, services, and ways of working [1]. In particular, modern information and communication technology (ICT) enables employees to use digital devices (e.g., laptops, tablets, smartphones) and software (e.g., email, videoconferencing tools, chat programs) to carry out their tasks and to interact with others at work [2]. At the same time, the workforces in most developed and many developing countries are aging and becoming increasingly age diverse [3]. Age-related differences in individual characteristics (e.g., abilities, needs) and work outcomes (e.g., job attitudes, performance), as well as interactive effects between employee age and established work characteristics (e.g., job autonomy, social support) have received much scholarly attention over the past decade [4–7].

While some research has integrated ICT use and (older) age, e.g., [8], the role of age as a moderator of associations between ICT use and important work outcomes is not yet well understood. Researchers have so far mostly focused on the main effects of age on ICT acceptance and use [9]. For example, a meta-analysis demonstrated that age had negative effects on perceived usefulness, intention to use, and perceived ease of use of technology [10]. Given well-documented age-related differences in individual needs and motives (e.g., socioemotional preferences) [11,12], specific functions of ICT use

(i.e., task-related, social) may be more or less beneficial for younger and older workers, respectively. To detect such age-differential effects of ICT use, it is essential to examine age as a moderator of associations between ICT use and work outcomes. Moreover, to understand why the interplay between ICT use and age may affect work outcomes, it is important to examine mediating mechanisms, such as employees' perceptions of their work characteristics, see [13].

Accordingly, we contribute to theory development by integrating the model of workplace ICT use and work design [14] with the lifespan theory of socioemotional selectivity [15] to develop and test a conceptual model on age, ICT use, work characteristics, and work outcomes (see Figure 1). In brief, we examine employee age as a moderator of the direct effects of ICT use for task and social functions on three work characteristics: job autonomy, team cohesion, and task significance, as well as a moderator of the direct effects of these work characteristics on two work outcomes: task proficiency and job satisfaction. In addition, we examine age-differentiated indirect and total effects of ICT use on task proficiency and job satisfaction through job autonomy, team cohesion, and task significance. To this end, we collected data from a large sample of employees in Germany at three time points, which were separated by one-month intervals. The longitudinal design allowed us to control for baseline measures of the mediator and outcomes variables and, thus, to examine the effects of ICT use on changes in work characteristics and outcomes [16].

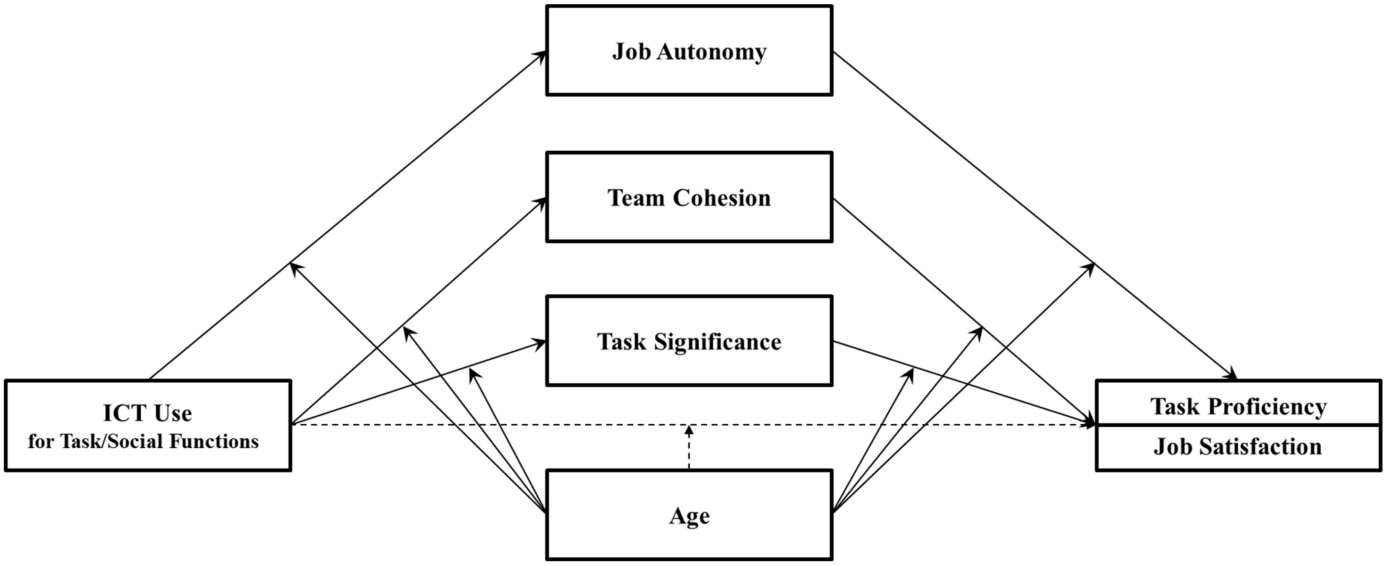


**Figure 1.** Conceptual model with first and second stage moderation in solid lines and proposed moderation of the total effect in dashed lines.

Our study contributes to the literature on age and ICT use at work in three important ways. First, drawing from two established theoretical frameworks from organizational and lifespan development research, we propose and test hypotheses on age-differential effects of ICT use for task and social functions on two important work outcomes. Whilst the model of workplace ICT use and work design includes age as one potential demographic moderator in the category "user-technology fit", see [14] (Figure 1), research has so far not empirically examined this effect. Thus, our study advances knowledge on interactive effects between age and workplace contextual factors on important work outcomes [13]. Second, by exploring the age-differentiated effects of ICT use on job autonomy, team cohesion, and task significance as mediators, we contribute to the literature on multilevel work design influences [17]. This is important, because research has focused on the effects of work design and neglected the important question of how employees come to perceive their work characteristics in a certain way. Wang et al.'s model suggests that ICT use may play a key role in this regard [14]. Finally, consistent with the model of ICT use and work design,

we advance research on the outcomes of ICT use, which has typically examined perceptions of usefulness, ease of use, and intention to use [10]. Job satisfaction and self-rated task proficiency are key employee outcomes that are associated with more objective indicators of job performance (e.g., supervisor ratings) [18,19].

**1. Model of Workplace ICT Use and Work Design**

The model of workplace ICT use and work design explains the mediating mechanisms and boundary conditions of ICT use on work outcomes [14]. *ICT use* in the work context entails the frequent use of hardware, software, and digital means of communication (e.g., email) and the dependency on the internet to achieve work-related goals [14]. Wang et al. differentiate between the intensity and functions of ICT use [14]. While ICT use intensity refers to the extent of usage, the functions of ICT use describe the different ways ICT may be used toward the achievement of work goals [14]. Two main functions of ICT use can be distinguished [20]. First, ICT can be used with an information focus to help employees carry out their work tasks. Here, ICT is used as a tool to directly accomplish tasks and is relevant for the completion of tasks. Second, ICT can be used with a communication focus at work to facilitate social connections and interactions with coworkers, for example through ICT-mediated communication, such as instant messaging platforms [14]. Consistent with the model, we focus on ICT use for task aspects (i.e., human-ICT interaction) and ICT use for social aspects (i.e., ICT-mediated communication) as predictor variables in the current study.

As relevant work outcomes, the model considers work effectiveness and well-being as rather well-established criteria, and cognitive and social outcomes as new criteria. As the main contribution of our study is the investigation of interactive effects between ICT use and age, we focus on task proficiency and job satisfaction as established work outcomes. This focus is also consistent with the literature on lifespan perspectives on job design [6]. *Task proficiency* has been defined as "the effectiveness with which job incumbents perform activities that contribute to the organization's technical core" [21] (p. 99). Thus, task proficiency includes behaviors directly related to the performance of tasks required for the job [22]. *Job satisfaction* can be defined as "the extent to which people like (satisfaction) or dislike (dissatisfaction) their jobs" [23] (p. 2). Thus, job satisfaction describes an affective reaction of individuals toward their job and job-related experiences [24].

In their model, Wang et al. [14] propose work characteristics as key mechanisms of the effects of ICT use on work outcomes. In particular, they consider job demands, job autonomy, relational aspects of work, and task significance as those aspects of work design that should be impacted by ICT use. In the current study, we focus on the three job-related resources of the model (i.e., job autonomy, team cohesion, task significance) as mediators. These resources are relevant from a lifespan perspective on job design. In their model, Truxillo et al. [6] distinguish between motivational and social work characteristics that are important to consider within a lifespan perspective approach. We examined job autonomy as a motivational work characteristic and team cohesion as a social work characteristic. *Job autonomy* has been defined as "the degree to which a job provides discretion over daily work decisions, such as when and how to do tasks" [25] (p. 664). There are three dimensions of autonomy, namely decision-making autonomy, work scheduling autonomy, and work methods autonomy [26]. ICT can cover all of these areas, but the autonomy of scheduling work in particular can be improved by the independence of location and time made possible by ICT technologies. Job autonomy is a job-related resource that has been shown to be associated with higher job satisfaction and performance [27,28]. We further consider *team cohesion* as an indicator of relational aspects of work, as it is "composed of interpersonal attraction, group pride, and task commitment" [29] (p. 990) and positively related to group performance [29,30].

We additionally included task significance as a third work characteristic because Wang et al. [14] note that this work characteristic might play an important role in the context of new technologies, such as ICT use, in affecting employees' perceptions of meaningfulness

of their work. *Task significance* entails the "degree to which the job has a substantial impact on the lives or work of other people—whether in the immediate organization or in the external environment" [31] (p. 161). High levels of task significance enable employees to experience meaningfulness [27], which in turn has been shown to positively impact job satisfaction and performance [28,32].

Finally, Wang et al.'s model includes contextual and individual factors that may affect the relationships of ICT use on work characteristics and work outcomes [14]. Specifically, the researchers consider a number of "influencing conditions" related to temporal factors and social-technology fit, including organizational norms (e.g., for segmentation), work design (e.g., IT technology support, technology use policy), and task characteristics (e.g., job requirements). In addition, Wang et al. [14] include a number of individual-level factors related to user-technology fit as moderators. These factors include demographic factors (e.g., age, gender), personal traits (e.g., segmentation preference), and ICT-related knowledge, skills, and abilities. In the current study, we focus on employee age as a moderator and draw from lifespan theorizing to justify its potential effects.

## 2. Lifespan Theory of Socioemotional Selectivity

Socioemotional selectivity theory suggests that the perception of future time (i.e., future time perspective, see [33]) is central for selecting and pursuing different life goals [15]. While younger employees tend to have a more open-ended future time perspective, employees' future time perspective tends to become more limited with increasing age [34]. Socioemotional selectivity theory differentiates between two broad types of goals: knowledge-acquisition vs. emotion-regulation goals [15,35]. Younger people with an unlimited time perspective are assumed to prioritize long-term, instrumental, and knowledge-related goals that help maximize future outcomes, whereas older people with a limited time perspective should prioritize rather short-term and emotion-related goals that help them maximize outcomes (e.g., enjoyment) in the present, given their scarce future time [15]. Indeed, empirical evidence shows that older people prefer emotional connections to superficial contacts and seek to enhance emotional encounters with important social partners [36].

Based on the assumptions of the socioemotional selectivity theory, we argue that the positive effects of the use of ICT on work outcomes are moderated by employees' age. Specifically, we assume that older employees primarily value ICT use for staying in touch and having positive interactions with their colleagues and, therefore, ICT use for social functions should have stronger positive effects among older compared to younger employees. In contrast, ICT use for task functions should have stronger positive effects among younger compared to older employees, given younger employees' greater focus on instrumental and knowledge-related goals. Younger employees may value the task function of ICT to promote their skills and advance their careers in the long term. Research showed that, in a non-work context, internet use for social aspects increases among older adults [8]. Moreover, when older people used the internet in a way that addressed their age-related needs (e.g., communication, seeking social support), they did not perceive technology as useless (as compared to when technology was used for growth and knowledge purposes) [10].

**Hypothesis 1 (H1).** *The positive relationship between ICT use for task functions and (a) task proficiency and (b) job satisfaction is stronger for younger (vs. older) employees.*

**Hypothesis 2 (H2).** *The positive relationship between ICT use for social functions and (a) task proficiency and (b) job satisfaction is stronger for older (vs. younger) employees.*

## 3. Work Characteristics as Mediators

Based on the model of workplace ICT use and work design [14], we further hypothesize that the interactive effects of ICT use and age on task proficiency and job satisfaction

are mediated by job autonomy, team cohesion, and task significance. Well-being is more strongly associated with a certain job characteristic when that characteristic is more highly valued, i.e., older employees value fulfilling and intrinsic challenging jobs more, whereas the motivation of younger employees increased when they were offered career opportunities [37]. Jobs with meaningful content were found to be valued by older workers [38]. Specifically, and consistent with the model by Wang et al. [14], we expect that age moderates not only the total effects of ICT use on task proficiency and job satisfaction, but also the direct effects of ICT use on work characteristics. Older employees showed stronger associations between interdependence and work engagement compared to younger employees, as well as a preference for social interactions with well-known coworkers compared to social work interactions with individuals outside the organization [39]. Since interdependence is closely related to team cohesion, we assume that team cohesion is particularly valuable to older employees. Consistent with the lifespan perspective on the job design of Truxillo et al. [6] and the model of Wang et al. [14], we further expect that age moderates the direct effects of work characteristics on work outcomes (see Figure 1).

With regard to job autonomy, ICT enables location- and time-independent task performance. For example, employees can work in virtual teams or from home [40]. Job autonomy that is caused by ICT use can lead to higher levels of work engagement, e.g., [41–43] and performance [44]. For example, job autonomy emerged during the COVID-19 outbreak as a virtual work characteristic that helped employees to deal with challenges of remote work and improved remote employees' well-being and effectiveness [45]. However, ICT does not necessarily have a positive effect on perceptions of autonomy, and learning new technologies was associated with an increase in perceived complexity by blue-collar workers [46]. Additionally, the increase in remote work during the COVID-19 pandemic highlighted several stressors that workers face when working from home, such as technological stressors, stressors related to work–family boundaries, and stressors related to work coordination [47] that may affect perceptions of autonomy. A paradox associated with the use of technology is that while autonomy can lead to greater self-determination and motivation, monitoring and control can also lead to a decline in intrinsic motivation [48]. Although digital monitoring results in primarily negative work outcomes, especially for manual workers [49], the different types of ICT use we examined in this study are thought to have stronger positive effects on workers because the use of ICT in a work context is more self-directed than technologies that track the time employees spend on a task (such as time monitoring on an assembly line).

Consistent with Hypotheses 1 and 2, and based on socioemotional selectivity theory, we expect that the association between ICT use for task functions and job autonomy is more positive for younger compared to older employees, whereas the association between ICT use for social functions and job autonomy should be more positive for older compared to younger employees. Moreover, based on a lifespan perspective on work design, we assume that the positive relationships between job autonomy and work outcomes are stronger among older compared to younger employees [50]. Older employees possess greater work experience, whereas younger employees often need more support and guidance and would not benefit equally from higher job autonomy [6]. Older employees can also be assumed to benefit more from higher job autonomy because it enables them to choose tasks and roles that are tailored to their strengths [6].

With regard to team cohesion, research has shown that social relationships and interactions at work have positive effects on performance and well-being [28,51]. For example, a shared mental model about ICT use among virtual team members can help to achieve better team coordination and performance at the individual and team levels [52]. Low flexibility in ICT use reinforces the positive relationship between shared mental models of ICT use and team coordination [52]. Through home office measures during the COVID-19 pandemic, overarching ICT measures may have been enforced, reducing ICT diversity and flexibility in teams, and ultimately leading to better team cohesion. Employees may build connections with coworkers via ICT easily for work or social purposes but, at the same time,

ICT could result in fewer face-to-face interactions (e.g., due to larger physical distance), which could lead to feelings of isolation [2]. Offline relationships cannot be easily replaced with ICT-mediated communication. Critically, ICT use could also enforce new forms of negative interpersonal behavior such as cyberbullying, cyber incivility, and cyberaggression (e.g., [53,54]). However, when there are no significant relationships offline available due to different workplaces, ICT use may have a favorable impact on employees' social life as a complement to offline relationships [55]. For example, ICT can help employees working from home to reduce social isolation by communicating with colleagues [56,57]. Overcoming temporal and spatial constraints, ICT use might promote the sharing of experiences, especially in times of a pandemic, and, therefore, mutual understanding [58].

Based on socioemotional selectivity theory [15], we expect that the association between ICT use for task functions and team cohesion is more positive for younger compared to older employees, whereas the association between ICT use for social functions and team cohesion should be more positive for older compared to younger employees. For example, through ICT-mediated communication, older employees could meet their need for generativity [59] and share their expertise with their colleagues. Moreover, based on a lifespan perspective on work design, we assume that team cohesion is a stronger predictor of work outcomes among older compared to younger employees [6]. Accordingly, higher levels of team cohesion should be associated with higher task proficiency and job satisfaction, especially among older employees.

With regard to task significance, adaption of ICT in a sense of automation could impair human work involvement and thus negatively influence perceptions of task significance [14]. On the other hand, ICT may not solely work in one direction. For example, ICT could allow virtual teams to pursue their goals, which could lead to higher task significance. Jobs can also become more enriched through technology-related changes [60]. For example, ICT might reduce monotonous routine work and, hence, allow, after proper implementation, more time for more complex or qualitative tasks (e.g., more time for patients in a nursing context). Particularly considering the COVID-19 pandemic, perceptions of task significance with ICT may have increased in a home office environment, as digital technologies were critical to maintaining work in closed offices. Based on socioemotional selectivity theory [15], we expect that the association between ICT use for task functions and task significance is more positive for younger compared to older employees, whereas the association between ICT use for social functions and task significance should be more positive for older compared to younger employees. Moreover, based on a lifespan perspective on job design, we expect that task significance has a stronger positive effect on work outcomes among older compared to younger employees [6]. Specifically, older employees should focus more on meaningfulness in their job than on career progression and gaining new skills for the job [11]. Accordingly, task significance should lead to positive work outcomes, especially among older employees [6].

**Hypothesis 3 (H3).** *The positive indirect effects of ICT use for task and social functions on task proficiency via (a) job autonomy, (b) team cohesion, and (c) task significance are moderated by age, such that the indirect effects of ICT use for task functions are stronger for younger employees, whereas the indirect effects of ICT use for social functions are stronger for older employees.*

**Hypothesis 4 (H4).** *The positive indirect effects of ICT use for task and social functions on job satisfaction via (a) job autonomy, (b) team cohesion, and (c) task significance are moderated by age, such that the indirect effects of ICT use for task functions are stronger for younger employees, whereas the indirect effects of ICT use for social functions are stronger for older employees.*

## 4. Method

### *4.1. Participants and Procedure*

Data were collected from employees in Germany at three consecutive measurement points (T1–T3), with time lags of one month between two measurement points. During data collection between July and September 2020, governmental restriction due to the COVID-19 pandemic was largely relaxed in Germany. The first national pandemic lockdown in Germany occurred between March and May 2020 and the second lockdown between November 2020 and May 2021. The data presented in this article were part of a larger data collection effort via an online survey. So far, no articles based on this dataset have been published. We commissioned a certified panel management and online research company to recruit participants for this study. Participants were compensated by the company for their time. To ensure the quality of the general panel, the company recruits its participants using a variety of sources, from online communities and news portals to members-get-members campaigns, social media campaigns, and invitations after in person interviews. All panelists register triple-opt-in and are deemed active according to ISO standards.

Initially, in July of 2020 (T1), 6545 invitations were sent to persons in the companies' database. In total, 2792 persons followed this invitation and provided basic demographic information, reflecting a response rate of 42.7%. Of these persons, 1761 indicated to work at least part-time ($\geq$20 h per week) and responded to the focal variables at T1 and T2. At T3, data was provided by 1.528 employees. Thus, the dropout rate was 13.23%.

The final sample consisted of $N$ = 1761 employees including 1.017 men (57.8%) and 744 women (42.2%) at T1. Ages ranged from 19 to 70 years, with an average age of 44.04 years ($SD$ = 11.91). Compared to the German working population, our sample included slightly more women and less men (German working population: 63.7% men, 54.0% women) [61]. The average age was similar (German population: 44 years) [62]. In terms of educational level, 63 persons (3.6%) had no occupational qualification, 850 persons (48.3%) finished vocational training, 196 persons (11.1%) held a technical college degree, 726 persons (33.0%) held a university degree, and 29 persons (1.6%) held a PhD. In total, 41 participants (2.3%) indicated to have another qualification. This distribution is similar to the German population, with approximately two thirds of individuals without a university degree (70.5%) and one third of individuals holding a university degree (29.5%) [63]. Participants worked in a broad range of sectors (e.g., education, health services, administration, sales, computer engineering). Detailed information is presented in the online Supplemental Material (Table S1).

To address systematic patterns of attrition, incomplete responders ($n$ = 1528) were compared to the panel of complete responders ($n$ = 233) on key demographic and substantive variables. A summary of these comparisons can be found in Tables S2–S5. Complete responders were somewhat older than incomplete responders, $t$ (1759) = −2.89, $p$ = 0.004, and men were more likely to be complete responders than women and persons indicating their gender as others, $U$ = 163,430.50, $Z$ = −2.36, $p$ = 0.018. In a logistic regression model, key demographic and substantive variables at T1 accounted only for about 3% of the variability in observed attrition ($R^2_{\text{Cox \& Snell}}$ = 0.024). Thus, we are confident that systematic attrition is not of principle concern here.

### *4.2. Measures*

Participants were instructed to relate their answers to the past 4 weeks.

**Task proficiency.** Task proficiency was measured with the 3-item scale validated by Griffin et al. [64] at T2 and T3. A sample item is "I carry out the core parts of my job well". Respondents rated each statement using a scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The scale had good reliability at all measurement points; $\alpha$ = 0.91 at T2, $\alpha$ = 0.91 at T3.

**Job satisfaction.** Job satisfaction was assessed by self-report at T2 and T3. We used a single item [65]: "How satisfied were you with your work considering all the circumstances?" Participants responded on a 5-point scale ranging from 1 (*very dissatisfied*) to 5

(*very satisfied*). Fisher et al. [66] argued that single items measuring homogenous constructs such as job satisfaction can have high reliability and validity.

**ICT use.** We used two adapted single items [14] to measure self-reported ICT use. ICT use was only measured at T1. The item for task related ICT use was: "How often do you have used information technologies (e.g., email, smartphone, or internet) to complete your work tasks (e.g., research, data transfer and storage)?" The item for ICT use with social functions was: "How often do you have used information technologies (e.g., email, smartphone, or internet) to communicate with others (e.g., colleagues, customers)? Participants responded on a 5-point scale ranging from 1 (*never*) to 5 (*very often*).

**Job autonomy.** Job autonomy was measured with the 4-item "influence at work"-scale from the German short version of the Copenhagen Psychosocial Questionnaire validated by Nübling and colleagues [67] at T1 and T2. A sample item is "Did you have any influence on what you do at work?". Respondents rated each statement using a scale ranging from 1 (*never*) to 5 (*always*). The scale had good reliability at all measurement points; $\alpha = 0.85$ at T1, $\alpha = 0.86$ at T2.

**Team cohesion.** Team cohesion was measured with the 4-item "sense of community"-scale from the German short version of the Copenhagen Psychosocial Questionnaire validated by Nübling and colleagues [67] at T1 and T2. A sample item is "Is there a good atmosphere between you and your colleagues?". Respondents rated each statement using a scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The scale had good reliability at all measurement points; $\alpha = 0.92$ at T1, $\alpha = 0.92$ at T2.

**Task significance.** Task significance was measured with three items from the work design questionnaire validated by Stegmann and colleagues [68] at T1 and T2. A sample item is "The results of my work are likely to significantly affect the lives of other people". Respondents rated each statement using a scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). The scale had good reliability at all measurement points; $\alpha = 0.85$ at T1, $\alpha = 0.90$ at T2.

### *4.3. Statistical Analyses*

Prior to testing our hypotheses, we conducted a Pearson's product-moment correlation analysis to examine associations between all study variables. In addition, we specified two CFA models with the substantive model variables to explore the factor structure of the measures of ICT use (T1), job autonomy (T2), team cohesion (T2), task significance (T2), task proficiency (T3), and job satisfaction (T3). Specifically, we specified and contrasted a multi factor model and a 1-factor model. We tested our hypotheses using path analysis in M*plus* [69] with a maximum likelihood estimator. All variables defining products were mean centered prior to analysis. Indirect effects were estimated with a bootstrapping procedure using a bootstrap sample size of 5000. The significance of the effects was tested at the 95% significance level. We first specified a mediation model (M1) including age as a covariate predicting the mediators and outcomes. In addition, the mediators and outcomes were specified to influence themselves over time (autoregressive effects reflecting temporal stability). Thus, we included job autonomy, team cohesion, and task significance at T1 and task proficiency and job satisfaction at T2 in the model. In a second model (M2), we added the interaction terms of age and ICT use (first stage moderation) as well as of age and the mediators (second stage mediation). The M*plus* code is available in the online appendix.

## 5. Results

### *5.1. Descriptive Statistics, Correlations, and Dimensionality of Study Variables*

Descriptive statistics and correlations among the study variables are presented in Table 1. Results of the CFA showed that the multi-factor model had a better fit ($X^2$ (86) = 492.14, $p < 0.001$, RMSEA = 0.05, CFI = 0.98, SRMR = 0.04) to the data than the 1-factor model ($X^2$ (104) = 11,352.18, $p < 0.001$, RMSEA = 0.25, CFI = 0.34, SRMR = 0.19; $\Delta X^2$ (18) = 10,860.04, $p < 0.001$).

**Table 1.** Descriptive statistics, reliabilities, and correlations between the study variables.

| | | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Age (T1) | 44.04 | 11.91 | - | | | | | | | | | | | |
| 2 | T ICT Use (T1) | 3.65 | 1.37 | −0.04 | - | | | | | | | | | | |
| 3 | C ICT Use (T1) | 3.64 | 1.33 | −0.05 * | 0.77 ** | - | | | | | | | | | |
| 4 | Job Autonomy (T1) | 2.93 | 1.06 | 0.03 | 0.25 ** | 0.26 ** | (0.85) | | | | | | | | |
| 5 | Team Cohesion (T1) | 3.60 | 1.01 | 0.06 ** | 0.21 ** | 0.20 ** | 0.14 ** | (0.92) | | | | | | | |
| 6 | Task Significance (T1) | 3.42 | 0.97 | 0.06 ** | 0.17 ** | 0.18 ** | 0.26 ** | 0.27 ** | (0.85) | | | | | | |
| 7 | Job Autonomy (T2) | 2.94 | 1.09 | 0.03 | 0.19 ** | 0.20 ** | 0.68 ** | 0.09 ** | 0.19 ** | (0.86) | | | | | |
| 8 | Team Cohesion (T2) | 3.61 | 0.99 | 0.09 ** | 0.18 ** | 0.17 ** | 0.17 ** | 0.68 ** | 0.26 ** | 0.16 ** | (0.92) | | | | |
| 9 | Task Significance (T2) | 3.26 | 1.03 | 0.03 | 0.11 ** | 0.12 ** | 0.16 ** | 0.23 ** | 0.67 ** | 0.18 ** | 0.31 ** | (0.90) | | | |
| 10 | Task Proficiency (T2) | 4.26 | 0.75 | 0.23 ** | 0.10 ** | 0.12 ** | 0.06* | 0.31 ** | 0.21 ** | 0.07 ** | 0.35 ** | 0.23 ** | (0.91) | | |
| 11 | Job Satisfaction (T2) | 3.49 | 0.99 | 0.08 ** | 0.09 ** | 0.10 ** | 0.27 ** | 0.32 ** | 0.23 ** | 0.31 ** | 0.39 ** | 0.25 ** | 0.29 ** | - | |
| 12 | Task Proficiency (T3) | 4.23 | 0.75 | 0.25 ** | 0.10 ** | 0.11 ** | 0.05 | 0.33 ** | 0.19 ** | 0.02 | 0.35 ** | 0.20 ** | 0.66 ** | 0.30 ** | (0.91) |
| 13 | Job Satisfaction (T3) | 3.51 | 0.99 | 0.07 ** | 0.11 ** | 0.12 ** | 0.27 ** | 0.32 ** | 0.22 ** | 0.29 ** | 0.37 ** | 0.24 ** | 0.30 ** | 0.62 ** | 0.32 ** |

Note. Due to missing data, *N* ranged from 1531 to 1761. T ICT Use = ICT use for task functions; C ICT Use = ICT use for social functions. Reliability estimates (α), where available, are shown in parentheses along the diagonal. * $p < 0.05$, ** $p < 0.01$.

### *5.2. Results of Hypothesis Tests*

To test our hypotheses, we specified two path models. The mediation model (M1) had a slightly better fit than the moderated mediation model (M2): $X^2$ (14) = 89.22, $p < 0.001$, RMSEA = 0.06, CFI = 0.99, SRMR = 0.02 for M1; $X^2$ (67) = 368.17, $p < 0.001$, RMSEA = 0.05, CFI = 0.95, SRMR = 0.04 for M2. Results of the path analysis are summarized in Table 2.

**Conditional total effects of ICT use on the outcomes.** Hypothesis 1 states that the positive relationship between ICT use for task functions and (a) task proficiency and (b) job satisfaction is stronger for younger (vs. older) employees. According to Hypothesis 2, the positive relationship between ICT use for social functions and (a) task proficiency and (b) job satisfaction is stronger for older (vs. younger) employees. ICT use for task and social functions had no significant total effects on task proficiency and job satisfaction (Table 3). These total effects were also not significantly moderated by age. Therefore, the results did not support Hypotheses 1 and 2.

**Conditional indirect effects of ICT use on task proficiency.** Hypothesis 3 states that the indirect effects of ICT use for task and social functions on task proficiency via (a) job autonomy, (b) team cohesion, and (c) task significance are moderated by age, such that the indirect effects of ICT use for task functions are stronger for younger employees, whereas the indirect effects of ICT use for social functions are stronger for older employees. ICT use for task and social functions had no significant direct effects on job autonomy, team cohesion, and task significance (Table 2). Age also did not significantly moderate these direct effects.

In turn, job autonomy had negative and team cohesion had positive effects on task proficiency (Table 2). Only task significance interacted with age in predicting task proficiency. The indirect effects of ICT use for task and social functions on task proficiency through the mediators were not significant (Table 3). The indirect effects through task significance were also not significantly moderated by age (Table 4). Overall, the results did not support Hypothesis 3.

**Conditional indirect effects of ICT use on job satisfaction.** Hypothesis 4 states that the indirect effects of ICT use for task and social functions on job satisfaction via (a) job autonomy, (b) team cohesion, and (c) task significance are moderated by age, such that the indirect effects of ICT use for task functions are stronger for younger employees, whereas the indirect effects of ICT use for social functions are stronger for older employees. Job autonomy and team cohesion had positive effects on job satisfaction (Table 2). However, age did not interact with the mediators in predicting job satisfaction. The indirect effects of ICT use for task and social functions on job satisfaction via job autonomy, team cohesion, and task significance were not significant (Table 3). Overall, the results do not support Hypothesis 4.

**Table 2.** Results of path analysis.

| | Effects on the Mediators at T2 | | | | | | Effects on the Outcomes at T3 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Job Autonomy | | Team Cohesion | | Task Significance | | Task Proficiency | | Job Satisfaction | |
| | M1 γ (*SE*) | M2 γ (*SE*) | M1 γ (*SE*) | M2 γ (*SE*) | M1 γ (*SE*) | M2 γ (*SE*) | M1 γ (*SE*) | M2 γ (*SE*) | M1 γ (*SE*) | M2 γ (*SE*) |
| Predictors | | | | | | | | | | |
| T1 ICT-T (*X*) | 0.01 (0.03) | 0.01 (0.03) | 0.03 (0.03) | 0.02 (0.03) | −0.01 (0.03) | −0.01 (0.03) | 0.01 (0.03) | 0.01 (0.03) | 0.02 (0.03) | 0.01 (0.03) |
| T1 ICT-S (*X2*) | 0.02 (0.03) | 0.02 (0.03) | 0.02 (0.03) | 0.02 (0.03) | 0.01 (0.03) | 0.01 (0.03) | 0.03 (0.03) | 0.03 (0.03) | 0.01 (0.04) | 0.01 (0.04) |
| T1 Age (*W*) | 0.01 (0.01) | 0.01 (0.02) | 0.06 (0.02) ** | 0.06 (0.02) ** | −0.01 (0.02) | −0.01 (0.02) | 0.11 (0.02) ** | 0.11 (0.02) ** | −0.00 (0.02) | −0.00 (0.02) |
| Mediators | | | | | | | | | | |
| T2 JA (*M1*) | | | | | | | −0.05 (0.02) * | −0.06 (0.02) ** | 0.09 (0.02) ** | 0.09 (0.02) ** |
| T2 TC (*M2*) | | | | | | | 0.11 (0.02) ** | 0.12 (0.03) ** | 0.14 (0.03) ** | 0.15 (0.03) ** |
| T2 TS (*M3*) | | | | | | | 0.03 (0.02) | 0.03 (0.02) | 0.03 (0.02) | 0.03 (0.02) |
| Interactions | | | | | | | | | | |
| *X***W* | | −0.01 (0.03) | | 0.01 (0.03) | | −0.01 (0.03) | | | | |
| *X2***W* | | −0.02 (0.03) | | 0.02 (0.03) | | 0.04 (0.03) | | | | |
| *M1***W* | | | | | | | | 0.03 (0.02) | | 0.00 (0.02) |
| *M2***W* | | | | | | | | −0.04 (0.02) | | −0.03 (0.02) |
| *M3***W* | | | | | | | | −0.05 (0.02)* | | −0.03 (0.02) |
| Baselines | | | | | | | | | | |
| T1 JA | 0.68 (0.02) ** | 0.68 (0.02) ** | | | | | | | | |
| T1 TC | | | 0.66 (0.02) ** | 0.66 (0.02) ** | | | | | | |
| T1 TS | | | | | 0.66 (0.02) ** | 0.66 (0.02) ** | | | | |
| T2 TP | | | | | | | 0.58 (0.03) ** | 0.57 (0.03) ** | | |
| T2 JS | | | | | | | | | 0.53 (0.03) ** | 0.52 (0.03) ** |
| $R^2$ | 0.47 ** | 0.47 ** | 0.46 ** | 0.46 ** | 0.44 ** | 0.44 ** | 0.45 ** | 0.45 ** | 0.40 ** | 0.41 |

Note. *N* = 1761; M1–Mediation model in light grey; M2–Moderated mediation model in grey; ICT-T = ICT use for task functions; ICT-S = ICT use for social functions; JA–job autonomy; TC–team cohesion; TS–task significance, TP–task proficiency; JS–job satisfaction. Standardized regression coefficients and standard errors are reported. * $p < 0.05$, ** $p < 0.01$.

**Table 3.** Indirect and total effects of ICT use for task and social functions on task proficiency and job satisfaction (moderated mediation model).

| **Indirect Effects of ICT-T on Task Proficiency and Job Satisfaction (through *M1, M2, M3*)** | | | | | | |
|---|---|---|---|---|---|---|
| | **Task Proficiency** | | | **Job Satisfaction** | | |
| Mediator | γ | 95% CI | | γ | 95% CI | |
| Job Autonomy (*M1*) | 0.000 | −0.002, | 0.001 | 0.001 | −0.003, | 0.004 |
| Team Cohesion (*M2*) | 0.002 | −0.002, | 0.006 | 0.002 | −0.004, | 0.009 |
| Task Significance (*M3*) | 0.000 | −0.002, | 0.001 | 0.000 | −0.003, | 0.001 |
| Total effects of **ICT-T** on Task Proficiency and Job Satisfaction | | | | | | |
| | Task Proficiency | | | Job Satisfaction | | |
| | γ | 95% CI | | γ | 95% CI | |
| Total | 0.007 | −0.022, | 0.039 | 0.011 | −0.037, | 0.059 |
| Total indirect | 0.001 | −0.003, | 0.006 | 0.003 | −0.005, | 0.011 |
| Conditional total effect at three levels of Age | | | | | | |
| −1 *SD* (−12.03) | 0.007 | −0.023, | 0.039 | 0.012 | −0.038, | 0.060 |
| *M* (0.00) | 0.007 | −0.022, | 0.039 | 0.011 | −0.037, | 0.059 |
| +1 *SD* (12.03) | 0.008 | −0.022, | 0.040 | 0.011 | −0.038, | 0.059 |
| Indirect effects of **ICT-S** on Task Proficiency and Job Satisfaction (through *M1, M2, M3*) | | | | | | |
| | Task Proficiency | | | Job Satisfaction | | |
| Mediator | γ | 95% CI | | γ | 95% CI | |
| Job Autonomy (*M1*) | −0.001 | −0.003, | 0.001 | 0.001 | −0.002, | 0.005 |
| Team Cohesion (*M2*) | 0.001 | −0.002, | 0.006 | 0.002 | −0.004, | 0.009 |
| Task Significance (*M3*) | 0.000 | −0.001, | 0.002 | 0.000 | −0.001, | 0.002 |
| Total effects of **ICT-S** on Task Proficiency and Job Satisfaction | | | | | | |
| | Task Proficiency | | | Job Satisfaction | | |
| | γ | 95% CI | | γ | 95% CI | |
| Total | 0.018 | −0.017, | 0.052 | 0.013 | −0.039, | 0.065 |
| Total indirect | 0.001 | −0.004, | 0.006 | 0.003 | −0.004, | 0.012 |
| Conditional total effect at three levels of Age | | | | | | |
| −1 *SD* (−12.03) | 0.014 | −0.022, | 0.049 | 0.011 | −0.043, | 0.064 |
| *M* (0.00) | 0.018 | −0.017, | 0.052 | 0.013 | −0.039, | 0.065 |
| +1 *SD* (12.03) | 0.019 | −0.016, | 0.053 | 0.012 | −0.041, | 0.064 |

Note. *N* = 1761. Unstandardized regression coefficients are reported. Bootstrap sample size = 5000.

**Table 4.** Conditional indirect effects of ICT use for task and social functions on task proficiency through task significance at three levels of age (moderated mediation model).

| | | **Task Proficiency (*Y*)** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **ICT for Task Functions (*X*)** | | | **ICT for Social Functions (*X2*)** | | |
| Mediator | Age | γ | 95% CI | | γ | 95% CI | |
| Task Significance (*M3*) | −1 *SD* (−12.03) | 0.000 | −0.004, | 0.004 | −0.002 | −0.008, | 0.001 |
| | *M* (0.00) | 0.000 | −0.002, | 0.001 | 0.000 | −0.001, | 0.002 |
| | +1 *SD* (12.03) | 0.000 | −0.001, | 0.003 | 0.000 | −0.003, | 0.001 |

Note. *N* = 1761. Unstandardized regression coefficients are reported. Bootstrap sample size = 5000.

## 6. Discussion

Digitalization and demographic change are two important megatrends that are shaping today's workplaces and organizations. Recently, scholars have highlighted the role of perceived work characteristics as mechanisms of the relationships between ICT use and employee outcomes [14]. This study contributes to the literature by presenting the

results of a longitudinal study on the role of age in relationships between ICT use for task and social functions, work characteristics, and the outcomes of task proficiency and job satisfaction. Specifically, based on an integration of the model of workplace ICT use and work design and socioemotional selectivity theory, we explored whether the assumed positive relationships between ICT use for task and social functions and task proficiency and job satisfaction are stronger for younger and older employees, respectively. In contrast to expectations, the results of the study—based on a relatively large sample of employees from various occupations—showed no empirical support for age-differentiated indirect and total effects of ICT use on work outcomes. Moreover, we also did not find significant effects of ICT use on work characteristics as proposed by the model of ICT use and work design. Findings regarding associations between work characteristics and employee outcomes were mixed. Some of these associations were in line with expectations and the literature [6,28]. In particular, we found positive associations of job autonomy and team cohesion with job satisfaction. Surprisingly, however, we found a negative association between job autonomy and task proficiency, and no significant associations between task significance and employee outcomes. These findings stand in contrast to much previous work, showing that job autonomy and task proficiency are positively related [28] and that task significance is a predictor of work motivation and performance [32]. Paradoxical effects might be an explanation. Increases in job autonomy through ICT could be undermined by perceptions of an extended monitoring through ICT, which is called the autonomy-control paradox [48].

### *6.1. Theoretical and Practical Implications*

Our findings have implications for theorizing on ICT use in the workplace and lifespan perspective on job design. First, using a relatively large sample and a lagged study design with three measurement waves, we found limited support for the recently proposed model of ICT use and work design [14], particularly for the proposed effects of ICT use for task and social functions on work characteristics and work outcomes. Our study represents an important first step in empirically testing the model by considering ICT use as a predictor of work characteristics and employee outcomes other than perceived usefulness, intention to use, and perceived ease of use of technology [10]. However, future conceptual development should consider that work characteristics are typically rather stable across time. That is, well designed work might not easily deteriorate by implementation or intensification of ICT use. There might also be other factors that are more important in shaping task proficiency and job satisfaction than ICT use. Moreover, future work should theorize on additional potential person-related and contextual boundary conditions of these effects. For example, at the individual level, ICT-related job crafting (e.g., seeking efficient ways of software use) could enhance meaningfulness of work and task significance [70]. In addition, Wang et al. [14] suggested that additional relevant moderators may reside at the organizational and team levels (e.g., technical support, organizational norms). A recent meta-analysis found that job autonomy as a moderator increased the relationship between ICT use and negative work outcomes such as stress [71]. In light of the persistent COVID-19 pandemic, future research could examine how forced ICT use and telecommuting as well as remote working arrangements affect employee well-being and performance [72].

Second, our findings suggest that ICT use for task and social functions does not have age-differentiated effects on work characteristics and work outcomes. Moreover, contrary to propositions of the lifespan perspective on job design [6], we were not able to detect age-differential effects of job resources (i.e., job autonomy, team cohesion, task significance) on employee outcomes, suggesting that these job resources are associated with outcomes independent of age. Future conceptual work could explore additional work characteristics (e.g., social support) that may be associated with ICT use for task and social functions. Moreover, individual differences other than age might play a greater role in these associations. Our findings also do not provide support for propositions of socioemotional selectivity theory, according to which employees prioritize socially meaningful goals over instrumental, knowledge-related goals as they become older. Importantly, socioemotional

selectivity theory was originally developed to explain motivational changes in old and very old age, albeit some support exists also in work settings [34,36]. A theoretical implication may be to carefully consider whether "older employees" are "old enough" to experience meaningful changes in goal priorities as hypothesized by socioemotional selectivity theory.

In terms of practical implications, we are very hesitant to issue recommendations to employees, human resource managers, and organizations given the limited support for our hypotheses. However, as noted by Ng and Feldman [4], no significant age-related differences (here: regarding the associations between ICT use, work characteristics, task proficiency, and job satisfaction) are also good news because they suggest that (a) neither younger nor older employees are disadvantaged by the use of ICT for certain functions, and (b) organizations can implement ICT use without worrying about potential age-differential effects. Indeed, different forms of ICT use did not lead to meaningful changes in work characteristics and employee outcomes for different age groups.

Furthermore, our results showed that team cohesion showed positive effects on task proficiency. Therefore, promoting team cohesion could be beneficial to an organization. The literature shows that communicating with colleagues through ICT can help reduce social isolation among employees working from home [56,57], hence, organizations could invest in the expansion of socially beneficial ICT structures.

Moreover, task significance interacted with age in predicting task proficiency, which supports findings that showed that older employees value fulfilling and meaningful jobs more compared to younger employees [37,38]. Hence, organizations should try to offer meaningful and intrinsically challenging tasks, especially to their older workers.

### *6.2. Limitations and Future Research*

This study has a number of limitations that could be addressed in future research. First, although distinct according to the CFA results, ICT use for task and social functions were strongly correlated, indicating a relatively large amount of conceptual overlap. The bivariate correlations suggest that ICT use for each of these two functions was significantly related to task proficiency and job satisfaction when ICT use for the respective other function was not accounted for in the analyses. Thus, based on conceptual considerations, future research should develop reliable and valid multi-item measures of these two ICT use functions that are more distinct. One reason for our results could be that the effects we hypothesized worked in the opposite direction, i.e., task significance, team cohesion, and autonomy decreased as a result of ICT use. In fact, Meske and Junglas [73] found in their study that autonomy and relatedness were associated with performance and well-being, which in turn were related with attitudes towards digital transformation of the workplace. Somewhat related to attitudes towards digital transformation, ICT use for different functions could be influenced by different work characteristics and well-being or subjective job performance.

Related to this point, future research could differentiate between instrumental and expressive social ties regarding ICT use. Research distinguishes between two types of social ties: "expressive ties are normative and affect based, whereas instrumental ties are information and cognition based" [74] (p. 742). It is not clear whether participants considered both types of social ties or only one of them when answering the question about ICT functions. It may be more likely that task-relevant information is transmitted via ICT and informational ties are fostered but relational aspects and corresponding expressive ties are falling short [14]. Nevertheless, substantial relationships were found between ICT motivation and the respective ICT use for information and social purposes [75]. The motives underlying ICT use can be divided into an instrumental orientation and a social interaction orientation [75,76]. Additionally, task interdependence may have been a confounding variable in our study, as ICT use for social functions may involve other team members, whereas ICT use for task functions does not rely on interdependence.

Second, our study is solely based on self-report questionnaires, which is not ideal [77]. While common method bias may not be a primary concern given the lagged assessments

and the tests of interaction effects, it could be questioned whether employees can reliably evaluate their ICT use and work characteristics. Moreover, self-reports of task proficiency may be inflated due to self-enhancement bias. Indeed, the relatively high means (>4.2; see Table 1) suggest a ceiling effect for task proficiency in our study.

Third, while the longitudinal study design is a strength of our study, the rather high autocorrelations (see Table 1) suggest that the time lags of one month may not be optimal for detecting changes in work characteristics and outcomes. Future studies could explore effects across longer time periods (e.g., 6 months) or examine the effects of interventions or experimental manipulations on these variables. Moreover, the COVID-19 pandemic may have caused more people to shift their work to the home office, and as research has shown [47], there were initially many stressors to working in a technologically under-equipped environment. The theoretically-assumed positive effect of ICT use may have been compromised by the impact of additional stressors when moving from the office to the home office.

## 7. Conclusions

Based on the model of ICT use and work design, as well as the lifespan perspective on job design and socioemotional selectivity theory, we investigated employee age as a moderator of the indirect and total effects of ICT use for task and social functions on task proficiency and job satisfaction. As potential mediators, we focused on job autonomy, team cohesion, and task significance. Overall, findings did not provide support for our hypotheses. Specifically, there was no empirical evidence for conditional total or indirect effects of ICT use on work outcomes through work characteristics. Thus, further conceptual and empirical research on the role of age for associations between ICT use, work characteristics, and employee outcomes is needed.

**Supplementary Materials:** The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/merits2030016/s1, Table S1: Descriptive statistics for industry; Table S2: Descriptive statistics for substantive variables for complete and incomplete responses; Table S3: Descriptive statistics of sex for complete and incomplete responses; Table S4: Descriptive statistics of occupational education for complete and incomplete responses; Table S5: Descriptive statistics of industry for complete and incomplete responses; Table S6: Correlations between the study variables.

**Author Contributions:** Conceptualization, C.D., P.B. and H.Z.; methodology, C.D.; formal analysis, C.D.; data curation, C.D. and P.B.; writing—original draft preparation, C.D., P.B. and H.Z.; writing—review and editing, C.D., P.B. and H.Z.; supervision, C.D. and H.Z.; project administration, C.D.; funding acquisition, H.Z. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was funded by the German Federal Ministry of Labour and Social Affairs, the European Social Fund, and the Saxon Ministry for Economy, Labour and Transportation.

**Institutional Review Board Statement:** Ethical review and approval were waived for this study because the study was planned and executed in line with the ethical guidelines of the German Psychological Society (DGPs). The study surveyed adult volunteers via online questionnaires containing no physical or emotional risks.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Publicly available datasets were analyzed in this study. This data can be found here: https://osf.io/gb83y/ (accessed on 9 March 2022).

**Conflicts of Interest:** The authors declare no conflict of interest.

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