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Winners and Losers of Telework? A Meta-Analysis of the Predictive Validity of Teleworker's Personality for Performance

Caja Hoffmann, Henning Nißen, Linov
Scheel, and Luke Willim

Author Note

This paper was written by students participating in a course in Work and Organizational Psychology at Kiel University.

Institute of Psychology
Christian-Albrechts-University
D-24098 Kiel
Germany
Fax: +49 431 880 4878

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Abstract

This meta-analysis investigates the relationship between teleworkers' personality traits and his/her performance. Drawing on Tett and Burnett's (2003) trait activation theory and the Big Five model in personality theory (Costa & McCrae, 1992), this research also examines if social, organizational, and task characteristics moderate these associations. Ten studies with 23 effect sizes were included in a random-effects model. The results established significant small positive effect sizes for emotional stability and conscientiousness with teleworkers' job performance and correspond with and expand prior research. No significant negative relation between extraversion and teleworkers' job performance was found which contradicts prior research. Task interdependence moderated the relation between emotional stability and conscientiousness with job performance. However, due to the low number of studies and their overall moderate study quality, this review can only draw preliminary conclusions.

Keywords: telework, telecommuting, personality traits, performance, extraversion, conscientiousness, emotional stability

Winners and Losers of Telework? A Meta-Analysis of the Predictive Validity of Teleworker's Personality for Performance

In the European Union the percentage of individuals with Internet access at least once a week has risen from 62% in 2010 up to 84% in 2019 (Eurostat, 2020). In the year 2020, the CORONA pandemic accelerated the digital transition of companies and public administrations (Craglia et al., 2020; EU Science Hub, 2020). The proportion of employees in Europe working remotely from home rose up to 48% in the first half of 2020 (Eurofund, 2020). This suggests a paradigm shift: Teleworking is now widely supported by the management and is also accepted by employees (EU Science Hub, 2020).

Recent reviews of more traditional, non-remote work settings have demonstrated that employees' personality traits are important predictors of job performance (Rotundo & Rotman, 2002) across tasks, organizational settings and cultures (e.g., Barrick & Mount, 1991; Tett et al., 1999; van Aarde et al., 2017). However, less research has been devoted to exploring the role of personality traits in telework settings, both at the individual and team level (Allen et al., 2015; Gajendran & Harrison, 2007; Konradt, Schmook, & Malecke, 2000; O'Neill et al., 2009).

There are some contradictions in the last to decades' research on the link between teleworkers' personality and performance. Researchers agree on the positive relationship between job performance and conscientiousness in jobs, though for different reasons. In terms of personality traits such as emotional stability and openness to experience significant findings are rare. Also, findings in a telework context regarding the effect of proactive behavior on job performance are scarce. Recent results indicate in both cases a negative effect on job performance. The underlying mechanisms beneath and the moderators of these relations remain rather unclear.

Despite the importance of personality traits to predict teleworkers' performance – to the best of our knowledge – little research has attempted to systematically examine the research available (Gajendran & Harrison, 2007; O'Neill et al., 2009; Siddaway et al., 2019). The purpose of this paper is thus to provide an updated and theory-driven meta-analysis of the association between personality traits and performance among teleworkers. This meta-

analysis is supposed to synthesize available literature in order to evaluate an existing theory and possibly adapt it, so an explanation for how findings fit together (Siddaway et al., 2019). Drawing on Tett and Burnett’s (2003) trait activation theory and the Big Five model in personality theory (Costa & McCrae, 1992), this research also examines if social, organizational, and task characteristics moderate these associations. This study both theoretically and empirically contributes to the literature. Theoretically, we provide an empirical test of Tett and Burnett’s (2003) theory in a highly significant remote work setting. We also expand our understanding in personnel psychology by examining the value of personality traits to predict performance. Our results also address critical gaps that could inform theory refinement and future research (Siddaway et al., 2019). Empirically, we extend our understanding of if, and to what extent organizations could use evidence-based design to optimize their leadership, placement, and personnel development strategies based on employees' personality traits.

Theoretical Background

Definitions and Types of Telework

In scientific literature, there exist several different kinds of working away from a company’s premises. Table 1 provides an overview about the different constructs.

Table 1
Sample of Telework Definitions used in Literature

Term	Definition	Publication
Distributed work / team	Groups of geographically dispersed employees with a common goal who carry out interdependent tasks using mostly technology for communication and collaboration.	Bosch-Sijtsema et al. (2009)
Flexible work	Work arrangement with flexibility in (terms of) the 1. scheduling of hours worked, 2. amount of hours worked, and / or 3. place of work.	Georgetown University Law Center (2006)
Mobile work	Work arrangements in a mobile context, with mobile workers, mobile technologies and / or mobile tasks.	Zheng & Yuan (2007)

Remote work	Work arrangements, where workers are remotely located and interact (collaboratively) crossing geographic, language, and cultural boundaries.	Veinott et al. (1999)
Working from home	Work arrangements, where workers partly or totally work from their home	Own definition
Telecommuting	Distributed work enabled by information technologies.	Shin et al. (2000)
Telework	Defined as reduction of commuting distance by working at home, taking place in non-traditional satellite offices, tele cottages, or neighborhood offices.	Shin et al. (2000)
Virtual work / team	Work arrangements with geographic dispersion and dependence on technology in work-related interactions between employees.	Raghuram et al. (2019)

Personality at Work and its Predictive Validity of Job Performance

Personality is a broad term that refers to relatively enduring styles of thinking, feeling, and acting (McCrae & Costa, 1997). In organizational settings, personality traits have shown to predict relevant work-related outcomes such as motivations, behavior, and other outcomes across situations and over time (Judge et al., 2014; Oswald & Hough, 2011). Specifically, Barrick and Mount (1991) have shown that personality plays a role in terms of various job performance criteria. Job performance, as the central outcome refers to the expected value an organization an individual's discrete behavioral episodes over a period of time have (Motowidlo & Keil, 2012). It is a measure of productivity, for instance of assignment completion (Gajendran & Harrison, 2007; Konradt et al., 2000; O'Neill et al., 2009).

Among the most useful theoretical frameworks of personality traits are the five-factor personality model (FFM), and the HEXACO (six-factor) model. According to the FFM (Costa & McCrae, 1995, 1997), personality is organized in the five factors of emotional stability, neuroticism, extraversion, agreeableness, conscientiousness, and openness. The HEXACO model (Ashton & Lee, 2001) includes three factors rather similar to the FFM dimensions extraversion, conscientiousness, and openness to experience, as well as the differing dimension honesty-humility, whilst agreeableness and emotionality share some interleave with the corresponding FFM dimensions (De Vries et al., 2016). A vast amount of literature

demonstrated that conscientiousness is a valid predictor of job and training proficiency across different occupational groups (Barrick & Mount, 1991), as well as of job achievement (Dudley et al., 2006). In terms of extraversion the Barrick and Mount (1991) demonstrated how it predicted training proficiency, whereas in terms of the other Big Five reported statistical figures remained relatively low. What we know about the personality-job performance linkage is largely based upon studies that investigate the relation unidirectional (Tett et al., 1999). Evidence suggests that personality-job performance relations can vary in direction as a function of rarely reported situational factors, it therefore stacks up to consider such bi-directionality (Tett et al., 1999).

Personality and Telework

In telework settings, personality can be an important psychological factor which influences motivation and effort in distributed work arrangements (Hertel et al., 2006). O'Neill et al. (2009) attempted to evaluate how the personality traits *organization*, *diligence*, and *sociability* were stronger related to teleworker effectiveness than to non-teleworker success. Only did the investigated trait *sociability* correlate significantly and negatively with performance, and to a greater extent in the telework sample than in the non-telework sample (O'Neill et al., 2009). O'Neill et al. (2009) and Schulze and Krumm (2017) empirically supported the claim that highly sociable teleworkers exhibit lower performance.

Clark, Karau and Michaelisin (2012) have argued that more conscientious individuals diligently follow their work responsibilities no matter whether they work from home or an office, which suggests a higher performance.

Tett and Burnett (2003) Personality Trait-Based Model of Job Performance

Tett and Burnett's (2003) trait activation theory explains how personality traits are related to job performance. According to the theory, individuals express their traits when presented with trait-relevant situational cues. There are three types of trait-relevant cues which elicit trait-relevant behavior: organizational, social, and task-related.

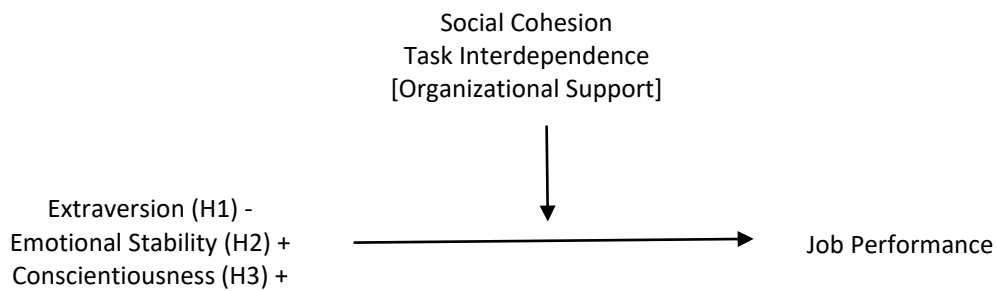


Figure 1. The Meta-Analytical Model of Personality Traits and Job Performance in Telework.

Evidence of the Tett and Burnett's Model

Judge and Zapata (2015) confirmed trait activation theory (Tett & Burnett, 2003). They specified the effects of the situation, and the degree to which these influence the performance-personality linkage (Judge and Zapata, 2015). They found a stronger positive relationship between conscientiousness and job performance in jobs which require independence (Judge & Zapata, 2015). Also, Judge and Zapata (2015) registered a more positive extraversion-job performance correlation in occupations which require social skills, a high level of competition and dealing with unpleasant and angry people, and the job requirement social skills positively predicted the relationship between emotional stability and job performance.

Personality researchers have claimed and empirically proven that individuals seek out situations which are congruent with their personalities (Judge & Cable, 1997). Meta-analytic evidence suggests that certain personality traits correlate with job performance (Barrick & Mount, 1991).

Conscientiousness

Conscientiousness is an important factor in predicting job performance. Conscientious people tend to be organized, self-disciplined, diligent, accurate, and responsible (Barrick & Mount, 1991). McCrae and Costa (1987) describe them as "purposeful and adhering to plans, schedules, and requirements". In traditional work settings more conscientious people tend to have better job performance evaluations than less conscientious ones (Barrick & Mount, 1991). It has been argued that teleworkers need to establish a work routine and be able to work independently and to properly manage their time (Haddon & Lewis, 1994). O'Neill, Hambley, and Chatellier (2014) demonstrated that highly conscientious individuals engaged

more readily in self-management tactics when performing distributed work (Schulze & Krumm, 2017). Also teleworkers ought to be ambitious, self-disciplined, and conscientious (Clark et al., 2012; Pratt, 1984). Clark et al. (2012) suggest conscientiousness may operate rather similarly across traditional and telecommuting contexts: Conscientious individuals might be expected to attend diligently to work responsibilities, independently of the work location (office vs. offsite).

Extraversion

Another important factor in predicting teleworkers' job performance is extraversion. It is a personality trait associated with descriptions of persons as "sociable, fun-loving, affectionate, friendly, and talkative" (McCrae & Costa, 1987) who enjoy debating and more frequently participate in group interactions than less extraverted individuals (Barry & Stewart, 1997). At a university level Bartone (2013) discovered that the student's extraversion level was negatively linked to the performance measures, final team grade and contribution to the joint grade. At a broader level however, researchers found out that highly sociable teleworkers exhibited lower performance (O'Neill et al., 2009; Schulze & Krumm, 2017). According to Clark et al. (2012) extravert persons may perceive a misfit between their personality and telecommuting. For instance, highly extroverted individuals are warned on CareerBuilder.com that they might miss the spontaneous and immediate social interaction provided in conventional offices when telecommuting (Clark et al., 2012). MacDonnell et al. (2009) surmised that introverts maintain a higher task focus than extraverts. Moreover, these might be frustrated in telework environments because the virtual communication systems hinder relationship building (MacDonnell et al., 2009).

Neuroticism / Emotional Stability

Persons high in neuroticism are characterized by a tendency to negative thoughts, worries, and self doubts (McCrae & Costa, 1987). Barrick and Mount (1991) pointed out that in traditional work settings the relation between emotional stability and job performance were quite low, which could be because of a certain self-selection as "emotionally stable enough" meaning that in order to permanently work in a place an employee will have a certain emotional stability. However, in a newer article Barrick et al. (2001) identify emotional stability as a valid predictor of overall work performance. One could assume that these negative feelings associated with neuroticism / emotional instability result from or intensify with social interactions. As these are less frequent in virtual work settings, it may be

reasonable that those negative emotions are less present and performance increases.

We used these three factors out of the Big-Five, because neuroticism, extraversion, and conscientiousness provided the most empirical data and theoretically let us expect the highest effect on teleworkers' job performance (Judge & Zapata, 2015; Haddon & Lewis, 1994; O'Neill, Hambley, & Chatellier, 2014; Clark et al., 2012; Schulze & Krumm, 2017; O'Neill et al., 2009; Barrick & Mount, 1991; Barrick et al., 2001). Thus we are not examining the effect of personality on teleworkers' job performance in general, but rather the effect of these three personality facets, as well as three others on it.

Hypotheses

Our theoretical model is displayed in Figure 1. On the basis of existing theory and research we hypothesize that among teleworkers extraversion is negatively related to job performance (H1), while emotional stability (H2) and conscientiousness (H3) are both positively related to job performance. We also determine the moderating effect of (a) task interdependence, (b) social cohesion, (C) organizational support on the personality-performance link.

H1a: The extent of task interdependence (task level) when teleworking moderates the relationship between extraversion and job performance to the extent that extroverted people score higher in job performance if they do tasks with higher task interdependence.

H2a: The extent of task interdependence (task level) when teleworking moderates the relationship between emotional stability and job performance to the extent that individuals with low scores of emotional stability score lower in job performance if they do tasks with higher task interdependence.

H3a: The extent of task interdependence (task level) when teleworking does not moderate the relationship between conscientiousness and job performance.

(b): In general, we hypothesize that the extent of social cohesion moderates the relationship between personality traits and job performance to the extent that individuals with high scores of social support when teleworking score higher in job performance.

(c): In general, we hypothesize that the extent of organizational support moderates the relationship between personality traits and job performance to the extent that individuals score higher in job performance if the organizational support is high.

Method

Literature search

Relevant studies were detected in two ways. Firstly, we carried out a keyword search on Web of Science, PsycInfo and Business Source Premier. Titles, abstracts and keywords were searched with the following syntax: ("big two" OR "self-discipline" OR "job autonomy" OR "proactive" OR "openness" OR "agreeableness" OR "personality" OR "Big Five" OR "Big-Five" OR "Big-six" OR "Big six" OR "Big-5" OR "Big 5" OR "Big-6" OR "Big 6" OR "Ocean" OR "Trait" OR "extr*version" OR "intr*version" OR "neuroticism" OR "emotional stability" OR "conscientiousness" OR "character" OR "HEXACO" OR "five*factor*model" OR "six*factor*model") AND ("performance" OR "success" OR "productivity" OR "achievement" OR "quality" OR "efficiency") AND ("telework*" OR "telecommut*" OR "home working" OR "working from home" OR "e-work" OR "home office" OR "computer-mediated-work" OR "work-at-home" OR "ICT" OR "homeoffice" OR "mobile-work" OR (("distribut*" OR "virtual" OR "remot*" OR "connect*" OR "flexible" OR "home-base*" OR "mobile" OR "distance*" OR "autonom*") NEAR/2 ("office" OR "work*" OR "team*" OR "schedul*" OR "workplace*" OR "organizat*")))). Secondly, we requested unpublished data by contacting researchers who published more than one paper in this area. However, this did not lead to additional findings. This search yielded 1,506 records.

Inclusion and Exclusion Criteria

The time criterion was set from 2000 to January 12th, 2021. We decided to exclude data before January 1st 2000 as the broadband connection enlarged with the year 2000 (Telekom, 2020), which is an important prerequisite for higher teleservices. We concentrated on primary research using quantitative methods measuring at least one of our criterion personality traits (extraversion, emotional stability/neuroticism, conscientiousness) and one kind of job performance in the telework context. In order to obtain a sufficient number of studies, a variety of performance measures were included. However, it was important that these would have some kind of impact on the success of the task/enterprise. Research with the following characteristic was excluded: qualitative designs. In the end, 10 studies (see Figure 2) with a total of 35 effect sizes were eligible for inclusion.

Coding Procedure

In a preliminary screening duplicates were excluded. Of the remaining 1,495 studies those which (a) investigated in a telework and/or virtual team context, (b) measured the job performance as outcome variable, and (c) measured personality traits as income variables were (manually) included. This process was performed by four judges.

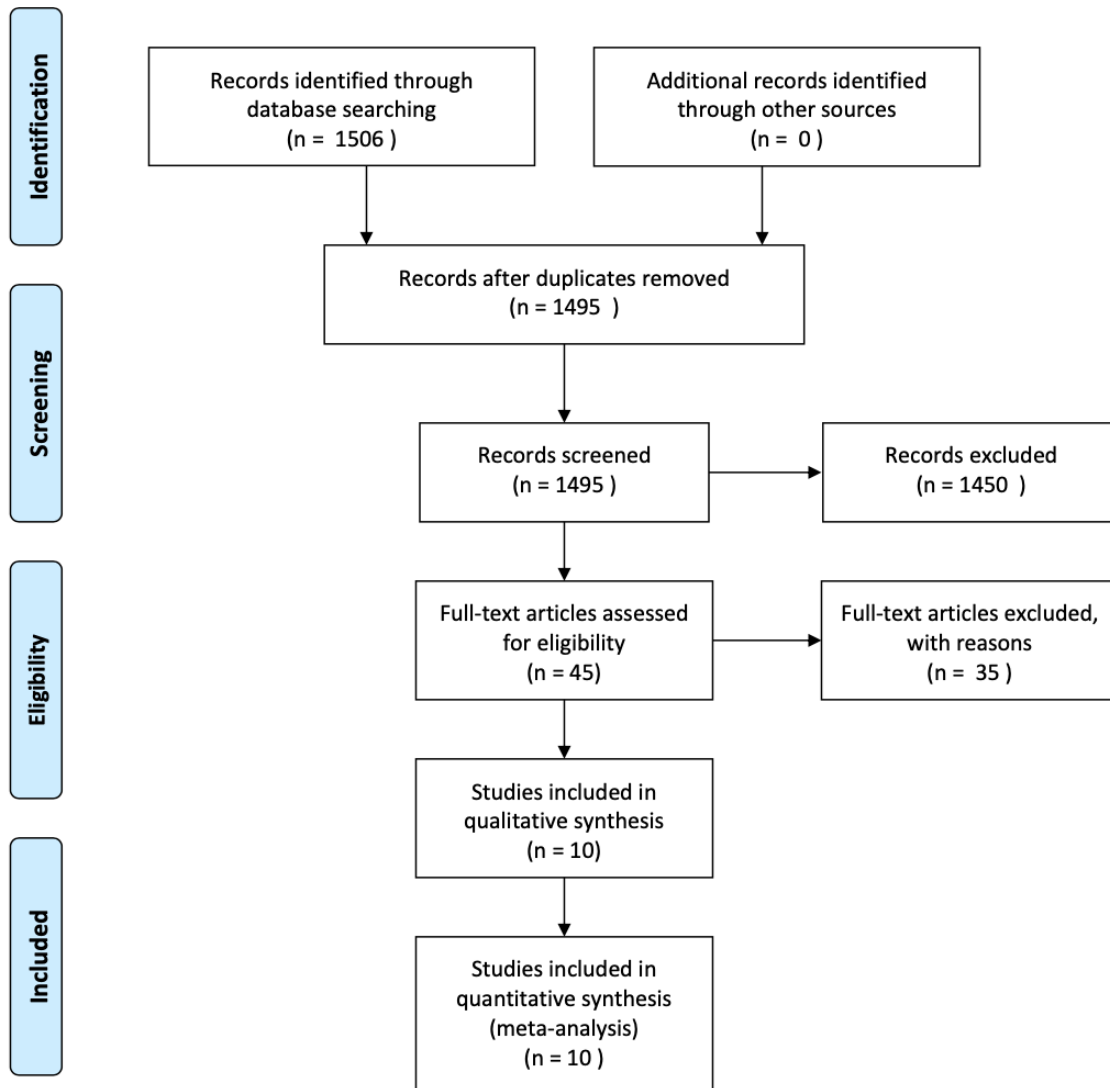


Figure 2. Flow chart of the exclusion and inclusion process.

Two reviewers with no prior experience used a standardized coding format to extract data from studies and coded the whole set of studies separately. After the first coding run, both raters compared their findings. They revised the coding manual. Existing discrepancies and ambiguous definitions were corrected. The revised coding manual (see Appendix A) was

the foundation for another coding run of the whole set of studies which was performed by the same two coders. The average interrater reliability was calculated on this final coding run using the software SPSS (version 22.0.0.0). The Cohen's kappa coefficient was $\kappa = .86$, which can be regarded as an almost perfect result (Landis & Koch, 1977). Any disagreements were resolved by consensus. The studies used self-reports (50.0%), expert/superior-ratings (20.0%), both of the aforementioned (20.0%) or other objective measurements (10.0%) in order to assess performance.

Final Sample

The final sample consists of ten studies - eight of these journal articles, two dissertations - published between 2004 and 2014. Typical designs were field or quasi-experimental. The mean age in the sample was 29.7 years (range 17-58). The average proportion of women was 51%.

The personality traits were measured through questionnaires in all studies. A particularity was that some studies out of the teamwork context aggregated personality traits at team level (eg. team level of extraversion). We decided to interpret these measurements as person variables, with the sample size reduced to the number of teams.

Our criterion job performance was measured more inconsistently. Job performance was mostly measured through self-ratings, in very few cases through co-worker or expert ratings. The measures included performance, cyberslacking (inverse), engagement and Organizational Citizenship Behavior.

Detailed descriptions of the tasks were scarce and homogeneous measures do not exist. We operationalized task interdependence by classifying if the tasks did include teamwork or did not. This approach underlies the assumption that task interdependence is higher in tasks which require teamwork than in tasks which are performed alone. Therefore studies with teamwork tasks were coded as high in task interdependence, whereas studies without teamwork were coded as low in task interdependence.

As there was almost no information about communication or social interaction during task performance we included all measures that yielded some sort of social unity. This social factor includes measures of professional isolation (inverse), social support, team cohesion, loneliness, cohesion, and interpersonal trust. We ensured that interpersonal trust or social support were measured as task-related states and not as personality-based traits.

We account for organizational support by coding the measures of feedback, interaction with supervisor, and regular upward communication. Due to the low number of these measures in the selected studies we were not able to perform further analyses. The reported measures were converted on a uniform Likert scale in order to be able to divide the studies via a median split into a dichotomous variable for later analyses. As a third moderator variable the degree of telework intensity was analyzed.

Statistical Adjustments

Forty-four measures were not independent as they originated from the same study. Where possible, we considered this dependency by calculating composite correlation (Schmidt & Hunter; 2015). In those cases where the correlation between the dependent measures was not available, we computed the mean correlation for both relations. Through this procedure our effect sizes reduced from 35 to 23 (see Table 2).

Table 2

Summary of Final Effect Sizes for Meta Analysis

Study	<i>N</i>	Personality trait	Task inter-dependence	Organizational support	Social cohesion	<i>r</i>
O'Neill et al. (2009)	78	EX	low			-.34
O'Neill, Hambley, & Chatellier (2014)	148	EX	low	1 ^a		.29
Cogliser et al. (2012)	71	EX	high		low	-.06
Balthazard et al. (2004)	63	EX	high		high	.13
MacDonnell et al. (2009)	285	EX	high		high	-.08
Vasilatos (2010)	15	EX	high			-.07
Venkatesh & Windeler, (2012)	47	EX	high		low	.05
Venkatesh & Windeler (2012)	44	EX	high		low	.08
Cogliser et al. (2012)	71	ES	high		high	.12
O'Neill, Hambley, & Bercovich (2014)	94	ES	low			.18
O'Neill, Hambley, & Chatellier (2014)	148	ES	low	1 ^a		.36
Vasilatos, O.R. (2010)	15	ES	high			-.11

Study	<i>N</i>	Personality trait	Task inter-dependence	Organizational support	Social cohesion	<i>r</i>
Venkatesh & Windeler (2012)	47	ES	high		low	.07
Venkatesh & Windeler (2012)	44	ES	high		low	.10
Cogliser et al. (2012)	71	C	high	-	high	.10
Glikson et al. (2019)	80	C	high	-	-	-.04
Hertel et al. (2006)	242	C	high	-	-	.12
O'Neill et al. (2009)	78	C	low	-	-	.18
O'Neill, Hambley, & Bercovich (2014)	94	C	low	-	-	.34
O'Neill, Hambley, & Chatellier (2014)	148	C	low	1 ^a	-	.38
Vasilatos (2010)	15	C	high	-	-	-.32
Venkatesh & Windeler (2012)	47	C	high	-	low	.14
Venkatesh & Windeler (2012)	44	C	high	-	low	.15

Note. Each study provides one effect size per personality trait for the meta-analysis. Venkatesh and Windeler (2012) provide two effect sizes per personality trait because they examined and reported effect sizes from two independent sample sizes. *r* = correlation between personality trait and job performance. EX = extraversion; ES = emotional stability; C = conscientiousness. ^a 1 = Organizational support was reported.

To correct for the unreliability, we used the procedure described by Schmidt and Hunter (2015). If the reliabilities were not reported, we imputed the average of the reported reliabilities regarding the same measure of job performance.

Methodological Quality and Statistical Power Assessment

Methodological quality was coded and the statistical power of the primary studies computed. Methodological quality of the included studies was evaluated by using 10 scored items (see Table B1). The individual scores were combined to calculate a summary score per study (see Table B2). The minimum score a study could achieve was 1, the maximum score a study could achieve was 18. The quality of the studies ranged from 6 to 14, with a mean score of 10.7 and a median of 10.5. Quality of the studies altogether can be regarded as moderate. Using G*Power (Faul et al., 2007) the post-hoc power of each study (mean = .46, median = .38, range: .06 to .99) was assessed.

Statistical Methods

The quantitative analysis was conducted with "R" using the "metafor" package (Viechtbauer, 2010). The main hypothesis was tested using a random-effects model, and the moderator hypotheses were tested using a mixed-effects model. The heterogeneity was estimated using the Hunter-Schmidt estimator (Schmidt & Hunter, 2015). The Knapp and Hartung adjustment was used to address the uncertainty of the estimate of τ^2 (Knapp & Hartung, 2003). All analyses were tested with a significance level of .05. Analyses were conducted when more than one effect size was present.

Sensitivity Analysis

To assess outliers or influential cases firstly, the "influence()" function of the "metafor" package (Viechtbauer, 2010) was used. Secondly, a cumulative meta-analysis (Schmidt & Hunter, 2015) was conducted, thirdly, the Egger Test (Egger et al., 1997). Lastly, a meta-analysis with the study quality as a moderator, in order to test for influences of methodological differences, was conducted.

Results

Figure 3 gives an overview of the studies' effect sizes and confidence intervals. Hypothesis 1 predicted that extraversion would be negatively related to job performance. Our meta-analytic findings do not support this hypothesis. The average correlation was .00 ($k = 8$, $n = 751$, 95% CI = -.23 to .23), not significant. The Q statistic was significant ($I^2(7) = 29.84$, $p < 0.001$), indicating the presence of moderators.

Hypothesis 2 predicted that emotional stability would be positively associated with job performance. The significant positive true score correlation of .24 ($k = 6$, $n = 419$) provides support for the hypothesis. The 95% CI ranged from .07 to .41. There was low heterogeneity ($I^2 = 21.9$) and the Q statistic was not significant ($I^2(5) = 7.89$, $p > 0.05$).

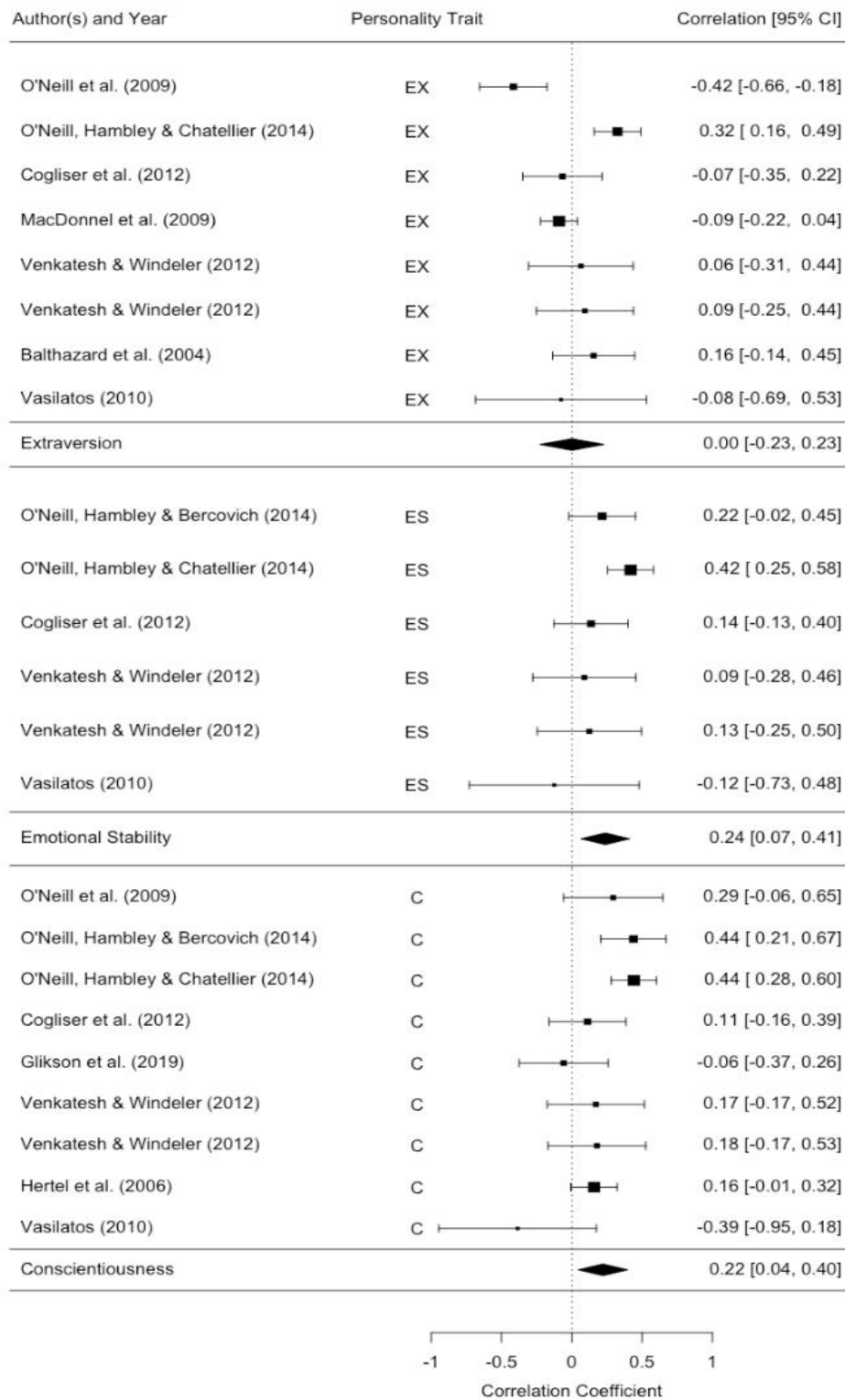


Figure 3. Forest plots of the studies for each personality trait. Below each set of studies, the computed true score correlation is indicated. EX = extraversion; ES = emotional stability; C = conscientiousness. Venkatেশ and Windeler's (2012) study is mentioned twice, as it provided two independent effect sizes of two different work settings with two different samples.

Hypothesis 3, which predicted that conscientiousness is positively associated with job performance, was supported. The estimated correlation is .22 and significant (95% CI = .04 to .4). The Q Statistic is also significant indicating the presence of a moderator ($I^2(8) = 20.76, p < .01$).

Moderators

In order to determine whether the task characteristics moderate the relationship between the personality traits and performance, we conducted a moderator-analysis for each personality trait and each proposed moderator of the relation with job performance. Table 3 provides a detailed overview of the results of these analyses.

Regarding the interaction between extraversion and task interdependence the test for moderators was not significant ($F(1,6) = 0.21, p = .66, \Delta R^2 = .09$). This suggests that the level of task interdependence does not moderate the relationship between extraversion and job performance.

The moderation analysis of task interdependence as a moderator of the relation between emotional stability and performance was not significant ($F(1,4) = 7.03, p = .06, \Delta R^2 = 1.00$). This, Hypothesis 2a was not supported.

The analysis of the effect of task interdependence on the relationship between conscientiousness and performance was significant ($F(1, 7) = 15.30, p = .01, \Delta R^2 = 1.00$). This, Hypothesis 3a was not supported.

We tested the influence of social cohesion on the relationship between personality and performance. The test of interaction of extraversion and social cohesion was not significant ($F(1, 3) = .30, p = .62, \Delta R^2 = .00$). The analysis of the moderating effect of social cohesion on the relation between emotional stability and performance was also not significant ($F(1,1) = 1.439, p = .44, \Delta R^2 = .00$). The moderating effect of social cohesion on conscientiousness and performance was also not significant ($F(1, 1) = 114.99, p = .06, \Delta R^2 = .00$). Overall, a moderating effect of social cohesion on the relationship between personality and performance could not be found. The moderating effect of organizational support could not be tested due to the lack of studies. Only one study included data about the variable organizational support.

Table 3

Meta-analytical Results for Main Effect and Moderator Analyses

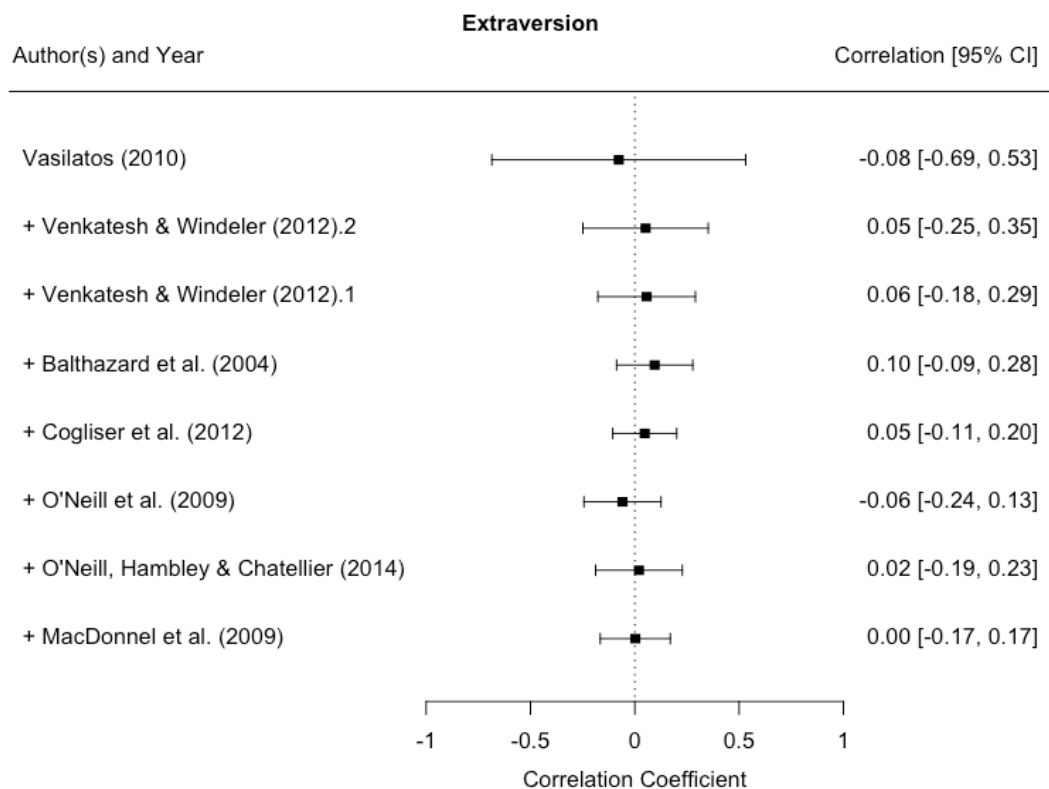
Variable	<i>k</i>	<i>n</i>	Mean <i>r</i>	Estimated ρ	95% CI	<i>Q</i>	<i>I</i> ²
All outcomes							
Extraversion	8	751	.00	.00	-.23, .23	29.84**	70.86
Emotional Stability	6	419	.20	.24	.07, .41	7.47	17.65
Conscientiousness	9	819	.17	.22	.04, .40	19.13**	51.10
Moderators							
Extraversion							
Interdependence (low)	2	226	.07	.07	-.34, .48	27.98***	65.09
Interdependence (high)	6	525	-.03	-.03	-.34, .29	27.98***	65.09
Social (low)	3	162	.01	.01	-.28, .31	2.85	.00 ^a
Social (high)	2	348	-.04	-.05	-.24, .14	2.85	.00 ^a
Organizational	1	-	-	-	-	-	-
Emotional Stability							
Interdependence (low)	2	242	.29	.34	.19, .49	2.52	.00 ^a
Interdependence (high)	4	177	.08	.10	-.10, .30	2.52	.00 ^a
Social (low)	2	91	.08	.11	-.12, .33	.02	.00 ^a
Social (high)	1	71	.12	.12	-.09, .37	.02	.00 ^a
Organizational	1	-	-	-	-	-	-
Conscientiousness							
Interdependence (low)	3	320	.32	.40	.27, .54	5.24	.00 ^a
Interdependence (high)	6	499	.08	.10	-.01, .22	5.24	.00 ^a
Social (low)	2	91	.14	.17	.13, .22	.00	.00 ^a
Social (high)	1	71	.10	.11	.06, .17	.00	.00 ^a
Organizational	1	-	-	-	-	-	-

Note. The results of the moderator analyses were reported for categorical variables with at least two studies. *k* = number of samples; *n* = total sample size; *r* = sample-size-weighted mean observed correlation; ρ = mean true score correlation; 95% CI = 95% confidence interval; *Q* = test for homogeneity; *I*² = percent of true heterogeneity.

^a Additional analyses indicated that the lack of heterogeneity is attributable to the overlapping confidence intervals and the basis of primary study's small sample sizes. **p* < .05, ***p* < .01, ****p* < .001.

Sensitivity Analysis

The sensitivity analysis of the metafor package (Viechtbauer, 2010) indicated the effect sizes of the study of O'Neill, Hambley and Chattelier (2014) as influential cases for extraversion and emotional stability. A further possible influential effect size came from study of MacDonnell et al. (2009) in the extraversion subset. We have not excluded these because of the generally critically low sample size, but have to keep these in mind for the interpretation of the results. Figure 4 shows the result of a cumulative meta-analysis. While the plot for extraversion is unremarkable, there are two peculiarities in the emotional stability and conscientiousness plots: Firstly, in the emotional stability plot, it is visible that the aforementioned study of O'Neill, Hambley and Chattelier (2014) triggers a drift of the plot. Secondly, the negative effect sizes of Vasilatos (2010) seem to have a great impact, especially in the conscientiousness data set.



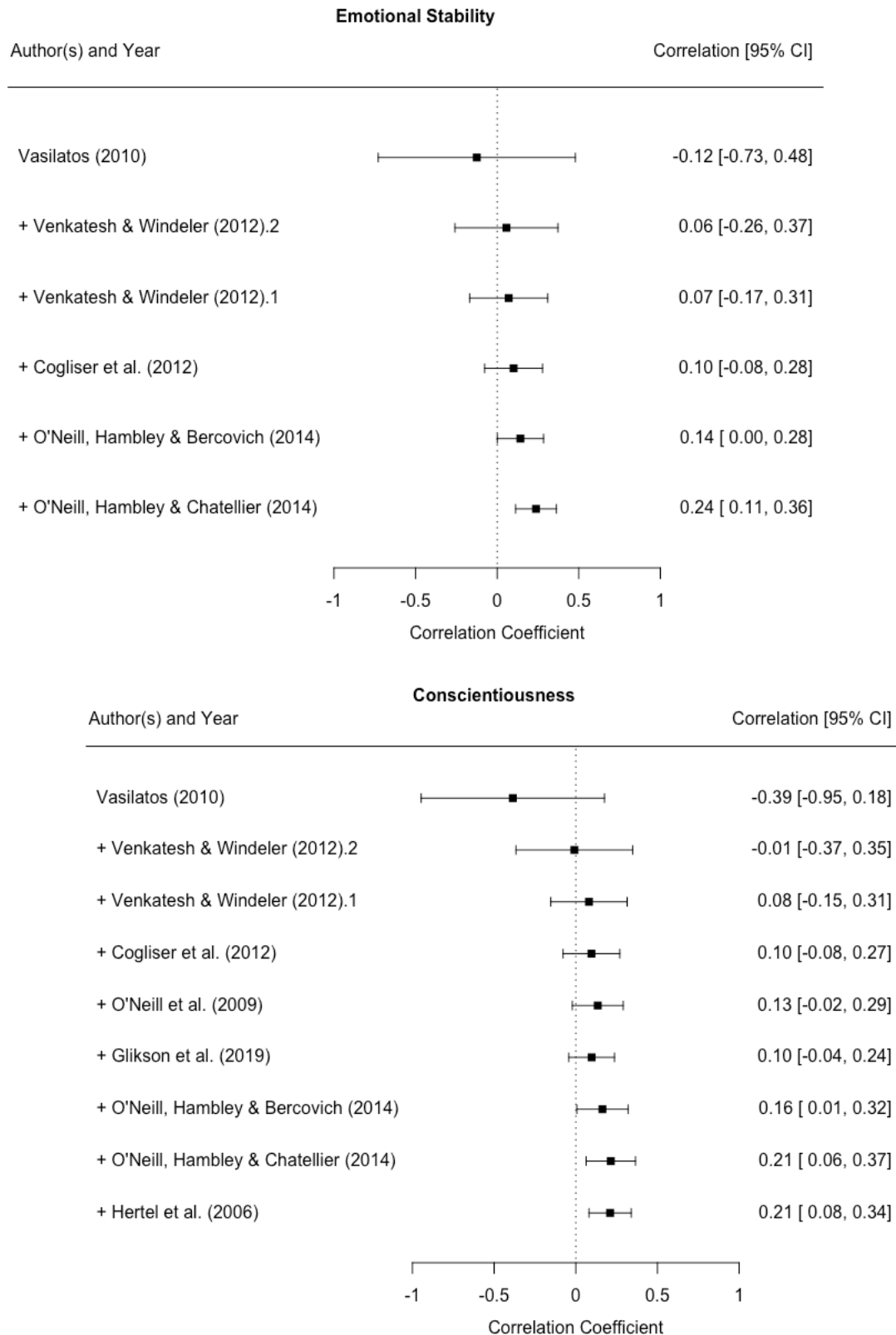


Figure 4. Forest plots illustrating the results of the cumulative meta-analysis ranked on sample sizes for each personality trait. The study of Venkatesh and Windeler (2012) is mentioned twice as it provided two effect sizes from two independent samples.

Further metaregressions were conducted to explore the robustness of our results. We included the studies' quality as a moderator of our prior main analyses. All tests for moderators, performed for each subset of the personality traits, were not significant (extraversion: $F(5,2) = 1.61, p = .43$; emotional Stability: $F(3,2) = 0.82, p = .59$; conscientiousness: $F(4,4) = 1.99, p = .26$). This indicates that the quality of the studies did not bias any of the three analyses.

Test for Publication Bias

To test for publication bias, an analysis for the complete data set as well as for the subsets of each personality trait was conducted. Figure 5 shows the funnel plots for each of the four datasets.

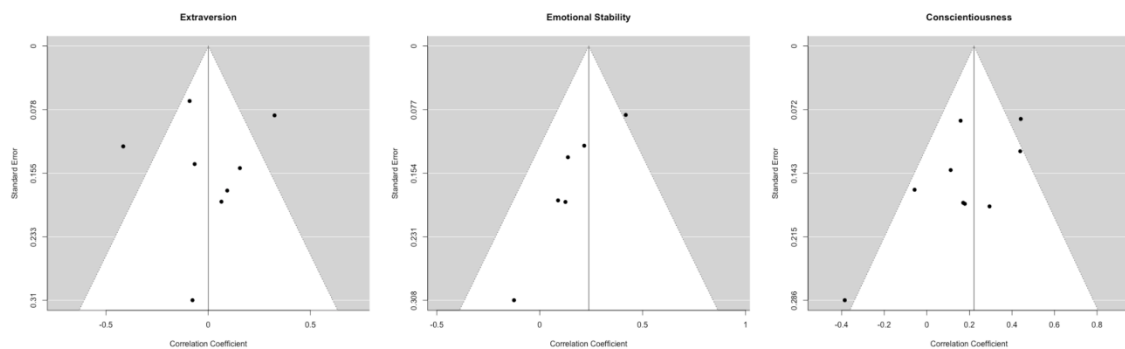


Figure 5. Funnel Plots for each data subset to illustrate possible publication biases.

The Egger Test (Egger et al., 1997) was conducted for quantitative purposes. The analyses yielded a significant result for the subset of studies regarding emotional stability ($t(4) = -4.36, p = .01$), whereas the analyses of extraversion ($t(6) = .00, p = .99$) and conscientiousness ($t(7) = -1.53, p = .17$) were not significant. It should be noted, however, that in the case of emotional stability, since the skewness goes in the wrong direction, we cannot speak of a classic publication bias. While the publication bias assumes that there are unpublished non-significant studies, the plot for emotional stability would suggest that there must be unpublished significant studies. However, this is rather unlikely.

Discussion

This meta-analysis seeks to find out whether there is an effect of the personality traits extraversion, emotional stability, and conscientiousness on teleworkers' job performance. The results indicate positive significant relations for conscientiousness and emotional stability, but not for extraversion. Not having found a significant negative relation between extraversion and teleworkers' job performance contradicts previous results of Bartone (2013), O'Neill et al. (2009), Schulze and Krumm (2017), Clark et al. (2012) and MacDonnell et al. (2009). The positive relation between emotional stability and job performance in telework corresponds with Barrick, Mount, and Judge's (2001) results in traditional work settings. Emotional stability could therefore be seen as a valid predictor of job performance in any work setting. However, it is important to note that sensitivity analyses have shown that there might be a great influence of the study of O'Neil, Hambley and Chattelier (2014), leading to a much higher correlation. Further studies could investigate how social interactions, negative and positive emotions moderate the relationship between teleworker' job performance and their emotional stability excess.

Hypothesis 3 predicted a positive significant relation between conscientiousness and job performance in a telework context and was confirmed. Companies could apply this knowledge in their employee selection in order to find the fitting personality whose job performance benefits from the effects of working offsite.

The most interesting, counterintuitive finding is the non-confirmation of the first hypothesis. The proposed positive relation between teleworkers' extraversion and job performance which has been a widely accepted "common sense fact" was not empirically supported. At the same time, the data analysis of this research confirmed robust findings of past meta-analysis concerning certain Big-Five's – emotional stability and conscientiousness – predictive validity of job performance (Barrick & Mount, 1991). This adds severity to the calculated non-presence of a positive extraversion-performance relation in telework settings.

Tett and Burnett's (2003) "Personality Trait-Based Model of Job Performance" only partly corresponds with our results. Only in terms of the Big Five traits conscientiousness and emotional stability hypotheses were confirmed, while extraversion and teleworkers' job performance shared no significant relation in the way hypothesized. The fit of Tett and Burnett's (2003) model and available data was rather poor as only a very limited number of

studies could be included in the analysis. Furthermore, it posed a formidable challenge to find evidence in existing literature of moderating variables of the three categories: task, organizational, and social (Tett & Burnett, 2003). In line with Judge and Zapata (2015) this meta-analysis highlights the potential importance of moderating factors such as independence and social skills in a telework context that can be captured even by emerging digital methods in human resource management (e.g., Hertel, Konradt, & Orlikowski, 2003; 2003; Konradt & Sarges, 2003; Woods, Ahmed, Nikolaou, Costa, & Anderson, 2020).

We think that the poor fit of the theoretical model and research practice is not due to problems to contextualize Tett and Burnett's (2003) trait-activation theory into a telework context, but rather because of the limited research focus on telework and limitations in data collection (e.g. sample selection). Future studies (preferably quasi-experimental and longitudinal ones) should include standardized measures and scales (e.g. of social support and job performance). Discoveries of a broader scope would have needed a more commonly accepted, less subjective definition of job performance as applied in this analysis. We suggest using non-self-report measures such as sales figures or other objective scales (Rotundo & Rotman, 2002). In their systematic review of the relation between job performance and flexible work De Menezes and Kelliher (2011) report very different measures of productivity used in the studies. They refer to Gajendran and Harrison (2007) who discovered a positive association between remote working and both self-reported and supervisor-reported performance, while the association was stronger in terms of self-report ratings (De Menezes & Kelliher, 2011). In addition, sub dimensions of organization members' performance should be addressed, such as proficiency, adaptivity, and proactivity (e.g., Hauschildt & Konradt, 2012).

Further studies should include, most importantly, contextual variables associated with telework. They potentially moderate the relation between job performance and personality traits (and other person-related variables as e.g. analyzed by Judge & Zapata, 2015) and could account for additional variance. For instance, studies could investigate the conditions of successful telework and its relation with the worker's personality profile, e.g. the intensity of telework, office characteristics or technology access. To improve the data situation for further meta-analyses, it would be desirable to agree on the same contextual factors here. Although experimental studies would be desirable, they are hardly feasible due to the enormous effort required to ensure ecological validity. Therefore, one approach could be to

develop a standardized inventory to capture contextual factors. This would at least allow field studies to be carried out in real companies that, for example, allow telework in phases. One might hope – due to the current pandemic state – that in the next months and years to come telework research of a greater amount and precision and accuracy in design and theory than in the last two decades will be published. Nonetheless does this meta-analysis enhance the visibility of systematic telework research.

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Appendix A

Manual for the coding of the studies

Category	Description	Coding
<i>Features of the study</i>		
STUDY_ID	Serial number	Serial number for the coded studies. Three-digit number including leading zeros beginning with 001 ascending from there on with each study. The fourth study, for example, is to be coded as 004 for study 4.
EFFECT_SIZE_ID	Effect size number	The serial number of the study is expanded by another number per reported effect size within the study. For example, if study 004 reports four relevant effect sizes, these are to be coded as 0041, 0042 and 0043.
AUTHORS	Authors of the study	Name of the authors of the study. APA 7 citation stands are to be applied. Example: Tett & Burnett or Craglia et al.
TITLE	Full title of the study	Title of the coded study. Example: "Predicting teleworker success: an exploration of personality, motivational, situational, and job characteristics"
BIAS_ISSUE	Was the data used in another study?	0 = no, 1 = yes
PUBLISHED_IN	Where was the study published?	1 = journal article, 2 = book, 3 = book chapter, 4 = dissertation, 5 = Bachelor-, Master-, or Diploma-thesis, 6 = study from the public sector, 7 = study from the private sector, 8 = available online-only article, 9 = others
YEAR	When was the study published?	Year of the publishing. Code as four-digit number.
Category	Description	Coding
COUNTRY_OF_PUBLICATION	Country in which the study was published	0 = not announced, 1 = USA, 2 = Canada, 3 = Germany, 4 = China, 5 = others
<i>Sample</i>		
SAMPLE_SIZE	Number of participants	Number of people that were participating in the study. If personality and/pr performance on a team level is reported, utilize the number of teams participating in the study.

AGE_MEAN	Mean age of the participants	Mean age of the participants as reported in the study. Leave blank space if none was reported.
AGE_MIN	Minimum age of the participants	Minimum age of the participants as reported in the study. Leave blank space if none was reported.
AGE_MAX	Maximum age of the participants	Maximum age of the participants as reported in the study Leave blank space if none was reported.
AGE_SD	Standard deviation of the age of the participants	Standard deviation of the participants' age Leave blank space if none was reported.
SEX	Percentage of female participants	Percentage of female participants of the study's sample size. If the study reports the percentage of male participants, the percentage of female participants is to be calculated. Leave blank space if none was reported. Calculate and report with one decimal.

Category	Description	Coding
NATIONALITY	What was the participants' nationality?	0 = not announced, 1 = US, 2 = canadian, 3 = german, 4 = chinese, 5 = different nationalities included in sample
<i>Method</i>		
DESIGN	What was the design of the study?	1 = experimental design with control group, 2 = experimental design without control group, 3 = quasi-experimental design with control group, 4 = quasi-experimental design without control group, 5 = field study, 6 = others
PREDICTOR	Which personality traits were examined in the study?	The personality traits that were examined in the study. Facets of a personality trait are to be coded accordingly. For example, if the study examined the personality trait diligence, this trait is to be coded as "1" because diligence is a facet of

conscientiousness. If the study examined a facet of conscientiousness, extraversion, or emotional stability/neuroticism, the exact construct is to be noted in the comment section. 1 = conscientiousness, 2 = extraversion, 3 = emotional stability/neuroticism

PR_OP	How was the predictor operationalized?	1 = test data, 2 = questionnaire, 3 = interview, 4 = rating 5 = others
CRITERIA	What kind of performance was measured?	The exact construct is to be noted in the comment section. 1 = individual performance, 2 = team performance
CR_OP	How was the criteria operationalized?	1 = test data, 2 = questionnaire, 3 = interview, 4 = rating 5 = others

Category	Description	Coding
<i>Results</i>		
MOD_ORG_M	Moderating variable "organizational support"	Regularly reported as measurement on a Likert-Scale. The reported number is to be converted into percentage for better comparability of different Likert-Scales. Leave blank space if none was reported. Code as number with two decimals.
MOD_SOCIAL_M	Moderating variable "social cohesion"	Regularly reported as measurement on a Likert-Scale. The reported number is to be converted into percentage for better comparability of different Likert-Scales. Leave blank space if none was reported. Code as number with two decimals.
MOD_TEAM	Did the study report a remote work or a virtual team setting?	1 = telework, 2 = virtual team
CR_RB	Reliability of the instrument that was used to measure the predictor	Code as number with two decimals. Leave blank space if none was reported.

PR_RB

Reliability of the measurement for
personality trait

Code as number with two decimals. Leave blank space if none was reported. Code as
number with two decimals.

Category	Description	Coding
CORRELATION	Correlation between predictor and criteria	If the predictor is neuroticism, the correlation is to be inverted so that the correlation between emotional stability and the criteria can be depicted. If the criterion is cyberslacking, the correlation is to be inverted so that the correlation between the predictor and performance can be depicted. Code as number with two decimals.
COMMENTS	Section for additional comments	Additional comments can be those as stated under the description sections of "CRITERIA", "PREDICTOR". For example: "cyberslacking", "engagement", "diligence". Section can also be used for additional notes the coders deem worth mentioning.

Appendix B

Table B1

Coding Manual for the Quality of the Studies Reviewed

Category	Definitions	Coding
<i>Sampling and representativeness</i>		
1 Response Rate	Was the response rate of the participants reported?	0 = not reported, 1 = rate was reported
2 Representativeness	Are the individuals selected to participate in the study likely to be representative of the target population (sex, age, type of personnel, operational context)? For example, teleworking employees match the categories „type of personnel“ (employees) and „operational context“ (telework).	1 = low, 2 = medium, 3 = high
3 Study and Subject Description	Were the study subjects and setting described in detail?	0 = not or insufficient, 1 = detailed description of study subjects or setting, 2 = detailed description of study subjects and setting
4 Dropouts	Are dropout/missing values described, analyzed, and discussed?	0 = poor, 1 = sufficient
Category	Definitions and Clarifications	Coding
<i>Statistical analyses</i>		
5 Statistical Power	Was the statistical power of the study reported?	0 = not reported, 1 = reported

6	Statistical Methods and Study Design	Are the statistical methods reported and are they appropriate for the study design?	0 = not reported, 1 = reported but no further information on appropriateness of the methods for the study design, 2 = reported including further information on the appropriateness or limitations or requirements of the statistical methods
 <i>Measurement</i>			
7	Measure of Predictor	How was the predictor measured?	0 = not reported, 1 = self-rating or expert rating, 2 = questionnaire
8	Measure of Criterion	How was the criterion measured?	0 = not reported, 1 = self-rating or expert rating on a singular scale, 2 = self-rating or expert rating with a questionnaire, 3 = objective measurement
 <i>Design and fidelity</i>			
9	Study Design	Which kind of study design was used?	0 = cross-sectional, 1 = longitudinal

Category	Definitions and Clarifications	Coding
10 Discussion of Limitations	Did a relevant discussion of the study's limitations take place?	0 = no or poor discussion of limitations, 1 = discussion of limitations took place

Table B2

Result of Quality Assessment of the in the Meta-Analysis Included Studies

Authors	Categories ^a									
	1	2	3	4	5	6	7	8	9	10
Glikson et al. (2019)	0	2	2	0	0	1	2	3	0	1
O'Neill, Hambley, & Bercovich (2014)	0	2	1	0	0	2	2	2	0	1
O'Neill, Hambley, & Chatellier (2014)	0	2	1	0	0	1	2	2	0	1
Cogliser et al. (2012)	1	1	2	0	0	1	2	1	0	1
Venkatesh & Windeler (2012)	1	4	2	0	0	1	2	2	0	1
Vasilatos (2010)	0	2	2	1	0	1	2	2	0	1
MacDonnell et al. (2009)	0	2	2	0	0	2	2	1	0	1
O'Neill et al. (2009)	1	4	2	1	0	2	2	1	0	1
Hertel et al. (2006)	1	4	2	1	0	2	2	1	0	1
Balthazard et al. (2004)	0	0	0	0	0	2	2	1	0	1

Note. ^a Definition and rating scales for the following categories can be found in Table B1.

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