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Leader Personality and Team Adaptive Performance in Virtuality Contexts: How Extraversion and Openness to Experience Impact Virtual Teams

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Master of Science in Human Resources Management and Organizational Consulting

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Resumo

Recentemente, desde que uma pandemia a nível mundial impeliu os indivíduos para o trabalho remoto, as equipas virtuais tornaram-se a regra. Esta dissertação examinou os mecanismos de mediação da virtualidade percebida pela equipa na relação entre a personalidade do líder e o desempenho adaptativo da equipa. O modelo foi testado numa amostra de 37 equipas (163 indivíduos) com diferentes graus de virtualidade de equipa. Enquanto que a extraversão do líder não foi preditorade uma maior proximidade da equipa, a abertura à experiência do líder foi preditora da eficácia na comunicação virtual. Contrariamente a conclusões de estudos anteriores, a extraversão e abertura à experiência dos líderes não aumentou o desempenho adaptativo da equipa. As constatações sugerem que o actual modelo de personalidade dos Big-five possa ser insuficiente para explicar a liderança e o desempenho da equipa em equipas virtuais. Também oferece novas perspectivas sobre os mecanismos da virtualidade percebida pela equipa.

Classificação JEL: M12; M50; D91; 032

Palavras-chave: personalidade líder, big-five, equipas virtuais, virtualidade da equipa, desempenho adaptativo da equipa

Abstract

At the latest, since a global pandemic has propelled individuals into home office, team virtuality has become the new normality. This thesis examined the mediating mechanisms team perceived virtuality in the relationship between leader personality and team adaptive performance. The model was tested in a sample of 37 teams (163 individuals) with different degrees of team virtuality. While leader extraversion did not predict higher team proximity, leader openness to experience predicted increased communication effectiveness in teams with a high degree of structural virtuality. Differently as assumed by prior findings, extraversion and openness to experience in leaders did not increase team adaptive performance. The findings suggest that the existing big-five personality framework is not sufficient to explain leadership and team performance in virtual teams. They also offer new insights into the mechanisms of team perceived virtuality.

JEL Classification: M12; M50; D91; 032

Keywords: leader personality, big-five, virtual teams, team virtuality, team adaptive performance

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1. Introduction

Since a global pandemic has disrupted work teams throughout almost all industries and drove many teams into working from home, virtual teams have become a new reality (Costa et al., 2021). Although the level of virtuality suddenly increased dramatically for many teams, the Covid-19 pandemic can be considered an accelerator to an existing trend. Virtual teams have grown explosively over the past decades (Dulebohn & Hoch, 2017) and even before the existence of Covid-19, is was rare to find teams that are not, at least to a certain extent, virtual (Kirkman & Mathieu, 2005; Handke et al., 2020). This continuous change is following a great number of promising advantages, including: functional expertise is not bound to a geolocation, continuous productivity or support is assured 24/7 by using different time zones, reduced travel or relocation cost, and reduced capacity of organizational sites (Dulebohn & Hoch, 2017).

In a recent study on the post-pandemic future of remote work, McKinsey Global Institute (2020) found that more than 20 percent of the workforce, especially those working in highly skilled and highly educated workers, could perform their work as effectively when working remote for three to five days, compared to working from the office. For the time after the pandemic, they predicted that a hybrid model of remote and co-located work will sustain for jobs with high remote work potential. This would mean three to four times more people working remotely than before the global pandemic.

Virtual teams have also given rise to a new set of challenges and the velocity of this change drives the need for a better understanding of virtual teams. The disadvantages for virtual teams include difficulties in collaboration due to differences in time zones, difficulties in communication due to non-verbal cues that are filtered out, lack of engagement, isolation, and leadership and management challenges (Dulebohn & Hoch, 2017). We have started to understand that what remote teams experience goes beyond mere structural dispersion. When not managed adequately, team members might be left feeling distant from each other, or information deficits can be experienced (Handke et al., 2020).

The challenges arising from virtual contexts and the degree of change predominant in today's work environment makes it vital for teams to promptly adapt to unexpected events in order to maintain adaptive performance (Maynard et al., 2015). Team leadership factors play an important role in understanding and predicting team performance (Kozlowski & Bell, 2003; Zaccaro et al., 2001). Opposed to the initial assumption that virtual and co-located teams were equal in terms of leadership, today it is widely recognized that the management and leadership of virtual teams requires distinct virtual skills and behaviours by the team leader (Dulebohn &

Hoch, 2010). Since leadership in virtual teams cannot be applied in the same way as in face-to-face teams to drive team performance, the leader's personality potentially has an important role in explaining team performance in virtual contexts. While some studies argue that leader emergence is likely to occur in virtual teams due to the geographic dispersion, virtual teams typically have an assigned leader responsible for important leadership functions, such as team performance (Hoch & Dulebohn, 2017).

Understanding the impact of personality and virtual contexts can help these leaders to determine where they stand in the organization and the trait information can suggest areas in which they have a strong impact on the organization and on their followers and other areas in which they want to get more training regarding leadership behaviours. It can also provide insights for managers and HR practitioners for leader selection, team composition (Kozlowksi, 2006), global recruitment policies, and adequate virtual communication platforms.

The current research of virtual team leadership rather addresses leadership style than the personality and traits of leaders (Alaiad et al., 2019). While leadership style is something which can be developed or changed over time, personality is correlated with leadership, but also deeply rooted within each individual (Andersen, 2006). In their study on personality and its association with transformational leadership in virtual teams, Balthazard and colleagues (2009) hypothesised that leadership is closely associated with leader personality. Gilson and colleagues (2015) further addressed, that personality and communication factors are the main drivers of transactional leadership and for team performance. Despite its relevance, current research on the impact of a leader's personality on team effectiveness remains underdeveloped in terms of virtual context and local dispersion of teams (Cogliser et al., 2012; Gibson & Gibbs, 2006). Therefore, it is still unknown what personality traits differentiate effective virtual team leaders from non-effective virtual team leaders and how we can better understand virtual contexts (Zhang & Fjermestad, 2006).

Leaders trait theory is backed up by a century of research and provides an intrinsic understanding of leader traits which can help both leaders to improve their leadership effectiveness, and organizations in leader selection and team composition, but the existing research on trait leadership fails to look at leadership outcomes (Northouse, 2013). Consequently, studying virtual team leader traits is therefore considered meaningful (Zhang & Fjermestad, 2006).

When looking at personality and cognitive style in virtual teams, the existing research is focused on the preference for working in virtual teams, lacking an understanding of other virtuality aspects as well as the impact on team performance (Luse et al., 2013). The need to

further understand the link between personality and individual performance has also been addressed by O'Neill and Allen (2011), stating that the effects of personality on team performance are understudied. However, like most existing studies, they tried to link team member personality with team performance (Driskell et al., 2006; Neuman et al., 1999; Peeters et al., 2006). Further teams research is focussed on team member personality as selection criteria (Hertel, et al., 2005), or the effect of team personality on team effectiveness and performance (Stipelman et al., 2019). Due to its nature, research on personality and its association with team performance lacks application in real-world teams (O'Neill & Allen, 2011).

When looking at the research body associated with virtual teams and their performance, it has received a lot of attention in the past years (Chang et al., 2014). Despite the extensive existing body of literature on virtual teams and their functioning (e.g., de Guinea et al., 2012), a significant number of research articles in the identified corpus investigated virtual team performance and effectiveness in a laboratory setting and on an individual level, lacking an understanding of team virtuality at a team level (Costa et al., 2021; Axtell et al., 2004). Furthermore, it has been criticized that there is more research required on how virtual teamwork affects team adaptation among other outcomes (Maynard et al., 2015). The factors that influence performance in virtual teams include team context (Schippers et al., 2012), reflexivity (Schippers et al., 2007), communication (Altschuller & Benbunan-Fich, 2010), information technology communication (Fuller et al., 2016), trust (Altschuller & Benbunan-Fich, 2010), team knowledge, team diversity (Siebdrat et al., 2008), culture (Friedrich et al., 2015), or team identification (Daim, 2012).

The goal of the underlying work is to provide empirical, quantitative results from real teams that help understanding the impact of the leader's personality on team performance. The scientific research body gives reason to assume that there are certain personality traits in leaders that help to predict team adaptive performance in virtual teams and that this relationship can be explained through virtuality contexts. Furthermore, there are indications that different dimensions of virtuality are associated with leaders' personality, which potentially can be explained through the team perceived virtuality concept. Therefore, the goal of this work is to re-examine the existing research on trait leadership and team performance for virtuality contexts and team adaptation and to develop an integrated framework that helps to understand the relationships.

2. Literature Review

Given the complexity of today's uncertain, global environments, work is often carried out by team members dispersed across time and space who interact only through computer-mediated communication, which enables them to keep up with the increasing job complexity and changing demands (Bell & Kozlowski, 2002). Since virtual teams bring new challenges for team leadership, this section focusses on exploring the antecedents of the variables and developing the theoretical framework for the hypotheses. The aim is to get a better understanding on how the leader's personality can influence virtuality and adaptive performance in virtual teams and on the role of virtuality and technology.

2.1 Team Adaptive Performance and Leadership

In order to manage the increasing complexity of modern work, teams have become the cornerstone of organizations (Rosen et al., 2011). Therefore, understanding team effectiveness and performance has been an important focus of the organizational research (Goodwin et al., 2009). Due to the increasing speed of change within organizations and their environment and the increasing technological advancement and communication through ICT, the effectiveness of teams depends on their capability to adapt to change and to deal with unexpected situations (Maynard et al., 2015). Therefore, performance is many times the result of the capacity to adjust to novel and unforeseen situations. Burke and colleagues (2006) argued that team adaptation is an essential part of team performance. It emerged from the criticism that team performance has too often been conceptualized as the result of action, instead of the longitudinal enactment of processes. Team adaptation can be described as a phenomenon which comprises individuals and teams. It is an emergent process where one or more individuals interact trough cognitive and behavioral goal-direct action to cope with the demands of the environment (Maynard et al., 2015). Charbonnier-Voirin & Roussel (2012, p. 280) defined adaptive performance on an individual level as "the ability of an individual to change his or her behavior to meet the demands of a new environment", and stressed the importance of adaptability as a component of team performance.

Team adaptive performance (TAP) can thus be defined as an emergent phenomenon whereby team members use their resources to functionally change current cognitive or behavioral goal-directed actions or structures to meet expected or unexpected demands (Kozlowski & Bell, 2003). Successful adaptive performance implies different dimensions: that individuals are able to adjust their behaviors to different needs of work situations and new

events; that they are able to effectively handle emergencies or crisis situations; their capability to solve new problems and to develop creative approaches to complex problems (Pulakos et al., 2002); and to efficiently deal with unpredictable and uncertain work situations, changing priorities, or resource shortages (Charbonnier-Voirin & Roussel, 2012). In a study with a large sample of students, researchers found that measuring both individual and team adaptive performance are reliable measurements of overall performance (Marques-Quinteiro et al., 2015). An important aspect of TAP is its continuous evolution over time and that it is a phenomenon with a bottom-up direction (Burke et al., 2006).

Zaccaro & Bader (2003) state that, especially in virtual teams, the complexity is much higher than in traditional teams, which makes it indispensable for them to adapt readily to changing circumstances. They pose that the core effectiveness is maintaining high performance while team situational circumstances become adverse. The team needs to develop individual and collective adaptability in order to maintain overall effectiveness. Bosch-Sijtsema (2007) added that working in virtual contexts often requires increased creativity in problem-solving and the solution of communication problems, among other issues that do not exist in face-to-face settings.

Since they face both the human and the technological aspects, leadership plays a central challenge in virtual teams (Hertel et al., 2005). The authors stress the critical role the team leader has in creating a virtual environment and team context in which team members make the best use of attributes that enable them to cooperate virtually with distributed team members.

Despite the broad advantages that virtual teams bring for organizations and individuals, they present significant challenges to teams and individuals because certain characteristics of virtual teams differ from conventional teams. Spatial distance between team members restricts face-to-face communication and requires the use of ICT to connect with team members. Team communication can be impeded when, e.g., members of virtual teams are challenged with feedback delays and scheduling difficulties. This can occur when team members are in different time zones, or through indirect communication, leading to misinterpretation in project or task requirements, additional effort, and decreased efficiency in accomplishing goals (Alaiad et al., 2019). When holding a virtual meeting (e.g., via videoconference), the team process behaviors are separated from the technological features, such as synchronicity, clarity, or pan-tilt-zoom (Larson & DeChurch, 2020). Challenges also arise when nonverbal cues would be needed for the recipient to fully understand context (Schaubroeck & Yu, 2017). The lack of co-located interaction of virtual teams can furthermore cause lower levels of trust, work satisfaction, team

cohesion, social control, commitment, and cooperative behavior, which can all lead to a decrease in overall team performance (Hoch & Kozlowksi, 2014).

The challenges imposed through virtual contexts can also affect decision-making, managing conflict, and expressing opinions, eventually impacting overall team performance. There is consensus among researchers that the leadership of virtual teams is more difficult than the leadership of face-to-face teams (Hoch & Kozlowksi, 2014) and that for technologically enabled contexts, unique considerations need to be made (Dulebohn & Hoch, 2017). Leadership needs to compensate for the increased level of difficulty caused by team virtuality in order to maintain overall team performance (Hoch & Dulebohn, 2017). Team leadership is believed to be a key mechanism for reducing loss in motivation and coordination and in maintaining team effectiveness in virtual teams (Bell & Kozlowski, 2002). Given the assumption that the leader has direct interaction with team members in the process of performance management, leadership has proven to be a predictor of performance over time (Fleishman, 1991; Ziek & Smulowitz, 2014). Zaccaro and colleagues (2001) even considered team leadership one of the fundamental characteristics of effective team performance, stressing the importance of the leader to define team directions and to organize the team to maximize progress. The leader's priority should be the monitoring of team performance and progress and, if required, take action to solve uprising problems. The management of team performance is one of the central tasks of the leadership function, it represents one of the most established ways to measure the effectiveness of team (Bell & Kozlowksi, 2002).

2.2 Trait Leadership

Early leadership research focused on trying to understand why some individuals become leaders and others not, trying to understand what traits make other people perceive someone as a leader (Andersen, 2006). Despite ongoing efforts to define leadership, more than a century later scholars and practitioners have not agreed on universal consensus (Northouse, 2013). The trait approach has been an important since there are different approaches to leadership. The change towards the trait leadership approach has been an important change (Kotter, 1990), describing leadership as a property or set of properties possessed in varying degrees by different people (Jago, 1982). It can be defined as a process whereby an individual influences a group of individuals to achieve a common goal or purpose (Northouse, 2013). The approach a leader takes in this process of influencing a group of individuals is strongly influenced by the leader's traits, characteristics, abilities, and behaviours (Northouse, 2013).

The trait approach towards leadership has been one of the first conceptual approaches towards leadership and received increasing attention throughout the 20th century. The "great man" theory focused on identifying innate qualities and characteristics possessed by leading figures from society, politics, and military. The predominant believe was that people are born with a set of traits which contrasted from follower traits making them great potential leaders, and which differentiated them from followers (Bass, 1990; Jago, 1982). Over time, it became apparent that a great leader might excel in certain situations, but not be a good leader in another situation, leading to considering leadership as a relationship between people in a social situation. Since the emergence of concepts such as visionary, charismatic, and transformational leadership (Bass, 1990; Bono & Judge, 2004; Nadler & Tushman, 1989; Zaccaro, 2007), the trait approach has received a new interest. Stogdill (1974) analyzed 163 studies completed between 1948 and 1970 and validated the idea that a leader's traits are part of leadership. Mann (1959) suggested that leaders differentiated from non-leaders by the following personality traits: intelligence, masculinity, adjustment, dominance, extraversion, and conservatism (Mann, 1959). Yet further developing this concept, Kirkpatick and Locke (1991) stated that leaders could be distinguished from team members in six traits: drive, confidence, motivation, integrity, task knowledge, and cognitive ability. They stressed that an individual could be born with these traits or they could be learned, or both. Zaccaro and colleagues (2001) list the following traits and characteristics for leaders: cognitive abilities, extraversion, conscientiousness, emotional stability, openness, agreeableness, motivation, social intelligence, self-monitoring, emotional intelligence, and problem solving. These traits are closely associated with the personality of an individual.

2.3 Leadership and Personality

While the first observations of personality go back to Aristotle, the idea of personality and its influence on workplace related behaviors were discarded for a long time due to the lack of a common taxonomy (Goldberg, 1993). Olver and Mooradian (2003, p. 110) defined personality as "enduring characteristics of the individual that summarize trans-situational consistencies in characteristic styles of responding to the environment". Existing research has found that it is related to physiological processes and that genetic factors heavily influence personality traits (Parks & Guay, 2009). McDougall (1932) provided the first basis for a common taxonomy of personality, consisting of five dimensions, but it was only in the 1980s that personality gained relevance when researchers reached a consensus on a broadly accepted taxonomy of personality (Judge & Bono, 2000). The *five-factor model (FFM)*, or so-called *big five* can be described as

an empirical generalization of the covariation of personality traits, which can be structured into five robust factors, or dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness (Goldberg, 1981; McCrae & Costa, 1987; Goldberg, 1990; McCrae & Costa, 2008). The FFM is based on the trait theory, which characterizes individuals' characteristics in terms of patterns of feelings, thoughts, and actions and can capture trait descriptions in everyday language (McCrae & John, 1992).

The FFM has been a reliable framework to predict different outcome variables, such as job performance (Salgado, 2003), job satisfaction, and turnover (Peeters et al., 2006). While earlier research focused more on leader personality as a predictor for individual performance outcomes, in the past years, the impact on team performance has received more attention over the years. Barry and Stewart (1997) found that some of the individual level personality traits correlate with individual impact on group performance. Pulakos and colleagues (2002) established that adaptive performance could be predicted by team member personality, but for leader personality there has not been sufficient evidence (cf. Andersen, 2006).

Over several decades, the leadership research body has made an effort to predict leadership effectiveness and emergence through the FFM. Personality research in leadership addresses whether personality can explain leadership emergence, which traits make people perceive someone as leader, and the relationship between personality of leaders and team or organizational effectiveness (Andersen, 2006). It was established from early on that certain personality dimensions had an impact on leadership (e.g., Stogdill, 1974; Hogan et al., 1994). Judge and colleagues (2002) conducted a qualitative meta-analysis of 78 leadership and personality studies published between 1967 and 1998. In general, they found a strong relationship between the big five traits and effective leadership. From the big five, extraversion was the factor most strongly associated with leadership, with openness to experience in third place.

There are numerous reasons why leader personality traits should be considered in predicting leadership and TAP. In Table 2.1, the dimensions *extraversion* and *openness to experience* or *openness* are listed with their most common labels and most commonly associated traits. We are focusing on these two dimensions, since there are several indications that they are the most meaningful in this context. DeRue (2011) developed a framework of leadership, which categorizes leader traits into demographics, task competence, and interpersonal attributes. While extraversion falls into the dimension of interpersonal attributes, openness to experience refers to the task competence dimension.

Table 2.1: Overview of dimensions, labels, and adjectives by different authors

Factor	Dimension Name	Traits	Authors
I	Surgency/Extraversion	dominance, energy, activity level, speech fluency, social participation	Stogdill, 1974
	Extraversion/Surgency	Sociable, fun-loving, affectionate, friendly, and talkative	Costa & McCrae, 1987
	Extraversion/Surgency	sociable, gregarious, assertive, talkative, and active	Barrick & Mount, 1991
	Extraversion	gregarious, friendly, compliant, cooperative, nurturing, caring and sympathetic	Balthazard, Potter & Warren, 2004
V	Intellect/Culture	intellectual, cultured, polished, independent-minded	Norman, 1963
	Openness to Experience	original, imaginative, broad interests, and daring	Costa & McCrae, 1987
	Intellect/Openness to Experience	intellectual, bright versus simple, unreflective	Goldberg, 1990
	Intellect/Openness to Experience	imaginative, cultured, curious, original, broad-minded, intelligent, artistically sensitive	Barrick & Mount, 1991

Extraversion has been closely associated with the leadership function (Judge et al., 2004). Especially in terms of leader emergence, extraversion has played an important role (Cogliser et al., 2012). Barry and Stewart (1997) found that at the individual level, extraversion was the main personality trait to correlate with individual impact on group performance. When predicting individual's job performance, Barrick and Mount (1991) found that extraversion was a personality factors that consistently related to success in the workplace. They concluded that extraversion correlates positively with individual performance in tasks involving social interaction. The sociable, outgoing, and assertive features of extraverts are associated with leadership roles requiring interaction with others and motivation and persuasion of them to achieve goals. Extraverted leaders are likely to be more confident in their leadership role and aware of their capabilities, which is associated with improved leader effectiveness (Kok-Yee et al., 2008). However, when it comes to research conducted in virtual settings, we see inconsistent results. Balthazard and colleagues (2004) investigated extraversion as a performance indicator in virtual teams and found a curvilinear relation to performance. A later study, focused on leader

extraversion in virtual teams, found that extraversion was associated with transformational leadership in face-to-face settings, but not in virtual teams (Balthazard et al., 2009). Nevertheless, the overwhelming evidence from the existing body of literature indicates that extraverted leaders are more likely to initiate communication and to signal trust and therefore, closeness towards team members, improving adaptive performance in teams.

Openness to experience has been described by Judge and colleagues (2002) as the most controversial, but least understood dimension of the FFM. Furthermore, the authors stated that it is not commonly related to team performance, but rather to leadership. Leaders with high levels of openness to experience are self-conscious, curious, and prefer diversity (Costa & McCrae, 1993). The personality trait is also associated with intelligence and creativity (Zhao, 2003), which is something that followers perceive as a good leader and can have a positive impact on team outcomes. Balthazard and colleagues (2009) posed that this dimension in leaders should influence followers to view them as imaginative or visionary, which fosters intellectual stimulation. The authors also argued that these individuals have a high degree of flexibility and adaptation to the perspectives of others, which could foster respect and confidence. Since TAP constitutes a high degree of creativity in solving problems around communication solving, it is potentially associated with openness to experience in leaders, since they have an imaginative and creative nature (Bosch-Sijtsema, 2007). They are generally fast adopters to change, incorporating new instruments, and deal adequately with new challenging situations. High scores in openness to experience predicted better decision-making in unexpected job situations (Le Pine et al., 2000). Since this likely yields satisfactory team outcomes, it might have positive implications for the team and increase TAP. Moreover, Pulakos and colleagues (2002) showed that openness to experience among team members increases adaptive performance. We believe that this prediction is not limited to team members' personality, but important in leaders. Due to their positive attitude towards change, curiosity, and imagination, they positively influence TAP, especially the team's readiness to handle new situations, or crisis, to approach complex problems in innovative ways, and to approach unpredictable work situations with an open mind.

We believe that in virtual teams, external contexts have an important role in explaining the relationship between leader personality and TAP. In the following section we focus on virtuality contexts and propose how they could be associated with leadership and team outcomes.

2.4 Team Perceived Virtuality

The most current definitions of *virtual teams* describe them as a group of geographically and/or organizationally dispersed workers who cooperate interdependently to attain a common goal through the common use of and support by *information and communication technology (ICT)* to enable them to communicate and coordinate across time, place, and organizational boundaries (Alaiad et al., 2019; Peñarroja et al., 2013; Bell & Kozlowksi, 2002). Gibson and Cohen (2003) additionally stress the importance of team functioning, shared responsibility for outcomes, and the team's perception as an intact social unit by themselves and by others. The terms virtual teams, distributed teams, remote teams, computer-mediated teams, online teams, and cross-site teams have been used interchangeably in the literature (Schumacher & Poehler, 2009). This approach to geographic dispersion implied that communication for the sake of collaboration was more likely to be initiated, conducted, and maintained mainly due to the chance of encounters (Axtell et al., 2004). The degree of virtuality in co-located versus virtual teams can be considered a continuum, ranging from slightly virtual to extremely virtual (Gibson & Cohen, 2003), depending on the proportion of communication that takes place face-to-face compared to virtually, mediated through ICT. Authors argued that today's availability of ICT, such as videoconferencing, email, decision support software, shareware (e.g., Google Drive, Microsoft OneDrive) (Maynard et al., 2012), collaboration software (e.g., Slack or Microsoft Teams™) Costa et al., 2021), and direct messengers (e.g., Skype), help to overcome structural dispersion and bring dispersed team members together. While technology may also be used in co-located teams, the main difference for dispersed teams is that the team's effective coordination entirely depends on technological support. With the increase of remote working, dispersion of teams and digitization of the workplace, these streams have emerged the concept of *team virtuality* (Kirkman & Mathieu, 2005). Team virtuality describes the extent to which individuals rely on ICT to achieve their team goals (Gilson et al., 2015). It consists of the following dimensions: to which extent team members use virtual communication, coordination, and decision making tools to execute team processes, the extent of informational value given by these tools, and the synchronicity between team members in virtual interaction (Kirkman & Mathieu, 2005). This implies that although dispersed teams are likely to adopt more virtual coordination means, it is not a prerequisite for a team to coordinate virtually. Equally, the mere co-location of teams does not automatically preclude team members from interacting virtually or prevent the team from coordinate and communicate in a highly virtual manner. Accordingly, higher levels of team virtuality do not only refer to the frequency of use of ICT, but also the richness of informational value provided by these media (Schaubroeck & Yu, 2017).

Researchers also argue that distance as such, and how well-connected team members are in their collaboration, are rather subjectively experienced concepts than an objective property (Gibson et al., 2011). This feeling of being together with other people in a remote or technology-created environment is also closely associated with earlier concepts. Korzenny (1978) first described electronic proximity, which was extended by Walther and Bazarova (2008) with the definition of the *electronic propinquity* construct, featuring physiological feelings of nearness between individuals when communicating. Similarly, Zhao (2003) describes the concept of *copresence* as a sense of being with others

Focussing more on this social-cognitive construct of situations, Handke and colleagues (2020) stressed that effective teamwork is rather influenced by how well synchronized the team members perceive themselves compared to the objective distance. This concept is called *team perceived virtuality (TPV)* and can be described as a "shared affective-cognitive emergent state that is characterized by team members' co-constructed and collectively-experienced (1) distance and (2) information deficits, thereby capturing the unrealized nature of the team as a collective system (Handke et al., 2020, p. 3). This definition of TPV considers virtuality as negatively connotated in terms of team functioning and argues that, although the distance and lack of information experienced by team members go beyond mere structural virtuality factors, such as geographic dispersion and technology use, and are based on social perceptions of virtuality (Larson & DeChurch, 2020). Therefore, TPV applies to all teams, not just structurally dispersed teams and consists of two main dimensions: the feeling of distance to team members, and perceived information deficits or vice versa: the feeling of proximity to team members and the effective use of communication (Handke et al., 2020). Like the construct of structural virtuality, subjectively experienced virtuality ranges on a continuum. Since the dimensions in this construct are independent, low levels in one dimension do not necessarily imply low levels in another dimension and vice versa.

The perception of team members to *collectively feel distant*, or conversely, *proximal,* from each other, as an affective dimension of TPV, derives from interdependent individuals' awareness of their emotional inaccessibility or unavailability to each other, resulting in relationships that are more distant, colder, less friendly, and less affectionate. The perceived distance does not relate to the objective distance between team members, but rather to how close they feel to each other. When teams are physically dispersed, but feel close, they can be described as "far-but-close", which is a desirable state for virtual teams. It implies that objectively remote team members have informal conversations with each other, make jokes, or support each other emotionally.

We assume that collectively-experienced proximity in teams can be associated with the leader's personality trait extraversion. Since extraverts are described as assertive, active, social, talkative, upbeat, energetic, and optimistic (Costa & McCrae, 1992), positive, influential, and ambitious, they are likely to generate confidence and enthusiasm among their team members. Proximity refers to the affective dimension of TPV, which is why it is potentially prevalent in teams with leaders that can be described as extraverts. Leaders high in extraversion are associated with establishing close relationships, proven to be especially beneficial for situations that require teamwork, interpersonal interaction, and high-performance expectations (Barrick & Mount, 1991). The interpersonal orientation affiliation which characterizes extraverted leaders, can be expected to be relate to teams that share key information, interact cooperatively, and focus on the generation of team solutions (Kok-Yee et al., 2008). Higher levels of extraversion in leaders predict higher levels of interaction and closeness with the team. A lower degree of face-to-face communication potentially has a negative impact on team proximity. Therefore, the more extraverted the leader, the more he or she will be able to overcome structural virtuality and create teams that perceive themselves to be proximal.

Consistently with the previous argumentation, high ratings of extraversion in leaders are likely to predict high TAP. In virtual teams, this relationship can be explained through virtuality contexts. Since extraverts are social and enjoy interpersonal interaction, we believe that they have a preference for communication media with high richness of cues in the team. Since face-to-face interaction has higher richness of cues compared to most ICT media, we pose that extraverted leaders are more likely to lead teams with a low degree of structural virtuality. This low degree of virtuality would positively influence team-perceived proximity, which will in turn have a positive impact on TAP.

H1: *The relationship between extraversion and TAP is sequentially mediated by structural virtuality and team perceived proximity.*

The feeling of team members to *collectively perceive information deficits*, or conversely, *virtual communication effectiveness,* as the cognitive dimension of TPV, consists in information exchange that is perceived to lack specific requirements: timely feedback, message personalisation for specific recipients, the inclusion of emotional cues, and the expression through rich and varied language. Brief and direct messages can be perceived as rude or commanding, sarcastic comments can be misunderstood, and meaning can get lost. Especially for communication media that does not enable prompt feedback, the loss of information might

remain undetected and have a negative impact on relationships, disrupt the workflow, or decrease the quality of work products. Collectively-experienced information deficits are characterized by poor information exchange by team members.

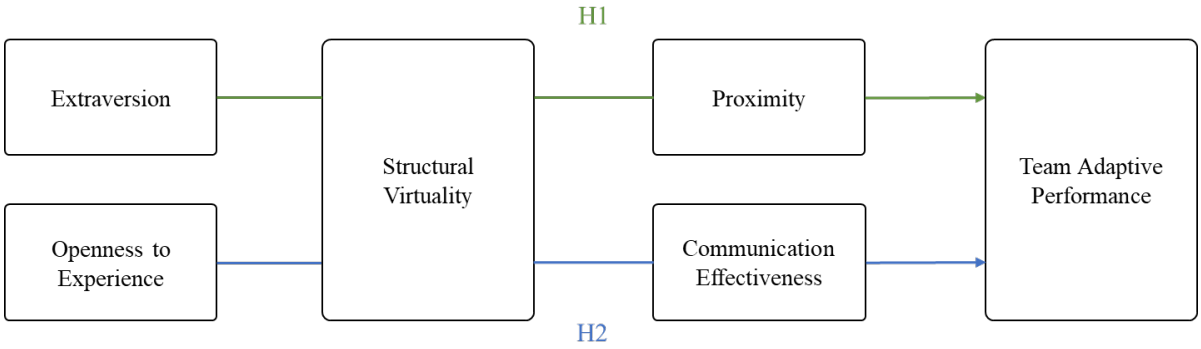
The nature of collectively-perceived information deficits does not allow timely feedback, allow team members to provide context for specific team members in messages, or convey verbal or non-verbal cues that have an emotional tone and make communication more natural. Leaders with a high degree of openness to experience can be described as original, imaginative, with broad interests, and daring (Costa & McCrae, 1992). Virtual communication effectiveness refers to the cognitive dimension of TPV, which is why it makes sense to assume that it is closely related with the cognitive dimension of personality traits. In virtual contexts, communication effectiveness is associated with a high degree of imagination regarding ICT choice and it requires the leader to adopt to the state of art ICT in order to maximize communication effectiveness. As leaders open to experience embrace change and are curious regarding innovation, they potentially fully exploit the potential of ICT media. Since they are perceived as innovative and visionary, they might have a substantial influence on the collective willingness to adapt to new communication channels and to the adequate communication needs. As there is a current tendency towards structural virtuality, leaders high in openness to experience are potentially curious to experiment with different degrees of virtuality and encourage high degrees of structural virtuality in the team. The channel expansion theory (Carlson & Zmud, 1999) helps to explain why increased exposure to structural virtuality could have a positive impact on virtual communication effectiveness. In teams with a high degree of structural virtuality, team members are exposed to the constant media-use and learn to communicate well virtually over time. Conversely, in teams with a high degree of face-to-face communication, team members are less exposed to virtual structures and might not experience virtual communication sufficiently in order to become good at it. The authors argue that certain experiences with ICT shape individuals' perceptions on media richness and preference for a channel.

Leaders with high ratings in openness to experience can be described as visionary and enthusiastic towards change, which was hypothesized to have a positive impact on TAP. In virtual teams, this relationship can be explained through virtuality contexts in a way that leaders that are open to experience are likely to create teams with a high degree of structural virtuality, which, in turn, leads to increased virtual communication effectiveness, resulting in overall increased TAP.

H2: *The relationship between openness to experience and TAP is sequentially mediated by structural virtuality and virtual team effectiveness.*

The hypotheses are presented in the conceptualized model (Figure 2.1).

Figure 2.1: Graphic representation of the conceptualized model with independent and dependent variables and potential mediators (excluding control variables)



3. Method

3.1 Sample

The sample in this study consists of 163 individuals nested into 37 teams. Each team consists of one leader and several team members with an average team size m = 3.41 (sd = 0.80).

The leader sample consists of 37 individuals between 26 and 63 years old (m = 42.70, sd = 10.55), mainly of German nationality (89.2%) with the majority residing in Germany (81.1%), followed by Portugal (8.1%) and Switzerland (5.4%). The majority has a Master's degree (48,6%), followed by high school degree (16.2%), Bachelor's degree (13.5%), Doctoral degree (10.8%), and less than high school degree (10.8%). The majority of the leaders is male (75.7%), with mostly 5 to 10 years (37.8%) and 1 to 2 years (24.3%) of overall leadership experience and 1 to 2 years (27.0%) and 2 to 5 years leading this team. The sample consists of diverse sectors with manufacturing having the greatest representation (37.8%), followed by health (16.2%). 81.1% of leaders worked at least one day per week from home. Further sociodemographic information is presented in Annex A.

The associated team members (n = 126) are up to 40 years old (65.9%), most of them working in a professional role (63.5%), followed by administrative or supporting clerk (23.0%). Slightly more than half of the team members are female (53.2%) with a Bachelor's (31.0%), or Master's (23.0%) degree. The majority of individuals are of German nationality (81.0%) and most of the sample resides in Germany (84.9%). They have been working together mostly for 2 to 5 years (24.6%) and 1 to 2 years (20.6%), with some 15.9% working together for over 10 years. Regarding the entire team as reported by the team leader, 13.5% never worked remotely, while among the team members that participated in the study, 21.4% never worked remotely. An overview of all sociodemographic information is presented in Annex B.

3.2 Procedure

The data was collected from teams through two different online questionnaires: one for team leaders and one for team members. Questionnaire 1 (Annex C) was administered as an online survey sent by e-mail to participants leading a team of at least three followers. The team leader then identified three or more team members who were e-mailed an invitation to participate in Questionnaire 2 (Annex D). The leader nominated the participating team members freely with no given prerequisite and the data was collected during January and May 2021.

3.3 Instruments

For all variables included in the survey, enough information on the measures was available from the literature research, which is why a deductive approach was chosen. The adoption of a deductive approach helped assuring content validity of the measures (Hinkin, 1998). For both questionnaires, the participants could complete the survey in English or German.

Personality. In the leadership sample, participants completed an online survey assessing the two dimensions *extraversion* and *openness* from the FFM on personality using the 50-item IPIP representation of the Goldberg (1992) markers for the Big-Five factor structure, a self-report test (Costa & McCrae, 1985). The items from these sub-dimensions (factors) consisted of randomized items. The sub-dimension extraversion consisted of 5 positive-keyed (e.g., "I feel comfortable around people") and 5 negative-keyed items (e.g., "I don't like to draw attention to myself") and the participants were asked to respond to each item using a Likert-type scale ranging from 1 ("very inaccurate") and 5 ("very accurate"). Openness was composed by 10 items, of which 7 were positive-keyed (e.g., "I am quick to understand new things") and 3 were negative-keyed (e.g., "I have difficulty understanding abstract ideas"), evaluated in a 5-point Likert scale

Structural Virtuality. To measure structural virtuality (Maynard et al., 2012), the respondents were asked to indicated the percentage of time spent using a certain communication channel, differentiating between the proportion of communication using non-virtual (i.e., face-to-face) and ICT facilitated communication means (e.g., "allocate the proportion (in %) of total work/project time you spent communicating with other team members this week using: face-to-face communication; Collaboration Software [e.g., MS Teams, Slack]"). This scale consisted of a single item scale, the percentage of face-to-face communication. The remaining items of the scale related to categories of ICT communication, which is why the sum of the remaining percentage of communication beside face-to-face makes up the variable structural virtuality.

Team Perceived Virtuality. The measurement of this dimension, created by Handke et al. (2020), consisted of the sub-dimensions collectively-experienced proximity (Walther & Bazarova, 2008), and virtual communication effectiveness (Hill & Bartol, 2016).

To measure *proximity*, the scale from Walther & Bazarova (2008) was adapted to a 5-item scale where participants had to place themselves on a continuum for each item , for example, "use the following scale to indicate how close you currently feel to your team members" with responses ranging from 1 ("far") to 5 ("close"). This construct had already previously been validated by Costa, Handke, and O'Neill (2021) through factor analysis in a study with 274 participants.

Virtual communication effectiveness was measured through a scale first developed as a subscale on virtual collaboration by Hill and Bartol (2016) and adapted to a 4-item Likert scale (e.g., "Our team communicates virtually (i.e., using technologies) with other team members in a way that is clear and easily understood") by Costa and colleagues (2021) with responses ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Team Adaptive Performance. TAP was assessed with a scale developed by Marques-Quinteiro and colleagues (2015) consisting of a total of 9 items from 4 different dimensions: solving problems creatively (e.g., "We find innovative ways to deal with unexpected events"); dealing with uncertain and unpredictable work situations (e.g., "We devise alternative plans in very short time, as a way to cope with new task demands"); learning work tasks, technologies and procedures (e.g., "We search and develop new competences to deal with difficult situations"); and handling work stress (e.g., "We remain calm and behave positively under highly stressful events"). Participants answered in a 5-point Likert-type scale ranging from 1 ("totally ineffective") to 5 ("totally effective").

Control Variables. The leader's gender and age were chosen to be included as control variables. Since the leader's highest education degree was significantly correlated to TAP, it was added to the list of covariates.

4. Results

4.1 Reliability, Validity, and Common Method Bias

The measurement scales were validated through commonly used processes assessing their reliability, validity, and unidimensionality. After reversion of the negative keyed scale items, the reliability of the contructs was evaluated using Crohnbach's alpha coefficient, which is presented in parentheses in Table 4.1. The Crohnbach's alpha ranged between 0.81 and 0.87 for all scales except for openness to experience (0.67). The latter value could not significantly be improved by excluding single items. Since it has already been validated sufficiently throughout the past decades (McCrae, 1994), we accepted the Crohnbach's alpha for this construct, yet recognizing this limitation.

Since the participants recorded their responses in different languages, we compared the variable means of both groups through t-tests. We conducted Levene's test for equality of variances and based on the *p*-values, we interpreted the results of the t-test for equality of means based on whether the assumption of equal variances could be met or not. We could retain the null hypothesis for the variables extraversion ($t = 0.45$, $p = 0.656$); openness to experience ($t = 0.41$, $p = 0.699$), structural virtuality ($t = -0.77$, $p = 0.444$), proximity ($t = -0.58$, $p = 0.561$), communication effectiveness ($t = 0.70$, $p = 0.368$), TAP ($t = -2.36$, $p = 0.076$), and highest educational degree ($t = 2.02$, $p = 0.062$). We rejected the null hypothesis for the control variables gender ($t = -3.46$, $p = 0.002$) and age ($t = -2.21$, $p = 0.034$). Since the nature of these questions did not allow for different interpretations in language, we assumed that these findings were related to differences in demographics and accepted them. Since we could retain the null hypothesis for all relevant variables, we could conclude that there is no difference between the mean score of participants that responded in English or German at 5% significance level. To ensure that the results can be interpreted, we examined whether the assumptions of normality, linearity, homoscedasticity, and absence of multicollinearity were met. The graphic results are presented in Annex E. The residuals followed normal distribution in the predicted probability plot. Equal distribution and homoscedasticity of the residuals were tested by plotting the predicted values and residuals on a scatterplot. To preclude multicollinearity, the correlation coefficients were examined (Table 4.1).

Table 4.1: Means, Standard Deviations, r_{wg}'s, ICCs and Intercorrelations

	Variable	M	SD	r_{wg}	$ICC_{(1)}$	$ICC_{(2)}$	1	2	3	4	5	6	7	8	9
1	Extraversion[1]	3.59	0.63	-			(0.86)								
2	Openness to Experience[1]	3.95	0.37	-			0.45**	(0.67)							
3	Structural Virtuality	0.18	0.29	0.73	0.61	0.84	0.18	0.45**	-						
4	Proximity	3.58	0.79	0.70	0.06	0.19	-0.26	-0.41*	-0.38*	(0.85)					
5	Communication Effectiveness	4.04	0.70	0.82	0.21	0.47	0.18	0.07	0.45**	0.08	(0.81)				
6	Team Adaptive Performance	3.83	0.57	0.84	0.08	0.24	-0.17	-0.32	-0.25	0.31	0.42*	(0.87)			
7	Gender[1]	-	-	-	-	-	0.08	-0.14	-0.06	-0.02	-0.12	-0.05	-		
8	Age[1]	42.7	10.55	-	-	-	-0.19	-0.03	-0.11	0.21	0.01	0.23	0.24	-	
9	Highest Educational Degree[1]	-	-	-	-	-	-0.09	0.00	0.37*	-0.29	0.20	-0.02	-0.02	0.17	-

*Note: n = 37 teams. [1]variables reported by leader. *p < .05. **p < .01.*

In order to analyse the data on a team level, the data from team members was aggregated (Costa et al., 2013). To justify the aggregation, we computed the interrater agreement r_{wg} (j) (James et al., 1993), designed for multiple-item scales, and intra-class correlation coefficients (ICC) (Bliese, 2000). The team variables were in accordance to the required criteria. In Table 4.1, we present the r_{wg}, ICC(1) and ICC(2) values for each item, as well as their correlations with each other. The r_{wg}, ICC(1) and ICC(2) values support the claim that proximity, virtual communication effectiveness, and TAP represent shared constructs at the team level. The personality dimensions extraversion and openness were only rated by leaders.

4.2 Hypothesis Testing

In the following, primary analysis examined the bivariate correlations of the personality traits, virtual contexts, and team adaptive performance which are provided in addition to the descriptive statistics in Table 4.1. Inconsistently with the literature, extraversion did not correlate with any of the examined variables, except with openness to experience, which is a known construct (McCrae, 1989) and not in scope of the underlying work. The results show that openness to experience is positively correlated with structural virtuality ($r = 0.45, p = 0.005$) and negatively correlated with proximity (r = -0.41, p = 0.013), but not with virtual communication effectiveness. Structural virtuality was negatively correlated with proximity (r = -0.38, p = 0.020), and interestingly, positively correlated with virtual communication effectiveness (r = 0.45, p = 0.005). Effectiveness of virtual communication was correlated positively with TAP ($r = 0.42, p = 0.010$). Regarding the control variables, the leader's highest education degree was positively correlated with structural virtuality at a significant level (r = -0.37, $p = 0.025$).

In consequence, several mediation models (PROCESS, Hayes, 2013) were tested to examine the extent of the mediating effects of virtual contexts. This macro allows for testing the indirect effects of personality on TAP through structural virtuality and TPV, even without a direct association between the personality dimensions and TAP. The leader's gender, age, and highest educational degree were entered as control variables. Through bootstrapping, the sample was re-sampled 5,000 times and examined for 95 percent confidence intervals (CI). We could assume significance of the indirect effects and occurrence of mediation if 0 fell outside the 95 percent confidence interval (Preacher & Hayes, 2008)

An overview of the indirect effects for the (partial) mediation models is presented in Table 4.2 and the path estimates for the models in Figure 4.1.

In hypothesis 1, we proposed that the relationship between leader extraversion and TAP was sequentially mediated by structural virtuality and collectively-experienced proximity. The results showed that structural virtuality and proximity did not sequentially mediate the relationship between extraversion and TAP (-0.01 [CI: -0.08, 0.01]. The mediation model was tested for partial mediations and no significant effect was found. Thus, the hypothesis was not supported.

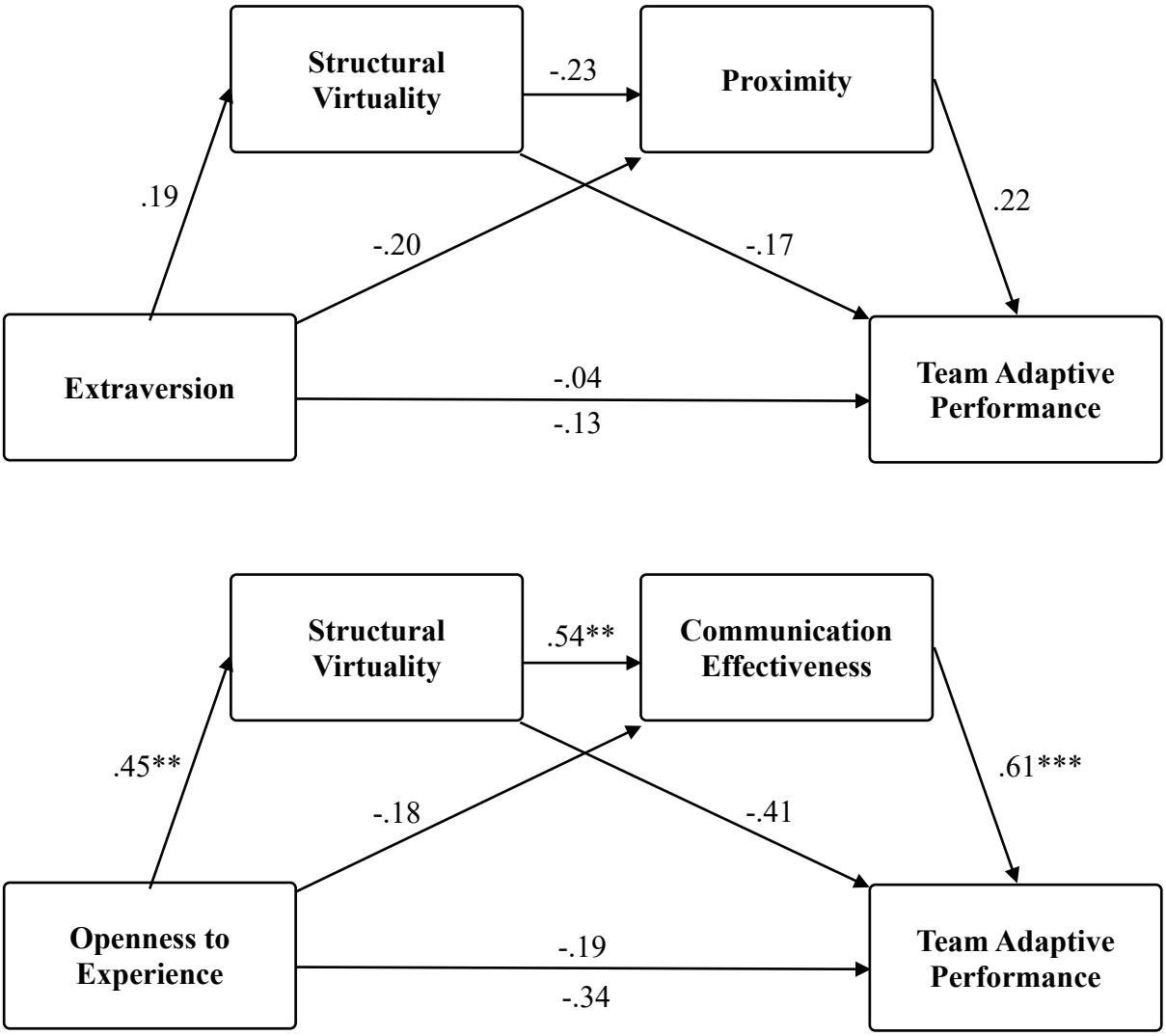
In hypothesis 2, we proposed that the relationship between leader openness to experience and TAP was sequentially mediated by structural virtuality and virtual communication effectiveness. The relationship between leader openness and TAP was sequentially mediated by structural virtuality and virtual communication effectiveness (0.15 [CI: 0.02, 0.42]. When testing the partial mediations of this model, we also found significant results for the mediating effect of structural virtuality on the relationship between openness and communication effectiveness (0.24 [CI: 0.04, 0.62], and TAP (-0.18 [CI: -0.41, -0.03]. Therefore, hypothesis 2 was supported.

Table 4.2: Indirect effects for mediation models

Mediations	**β**	**CI_{low}**	**CI_{high}**
Extraversion → Structural Virtuality → Proximity	-0.04	-0.21	0.05
Extraversion → Structural Virtuality → TAP	-0.03	-0.13	0.07
Extraversion → Proximity → TAP	-0.04	-0.16	0.07
Extraversion → Structural Virtuality → Proximity → TAP	-0.01	-0.08	0.01
Openness → Structural Virtuality → Communication Effectiveness	0.24	0.04	0.62
Openness → Structural Virtuality → TAP	-0.18	-0.41	-0.03
Openness → Communication Effectiveness → TAP	-0.11	-0.46	0.11
Openness → Structural Virtuality → Communication Effectiveness → TAP	0.15	0.02	0.42

Note: N= 37 teams. The regression coefficient (β) and confidence intervals refer to standardized values. CI = 95% confidence level (bootstrapping)

Figure 4.1: Model path coefficients for mediation models



*Note: n = 37 teams. **p < .01. ***p < .001.*

5. Discussion

The purpose of this study was to obtain a better understanding of the relationship between leader personality and team performance in virtual contexts, where teams collaborated in structural and collectively-experienced virtuality. The results of the study partially supported the hypothesized relationship between leaders' personality traits, team adaptive performance, and the mediating role of structural and perceived virtuality and provided interesting insights.

Opposed to what we hypothesized based on the literature review, the relationship between *extraversion* in leaders and TAP was not sequentially mediated by structural virtuality and collectively-experienced proximity. We did not find a significant direct effect of extraversion in leaders on TAP. Supporting the hypothesized claim, the relationship between *openness to experience* and TAP was sequentially mediated by structural virtuality and virtual communication effectiveness, i.e., openness to experience in leaders predicted higher levels of *structural virtuality*, which led to increased *virtual communication effectiveness*, resulting in higher levels of TAP. All these predicted relationships were significant. However, we did not find a significant direct effect of openness to experience in leaders on TAP.

The sub-dimensions extraversion and openness to experience were among the sub-dimensions of the FFM which have been closely associated with leadership and team effectiveness in the existing research body. Therefore, it is surprising that the results did not show a significant direct effect of these sub-dimensions on TAP. For extraversion, these findings were in accordance with newer research that examines leader personality and team performance in virtual teams (Balthazard et al., 2009) and reported inconsistent findings.

Even though we expected extraverted leaders to have a low degree of structural virtuality in teams, this claim was not supported by the findings. For the lack of other explanations, we believe that this effect might have been caused by organizational constraints caused by Covid-19, which forced teams that usually work with low structural virtuality to work from home for most of the time. For the lack of significant findings for the mediating effect of collectively-experienced proximity, we offer different possible explanations.

One first conclusion could be that the positive effect of extraversion on leadership situations that require interpersonal interaction (Barrick & Mount, 1991) does not apply for interpersonal interaction that is structurally virtual. The influence of virtuality contexts could be explained through trait activation theory (Tett & Burnett, 2003). The researchers found that personality traits require relevant situations for their expressions and that the latent potentials residing in individuals can be triggered into behaviors by situational cues relevant to the trait characteristics. Conversely, there are situations that can suppress responses relevant to a trait

by restricting relevant cues for the expression. In that sense, extraverted supervisors could constrain displaying their sociability when subordinates were dispersed over a large geographic area. However, structural virtuality was not a significant mediator in this model, which leaves us with two possible conclusions: virtual communication and ICT is more complicated than predicted in the model and does not reflect the communication needs of extraverted leaders, or the choice of ICT medium is not determined by extraversion in leaders, but rather provided by organizational structures. If structural virtuality and communication through ICT is more complicated than predicted, it is possible that there are specific ICT media that work well for extraverted leaders, but they were not captured by the construction of the variable in this model. It is possible that differences were not determined by the choice of ICT, but rather in which ways and frequencies these media were used. Since extraverted leaders are known to be strong in situations that require personal interaction, it is possible that there are specific ICT that resemble social interactions that are more adequate for the communication needs of extraverts. This could be the case for ICT that allow for synchronous interaction and convey a high degree of emotional cues (Daft & Lengel, 1984). Since the process of virtual communication is different from face-to-face communication, it is also possible that the role of extraversion is reduced in significance as a leader's personality trait in virtual team leadership because the positive aspects of leader extraversion are levelled out by structural virtuality.

Looking at openness to experience in leaders, we found that it influenced virtual team contexts. It became apparent that leaders rating high in openness to experience were strongly associated with teams that collaborated more through ICT and had a high degree of structural virtuality in communication. A possible explanation for this is that leaders rating high in openness to experience are faster to adopt new trends and are enthusiastic towards change. They are quicker to see advantages and opportunities of virtual teams and encourage the teams to work remotely. They also tend to trust the team that they complete their tasks, prioritize their work and work effectively and independently to achieve the team goals.

A high percentage of virtual, ICT-facilitated communication, as opposed to face-to-face communication, also leads to higher communication effectiveness. When teams are co-located, information flow happens through many different channels that are often not formally agreed on. Information exchange can take place through face-to-face meetings, by the water-cooler, by stepping by someone's desk, or through ICT. This unstructured approach excludes some individuals from the information flow, especially if only few team members are not co-located. The more team members are structurally co-located and communicate through non-virtual media, the fewer individuals working remotely are excluded from the information flow. In

teams with a high degree of structural virtuality, team members do not encounter each other by chance, but exchange is rather planned and intentional. It is very likely that team leaders and team members have a shared concept on which media they use to communicate, and the content of information is better elaborated and documented. This effect can furthermore be explained through the experiential nature of media richness perceptions and channel expansion theory (Carlson & Zmud, 1999). In teams with a high degree of structural virtuality, team members are exposed to the constant media-use and learn to communicate well virtually over time. Since extraverted leaders might prefer non-virtual communication, the team might not have sufficient positive experience with different virtual communication channels to learn how to communicate effectively.

Another interesting finding which was not hypothesized was that leaders rating high in openness to experience were significantly associated with teams that collectively felt more distant from each other. This relationship was not mediated by structural virtuality but caused by a direct effect. The enthusiasm towards technology and virtual teams that is potentially associated with openness to experience paired with the empowerment to the team to work autonomously might prevent the leader from acknowledging the perceived distance within the team. The team feels far from each other and technologies do not seem to bridge the chasm to work as a unit. These findings are in accordance with previous findings focused on autonomy and interdependence as predictors of TPV (Costa et al., 2021). The authors recommended that, in teams with a high degree of structural virtuality, work processes should be designed in a way that they prevent the team from growing apart, specifically that interdependence is fostered to promote increased opportunities to interact.

The team states resulting from different dimensions of perceived virtuality can be explained through the combination of the dimensions (Handke et al., 2020). By combining the affective and the cognitive dimension of TPV, the authors provided a framework of different team states. High levels of distance and high levels of information deficits resulted in team states that are “lost in translation”. Due to the affective distance, teams that feature this state likely feel confused and disconnected. They have a low level of relational communication, which might negatively affect team satisfaction and team performance. High levels of distance and low levels of information deficits resulted in “machine” states. This team describes teams that are emotionally distant and cold from each other but communicate with machine-like efficiency. The team outcomes associated with this state are high team performance, but low team satisfaction. Low distance and high information deficits resulted in “nightclub” states, which reflect a high degree of emotional connection paired with ineffective communication. Since the

affective proximity, the team member relationship is characterized by warmth and intimacy, which might lead to increased team satisfaction, but decreased performance. The combination of low distance and low information deficits resulted in “cruising speed” team states, which is most likely to be associated with positive team outcomes. It is characterized by smooth collaboration and information flow and warm affective relationships. Despite the physical distance, cruising speed teams, are unlikely to perceive themselves as virtual. The present combination of high collectively experienced distance and low collectively experienced information deficits can be categorized into a machine-like team state, which refers to teams that exhibit a mixture of machine-like efficiency paired with coldness with each other. The authors state that machine-state teams would gain a shared understanding of team goals and resulting tasks, and they exchange task-related information with each other, but they are emotionally disconnected from each other and from the team. They propose that this state can, on an ad-hoc basis, yield high performance outcomes. This proposition on team performance has been confirmed by our underlying study, since low levels of proximity and high levels of virtual communication effectiveness in teams predicted TAP on a significant level. These machine-state teams were strongly associated with openness to experience in leaders, which indicates that leaders with this character trait foster machine-state teams. Potentially, they value the cognitive and task-related dimensions more than the affective, social dimensions.

Another possible explanation for this TPV state could draw the conclusion that the sample consists of leaders who do not have many years of leadership experience. Therefore, they might have not experienced negative impacts of collectively distant teams, and therefore do not see the value of team proximity and interpersonal relationships, so it is possible that they do not facilitate and foster proximity as a team state. Even though age has been controlled in the analysis, due to the small sample it should not be excluded from the interpretation. Since the sample is quite young, there might be some age effects impacting the findings. Young employees tend to be more task-focused than senior employees, who in contrast put a stronger emphasis on relationships with colleagues and leaving a legacy, so it could be concluded that young leaders are focused more on the communication effectiveness part of TPV than on proximity. This claim could be sustained by combining socioemotional selectivity theory and job characteristics theory (Cavanagh et al., 2020). Socioemotional selectivity theory proposes that with progressing age, emotional and social changes seem generally positive (Carstensen, 1993). These changes in affect reflect a change in motivation and priorities as people age. Job characteristics theory posits that certain job characteristics motivate workers through the intrinsic satisfaction found in performing job tasks (Hackman & Oldham, 1976). Job tasks that

are perceived as enjoyable and meaningful result in personal and work outcomes including quality of work performance, job satisfaction, and work motivation. By combining these theories, Cavanagh and colleagues (2020) found that with progressing age, employees are rather motivated by job characteristics that are emotionally and socially satisfying (e.g., job autonomy, positive social interactions with colleagues), than by characteristics related to accumulating resources (e.g., job training, salary).

Since the data collection was conducted during a period when most European countries were in lockdown, many teams that would usually work in a co-located manner, were forced into an entirely virtual setup. Since they might have only had little time to adjust to this period, leaders might still be readjusting to virtuality, or accepting high degrees of distance as a temporary state, ready to bounce back into structurally co-located teams. However, it is also likely that the machine-state leads to exhaustion and work stress among the team. The psychological strain might be especially high for individuals that do not only feel distant from their team, but also cannot rely on social exchange and proximity to other teams in the organization. This might be the case for virtual teams with individuals that work fully dispersed and which attribute most of their working time to working in that team.

5.1 Theoretical and Practical Implications

Personality traits are deeply rooted within individuals and difficult to change, the findings of the survey have important indications for managers, HR practitioners, and researchers.

Even though the leader's personality traits in the dimensions of extraversion and openness to experience do not suffice in order to predict TAP, the study provides important findings for virtuality contexts. We found that leaders with high ratings in openness to experience foster teams with a high degree of structural virtuality, possibly resulting in "machine-state" teams. Even though Costa and colleagues (2021) stress the relevance of increasing proximity for these types of teams, there might be situations when a high-performance team is created to complete a temporary task, where proximity is not needed. This could be the case for crisis or emergency teams. When it comes to leader selection, openness to experience as a selection criterion can be a clear recommendation. Even though the overwhelming body of literature suggests extraversion in leaders as a strong predictor for team performance, this study provides, similar to previous studies conducted in virtuality contexts, inconsistent results. For leader selection, the practical implication is therefore to select leaders for teams with low degrees of virtuality.

In order to complement our understanding of trait leadership in this context, it could be helpful to focus on leadership style. Leadership styles that have been associated with increased

team performance are transformational/transactional leadership (Zhang & Fjermestad, 2006), which have been associated with extraversion and openness to experience in previous research (Judge & Bono, 2000). In a study on extraversion and openness to experience as a personality trait for leader emergence and transformational leadership, Balthazard and colleagues (2009) presented that although these personality dimensions had predictive power in face-to-face settings, in virtual teams, they were unrelated to leadership emergence. Additionally, we should look at leader behaviors, such as leader-member exchange (e.g., Larson & DeChurch, 2020). Acknowledging the fact, that all teams have a certain degree of virtuality nowadays, some streams in leadership have shifted to a focus on virtual approaches on leadership that incorporate the virtual nature of much of today's communication, such as e-leadership (Avolio et al., 2014). Since we need to conclude that virtual teams function differently than traditional teams and we cannot apply existing theory, in order to better understand trait approaches in virtual teams, it could be helpful to conduct inductive research to find out if there are specific personality traits that make for good virtual leaders.

In order to get to the team stage that has been described by Handke and colleagues (2020) as cruising-speed level, the collectively perceived proximity needs to be augmented. This could be achieved through applying shared mental models (SMM). They are an emergent state and can be defined as the cognitive representations that individuals form regarding how the systems they interact with operate. Applied to the team level, team mental models reflect a shared understanding among team members of particular aspects of their work environment, most commonly focusing on tasks or interactions among teammates (Resick et al., 2010) and on a shared understanding of information and communication technology (ICT) (Müller & Antoni, 2020). This could contribute to form a common use of technology, which is especially important in regards to building personal relationship.

Even though the proximity construct is independent from ICT media, a common understanding of ICT media that are frequently used for relationship building, or making social interaction possibilities of ICT explicit, might increase proximity. Leadership instruments to foster social exchange beyond the business agenda include videoconferences that feature daily check-ins, virtual coffees, or setting time apart at the beginning of meetings for informal exchange. These help on creating interpersonal affective relationships and trust in each other.

The future of technological advancements might also contribute to a broader availability of hardware and ICT communication that allows for interaction that is rich in information and emotional cues, without the challenges that are imposed these days due to synchronicity,

connection issues, and image quality. It is also possible that corporate social media platforms are introduced for organizational use in order to foster interpersonal exchange.

5.2 Limitations and Future Research

Although the present results indicate strong statistical findings, it is appropriate to recognize several potential limitations.

The sample was limited to 37 teams, which is quite small to measure mediation effects. The trade-off in sample size was accepted in view of the unique opportunity to conduct the study with real-world virtual teams characterized by different degrees of virtuality. The sample is non-probabilistic and convenient, consisting mainly of team leaders and members from the personal network. This might have an effect on gender, age, level of education, respondent nationality, and sector, but only the first three variables were controlled. It might also result in socially expected behaviors which might alter the responses, especially in terms of personality traits and team outcomes. Limitations regarding reliability concern a small Crohnbach's alpha for the variable openness to experience. We expect that this value derives from a small sample size since the construct has been validated sufficiently through factor analysis (McCrae, 1994). The difference in the mean score in the variables gender and age between English and German language was recognized but controlled for throughout the analysis. Since leaders were not given any selection criteria to nominate team members to participate in the study, it occurred through snowball distribution, which increases the possibility for rater bias. The study is cross-sectional in nature, which makes casual relationships difficult to verify and can involve common method bias (Hill & Bartol, 2016). Both predictors and criteria are self-rated measures (by leaders or by peers) and were obtained anonymously. Self-report predictors and performance criteria can raise concern (Ashton, 1998), but this was mitigated by obtaining information from different sources.

Extraversion and openness to experience as sub-dimensions of the leader's personality traits, were constructed as self-report measures. Especially in virtual settings, the way the leader's personality is perceived by followers changes throughout different ICT media (Potter & Balthazard, 2002). Since it is possible that the impact on team emergent states and team outcomes according to the trait approach to leadership depends on the leader's personality as perceived by team members, it could be meaningful to address this in future studies. Similarly, we did not consider the role of the team members' personality and team composition as variables in this study. The effectiveness of virtual teams might also depend on behaviors and traits on part of the team members (Hill & Bartol, 2016), which could be addressed in the future.

Similarly, one problem in the design of the study is that only formal leadership has been regarded. This choice was made due to the fact that in most organizations, formal leadership persists. However, the formal leadership role has been described as management and was criticized to not always reflect true leadership (Andersen, 2006). He argued that in the absence of leadership, within teams, team members naturally assume the leadership role. Since emergent leadership has a strong association with the trait approach to leadership, it could be interesting for further research, since extraversion has a strong prediction for emergent leadership (Spark et al., 2018).

Regarding team outcomes, we only measured team performance and not team satisfaction. It is possible that virtual communication effectiveness is a stronger predictor for TAP and that proximity has a closer relationship with team satisfaction, turnover intention, and well-being. The inclusion of such a team outcome variable should be considered in future studies.

Another main limitation to the study is that it was conducted during a major lockdown in Europe caused by a global pandemic. Some teams were temporarily forced into an entirely dispersed and virtual setup, which disrupted many teams and imposed an increased coordination and psychological burden on leaders and team members. It is possible that leaders have not managed to create a collective unity in the team, or that the companies' ICT landscape did not provide technological platforms high in media richness. The ongoing crisis mode created by the on-and-off lockdown stages as they took place in various countries might also have contributed to an overall decline in individual performance and work motivation, but to our knowledge, these effects yet need to be studied. Since extraversion in leaders failed to predict low degrees of virtuality or distance, we suggest that future studies should study the effects of extraversion on virtuality contexts and team outcomes in contexts that allow the team to operate in their natural setup with a degree of virtuality and which could be influenced by the leader.

Since the leader has an important role in the creation of the environment a virtual team operates in, it might be helpful to focus on better understanding his or her view on technology and virtuality. If he or she considers virtual communication and technology as something beneficial and promotes virtual collaboration might contribute to higher levels of performance in dispersed teams (Hill & Bartol, 2016). This idea derives from a study on diversity in student groups, where diversity beliefs were found to have an important role in team performance (Van Dick et al., 2008). Similarly, a virtuality beliefs can be described as beliefs individuals hold about how team virtuality and collaboration through ICT affects team functioning, that is, the extent to which individuals perceive virtuality to be beneficial for or detrimental to the team's functioning. In the present study, one potential implication could be made upon the choice of

team members to participate in the present study, which was up to the leader. Since the leaders tended to nominate team members that had a higher degree of presence in the office (21.4%) than the average team member (13.5%), it could imply that the structurally co-located team members were more present in the leader's minds, or that they have a more trustful relationship with members that are co-located. Furthermore, potential antecedents such as the leader's personality, previous exposure to team virtuality, and trust could be associated with the leader's role in promoting high virtual proximity and impact TAP.

Collectively-experienced information deficits proved to be detrimental for team adaptative performance. Therefore, it would be meaningful to further understand this relationship and which factors could influence this relationship. Since virtual communication effectiveness is a dimension of team state, it potentially requires some level of SMM among team the team members on how they view information communication and technology. Existing research on shared mental models found that a more common understanding of ICT results in increased team coordination and team performance (Maynard & Gilson, 2014; Müller & Antoni, 2020).

Team-perceived virtuality is a relatively new concept with little empirical backup. It could be meaningful to conduct a study in a longitudinal setup to examine how collectively-experienced proximity and collectively-experienced virtual information effectiveness develop over time and how they affect team performance and team satisfaction in virtual teams.

6. Conclusion

Despite these limitations, the present study of 37 teams enhances the understanding of the relationship between leader personality and team performance. The empirical research contributes to the growing body of team adaptive performance and team perceived virtuality and can be seen as a first step towards integrating the lines of research on trait-based leadership, team adaptive performance, and virtuality contexts. We hope that our findings provide new implications for the research body focussed on trait-based team leadership and for organizations and that the current research will stimulate further investigation of these areas.

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Annex A: Sociodemographic charaterisation of leaders

Variables	Answers	Frequency
Sex	Male	75.7%
	Female	24.3%
Age (in years)	26-30	13.5%
	31-35	21.6%
	36-40	8.1%
	41-45	13.5%
	46-50	21.6%
	51-55	5.4%
	> 55	16.2%
Nationality	Germany	89.2%
	Italy	5.4%
	Mexico	2.7%
	Netherlands	2.7%
Country of Residence	Germany	81.1%
	Mexico	2.7%
	Netherlands	2.7%
	Portugal	8.1%
	Switzerland	5.4%
Highest Educational Degree	less than High School	10.8%
	High school / Diploma	16.2%
	Bachelor's Degree	13.5%
	Master's Degree	48.6%
	Doctoral Degree	10.8%
Seniority (leadership experience)	0 - 6 months	2.7%
	6 - 12 months	13.5%
	1 - 2 years	24.3%
	2 - 5 years	16.2%
	5 - 10 years	37.8%
	> 10 years	5.4%
Sector	Education/Research	5.4%
	Health	13.5%
	Commercial/Trade	2.7%
	Manufacturing	40.5%
	IT	10.8%
	Media	5.4%
	Transport/Logistics	5.4%
	Public administration	2.7%
	Finance/Insurance	8.1%
	Customer Service	5.4%

Annex B: Sociodemographic charaterisation of team members

Variables	Answers	Frequency
Sex	Male	46.8%
	Female	53.2%
Age (in years)	< 26	13.5%
	26-30	23.8%
	31-35	16.7%
	36-40	11.9%
	41-45	4.8%
	46-50	11.1%
	51-55	9.5%
	> 55	8.7%
Nationality	Germany	81.0%
	Italiy	4.8%
	Mexico	3.2%
	Switzerland	3.2%
	Other	7.8%
Country of Residence	Germany	84.9%
	Mexico	3.2%
	Portugal	3.2%
	Switzerland	3.2%
	Other	5.5%
Highest Educational Degree	less than High School	9.5%
	High school / Diploma	11.9%
	Trade/technical/vocational training	17.5%
	Bachelor's Degree	31.0%
	Master's Degree	23.0%
	Doctoral Degree	7.1%
Profession	Manager	5.6%
	Professional	64.0%
	Administrative or supporting clerk	23.2%
	Skilled manual labor	6.4%
	Unskilled manual labor	0.8%

Annex C: Questionnaire 1 (leaders)

Dear Participant,
Thank you for taking the time to participate in this survey, which is an essential part of my research for my Master's thesis conducted at the ISCTE Business School in Lisbon. The focus of the research project is team and leadership effectiveness in virtual contexts.
You will be asked to complete this survey in your position as project or team leader with a minimum of 4 team members and you will be asked questions regarding the collaboration with this team. It will take approximately 10-15 minutes to answer all questions. In the course of the survey, you will be asked to provide the e-mail addresses of 4 of your team members who are willing to take part in the survey as well. For them, answering to the survey will take approximately 5-10 minutes.
Your participation is of utmost value, and crucial for the success of this research project. Please answer all questions honestly. There are no right or wrong answers. All of your answers will be treated confidentially and processed in an anonymous way for scientific purposes only. Your team won't receive any information on the answers you provided.
If you are interested in the results of this research or if you have any questions or concerns, please contact moana_koenig@iscte-iul.pt.
The survey is available in English and German. Please select the language you feel most comfortable with on the top of the page and confirm that you would like to participate in this survey and that you are currently leading a team of at least 4 members. Afterwards, please klick on the arrow on the bottom of the page.

○ Yes (1)

Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,
Ich danke Ihnen, dass Sie sich Zeit nehmen, an dieser Umfrage teilzunehmen, welche ein wesentlicher Teil meiner Forschungsarbeit für meine Masterarbeit an der ISCTE Business School in Lissabon ist. Der Schwerpunkt dieses Forschungsprojekts liegt auf der Effektivität von Teams und Führungskräften virtuellen Kontext.
Sie werden gebeten, diese Umfrage in Ihrer Position als Projektteam- oder Teamleiter mit mindestens 4 Mitarbeitern auszufüllen. Die Beantwortung aller Fragen dauert etwa 10-15 Minuten.
Im Verlauf der Umfrage werden Sie gebeten, die E-Mail-Adressen von 4 Teammitgliedern anzugeben, die bereit sind, ebenfalls an dieser Umfrage teilzunehmen. Weil deren Fragebogen kürzer ist, werden ca. 5-10 Minuten zur Beantwortung aller Fragen benötigt. Ihre Teilnahme ist von höchstem Wert und entscheidend für den Erfolg dieses Forschungsprojekts. Bitte beantworten Sie alle Fragen ehrlich. Es gibt keine richtigen oder falschen Antworten. Alle Ihre Antworten werden vertraulich behandelt und in anonymisierter Form ausschließlich für

wissenschaftliche Zwecke ausgewertet. Ihr Team wird keine Informationen über die von Ihnen gegebenen Antworten erhalten.
Wenn Sie an den Forschungsergebnissen interessiert sind oder wenn Sie Fragen oder Bedenken haben, wenden Sie sich bitte an moana_koenig@iscte-iul.pt.
Die Umfrage ist in Englisch und Deutsch verfügbar. Bitte wählen Sie am Seitenanfang die Sprache, in der Sie sich am wohlsten fühlen und bestätigen Sie, dass Sie an dieser Umfrage teilnehmen möchten und derzeit ein Team von min. 4 Mitarbeitern leiten. Klicken Sie anschließend auf den Pfeil unten auf der Seite.

○ Ja (1)

Please provide a **brief description or title** of the project/work team which you are leading. As your employees might be part of several work/project teams, this will help them as a reference when responding to the questions.

_____

Bitte **betiteln oder beschreiben Sie kurz** das Projekt- oder Arbeitsteam, welches Sie leiten. Da Ihre Teammitglieder möglicherweise Teil mehrerer Arbeits-/Projektteams sind, dient ihnen dies als Referenz bei der Beantwortung der Fragen.

_____

Please insert the e-mail addresses of 4 of your team members working in this team who are willing to participate in the survey. After your completion of this survey, they will receive an invitation with a link to the survey.

_____

Bitte geben Sie die E-Mail-Adressen von 4 Ihrer Mitarbeiter ein, die in diesem Team tätig und bereit sind, an der Umfrage teilzunehmen. Nach Beendigung dieser Umfrage erhalten diese Teammitglieder eine Einladung mit einem Link zur Umfrage.

_____

In order to ensure anonymity when matching the data, please **create a team code** consisting of the following elements:

first letter of your first name, your *current age,* and *first letter of your company name*.

e.g. for **J**ohn Doe, aged **45**, working at **S**ample Enterprise Ltd., the code would be "**J45S**"

_____

Um die Anonymität beim Datenabgleich zu gewährleisten, erstellen Sie bitte einen Team-Code, der sich folgendermaßen zusammensetzt:

erster Buchstabe Ihres Vornamens, Ihr aktuelles Alter, erster Buchstabe des Firmennamens.

z.B. für **H**ans Meier, Alter 45 Jahre, der bei der **B**eispielfirma GmbH arbeitet, wäre der Code "**H45B**".

Describe yourself as honestly as you see yourself and in relation to other people of the same sex and roughly the same age in your work and private life. Please be as precise and honest as possible. Your responses will be kept in absolute confidence. Indicate for each statement how accurately it describes you.

I ...

	Very inaccurate (1)	Moderately inaccurate (2)	Neither accurate nor inaccurate (3)	Moderately accurate (4)	Very accurate (5)
Am the life of the party. (1)	○	○	○	○	○
Feel little concern for others. (2)	○	○	○	○	○
Am always prepared. (3)	○	○	○	○	○
Get stressed out easily. (4)	○	○	○	○	○
Have a rich vocabulary. (5)	○	○	○	○	○
Don't talk a lot. (6)	○	○	○	○	○
Am interested in people. (7)	○	○	○	○	○

Leave my belongings around. (8)	○	○	○	○	○
Am relaxed most of the time. (9)	○	○	○	○	○
Have difficulty understanding abstract ideas. (10)	○	○	○	○	○
Feel comfortable around people. (11)	○	○	○	○	○
Insult people. (12)	○	○	○	○	○
Pay attention to details. (13)	○	○	○	○	○
Worry about things. (14)	○	○	○	○	○
Have a vivid imagination. (15)	○	○	○	○	○
Keep in the background. (16)	○	○	○	○	○
Sympathize with others' feelings. (17)	○	○	○	○	○

Beschreiben Sie sich selbst so ehrlich, wie Sie sich selbst sehen, im Verhältnis zu anderen Menschen des gleichen Geschlechts und ungefähr des gleichen Alters in Ihrem Berufs- und Privatleben. Seien Sie bitte so genau und ehrlich wie möglich. Ihre Antworten werden absolut vertraulich behandelt. Geben Sie für jede Aussage an, wie zutreffend sie Ihre Person beschreibt.

Ich ...

	Sehr unzutreffend (1)	Eher unzutreffend (2)	Neutral (3)	Eher zutreffend (4)	Sehr zutreffend (5)
bringe eine Party in Schwung. (1)	○	○	○	○	○

empfinde wenig für andere. (2)	○	○	○	○	○
bin immer vorbereitet. (3)	○	○	○	○	○
gerate schnell in Stress. (4)	○	○	○	○	○
besitze einen großen Wortschatz. (5)	○	○	○	○	○
rede nicht viel. (6)	○	○	○	○	○
bin an anderen Menschen interessiert. (7)	○	○	○	○	○
lasse meine Sachen herumliegen. (8)	○	○	○	○	○
bin die meiste Zeit entspannt. (9)	○	○	○	○	○
habe Schwierigkeiten, abstrakte Ideen zu verstehen. (10)	○	○	○	○	○
fühle mich wohl unter Menschen. (11)	○	○	○	○	○
beleidige andere. (12)	○	○	○	○	○
achte auf Details. (13)	○	○	○	○	○
grüble über Dinge. (14)	○	○	○	○	○
habe eine lebhafte Vorstellungskraft. (15)	○	○	○	○	○
halte mich im Hintergrund. (16)	○	○	○	○	○
fühle mit anderen Menschen mit. (17)	○	○	○	○	○

I ...

	Very inaccurate (13)	Moderately inaccurate (14)	Neither accurate nor inaccurate (15)	Moderately accurate (16)	Very accurate (17)
Make a mess of things. (18)	○	○	○	○	○
Seldom feel blue. (19)	○	○	○	○	○
Am not interested in abstract ideas. (20)	○	○	○	○	○
Start conversations. (21)	○	○	○	○	○
Am not interested in other people's problems. (22)	○	○	○	○	○
Get chores done right away. (23)	○	○	○	○	○
Am easily disturbed. (24)	○	○	○	○	○
Have excellent ideas. (25)	○	○	○	○	○
Have little to say. (26)	○	○	○	○	○
Have a soft heart. (27)	○	○	○	○	○
Often forget to put things back in their proper place. (28)	○	○	○	○	○
Get upset easily. (29)	○	○	○	○	○
Do not have a good imagination. (30)	○	○	○	○	○
Talk to a lot of different people at parties. (31)	○	○	○	○	○

Am not really interested in others. (32)	○	○	○	○	○
Like order. (33)	○	○	○	○	○
Change my mood a lot. (34)	○	○	○	○	○

Ich ...

	Sehr unzutreffend (13)	Eher unzutreffend (14)	Neutral (15)	Eher zutreffend (16)	Sehr zutreffend (17)
vermassle die Dinge. (18)	○	○	○	○	○
fühle mich selten deprimiert (bedrückt). (19)	○	○	○	○	○
bin an abstrakten Ideen nicht interessiert. (20)	○	○	○	○	○
beginne Gespräche. (21)	○	○	○	○	○
bin nicht interessiert an den Problemen anderer Leute. (22)	○	○	○	○	○
erledige Hausarbeiten unmittelbar. (23)	○	○	○	○	○
bin schnell beunruhigt. (24)	○	○	○	○	○
habe ausgezeichnete Ideen. (25)	○	○	○	○	○
habe wenig zu sagen. (26)	○	○	○	○	○
habe ein weiches Herz. (27)	○	○	○	○	○

vergesse oft, Dinge an ihren Platz zurückzulegen. (28)	○	○	○	○	○
rege mich leicht auf. (29)	○	○	○	○	○
habe kein gutes Vorstellungsvermögen. (30)	○	○	○	○	○
spreche mit vielen verschiedenen Leuten auf Parties. (31)	○	○	○	○	○
bin nicht wirklich interessiert an anderen. (32)	○	○	○	○	○
mag Ordnung. (33)	○	○	○	○	○
wechsle oft meine Stimmung. (34)	○	○	○	○	○

I ...

	Very inaccurate (1)	Moderately inaccurate (2)	Neither accurate nor inaccurate (3)	Moderately accurate (4)	Very accurate (5)
Am quick to understand things. (35)	○	○	○	○	○
Don't like to draw attention to myself. (36)	○	○	○	○	○
Take time out for others. (37)	○	○	○	○	○
Shirk my duties. (38)	○	○	○	○	○
Have frequent mood swings. (39)	○	○	○	○	○

Use difficult words. (40)	○	○	○	○	○
Don't mind being the center of attention. (41)	○	○	○	○	○
Feel others' emotions. (42)	○	○	○	○	○
Follow a schedule. (43)	○	○	○	○	○
Get irritated easily. (44)	○	○	○	○	○
Spend time reflecting on things. (45)	○	○	○	○	○
Am quiet around strangers. (46)	○	○	○	○	○
Make people feel at ease. (47)	○	○	○	○	○
Am exacting in my work. (48)	○	○	○	○	○
Often feel blue. (49)	○	○	○	○	○
Am full of ideas. (50)	○	○	○	○	○

Ich ...

	Sehr unzutreffend (1)	Eher unzutreffend (2)	Neutral (3)	Eher zutreffend (4)	Sehr zutreffend (5)
verstehe Dinge schnell. (35)	○	○	○	○	○
mag es nicht, Aufmerksamkeit auf mich zu ziehen (36)	○	○	○	○	○
nehme mir Zeit für andere. (37)	○	○	○	○	○

drücke mich vor meinen Pflichten. (38)	○	○	○	○	○
habe häufig Stimmungsschwankungen. (39)	○	○	○	○	○
gebrauche schwierige Wörter. (40)	○	○	○	○	○
habe kein Problem damit, im Zentrum der Aufmerksamkeit zu stehen. (41)	○	○	○	○	○
fühle die Emotionen anderer. (42)	○	○	○	○	○
folge einem Plan. (43)	○	○	○	○	○
bin leicht gereizt. (44)	○	○	○	○	○
verbringe Zeit damit, über Dinge nachzudenken. (45)	○	○	○	○	○
bin still unter Fremden. (46)	○	○	○	○	○
kann andere beruhigen. (47)	○	○	○	○	○
bin anspruchsvoll in meiner Arbeit. (48)	○	○	○	○	○
fühle mich oft deprimiert (bedrückt). (49)	○	○	○	○	○
bin voller Ideen. (50)	○	○	○	○	○

In the following part you're asked to provide information on working with the work/project team specified above. When answering the questions, always think about working only with this team.

Indicate to which degree you agree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Creating work teams that interact via technology can be a recipe for trouble. (1)	○	○	○	○	○
I think that work teams should interact mostly face-to-face. (2)	○	○	○	○	○
Interacting via technology helps doing the task well. (3)	○	○	○	○	○

Im folgenden Teil werden Sie gebeten, Angaben zur Zusammenarbeit mit dem oben angegebenen Arbeits-/Projektteam zu machen. Denken Sie bei der Beantwortung der Fragen ausschließlich an die Zusammenarbeit mit diesem Team.

Geben Sie an, inwiefern Sie den folgenden Aussagen zustimmen.

	Stimme überhaupt nicht zu (1)	Stimme eher nicht zu (2)	Teils teils (3)	Stimme eher zu (4)	Stimme voll und ganz zu (5)
Die Bildung von Arbeitsteams, die mittels Technologie interagieren, bringt nur Ärger. (1)	○	○	○	○	○
Ich denke, dass Arbeitsteams vor allem von Angesicht zu Angesicht interagieren sollten. (2)	○	○	○	○	○
Mittels Technologien zu interagieren hilft dabei, die Aufgabe gut zu erledigen. (3)	○	○	○	○	○

Please allocate the proportion (in %) of total work/project time you currently spend communicating with other team members using:

Face-to-face communication : _____ (1)
Telephone : _____ (2)
Email : _____ (3)
Videoconferences : _____ (4)
Instant messaging : _____ (5)
Document sharing : _____ (6)
Collaboration Software (e.g. MS Teams, Slack) : _____ (8)
Other : _____ (7)
Total : _____

Bitte geben Sie in den zeitlichen Anteil (in %) der Arbeits-/Projektzeit an, mit dem Sie momentan unter Nutzung der jeweiligen Medien mit Ihrem Team kommunizieren:

In einem Raum/face-to-face : _____ (1)
Telefon : _____ (2)
E-Mails : _____ (3)
Videokonferenzen : _____ (4)
Instant Messaging : _____ (5)
Document sharing/geteilte Dokumente : _____ (6)
Kollaborationssoftware (z.B. MS Teams, Slack) : _____ (8)
Sonstiges : _____ (7)
Total : _____

Consider your team work over the last week. On each line below, select the option you think best describes your connection to your team while you were working on your task or project.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
distant	○	○	○	○	○	nearby
far	○	○	○	○	○	close
separate	○	○	○	○	○	together
remote	○	○	○	○	○	proximal
disconnected	○	○	○	○	○	connected

Denken Sie an die Teamarbeit während der letzten Woche. Wählen Sie in jeder Zeile unten die Option aus, die Ihrer Meinung nach Ihre Verbindung zu Ihrem Team am besten beschreibt, während Sie an Ihrer Aufgabe oder Ihrem Projekt gearbeitet haben.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
entfernt	○	○	○	○	○	nahegelegen
weit (weg)	○	○	○	○	○	eng
getrennt	○	○	○	○	○	zusammen
entlegen	○	○	○	○	○	nah
abgekoppelt	○	○	○	○	○	verbunden

Think about the work/project team and answer to the following statements.

	Strongly disagree (8)	Somewhat disagree (9)	Neither agree nor disagree (10)	Somewhat agree (11)	Strongly agree (12)
Our team uses technology effectively to communicate virtually (i.e., using technologies) with one another. (1)	○	○	○	○	○
Our team communicates virtually (i.e., using technologies) with other team members in a way that is clear and easily understood. (2)	○	○	○	○	○
Our team takes steps to avoid misunderstandings when communicating virtually (i.e., using technologies) with team members (e.g., by	○	○	○	○	○

providing important background information, verifying receipt of messages, requesting and providing clarification). (3)					
Our team sends virtual (i.e., using technologies) communication with a positive and encouraging tone. (4)	○	○	○	○	○

Think about the work/project team and answer to the following statements.

Denken Sie an Ihr Arbeits-/Projektteam und gehen Sie auf die folgenden Aussagen ein.

	Stimme überhaupt nicht zu (8)	Stimme eher nicht zu (9)	Teils teils (10)	Stimme eher zu (11)	Stimme voll und ganz zu (12)
Unser Team setzt Technologie effektiv ein, um virtuell (d.h. unter Verwendung von Technologien) miteinander zu kommunizieren. (1)	○	○	○	○	○
Unser Team kommuniziert mit anderen Teammitgliedern virtuell auf eine Art und Weise, die klar und einfach zu verstehen ist. (2)	○	○	○	○	○
Unser Team ergreift Maßnahmen, um Missverständnisse bei der virtuellen Kommunikation zu vermeiden (z.B. durch Bereitstellung wichtiger Hintergrundinformationen, Bestätigung des Empfangs von Nachrichten, Anforderung und	○	○	○	○	○

Bereitstellung von Klarstellung). (3)					
Unser Team kommuniziert virtuell in einem positiven und ermunterndem Ton. (4)	○	○	○	○	○

Indicate how effective you think the team is.

	Totally ineffective (1)	Somewhat ineffective (2)	Neither effective nor ineffective (3)	Somewhat effective (4)	Totally effective (5)
We find innovative ways to deal with unexpected events. (1)	○	○	○	○	○
We use creative ideas to manage incoming events. (2)	○	○	○	○	○
We engage in creative action to solve problems for which there are no easy or strait forward answers. (9)	○	○	○	○	○
We devise alternative plans in very short time, as a way to cope with new task demands. (3)	○	○	○	○	○
We adjust and deal with unpredictable situations by shifting focus and taking reasonable action. (4)	○	○	○	○	○
Periodically, we update technical and interpersonal competences as a way to better perform the tasks in which we are enrolled. (5)	○	○	○	○	○

We search and develop new competences to deal with difficult situations. (6)	○	○	○	○	○
We remain calm and behave positively under highly stressful events. (7)	○	○	○	○	○
We maintain focus when dealing with multiple situations and responsibilities. (8)	○	○	○	○	○

Geben Sie an, wie effektiv das Team Ihrer Meinung nach ist.

	Völlig ineffektiv (1)	Eher ineffektiv (2)	Weder effektiv noch ineffektiv (3)	Eher effektiv (4)	Völlig effektiv (5)
Wir finden innovative Wege, um mit unerwarteten Ereignissen umzugehen. (1)	○	○	○	○	○
Wir ergreifen kreative Maßnahmen, um Probleme zu lösen, für die es keine einfachen oder direkten Antworten gibt. (2)	○	○	○	○	○
Wir handeln kreativ, um Probleme zu lösen, für die es keine einfachen oder direkten Antworten gibt. (9)	○	○	○	○	○
Wir entwickeln in sehr kurzer Zeit Alternativpläne, um den neuen Aufgabenanforderungen gerecht zu werden. (3)	○	○	○	○	○
Wir passen uns unvorhersehbaren Situationen an und bewältigen sie, indem	○	○	○	○	○

wir den Schwerpunkt verlagern und angemessene Maßnahmen ergreifen. (4)					
In regelmäßigen Abständen bringen wir unsere fachlichen und zwischenmenschlichen Kompetenzen auf den neuesten Stand, um die Aufgaben, für die wir zuständig sind, besser erfüllen zu können. (5)	○	○	○	○	○
Wir suchen und entwickeln neue Kompetenzen für den Umgang mit schwierigen Situationen. (6)	○	○	○	○	○
Wir bleiben gelassen und verhalten uns auch unter äußerst stressreichen Ereignissen positiv. (7)	○	○	○	○	○
Wir bleiben ruhig und verhalten uns auch unter stark belastenden Ereignissen positiv. (8)	○	○	○	○	○

Please indicate how many days per week you spend working remotely at the moment (e.g. from home).

- ○ Never (I always work on-site) (1)
- ○ Sometimes (1-2 days a week) (4)
- ○ Most of the time (3-4 days a week) (5)
- ○ All the time (all weekdays) (6)

Bitte geben Sie an, an wie vielen Tagen pro Woche Sie derzeit mobil arbeiten (z. B. von zu Hause aus).

- ○ Nie (ich arbeite immer vor Ort) (1)
- ○ Manchmal (1-2 Tage pro Woche) (4)
- ○ Die meiste Zeit (3-4 Tage pro Woche) (5)
- ○ Die ganze Zeit (an allen Werktagen) (6)

Please indicate how many days per week in average your team (i.e. all team members) spend working remotely at the moment.

- ○ Never (they always work on-site) (1)
- ○ Sometimes (1-2 days a week) (7)
- ○ Most of the time (3-4 days a week) (8)
- ○ All the time (all weekdays) (9)

Bitte geben Sie an, an wie vielen Tagen pro Woche Ihr Team (d.h. alle Teammitglieder) derzeit im Durchschnitt mobil arbeitet.

- ○ Nie (sie arbeiten immer vor Ort) (1)
- ○ Manchmal (1-2 Tage pro Woche) (7)
- ○ Die meiste Zeit (3-4 Tage pro Woche) (8)
- ○ Die ganze Zeit (an allen Werktagen) (9)

For how long have you been leading this team?

- ○ 0 - 6 months (1)
- ○ 6 - 12 months (2)
- ○ 1 - 2 years (3)
- ○ 2 - 5 years (4)
- ○ 5 - 10 years (5)
- ○ > 10 years (6)

Wie lange führen Sie dieses Team bereits?

- ○ 0 - 6 Monate (1)
- ○ 6 - 12 Monate (2)
- ○ 1 - 2 Jahre (3)
- ○ 2 - 5 Jahre (4)
- ○ 5 - 10 Jahre (5)
- ○ > 10 Jahre (6)

How much overall leadership experience do you have (including current and past leadership positions)?

- ○ 0 - 6 months (2)
- ○ 6 - 12 months (3)
- ○ 1 - 2 years (4)
- ○ 2 - 5 years (5)
- ○ 5 - 10 years (6)
- ○ > 10 years (7)

Wie viel Führungserfahrung haben Sie insgesamt (einschließlich gegenwärtiger und ehemaliger Führungspositionen)?

- ○ 0 - 6 Monate (2)
- ○ 6 - 12 Monate (3)
- ○ 1 - 2 Jahre (4)
- ○ 2 - 5 Jahre (5)
- ○ 5 - 10 Jahre (6)
- ○ > 10 Jahre (7)

How many members are part of this team (excluding yourself)?

_____

Wie viele Mitarbeiter gehören diesem Team an (Sie selbst ausgenommen)?

_____

What percentage of your work time each week is allocated to working with this team?
_____ % of total working time (1)

Wie viel Prozent Ihrer Arbeitszeit pro Woche ist für die Arbeit in diesem Team vorgesehen?
_____ % der gesamten Arbeitszeit (1)

Which sector do you work in?

- ○ Education/Research (1)
- ○ Health (21)
- ○ Commercial/Trade (22)
- ○ Crafts (e.g., plumbing, carpentry) (23)
- ○ Hotel/Gastronomy (24)
- ○ Manufacturing (25)
- ○ IT (26)
- ○ Media (27)
- ○ Social work (28)
- ○ Transport/Logistics (29)
- ○ Public administration (30)
- ○ Defense/Security/Judiciary (31)
- ○ Other (32) _____

In welcher Branche arbeiten Sie?

- ○ Bildung/Forschung (1)
- ○ Gesundheitswesen (21)
- ○ Handel (22)
- ○ Handwerk (23)
- ○ Hotel/Gastronomie (24)
- ○ Industrie (25)
- ○ IT (26)
- ○ Medien (27)
- ○ Sozialwesen (28)
- ○ Transport, Verkehr, Logistik (29)
- ○ Öffentliche Verwaltung (30)
- ○ Verteidigung, Sicherheit, Justiz (31)
- ○ Sonstiges (32) _____

Finally, please provide some information about yourself. We remind you that all of this information is confidential, and will only be used in an aggregated form.

What is your age (in years)?

_____

Bitte teilen Sie uns abschließend noch ein paar allgemeine Informationen über sich und das Team mit. Selbstverständlich werden diese streng vertraulich behandelt und ausschließlich in aggregierter Form weiterverwendet.

Wie alt sind Sie (in Jahren)?

_____

What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other (4)

Welches Geschlecht haben Sie?

- ○ Männlich (1)
- ○ Weiblich (2)
- ○ Sonstiges (4)

What is your nationality?

▼ Afghanistan (1) ... Zimbabwe (1357)

Welche Staatsangehörigkeit haben Sie? (die Liste ist auf Englisch, von daher suchen Sie bitte nach z.B. "Germany" für Deutschland)

▼ Afghanistan (1) ... Zimbabwe (1357)

In which country do you currently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

In welchem Land wohnen Sie aktuell? (die Liste ist auf Englisch, deshalb suchen Sie bitte nach z.B. "Germany" für Deutschland)

▼ Afghanistan (1) ... Zimbabwe (1357)

What is the highest level of school you have completed or the highest degree you have received?

- ○ Less than high school degree (e.g. Secondary Education) (1)
- ○ High school graduate, diploma or equivalent (e.g. GCE) (2)
- ○ Trade/technical/vocational training (3)
- ○ Bachelor's degree or equivalent (5)
- ○ Master's degree or equivalent (6)
- ○ Doctoral degree or equivalent (7)

Was ist Ihr höchster Schulabschluss oder der höchste akademische Grad, den Sie absolviert haben?

- ○ Mittlerer Bildungsabschluss (z.B. Realschulabschluss) oder niedriger (1)
- ○ Abitur, Hochschulabschluss oder gleichwertiger Abschluss (2)
- ○ Gewerblich/technische/berufliche Ausbildung (3)
- ○ Bachelor-Abschluss oder gleichwertiger Abschluss (5)
- ○ Master-Abschluss oder gleichwertiger Abschluss (6)
- ○ Doktorat/Promotion (7)

If you would like to receive an analysis of the outcome of the results, please leave your e-mail address (optional):

_____

Falls Sie die Ergebnisse der Datenerhebung zugeschickt bekommen möchten, geben Sie bitte Ihre E-Mail-Adresse an (freiwillig):

_____

Annex D: Questionnaire 2 (members)

Dear Participant,
Thank you for taking the time to participate in this survey, which is an essential part of my research for my Master's thesis conducted at the ISCTE Business School in Lisbon. The focus of the research project is team and leadership effectiveness in virtual contexts.
You are asked to complete this survey in your position as member of the work or project team described in the e-mail and you will be asked questions regarding the collaboration with this team. It will take approximately 5-10 minutes to answer all questions. Your team leader has already responded to a similar survey. Always think of the same work/project team specified in the e-mail when answering. Your leader won't receive any information on the answers you provided.
Your participation is of utmost value and crucial for the success of this research project. Please answer all questions honestly. There are no right or wrong answers. All of your answers will be treated confidentially and processed in an anonymous way for scientific purposes only.
If you are interested in the results of this research or if you have any questions or concerns, please contact moana_koenig@iscte-iul.pt.
The survey is available in English and German. Please select the language you feel most comfortable with on the top of the page and confirm that you would like to participate in this survey. Afterwards, please klick on the arrow on the bottom of the page.

○ Yes (1)

Sehr geehrte Teilnehmerin, sehr geehrter Teilnehmer,
Ich danke Ihnen, dass Sie sich die Zeit nehmen, an dieser Umfrage teilzunehmen, welche ein wesentlicher Teil meiner Forschung meiner Masterarbeit an der ISCTE Business School in Lissabon ist. Der Schwerpunkt dieses Forschungsprojekts liegt auf der Effektivität von Teams und Führungskräften im virtuellen Kontext.
Sie werden gebeten, diese Umfrage in Ihrer Position als Mitglied eines Arbeits-/Projektteams auszufüllen und es werden Ihnen Fragen zur Zusammenarbeit mit diesem Team gestellt. Die Beantwortung aller Fragen wird ca. 5-10 Minuten in Anspruch nehmen. Ihr Teamleiter hat bereits an einer ähnlichen Umfrage teilgenommen. Denken Sie bei der Beantwortung immer an das in der E-Mail angegebene Arbeits-/Projektteam. Ihre Führungskraft wird keine Informationen über die von Ihnen gegebenen Antworten erhalten.
Ihre Teilnahme ist von größtem Wert und entscheidend für den Erfolg dieses Forschungsprojekts. Bitte beantworten Sie alle Fragen ehrlich. Es gibt keine richtigen oder falschen Antworten. Alle Ihre Antworten werden vertraulich behandelt und in anonymisierter Form ausschließlich für wissenschaftliche Zwecke ausgewertet.
Wenn Sie an den Ergebnissen dieser Forschung interessiert sind oder wenn Sie Fragen oder Bedenken haben, wenden Sie sich bitte an moana_koenig@iscte-iul.pt.
Die Umfrage ist in Englisch und Deutsch verfügbar. Bitte wählen Sie am Seitenanfang die

Sprache, in der Sie sich am wohlsten fühlen und bestätigen Sie, dass Sie an dieser Umfrage teilnehmen möchten. Klicken Sie anschließend auf den Pfeil unten auf der Seite.

○ Ja (1)

In order to match your answers in an anonymous way, please enter the code provided in the e-mail:

_____

Um eine anonymisierte Zuordnung Ihrer Antworten zu ermöglichen, geben Sie bitte den in der E-Mail angegebenen Code ein:

_____

Within the entire survey, you're asked to provide information on working with the project/work team referenced in the e-mail. When answering the questions, always think about working only with this team.

Indicate to which degree you agree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Creating work teams that interact via technology can be a recipe for trouble. (1)	○	○	○	○	○
I think that work teams should interact mostly face-to-face. (2)	○	○	○	○	○
Interacting via technology helps doing the task well. (3)	○	○	○	○	○

In der gesamten Umfrage werden Sie gebeten, Ihre Einschätzung zur Zusammenarbeit mit dem in der E-Mail genannten Arbeits-/Projektteam anzugeben. Denken Sie bei der Beantwortung der Fragen stets an die Zusammenarbeit mit diesem Team.

Geben Sie an, inwiefern Sie den folgenden Aussagen zustimmen.

	Stimme überhaupt nicht zu (1)	Stimme eher nicht zu (2)	Teils teils (3)	Stimme eher zu (4)	Stimme voll und ganz zu (5)
Die Bildung von Arbeitsteams, die mittels Technologie interagieren, bringt nur Ärger. (1)	○	○	○	○	○
Ich denke, dass Arbeitsteams vor allem von Angesicht zu Angesicht interagieren sollten. (2)	○	○	○	○	○
Mittels Technologien zu interagieren hilft dabei, die Aufgabe gut zu erledigen. (3)	○	○	○	○	○

Please allocate the proportion (in %) of total work/project time you spent communicating with other team members this week using:

Face-to-face communication : _____ (1)
Telephone : _____ (2)
Email : _____ (3)
Videoconferences : _____ (4)
Instant messaging : _____ (5)
Document sharing : _____ (6)
Collaboration Software (e.g. MS Teams, Slack) : _____ (8)
Other : _____ (7)
Total : _____

Bitten geben Sie in den Anteil (in %) der Arbeits-/Projektzeit an, mit dem Sie in der vergangenen Woche unter Nutzung der jeweiligen Medien mit Ihrem Team kommuniziert haben:

In einem Raum/face-to-face : _____ (1)
Telefon : _____ (2)
E-Mails : _____ (3)
Videokonferenzen : _____ (4)
Instant Messaging : _____ (5)
Document sharing/geteilte Dokumente : _____ (6)
Kollaborationssoftware (z.B. Slack, MS Teams) : _____ (8)
Sonstiges : _____ (7)
Total : _____

Consider your team work over the last week. On each line below, select the option you think best describes your connection to your team while you were working on your task or project.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
distant	○	○	○	○	○	nearby
far	○	○	○	○	○	close
separate	○	○	○	○	○	together
remote	○	○	○	○	○	proximal
disconnected	○	○	○	○	○	connected

Denken Sie an die Teamarbeit während der letzten Woche. Wählen Sie in jeder Zeile unten die Option aus, die Ihrer Meinung nach Ihre Verbindung zu Ihrem Team am besten beschreibt, während Sie an Ihrer Aufgabe oder Ihrem Projekt gearbeitet haben.

	1 (1)	2 (2)	3 (3)	4 (4)	5 (5)	
entfernt	○	○	○	○	○	nahegelegen
weit (weg)	○	○	○	○	○	eng
getrennt	○	○	○	○	○	zusammen
entlegen	○	○	○	○	○	nah
abgekoppelt	○	○	○	○	○	verbunden

Indicate to which degree you agree with the following statements.

	Strongly disagree (1)	Somewhat disagree (2)	Neither agree nor disagree (3)	Somewhat agree (4)	Strongly agree (5)
Each team member has a good idea of the technical features of the digital media used. (1)	○	○	○	○	○
Everyone in the team knows the technical capabilities of our digital media. (2)	○	○	○	○	○
Everyone in the team knows the technical limitations of our digital media. (3)	○	○	○	○	○
All team members know which digital media we use for which tasks. (4)	○	○	○	○	○
We have the same idea about what tasks we use which digital media for. (5)	○	○	○	○	○
We have the same idea about which digital media we use for different documentation purposes. (6)	○	○	○	○	○
We have the same idea within the team about which digital media we use for which purpose (documentation, agreements, appointments, minutes, etc.). (7)	○	○	○	○	○

We agree on when we change from one medium to another. (8)	○	○	○	○	○
In changing situations, we have the same idea about which medium we switch to. (9)	○	○	○	○	○
We have the same idea about which other digital medium would be more appropriate when the task changes. (10)	○	○	○	○	○
Everyone in the team knows which writing style is appropriate in digital media. (11)	○	○	○	○	○
Everyone in the team knows what manners are considered appropriate in the different digital media. (12)	○	○	○	○	○

Geben Sie an, inwieweit Sie mit den folgenden Aussagen einverstanden sind.

	Stimme überhaupt nicht zu (1)	Stimme eher nicht zu (2)	Teils teils (3)	Stimme eher zu (4)	Stimme voll und ganz zu (5)
Jedes Teammitglied besitzt eine gute Vorstellung über die technischen Optionen der verwendeten digitalen Medien. (1)	○	○	○	○	○
Jeder im Team kennt die technischen Möglichkeiten unserer digitalen Medien. (2)	○	○	○	○	○

Jeder im Team kennt die technischen Grenzen unserer digitalen Medien. (3)	○	○	○	○	○
Alle Teammitglieder wissen, welche digitalen Medien wir für welche Aufgaben nutzen. (4)	○	○	○	○	○
Wir haben dieselbe Vorstellung darüber, welche Aufgaben wir mit welchen digitalen Medien bearbeiten. (5)	○	○	○	○	○
Wir haben dieselbe Vorstellung darüber, welche digitalen Medien wir für verschiedene Dokumentationszwecke verwenden. (6)	○	○	○	○	○
Wir haben im Team dieselbe Vorstellung darüber, für welchen Zweck (Dokumentation, Absprachen, Termine, Protokolle, etc.) wir welches digitale Medium nutzen. (7)	○	○	○	○	○
Wir sind uns darüber einig, wann wir von einem zum anderen Medium wechseln. (8)	○	○	○	○	○
In sich verändernden Situationen, haben wir dieselbe Vorstellung zu welchem Medium wir wechseln. (9)	○	○	○	○	○
Wir haben dieselbe Vorstellung darüber, welches andere digitale Medium passender wäre, wenn sich die Aufgabe ändert. (10)	○	○	○	○	○
Jeder im Team weiß, welcher Schreibstil in den digitalen Medien angebracht ist. (11)	○	○	○	○	○
Jeder im Team weiß, welche Umgangsformen in den verschiedenen digitalen Medien als angemessen gelten. (12)	○	○	○	○	○

Think about the work/project team and answer to the following statements.

	Strongly disagree (21)	Somewhat disagree (22)	Neither agree nor disagree (23)	Somewhat agree (24)	Strongly agree (25)
Our team uses technology effectively to communicate virtually (i.e., using technologies) with one another. (1)	○	○	○	○	○
Our team communicates virtually (i.e., using technologies) with other team members in a way that is clear and easily understood. (19)	○	○	○	○	○
Our team takes steps to avoid misunderstandings when communicating virtually (i.e., using technologies) with team members (e.g., by providing important background information, verifying receipt of messages, requesting and providing clarification). (20)	○	○	○	○	○
Our team sends virtual (i.e., using technologies) communication with a positive and encouraging tone. (21)	○	○	○	○	○

Denken Sie an Ihr Arbeits-/Projektteam und gehen Sie auf die folgenden Aussagen ein.

	Stimme überhaupt nicht zu (21)	Stimme eher nicht zu (22)	Teils teils (23)	Stimme eher zu (24)	Stimme voll und ganz zu (25)
Unser Team setzt Technologie effektiv ein, um virtuell (d.h. unter Verwendung von Technologien) miteinander zu kommunizieren. (1)	○	○	○	○	○
Unser Team kommuniziert mit anderen Teammitgliedern virtuell auf eine Art und Weise, die klar und einfach zu verstehen ist. (19)	○	○	○	○	○
Unser Team ergreift Maßnahmen, um Missverständnisse bei der virtuellen Kommunikation zu vermeiden (z.B. durch Bereitstellung wichtiger Hintergrundinformationen, Bestätigung des Empfangs von Nachrichten, Anforderung und Bereitstellung von Klarstellung). (20)	○	○	○	○	○
Unser Team kommuniziert virtuell in einem positiven und ermunterndem Ton. (21)	○	○	○	○	○

Indicate how effective you think the team is.

	Not effective at all (1)	Slightly effective (2)	Moderately effective (3)	Very effective (4)	Extremely effective (5)
We find innovative ways to deal with unexpected events. (1)	○	○	○	○	○
We use creative ideas to manage incoming events. (2)	○	○	○	○	○
We engage in creative action to solve problems for which there are no easy or strait forward answers. (9)	○	○	○	○	○
We devise alternative plans in very short time, as a way to cope with new task demands. (3)	○	○	○	○	○
We adjust and deal with unpredictable situations by shifting focus and taking reasonable action. (4)	○	○	○	○	○
Periodically, we update technical and interpersonal competences as a way to better perform the tasks in which we are enrolled. (5)	○	○	○	○	○
We search and develop new competences to deal with difficult situations. (6)	○	○	○	○	○
We remain calm and behave positively under highly stressful events. (7)	○	○	○	○	○
We maintain focus when dealing with multiple situations and responsibilities. (8)	○	○	○	○	○

Geben Sie an, wie effektiv das Team Ihrer Meinung nach ist.

	Völlig ineffektiv (1)	Eher ineffektiv (2)	Weder effektiv noch ineffektiv (3)	Eher effektiv (4)	Völlig effektiv (5)
Wir finden innovative Wege, um mit unerwarteten Ereignissen umzugehen. (1)	○	○	○	○	○
Wir nutzen kreative Ideen für das Management eingehender Ereignisse. (2)	○	○	○	○	○
Wir ergreifen kreative Maßnahmen, um Probleme zu lösen, für die es keine einfachen oder direkten Antworten gibt. (9)	○	○	○	○	○
Wir entwickeln in sehr kurzer Zeit Alternativpläne, um den neuen Aufgabenanforderungen gerecht zu werden. (3)	○	○	○	○	○
Wir passen uns unvorhersehbaren Situationen an und bewältigen sie, indem wir den Schwerpunkt verlagern und angemessene Maßnahmen ergreifen. (4)	○	○	○	○	○
In regelmäßigen Abständen bringen wir unsere fachlichen und zwischenmenschlichen Kompetenzen auf den neuesten Stand, um die Aufgaben, für die wir zuständig sind, besser erfüllen zu können. (5)	○	○	○	○	○
Wir suchen und entwickeln neue Kompetenzen für den Umgang mit schwierigen Situationen. (6)	○	○	○	○	○
Wir bleiben gelassen und verhalten uns auch unter äußerst stressreichen Ereignissen positiv. (7)	○	○	○	○	○
Wir behalten den Überblick, wenn wir mit mehreren Situationen und Verantwortlichkeiten konfrontiert sind. (8)	○	○	○	○	○

Finally, please provide some information about yourself and the team. We remind you that all of this information is confidential, and will only be used in an aggregated form.

Please indicate how many days per week you spend working remotely at the moment (e.g. from home).

- ○ Never (I always work on-site) (1)
- ○ Sometimes (1-2 days a week) (4)
- ○ Most of the time (3-4 days a week) (5)
- ○ All the time (all weekdays) (6)

Bitte teilen Sie uns abschließend noch ein paar allgemeine Informationen über sich und das Team mit. Selbstverständlich werden diese streng vertraulich behandelt und ausschließlich in aggregierter Form weiterverwendet.

Bitte geben Sie an, an wie vielen Tagen pro Woche Sie derzeit mobil arbeiten (z. B. von zu Hause aus).

- ○ Nie (ich arbeite immer vor Ort) (1)
- ○ Manchmal (1-2 Tage pro Woche) (4)
- ○ Die meiste Zeit (3-4 Tage pro Woche) (5)
- ○ Die ganze Zeit (an allen Werktagen) (6)

What percentage of your work time each week is allocated to working on this team?
_____ % of total working time (1)

Wie viel Prozent Ihrer Arbeitszeit pro Woche ist für die Arbeit in diesem Team vorgesehen?
_____ % der gesamten Arbeitszeit (1)

For how long have you been part of this team?

- ○ 0 - 6 months (1)
- ○ 6 - 12 months (2)
- ○ 1 - 2 years (3)
- ○ 2 - 5 years (4)
- ○ 5 - 10 years (5)
- ○ > 10 years (6)

Wie lange Sind Sie schon Teil dieses Teams?

- ○ < 6 Monate (1)
- ○ 6 - 12 Monate (2)
- ○ 1 - 2 Jahre (3)
- ○ 2 - 5 Jahre (4)
- ○ 5 - 10 Jahre (5)
- ○ > 10 Jahre (6)

What is your age (in years)?

_____

Wie alt sind Sie (in Jahren)?

_____

What is your gender?

- ○ Male (1)
- ○ Female (2)
- ○ Other (4)

Welches Geschlecht haben Sie?

- ○ Männlich (1)
- ○ Weiblich (2)
- ○ Sonstiges (4)

What is your nationality?

▼ Afghanistan (1) ... Zimbabwe (1357)

Welche Staatsangehörigkeit haben Sie? (die Liste ist auf Englisch, von daher suchen Sie bitte nach z.B. "Germany" für Deutschland)

▼ Afghanistan (1) ... Zimbabwe (1357)

In which country do you currently reside?

▼ Afghanistan (1) ... Zimbabwe (1357)

In welchem Land wohnen Sie aktuell? (die Liste ist auf Englisch, von daher suchen Sie bitte nach z.B. "Germany" für Deutschland)

▼ Afghanistan (1) ... Zimbabwe (1357)

What is your current profession? Please read the descriptions below and indicate the profession that best fits your current position.

○ **Manager**: You are primarily concerned with managing people and things. For example administrative or commercial manager. You manage people and / or you are responsible for managing a department or the entire organization (4)

○ **Professional**: Your main job is in a specific professional area, for which you have also followed specific training at the college or university. For example you are doctor / nurse, teacher, researcher, engineer, legal, social and cultural expert, IT professional, economist, or business administrator (5)

○ **Administrative or supporting clerk**: Your main job consists of supporting others, administrative work and / or service tasks. Examples are secretarial work, customer service representative, sales person. This work sometimes requires, sometimes no higher education / university degree in a specific direction. (6)

○ **Skilled manual labor:** Your work consists mainly of manual labor and requires specific skills. For example technician, skilled farmer, machine operator, craftsman / woman, mechanic, driver. A specific diploma at the college or university is usually not required. (7)

○ **Unskilled manual labor**: You have a job where you mainly do manual work and for which no formal training is required. Examples are cleaners and helpers, agricultural, forestry or fish laborer, food preparation staff, street worker, miner, construction worker, production and transport worker (8)

Was ist Ihr derzeitiger Beruf? Bitte lesen Sie die unten stehenden Beschreibungen und geben Sie den Beruf an, der am besten zu Ihrer aktuellen Position passt.

○ **Führungskraft**: Sie beschäftigen sich in erster Linie mit dem Management von Menschen und Dingen. Zum Beispiel Verwaltungs- oder kaufmännischer Manager. Sie leiten Mitarbeiter / Teams / sind für die Leitung einer Abteilung oder der gesamten Organisation verantwortlich. (4)

○ **Fachkraft**: Ihre Haupttätigkeit liegt in einem bestimmten Fachgebiet, für das Sie auch eine spezifische Ausbildung an einer Hochschule oder Universität absolviert haben. Zum Beispiel sind Sie Arzt / Krankenpfleger, Lehrer, Forscher, Ingenieur, Rechts-, Sozial- und Kulturexperte, IT-Fachmann, Ökonom oder Betriebswirt. (5)

○ **Verwaltungssachbearbeiter oder Assistenzstelle**: Ihre Hauptaufgabe besteht in der Unterstützung anderer, in administrativen Aufgaben und / oder Serviceleistungen. Beispiele sind Sekretariatstätigkeiten, Kundenbetreuer, Vertriebsmitarbeiter. Diese Arbeit erfordert in manchen Fällen einen Hochschul-/Universitätsabschluss in einer bestimmten Fachrichtung. (6)

○ **Handwerklich qualifizierte Arbeitskraft**: Ihre Arbeit besteht hauptsächlich aus manueller Arbeit und erfordert besondere Fähigkeiten. Zum Beispiel Techniker, Fachlandwirt, Maschinenführer, Handwerker, Mechaniker, Fahrer. Ein spezifisches Diplom an der Hochschule oder Universität ist normalerweise nicht erforderlich. (7)

○ **Ungelernte Arbeitskraft**: Sie haben einen Beruf, in dem Sie hauptsächlich manuelle Arbeit verrichten und für den keine formale Ausbildung erforderlich ist. Beispiele sind Reinigungskräfte und Helfer, Land-, Forst- oder Fischarbeiter, Mitarbeiter in der Lebensmittelzubereitung, Straßenarbeiter, Bergarbeiter, Bauarbeiter, Produktions- und Transportarbeiter. (8)

What is the highest level of school you have completed or the highest degree you have received?

○ Less than high school degree (e.g. Secondary Education) (1)

○ High school graduate, diploma or equivalent (e.g. GCE) (2)

○ Trade/technical/vocational training (3)

○ Bachelor's degree or equivalent (5)

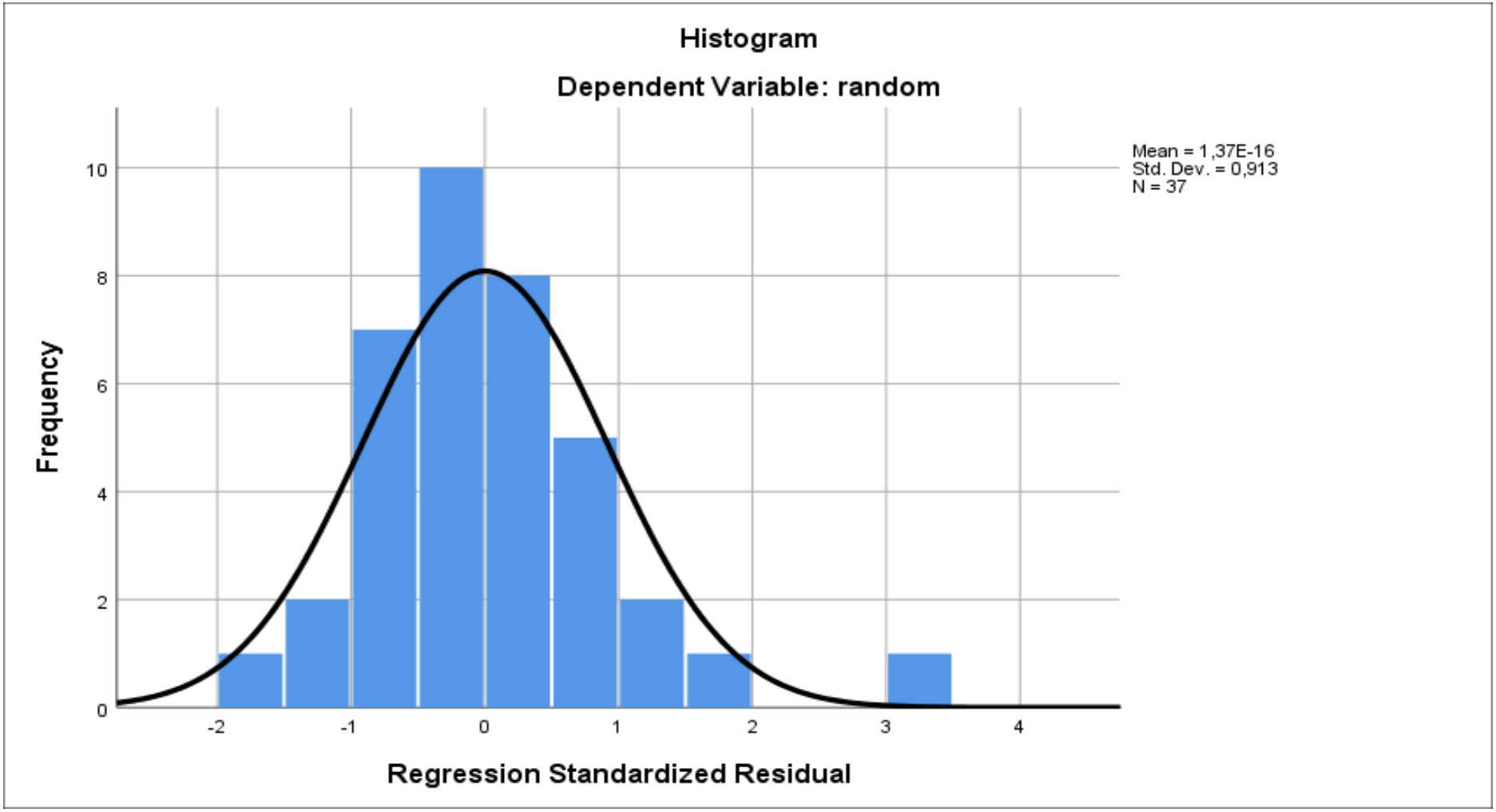
○ Master's degree or equivalent (6)

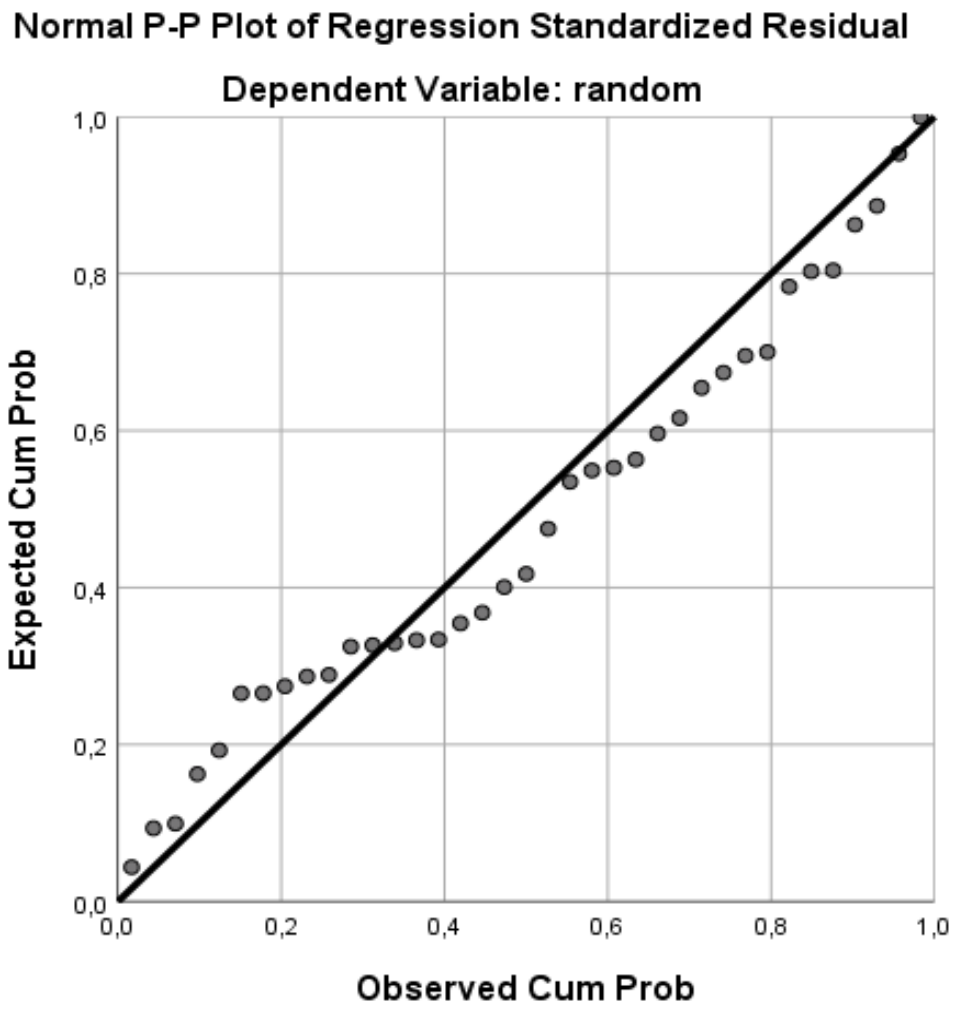
○ Doctoral degree (7)

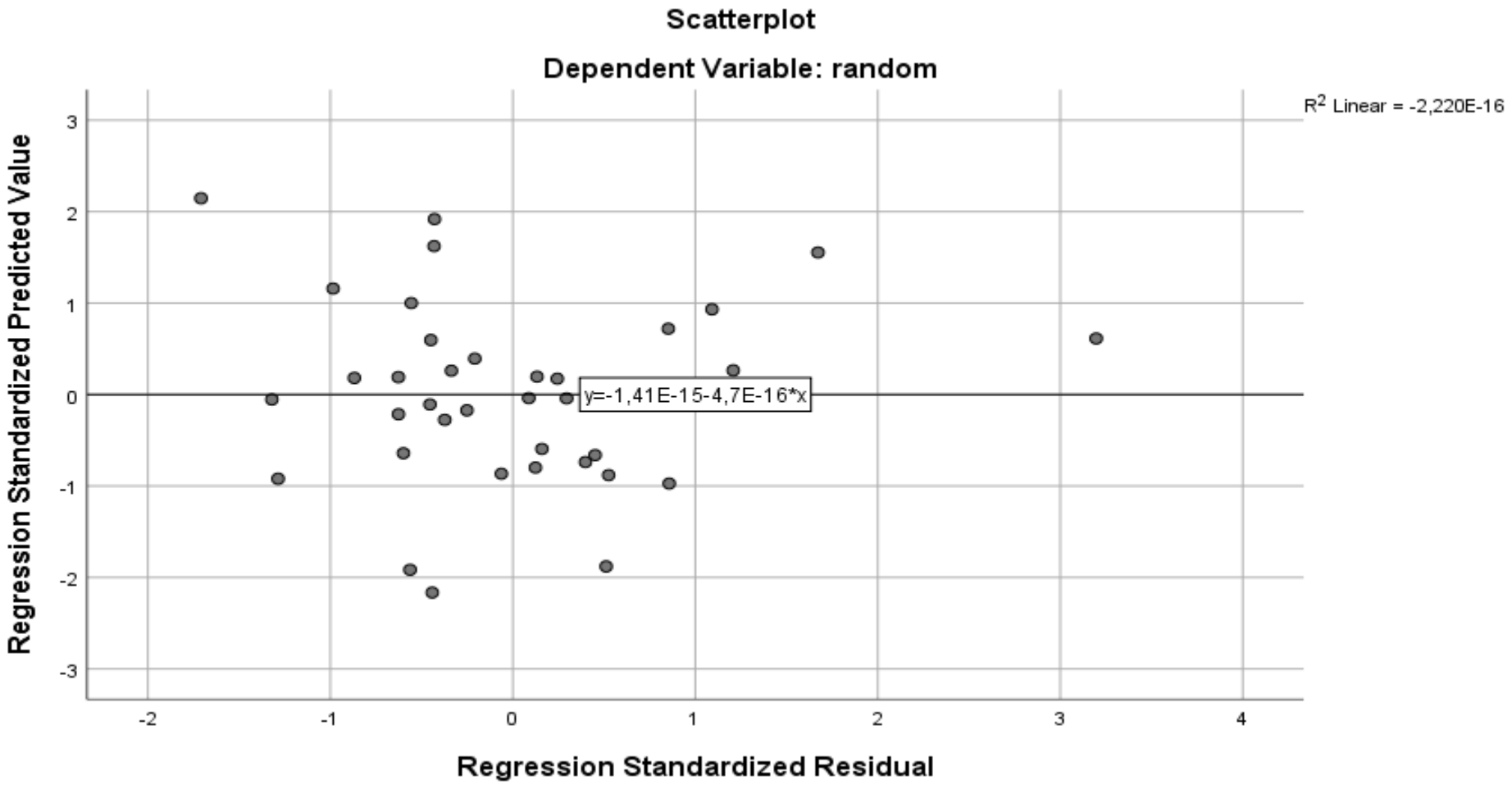
Was ist Ihr höchster Schulabschluss oder der höchste akademische Grad, den Sie absolviert haben?

- ○ Mittlerer Bildungsabschluss (z.B. Realschulabschluss) oder niedriger (1)
- ○ Abitur, Hochschulabschluss oder gleichwertiger Abschluss (2)
- ○ Gewerblich/technische/berufliche Ausbildung (3)
- ○ Bachelor-Abschluss oder gleichwertiger Abschluss (5)
- ○ Master-Abschluss oder gleichwertiger Abschluss (6)
- ○ Doktorat/Promotion (7)

Annex E: Assumptions of Normality




Normal P-P Plot of Regression Standardized Residual
Dependent Variable: random
Expected Cum Prob
Observed Cum Prob
0,0
0,2
0,4
0,6
0,8
1,0


Scatterplot
Dependent Variable: random
R2 Linear = -2,220E-16
y=-1,41E-15-4,7E-16*x
Regression Standardized Predicted Value
Regression Standardized Residual
3
2
1
0
-1
-2
-3
-2
-1
0
1
2
3
4