Something Old or Something New?

An Empirical Study on the Instant Adjustment to Virtual Teamwork During COVID-19

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Abstract. In 2020, the COVID-19 pandemic forced organizations to adjust co-located teams to virtual teams instantly. The applicability of known success factors for virtual teamwork to this situation is uncertain. Therefore, this study addresses the following research question: what factors relate to successful team adjustment to the new virtual work context? We hypothesize that perceived team success is influenced by individual and team factors and that these effects of team-related factors on perceived team success are moderated by team processes and team-/task-technology fit. A time-lagged online study was conducted at two timepoints during the initial lockdown in Germany with $N = 110$ employees working in teams. We found trust, task-technology fit, and communication to be significantly associated with perceived team performance. The results suggest that the instant adjustment might have led to a new phase related to team cycle episodes. We propose guidelines to prepare teams for future instant adjustments.

Keywords: spatially dispersed teams, lockdown, team adaptation, team performance, team satisfaction

Something Old or Something New? Eine empirische Studie über die ad-hoc Anpassung an virtuelle Teamarbeit während COVID-19

Zusammenfassung. Der Ausbruch von COVID-19 im Jahr 2020 hat Organisationen dazu gezwungen, co-lokalisierte Teamarbeit unmittelbar auf virtuelle Teamarbeit umzustellen. Für diese Situation ist die Anwendbarkeit von bekannten Erfolgsfaktoren für virtuelle Teamarbeit ungewiss. Diese Studie befasst sich daher mit folgender Forschungsfrage: Welche Faktoren hängen mit einer erfolgreichen Anpassung von Teams an den neuen virtuellen Arbeitskontext zusammen? Wir nehmen an, dass wahrgenommener Teamerfolg durch individuelle und Teamfaktoren beeinflusst wird und der Effekt der Teamfaktoren auf den wahrgenommenen Teamerfolg durch Teamprozesse sowie Team-/ und Task-Technology Fit moderiert werden. Eine time-lagged online-Studie wurde zu zwei Messzeitpunkten während des ersten Lockdowns in Deutschland mit $N = 110$ Arbeitnehmenden in Teams durchgeführt. Es wurden Zusammenhänge zwischen von Vertrauen und Task-Technology-Fit und Kommunikation und der wahrgenommenen Teamperformanz gefunden. Die Ergebnisse deuten an, dass diese Sofortanpassung zu einer neuen Phase bezogen auf Teamzyklusepisoden geführt haben könnte. Wir empfehlen Richtlinien, die Teams auf zukünftige unmittelbare Adaptionen vorbereiten können.

Schlüsselwörter: räumlich verteilte Teams, Lockdown, Team-Adaption, Teamleistung, Teamzufriedenheit

The global outbreak of COVID-19 at the beginning of 2020 had a major impact on both domestic and work lives. By March 2020, at the latest, the governments of almost every EU country had imposed restrictions to limit the spread of the SARS-CoV-2-virus (i.e., *social distancing*; Greenstone & Nigam, 2020), which contributed to significant changes in organizations. Many companies had to send their employees to work at home, meaning that they had to restructure, reorganize, and digitize their businesses. Consequently, this also affected work teams. Previous colocated teams (CLTs) suddenly had to coordinate their teamwork virtually. Because of the fast-increasing infection rates, this conversion from CLTs to virtual teams (VTs) had to take place at short notice.

Under regular (nonpandemic) conditions, organizations have the chance to accompany the formation of VTs with

personnel, team, or organizational development activities to provide teams with time to adjust to the virtual working context (Boos et al., 2017). During the COVID-19 pandemic, however, such preparation was not applicable, as CLTs were forced to adjust more or less instantly to working as VTs: organizations basically had to “take what they had” (Feitosa & Salas, 2021). Knowing what drives a team’s success in the adjustment to a dynamic and uncertain situation is of the utmost importance for teams and organizations regarding future incisive events.

Although there is a large body of research about factors contributing to VT success (Handke et al., 2020b; Hertel et al., 2005; Martins et al., 2004), the applicability of these results to instantly transitioned teams is limited. The research to date has addressed mostly “purposefully” built VTs (Kilcullen et al., 2021). The teams in this study,

on the other hand, have a shared history working as a CLT but started anew as a VT with limited experience of virtual teamwork. Research addressing this rapid development of virtual work is missing (Kilcullen et al., 2021). Therefore, this study investigates whether known input factors comparably drive perceived team success, which is operationalized by perceived team performance and satisfaction, during such nonroutine situations. We investigate the effects of team-related factors (e.g., trust) on perceived team success during the first COVID-19 lockdown in Germany, while controlling for individual-related factors (e.g., experience with working from home, WFH). We assume that the relationship between team-related factors and team success might be influenced by additional demands, resulting from the new spatially dispersed working context (e.g., virtual communication; LePine, 2003). Thus, we argue that the effects are moderated by team processes that foster the adjustment (e.g., communication) and the fit between task/team and technology (e.g., video-aided tools).

By investigating the aforementioned predictive and moderating variables, this study contributes to the derivation of practical guidelines to prepare teams and organizations for instant adjustment from CLTs to VTs and, thus, for potential future incisive events.

Instant Adjustment to Virtual Teams

VTs are teams in which at least one team member works in a spatially dispersed manner and technological tools are mainly used to communicate and coordinate work (Hertel et al., 2005).

To investigate the potential success factors for the instant adjustment to VTs, we apply the input-process-output (IPO) framework (Hackman & Morris, 1975; McGrath, 1964). *Input factors* represent the team's general components and resources, including personal factors, situational factors, and task characteristics. *Output factors* represent team consequences that are behavioral, attitudinal, or performance-related. *Processes* depict how team members accomplish organizational objectives such as dynamic interactions, interpersonal processes, and planning processes (Martins et al., 2004; Ortiz de Guinea et al., 2012).

The research to date has already derived a variety of important input factors and processes that drive VT success. This research is mainly based on "purposefully" planned VTs. But the COVID-19 situation differs in multiple ways from the contexts in which previous results were derived (Feitosa & Salas, 2021; Rudolph et al., 2020). First, the teams did share a history of working together as CLTs, but most had only limited experience

with working virtually (Kilcullen et al., 2021). Furthermore, the pandemic meant that employees faced additional challenges (e.g., no equipment for WFH), and that WFH was mandatory, not a preference (Kniffin et al., 2021). Thus, the relative importance of input factors of individuals and teams for team success might have changed. Finally, the instant adjustment from CLTs to VTs caused by COVID-19 was not prepared for in advance, but rather dynamic and uncertain for teams, constituting a nonroutine situation (LePine, 2003). Because the specific context of nonroutine situations (e.g., the COVID-19 lockdown) influences how team processes and states impact team performance (Christian et al., 2017), the applicability of previous research results to this situation may be limited.

This study reassesses the relative importance of established individual and team input factors for perceived VT success in the instant adjustment to virtual teamwork by applying the existing IPO framework to the new context. As elaborated below, we expect team input factors to comparably predict perceived VT success during COVID-19. We acknowledge that the original aim was to analyze more complex models with moderating influences of team processes and team-/task-technology fit for the effect of individual as well as team-related factors on perceived team success. As described in more detail in the Methods section, we aimed at surveying teams shortly after they transitioned to the virtual working context to capture the initial phase of adjustment. Thus, the time-frame for data collection was limited to the early lockdown phase. As a result, the recruited sample size was smaller than the estimated sample size for the planned analyses. We reduced the models so that moderating effects are considered only for team-, but not for individual-related factors; individual-related factors were included as control variables. We expect team factors to be significantly influenced by team processes needed for adjusting to nonroutine situations (Christian et al., 2017; Hagemann & Kluge, 2017). We further assume that the strength of the relationship between team and output factors is influenced by the degree to which the applied technology fits the task and team.

Against the original IPO model (McGrath, 1964), we recognize that team performance does not end with a particular output, and that processes are not only individual actions but also emergent states (see below). This multicyclic character is mirrored in extensions of the IPO model, i.e., input-mediator-output-input (IMOI) models, which additionally reflect various interactions between the factors (Ilgen et al., 2005). Because of the focus on a specific point of time (initial lockdown phase), and for the sake of simplicity, we frame the theoretical background in the context of the IPO model.

Input: Team-Related Factors

One resource for functioning as a team and overcoming challenges concerns team-related factors, which subsumes emergent team states, i.e., cognitive, affective, or motivational constructs developing between team members (Marks et al., 2001; Mathieu et al., 2008), whose effects on outcomes can vary across different work situations (Rudolph et al., 2020). Within the traditional IPO framework, team processes are not differentiated from emergent states (Mathieu et al., 2008), though they can also be considered proximal outcomes when conceptualized as dynamic properties. At the start of the teamwork, these properties are dynamic but seem to stabilize over time and reciprocally influence subsequent processes (Curşeu, 2006; Marks et al., 2001). Here, we consequently treat emergent team states as input factors because we assume them to be already developed to a certain degree at the time of adjustment.

Trust is one of the most prominent emergent states being investigated in VTs (Breuer et al., 2016, 2020). It is understood as the expectation of benevolent treatment by others and the compliance with being vulnerable to others (Mayer et al., 1995). Cumulative evidence suggests that trust is a significant predictor of task and contextual performance or satisfaction among team members (Breuer et al., 2016; Feitosa & Salas, 2021). Furthermore, with higher degrees of virtuality, the role of trust becomes even more important (Breuer et al., 2016; Handke et al., 2020b), while establishing and maintaining trust becomes more challenging because of a possible lack of communication (Marlow et al., 2017).

The role of trust has been questioned in nonroutine situations, because these situations might provoke individuals to focus on different interpersonal cues. In nonroutine situations, individuals expect the environment to be invalid, seemingly triggering a focus on distrust (Lowry et al., 2015). Its impact needs to be reassessed regarding this nonroutine situation.

H1a: There is a positive correlation between trust and perceived team success.

Team cohesion is another widely researched emergent state (Kozlowski & Ilgen, 2006) which describes the “sense of we” or belonging within a team (Casey-Campbell & Martens, 2009). Cohesion, in turn, can be differentiated into task and social cohesion (Kozlowski & Ilgen, 2006). Because of its strong link with team communication and coordination, we focus on social cohesion, i.e., the closeness in the team, (Casey-Campbell & Martens, 2009; Paul et al., 2016). The feeling of togetherness leads team members to care about the team outcome, which increases their motivation to collaborate and contribute (Hertel et al., 2005; Lu, 2015). Consequently, higher

cohesion is associated with better team performance and higher satisfaction (Kozlowski & Ilgen, 2006; Lu, 2015; Paul et al., 2016). This relationship is even more profound and more difficult to establish in VTs.

H1b: There is a positive correlation between cohesion and perceived team success.

Input: Individual-Related Factors

Job experience and knowledge are well-established success factors for CLTs (Schmidt et al., 1986). During the early stages of the lockdown, WFH became the norm for many employees formerly working in an office (Kniffin et al., 2021). Individuals might have faced several challenges, e.g., not having a fixed workspace (Kniffin et al., 2021; Rudolph et al., 2020). Thus, WFH experience is expected to help individuals overcome challenges and adjust to this nonroutine situation.

Yet, it is not enough to be able to work virtually, but one must also *want* to work virtually (Schulze & Krumm, 2017). In the present situation, some individuals might have welcomed the virtual working context, e.g., because of higher flexibility, others might have been opposed to working virtually, e.g., because of difficulties in setting boundaries between work and personal life (Rudolph et al., 2020). It is conceivable that the acceptance of the virtual teamwork situation differs significantly between these groups and impacts team success.

Moreover, collective orientation (CO), that is, the degree to which a team member seeks to work with others and values other opinions, influences team functioning (Dierdorff et al., 2011; Driskell et al., 2010). Because of their identification with the group, individuals with high CO are more engaged in support behaviors to accomplish team tasks (Dierdorff et al., 2011). Collectively oriented members increasingly engage in interaction behaviors, which amends team performance (Driskell et al., 2010; Hagemann et al., 2021). CO has been shown to be advantageous for complex (nonroutine) situations, as teams are better able to coordinate their actions (Hagemann et al., 2021). We assume that experience and acceptance with WFH and CO are associated with team success in the instant adjustment to virtual teams. We included them as control variables to account for their potential relation with team success.

Team (Adjustment) Processes

The pandemic demanded high levels of adaptability from teams, i.e., reactive adjustments in activities and behav-

iors to enable coping with the situation (LePine, 2003). CLTs needed to adjust to a new way of working by modifying their environment (office to home), time management (fixed to flexible working hours), and interaction with technology.

We argue that, for a successful adjustment to the virtual context, teams needed to rely on team processes to adapt to this nonroutine situation (Christian et al., 2017; Hagemann & Kluge, 2017). These processes can be defined as interdependent team activities that convert input into output, though they can also foster relationships between input and output (LePine et al., 2008; Marks et al., 2001). To address the changes caused by COVID-19 and to adjust to this specific situation, we expect that teams required mainly action processes to accomplish fundamental work. Hagemann and Kluge (2017) introduced the model of an idealized teamwork process, which is based on complex problem-solving. The latter is important for teams who need to handle dynamic, nonroutine, non-transparent situations because they require three essential teamwork skills: communication, coordination, and cooperation to solve complex problems and overcome non-routine situations.

Communication is the exchange and matching of information between at least two people (Hagemann & Kluge, 2017). In VTs, communication is considered an essential process factor for team functioning because it can be challenged because of asynchronicity and low richness of conveyed information (Martins et al., 2004). This may lead to misunderstandings and silence, which can have a detrimental impact on trust within VTs (Montoya-Weiss et al., 2001; Panteli & Fineman, 2005). Interestingly, teams with a prior history of working face-to-face can share their information evenly and communicate effectively using technology (Alge et al., 2003).

Coordination describes the organization of actions and task prioritization, whereby interpersonal knowledge about the team, its requirements, and a shared understanding of the situation are required to function effectively (Hagemann & Kluge, 2017). Paul et al. (2016) acknowledge that VTs often strive against coordination problems resulting from misunderstandings and a lack of timely provision of information. Concurrently, knowledge exchange mechanisms and temporal coordination mechanisms can compensate and support coordination in VTs (Caya et al., 2013). However, effective coordination only seems to be possible when teams communicate and cooperate adaptively.

Cooperation is the intended contribution of individual efforts by two or more people to accomplish interdependent tasks and goals (Wagner, 1995). Effective conflict management strategies are essential to retaining the willingness of team members to cooperate and minimize

detrimental conflicts. According to Montoya-Weiss et al. (2001), VTs are prone to conflicts. However, conflicts can lead to constructive discussions encouraging the exploration of alternatives when a common goal, knowledge, and logical argumentation are emphasized (Somech et al., 2009). We focus on a cooperative approach in dealing with conflicts, which is reflected by collaboration and compromise conflict management behaviors and characterized by a high level of concern for others and the self (Montoya-Weiss et al., 2001; Somech et al., 2009).

The impact of predictors on perceived team success might be influenced by team processes to overcome nonroutine situations. Thus, whether the effect of team factors on team success is amplified or diminished may depend on the influence of team coordination (Entin & Serfaty, 1999), communication (Butchibabu et al., 2016), and cooperative conflict management (Somech et al., 2009).

H2a: The impact of team-related factors on perceived team success is amplified by effective communication.

H2b: The impact of team-related factors on perceived team success is amplified by effective team coordination.

H2c: The impact of team-related factors on perceived team success is amplified by effective cooperative conflict management.

Technology

With the spatial dispersion of team members, an adequate application of the technology is a necessity to transmit information and to develop or maintain a sense of belonging (Powell et al., 2004). For teams to perform effectively, it is assumed that the specific fit of a technology for performing a *task* is decisive (*task-technology fit*) (Goodhue & Thompson, 1995; Thomaschewski et al., 2020). Accordingly, the effectiveness of a team depends on how well a technology matches the requirements of a specific task (Powell et al., 2004). This notion is supported by human-centered design theories, which aspire to have the technology meet the needs of the user, task, and environment rather than the user adapt to the technology (Bevan et al., 2015). Complex tasks might necessitate reciprocal feedback, which is best enabled by synchronous technologies (e.g., video calls), whereas simple tasks might be executed with less rich media, such as e-mail (Maruping & Agarwal, 2004). When a team is working on a complex task, it would be considered more effective for it to adapt the type of technology (e.g., video call) rather than adapting the quantity of communication (e.g., more e-mails). Congruently, an incompatible application of the technology to the requirements of the task

Figure 1. Input-process-output model.

can cause misunderstandings and decrease team performance (Schulze & Krumm, 2017).

Additionally, recent work suggests that the fit between the technology and the team can also exhibit a significant impact on team success, i.e., *team-technology fit* (Thomaschewski et al., 2019). Different team characteristics (e.g., experience, size) can necessitate diverse technologies (e.g., visual, auditive, or haptic information presentation; Thomaschewski et al., 2020). In the initial teamwork phase, VTs have been shown to adapt what and how they communicate with the technology – and only later adapt the technology to their needs (Fuller & Dennis, 2009). Although teams can be successful in adapting their communication, work patterns, and coordination to the technology, this requires effort and time, and occurs at the cost of satisfaction (Kayworth & Leidner, 2000; Powell et al., 2004). On the contrary, adapting the technology to the team's goals and needs improves trust and, subsequently, performance in VTs (Thomas & Bostrom 2010). We argue that team input factors exhibit an even stronger positive impact on perceived team success if the technology used corresponds to the needs of the team and the task.

H3a: The impact of team-related factors on perceived team success is amplified by task-technology fit.

H3b: The impact of team-related factors on perceived team success is amplified by team-technology fit.

Taken together, this study contributes to virtual team research by investigating the factors for team success during this unique nonroutine situation in the life of teams. It is hypothesized that the effects of team-related factors are fostered by team processes, which are important for adjusting to the nonroutine context and by

technology fit factors. Figure 1 summarizes the conceptual model of this study.

Methods

Study Setting and Procedure

Data collection took place online via Qualtrics (www.qualtrics.com) during the first COVID-19 lockdown in Germany (1 April 2020–24 May 2020). To mitigate common method bias, we collected the data with a time-lagged design. The second measurement (T2) was completed 7–10 days after the first (T1). The survey was distributed via social networks (e.g., LinkedIn). Participants (ppn) were informed about the procedure of the study, and anonymity was ensured via standard written instructions (German Research Foundation; Schönbrodt et al., 2017). Participation was voluntary; no incentives were offered. Initially, we aimed to collect data from two members of a team. Therefore, the first person to fill in the survey was asked to send the link to a teammate. Based on the generated code, only 14 team dyads were matched, so that the data of team members were treated as individual responses. As we assessed data with the *referent shift* method (see the Instruments section), the representativeness of the answers was not severely restricted. Only complete T1 and T2 data sets were considered. Data are available in the open science framework (OSF) repository (see below).

Initially, we had planned to analyze more complex models, by including individual and team factors as direct

predictors. Further, we had planned to study the moderation effects of team processes and technology factors on the relationship between (a) individual factors and perceived team success and (b) team factors and perceived team success. For these analyses, a sample size of 121 ppn was determined. We aimed at surveying teams shortly after they transitioned to virtual teamwork, to capture the early transition phase in which teams had not yet had the time to develop coping strategies. As we also aimed at surveying ppn at two measurement occasions, the time-frame for data collection was limited. We recruited a sample size of 110 ppn. To be able to give robust insights, we reduced the complexity of the models and included individual-related variables as control variables. Based on these models, adjusted alpha level (0.01) and an effect size of $f^2 = 0.30$, G*Power (Faul et al., 2009) suggested 76–130 ppn for reaching a power of 0.6–0.9. A sample size of 98 ppn was determined for reaching a power of 0.80.

Participants

All complete data sets (T1 and T2) yielded a total sample size of $N = 111$ individuals working in teams. One person was excluded from analysis because of contradictory answers to the screening question.

The final sample thus consisted of $N = 110$ ppn (72 females), with a mean age of $M = 39.42$ ($SD = 12$, $range = 21–62$). The ppn mainly held university (68.1%) or high-school degrees (25.5%), and most ppn (55.45%) worked in large companies (> 500 employees). The sample mainly consisted of ppns who had no prior experience with WFH but were currently working in a VT. The mean team size was $M = 9.38$ ($SD = 7.66$), and the teams had been working together for 4.13 years ($SD = 4.45$; $range = 0.1–20$ years) on average.

To account for the specific circumstances (Feitosa & Salas, 2021), we asked the ppns for pandemic-related strains (e.g., homeschooling), but no particular demands were reported (cf. electronic supplementary material; ESM 1, Table E1).

Instruments

To increase the representativeness of the ratings by individual team members for the entire team, we assessed the data with the referent-shift method (Chan, 1998): The reference point for items is changed so that individuals answer collectively formulated items that refer to the team level, e.g., “My team is ...” (Chan, 1998). The instruments used at T1 and T2 are displayed in Table 1. The survey was conducted in German.

Statistical Analyses

Statistical analyses were conducted in RStudio (Version 1.2.5033; R version 3.6.3). Hypothesis testing was based on multiple (H1) and moderated (H2/ H3) linear regression models. First, we investigated the main effects of team-related predictors on perceived team success and then calculated the regression analyses to investigate process and technology factors as moderators for the effect between team-related predictors and perceived team success. Second, we computed relative weight analysis (RWA) based on RWA Web (Tonidandel & LeBreton, 2015), which indicates the relative importance of predictors and is not distorted by multicollinearity, making RWA helpful for investigating the correctly partitioned variance despite potential correlations among predictors. To account for the multiple tests, we adjusted the alpha level to 1% to counteract alpha error accumulation.

Results

Regression diagnostics confirmed that the assumptions for all the models were met. Multicollinearity was reduced by centering factors for the moderated regression analyses. Table 2 reports the Spearman correlations and descriptive statistics. The outcomes (perceived team performance and satisfaction) correlated moderately. The correlations between the control variables, predictors, and outcomes were weak to moderate and generally stronger for the correlation with satisfaction in contrast to perceived team performance.

H1: Team-Related Factors

As presented in Table 3, only trust showed a significant link to perceived team success. Individual-related factors were included as control variables because of their potentially significant impact on team success. Yet, none of the individual factors related significantly to successful outcomes. Interestingly, the beta value for cohesion was negative in both regression models, although the correlation between cohesion and both outcomes was positive (Table 2). Relative weights (RW) provide estimates of the predictors' relative importance for the *predicted* variance of each outcome (i.e., raw relative values divided by model R^2) (Tonidandel, & LeBreton, 2015). In both models, trust emerged as the most important factor. Taken together, only H1a was supported, with a medium effect size of $f^2 = 0.33$ for both models.

Table 1. Control variables, predictors (T1), and outcomes (T2)

	Example item	No. items	Range	Cronbach's α	Author
Individual-related control variables (T1)					
Acceptance with WFH ¹	Working from the home office has more disadvantages than advantages.	4	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.72	Self-developed
Experience with WFH	How often did you work from home before the current situation?	1	<i>never</i> (1), <i>sometimes/on special occasions</i> (e.g., delivery, craftsmen) (2), <i>regularly</i> (3), <i>always</i> (4)		Self-developed
Collective orientation	I find the work on team projects very satisfying.	16	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.86	Hagemann (2017)
Team-related (T1)					
Team cohesion (subscale of the F-A-T)	We feel like a team.	8	6-point Likert scale 1 = <i>do not agree</i> , 6 = <i>agree</i>	.87	Kauffeld & Frieling (2001)
Team trust	In our team, we trust each other very much.	7	7-point Likert scale 1 = <i>not true at all</i> , 7 = <i>entirely true</i>	.92	Eisenbeiß (2008) originally reported by Langfred (2004)
Processes (T1)					
Communication ² (subscale Teamwork Quality Scale)	There is frequent communication in our team.	10	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.80	Hoegl & Ge-muenden (2001)
Coordination ² (subscale Teamwork Quality Scale)	There are clear and understandable goals for subtasks within the teamwork process.	4	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.70	Hoegl & Ge-muenden (2001)
Cooperative conflict management (items of subscales collaboration and compromise)	When my team experiences conflict ... I give in to the wishes of my team colleagues.	5	5-point Likert scale 1 = <i>almost never</i> , 5 = <i>almost ever</i>	.78	Montoya-Weiss et al. (2001)
Technology (T1)					
Team-technology fit ³	The technology available to our team meets the requirements of the team well.	6 + 2	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.90	Self-developed + Staples & Seddon (2004)
Task-technology fit ²	The technology enables us to process our team tasks faster.	8	5-point Likert scale 1 = <i>do not agree</i> , 5 = <i>agree</i>	.94	Staples & Seddon (2004)
Outcomes (T2)					
Performance	How much did your team succeed in adhering to the schedule?	6	5-point scale 1 = <i>very low</i> , 5 = <i>very high</i>	.80	Robey et al. (1993) (shortened and adapted to context)
Satisfaction	How satisfied are you with the team's solution processes?	4	5-point Likert scale 1 = <i>not satisfied</i> , 5 = <i>very satisfied</i>	.83	Melchior (2008)

Notes. ¹item "My job is not suitable for working from home." was removed as it rather assessed practicability than acceptance, which increased internal consistency from $\alpha = 0.69$ to 0.72. ²Items were translated to German by the authors, and the scale was shortened from 10 to 8 items based on study context.

³2 items from Staples and Seddon (2004) were additionally integrated and translated into German by the authors.

H2: Moderation Effect of Process Factors

Moderated regression models were fitted to investigate the effect of coordination, communication, and cooperative conflict management on the relationship between team-related factors and perceived team success. Individual-related factors were included as control variables. The effect sizes of the moderated regression models predicting perceived performance ($f^2 = 0.56$) and satisfaction ($f^2 = 0.43$) were large. In line with the first model, cohesion emerged as a negative predictor, and communication

showed a direct positive relation with perceived performance. Despite the significant link between cohesion and performance, RW again indicated a higher relative importance of trust over cohesion. Coordination, communication, and cooperative conflict management did not moderate the relationship between team factors and perceived team success (Table 4). Taken together, H2a-c were not supported.

Table 2. Correlation matrix and descriptive statistics

	Scale	M (SD)	1	2	3	4	5	6	7	8	9	10	11	12
Outcome	1–5	5.35 (0.78)	1											
Individual	1–5	4.15 (0.64)	.66**	1										
Team	1–5	3.69 (0.85)	.05	.18	1									
Process	1–4	2.03 (0.74)	.23*	.34	.22*	1								
Technology	1–5	3.29 (0.51)	.15	.34**	-.004	.39**	1							
	1–6	4.89 (0.79)	.21*	.40**	.08	.17	.24*	1						
	1–7	5.85 (0.94)	.34**	.45**	.007	.22*	.32**	.85**	1					
	1–5	3.85 (0.60)	.36**	.32**	.04	.11	.19*	.45**	.44**	1				
	1–5	3.90 (0.52)	.38**	.42**	.09	.11	.28**	.60**	.65**	.59**	1			
	1–5	4.30 (0.52)	.21*	.34**	-.02	.11	.31**	.40**	.33**	.25**	.28**	1		
	1–5	3.91 (0.69)	.34**	.43**	.31**	.45**	.26*	.17	.18	.28**	.23*	.13	1	
	1–5	3.50 (0.88)	.41**	.44**	.31**	.23*	.11	.29**	.23*	.34**	.26**	.09	.63**	1

Notes. WFH = Working from home; CO = Collective orientation; CCM = Cooperative conflict management; * $p < .05$, ** $p < .01$

H3: Moderation Effect of Technology Factors

Table 5 displays the results of the moderated regression models for the effects of team- and task-technology fit on the relationship between team factors and perceived team success. Again, individual factors were included as control variables but showed no significant association with team outcomes. Effect sizes of the moderated regression models for the prediction of perceived performance ($f^2 = 0.39$) and satisfaction ($f^2 = 0.49$) were large. Trust was significantly associated with perceived performance. A significant relationship between task-technology fit and perceived performance was found. RW also proved trust and task-technology fit to be the most important predictors of team success. There were no significant moderation effects. Congruently, H3a-b were not supported.

In summary, trust, communication, and task-technology fit exhibited medium to large effects on the prediction of perceived team performance. Cohesion was negatively linked to perceived performance. Contrary to expectations, no moderations were found.

Discussion

The purpose of this study was to obtain insights into success-related factors for instantly formed VTs during an incisive event. The question is: Did we find something new or confirm something old? We would argue that we took on well-researched success factors of virtual teams and surveyed teams with a shared history and obtained new insights for teams and organizations, which we discuss in the Theoretical Implications section below. We investigated whether team factors (trust, cohesion), processes (communication, coordination, and cooperative conflict management), and technological factors (team-/task-technology fit) were associated with team success during unforeseen events.

The results revealed that trust, communication, and task-technology fit were essential predictors of perceived team performance. We found no evidence for moderating influences and for the prediction of team satisfaction by the studied variables. The input, process, and team-/task-technology fit factors showed moderate to high correlations with team outcomes. Multiple regression analyses demonstrated the relative importance of trust, communication, and task-technology fit for team performance. We further included experience and acceptance with WFH and CO as control variables as we expected them to be linked to team success. Although there were significant

Table 3. Regression coefficients of individual and team factors on outcomes

	Effects on performance					RW
	<i>B</i>	β	<i>SE</i>	<i>t</i> -value		
Intercept	3.32	0	0.62	5.39**		
Acceptance WFH	0.10	0.11	0.08	1.15		4.17
Experience WFH	0.09	0.09	0.10	0.87		4.41
CO	-0.06	-0.04	0.15	-0.40		4.35
Cohesion	-0.35	-0.34	0.16	-2.25		17.88
Trust	0.59	0.71	0.13	4.55**		69.19
$F(5, 94) = 6.19, p < .001; R^2 = .25$						
	Effects on satisfaction					RW
	<i>B</i>	β	<i>SE</i>	<i>t</i> -value		
Intercept	1.56	0	0.50	3.14*		
Acceptance WFH	0.11	0.14	0.07	1.62		9.04
Experience WFH	0.14	0.16	0.08	1.68		13.96
CO	0.10	0.08	0.12	0.77		12.56
Cohesion	-0.06	-0.07	0.13	-0.45		19.07
Trust	0.32	0.47	0.10	3.09*		45.37
$F(5, 94) = 7.77, p < .001; R^2 = .25$						

Notes. *B* = unstandardized regression coefficient; β = standardized regression coefficient; *SE* = standard error; RW = rescaled relative weight; WFH = Working from home; CO = collective orientation; * $p < .01$, ** $p < .001$

Table 4. Moderation models for process factors

	Moderation model for predicting performance					Moderation model for predicting satisfaction				
	<i>B</i>	β	<i>SE</i>	<i>t</i> -value	RW	<i>B</i>	β	<i>SE</i>	<i>t</i> -value	RW
Intercept	0.07	0	0.07	0.987		0.05	0	0.06	0.81	
Acceptance WFH	0.07	0.09	0.07	1.04	2.64	0.11	0.17	0.06	2.27	7.61
Experience WFH	0.18	0.18	0.10	1.90	6.28	0.19	0.22	0.08	2.27	13.66
CO	-0.27	-0.18	0.15	-1.77	3.00	-0.01	-0.01	0.13	-0.08	12.70
Cohesion	-0.50	-0.48	0.17	-2.99*	9.91	-0.05	-0.06	0.14	-0.38	9.71
Trust	0.36	0.43	0.14	2.51	28.13	0.13	0.18	0.12	1.03	24.22
Communication (COM)	0.56	0.37	0.19	2.90*	31.84	0.25	0.20	0.17	1.52	13.95
Coordination (COOR)	0.08	0.06	0.13	0.57	16.61	0.08	0.07	0.11	0.70	10.37
CCM	0.16	0.11	0.13	1.25	1.60	0.20	0.16	0.11	1.74	7.79
Cohesion * COM	-0.01	-0.01	0.28	-0.04		0.41	0.43	0.24	1.68	
Trust * COM	-0.39	-0.36	0.25	-1.55		-0.49	-0.55	0.22	-2.25	
Cohesion * COOR	0.61	0.32	0.40	1.53		0.32	0.20	0.35	0.92	
Trust * COOR	-0.21	-0.14	0.30	-0.68		-0.20	-0.16	0.26	-0.78	
Cohesion * CCM	-0.19	-0.08	0.30	-0.54		-0.13	-0.07	0.31	-0.43	
Trust * CCM	0.49	0.28	0.27	1.85		0.18	0.12	0.23	0.77	
$F(14, 85) = 4.96, p < .001; R^2 = .36$						$F(14, 85) = 4.09, p < .001; R^2 = .30$				

Notes. *B* = unstandardized regression coefficient; β = standardized regression coefficient; *SE* = standard error; RW = rescaled relative weight; WFH = Working from home; CO = collective orientation; CCM = Cooperative conflict management; * $p < .01$, ** $p < .001$

correlations between control and outcome variables (Table 2), they did not emerge as significant predictors.

The replication of trust as an indispensable component for successful teamwork in situations of instant transitions is important as it underlines the need for establishing trust early on (Hertel et al., 2005). The consistently high

relative weights of trust for the prediction of both team outcomes demonstrated that trust is an important boundary condition for teams to work effectively. We therefore take up the role of trust in the Practical Implications section below.

Table 5. Moderation models for the technology factors

	Moderation model for predicting performance					Moderation model for predicting satisfaction				
	<i>B</i>	β	<i>SE</i>	<i>t</i> -value	<i>RW</i>	<i>B</i>	β	<i>SE</i>	<i>t</i> -value	<i>RW</i>
Intercept	0.01	0	0.07	-0.15		-0.03	0	0.06	-0.49	
Acceptance WFH	-0.02	-0.03	0.07	-0.30	1.42	0.03	0.04	0.06	0.47	2.90
Experience WFH	0.09	0.09	0.10	0.85	3.91	0.10	0.12	0.08	1.21	8.21
CO	-0.11	-0.07	0.16	-0.70	4.00	0.11	0.09	0.13	0.87	12.86
Cohesion	-0.32	-0.31	0.17	-1.89	11.00	0.04	0.05	0.13	0.32	12.04
Trust	0.47	0.56	0.14	3.44**	39.09	0.19	0.28	0.11	1.78	25.64
Team Fit	0.07	0.06	0.14	0.47	16.63	0.08	0.09	0.11	0.75	17.10
Task Fit	0.30	0.32	0.11	2.75*	23.94	0.22	0.28	0.09	2.47	21.25
Cohesion * Team Fit	-0.21	-0.15	0.28	-0.75		-0.47	-0.39	0.23	-2.07	
Trust * Team Fit	0.33	0.32	0.23	1.40		0.42	0.50	0.19	2.24	
Cohesion * Task Fit	0.16	0.12	0.22	0.72		0.27	0.25	0.18	1.52	
Trust * Task Fit	-0.32	-0.37	0.19	-1.74		-0.28	-0.38	0.15	-1.85	
$F(11, 88) = 4.55, p < .001; R^2 = .28$						$F(11, 88) = 5.37, p < .001; R^2 = .33$				

Notes. *B* = unstandardized regression coefficient; β = standardized regression coefficient; *SE* = standard error; WFH = Working from home; Team Fit = Team-Technology Fit; Task Fit = Task-Technology Fit; * = $p < .01$; ** = $p < .001$

Task-technology fit emerged as a significant predictor of perceived performance. A direct effect was found, underlining the importance of aligning the technology to the requirements of the task (Maruping & Agarwal, 2004; Schulze & Krumm, 2017). Contrary to the results on which our hypotheses were based (Maruping & Agarwal, 2004; Thomas & Bostrom, 2010), team-/task-technology fit did not prove to be moderators. The technology variables did not enforce the positive relationships of, say, trust, though task-technology fit had an independent (direct) influence.

Communication was linked to perceived performance. In times of changes (e.g., adjustments to virtual teamwork), action processes help teams to organize individual behaviors, which increases team performance (Christian et al., 2017). Contrary to our expectations, communication was the only action process variable associated with perceived team performance. This can be explained by the fact that communication is a prerequisite for other action processes. To coordinate individual actions, communication is necessary. This is in line with team life cycles, in which communication is an indispensable factor at an early stage in which planning and structuring of team actions are prioritized (Ilgen et al., 2005).

Cohesion was negatively linked to perceived performance. As cohesion was positively correlated with perceived team success but emerged as a negative predictor in the moderated regression models, this might indicate a suppression effect (Falk & Miller, 1992).

Despite significant correlations between the studied variables and team satisfaction, there were no significant effects within the regression analysis. It is conceivable that the nonsignificant relationships emerged because of

the specific situation. Recent studies showed that the global character of the COVID-19 situation helped individuals to overcome negative emotions using social downward comparison, i.e., comparing oneself with less-fortunate others (e.g., with teams working in industries that were forced to continue to work in a co-located manner; Ruggieri et al., 2020). Such comparisons might have resulted in a sense of gratitude to be able to work virtually rather than being laid off or exposed to health risks. These emotions might have been more important, compared to the studied variables.

Finally, we expected teams to rely on team processes to achieve successful teamwork during the nonroutine situation, whereas moderation analyses showed no significant effect. Regarding all results in conjunction, the respective findings suggest a pattern that is theoretically meaningful concerning team life-cycle models (Kozlowski & Bell, 2013). Teams can adapt to changing circumstances including context, tasks, and technologies (Ilgen et al., 2005; McGrath et al., 2000). Thereby teams permanently cycle and recycle through initial stages of team development to finishing stages (Ilgen et al., 2005). In the process of cycling and recycling, the time and context of a change are crucial. COVID-19 demonstrated how fast working conditions can change. Such a major disruption both externally, because of the change of location (office to home), and internally, e.g., because of technology-mediated interaction, might have led to a new team transformation (Christian et al., 2017). Results from Klonek et al. (2021) indicated that teams needed time to adjust to this disruptive situation of working virtually. According to dynamic, cyclical team development mod-

els, the pandemic may have caused teams in this study to recycle back to an initial stage in which trust, the assembly of information, and the development of mental models are central components. Processes including conflict management and cooperation become more relevant at a later team development stage (Ilgen et al., 2005).

The results demonstrate the importance of reassessing success-related drivers for instant adjustments to VTs. We expected teams to rely on team processes to overcome the obstacles of this nonroutine situation. However, on the contrary, the pattern of results suggests that the instant adjustment reorganized the temporal features of team development. Simply put, teams might have been forced to resume team formation processes.

Limitations

Methodologically, the results at hand rely on the responses of individuals rather than teams, which might impair the criterion-related validity (Arthur et al., 2007). Although the dyadic data collection was not successful, so that an in-team agreement remained unmeasurable, the use of the referent shift mode mitigates threats to validity (Chan, 1998). The assessed time frame of 7–10 days was rather short for a time-lagged design, but it did allow us to minimize common method bias (Podsakoff et al., 2003). Regarding the proposed effects of incisive events on team life cycles and causal conclusions, longitudinal observations over a longer period and time-lagged models with more measurement points are indispensable.

Furthermore, the sample did not report additional challenges because of governmental restrictions (e.g., homeschooling; see ESM1, Table E1). This is not in line with the general perception of increased demands during COVID-19, and the sample might therefore not be representative in that regard. While comparisons to other COVID-19-related samples might be impaired, the generalizability of results to future instant transitions that are not accompanied by general severe changes in other life domains is strengthened.

The items for assessing team-technology fit were designed by the authors and have not yet been validated. Although internal consistency was satisfying, the assessment of the reliability and internal and external validity of the scale is a subject for future studies.

Finally, the sample size was too small for analyzing the originally planned models, which were reduced to reach an acceptable power. Although the replication of the COVID-19-driven situation in the life of the teams is unlikely in the present form, the question of whether team processes or team-/task-technology fit moderate the

relationship between individual factors and team success remains an interesting question for future research.

Theoretical Implications

Research on well-established success factors for virtual teams is not new, but our results reveal a new research context by demonstrating distinct effects of previously derived factors for short-term team success after instant team adjustment. Not all well-established success factors for VTs proved to be important during this situation. Thus, our results indicate that success factors for virtual teams might vary considering situational characteristics (e.g., disruptive events). This finding calls for the assessment of processes for specific situational characteristics (Christian et al., 2017), which can stimulate further research to uncover differential input and process factors for instant team adjustment. We propose a long-term investigation of success factors through the lens of team life-cycle models as an interesting research realm (Ilgen et al., 2005; Kozlowski & Bell, 2013). We argue that the teams were undergoing a new team formation stage, triggered by the instant adjustment. The new virtual context might have triggered “old” teams to cycle back to “new” team-formation processes. To decipher cyclic team processes, future studies should focus on relevant task-related and interpersonal factors possibly becoming more or less significant in the team-development stages over time for team performance and satisfaction.

Future studies might further build on the results by investigating the effects of increased and fluctuating degrees of virtuality. Teams will probably continue to work virtually in the future, e.g., because of changing working conditions or political restrictions. The effects of increased (virtual) team familiarity or levels of (perceived) virtuality on teams’ adjustments to the teamwork context emerge as important research questions (Handke et al., 2020a; Kniffin et al., 2021).

Practical Implications

The practical implications focus on the key factors that emerged from this study. We want to stress that our results are based on this specific COVID-19-induced situation, and that one should always consider the context and duration of a nonroutine situation when considering implementation of guidelines, training, or interventions. Because of the dynamic contexts in which teams operate, we propose guidelines based on a temporal framework of teamwork episodes (Marks et al., 2001). In dynamic contexts, we distinguish between action phases and

Figure 2. Recommendations for building and maintaining trust, task-technology fit, and communication.

transition phases (Marks et al., 2001): Transition phases differ from action phases in that predominately planning and coordinating activities are accomplished, whereas in action phases, teams are mainly engaged in those activities that help them to manage the dynamic (e.g., non-routine) situation (Hagemann & Kluge, 2017; Marks et al., 2001). We believe this to be helpful, as our results signal that the situation leads teams to being occupied with interpersonal formation processes rather than task work. We recognize that our results focus on the specific nonroutine situation of the initial lockdown and do not include intrateam comparisons over action and transition phases. Thus, practical implications for transition phases (e.g., routine situations) are limited to theoretical considerations. However, we think that adapting this theoretical framework is helpful for long-term preparations, because in adapting a mindset in which nonroutine situations are anticipated and prepared for, teams can be equipped to focus on taskwork rather than being occupied with planning and coordinating activities (Hagemann & Kluge, 2017). For this, leadership plays a key role. Leaders are seen as responsible for retaining a calm environment when the team is confronted with a nonroutine situation (O'Connor & Long, 2011), and they seem to have a powerful influence on the establishment of virtual team structures (Bartsch et al., 2021). Thus, the following implications apply not only to the teams themselves but should also be built into leadership training. Practical implications are differentiated and presented for routine situations, which we consider transition phase processes,

and nonroutine situations, which we consider action phase processes (Figure 2).

Routine Situations

VTs can be prone to conflicts because of irregular communication and information sharing and a lack of feedback, which can have detrimental effects on trust (Ilgen et al., 2005; Montoya-Weiss et al., 2001). Figure 2 thus contains recommendations on implementing communication strategies and establishing trust by mitigating these threats.

Additionally, a profound assessment of the alignment of task and technology should be implemented in advance (during routine work), so that teams can draw on this during nonroutine situations, as presented in Figure 2. Especially if the opportunity for gaining WFH experience is sparse, teams should focus on this. For the identification and assessment of the best technology fits, several technological tools should be considered for a task. For instance, a task such as giving an update about the team's project progress could be managed via collaborative work technologies (e.g., groupware), e-mail, or face-to-face. The importance of synchronicity (e.g., fast information sharing) and richness (e.g., need to transfer the information face-to face) is worthy of further consideration (Weimann et al., 2013).

Nonroutine Situations

To maintain trust during an instant transition, we must consider socialization and transparency of task manage-

ment. Whereas aspects of socialization contribute to a feeling of trust, transparency of task management can minimize potential mistrust. A detailed description of methods is presented by Feitosa and Salas (2021). For maintaining task-technology fit, we must consider changes because of the disruptive nature of the nonroutine situation. Because tasks can change, the fit between the technology and the task needs to be reassessed. A diagnostic tool for a reassessment of task-technology fit could be the five-trigger model for technology adaptation (Thomas & Bostrom, 2010; see Figure 2). It is recommended to consider human-centered design principles in the evaluation of the technology fit, i.e., to account for team members' "preferences, perceptions, emotions and physical and psychological responses that occur before, during and after use" (Bevan et al., 2015, p. 149). Because communication is sensible to the origin and duration of the change (Christian et al., 2017), it is crucial to examine the type of change and adjust communication strategies in nonroutine situations accordingly. Strategies, including the encouragement to maintain established interactional and coordinating routines, can help teams to overcome disruptive events (Christian et al., 2017).

Conclusion

In the modern working world, where dynamic tasks and virtual and agile work procedures are becoming increasingly important, teams need to be able to adjust instantly to nonroutine situations. Preparing for and leading during nonroutine situations are crucial tasks – not only regarding the persistent infection situation or the outbreak of another pandemic, but also other unplanned incisive events or the general fostering of virtual work practices. The results of this study indicate that it is advisable to prepare teams for nonroutine situations by establishing trust, ensuring team communication, and by preparing technology-mediated work procedures that fit the team tasks. In today's unforeseeable world of work, in which working virtually is no longer a choice but a prerequisite for business survival, these lessons learned from the COVID-19 pandemic are of incremental value and can aid in making successful team adjustments not a matter of luck but of evidence-based preparations.

Electronic Supplementary Material

The electronic supplementary material is available with the online version of the article at <https://doi.org/10.1026/0932-4089/a000368>

ESM 1. Table E1. Individual and team working situation characteristics of the sample

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Marina Klostermann, Greta Ontrup, Lisa Thomaschewski, and Annette Kluge designed the research. Greta Ontrup was responsible for data management and analysis. Marina Klostermann and Greta Ontrup wrote the article. Lisa Thomaschewski and Annette Kluge commented on an earlier draft of this article and revised it. Marina Klostermann and Greta Ontrup share first authorship.

Open Data

The data generated/analyzed in this study are available in the OSF repository: <https://osf.io/48pmu/>

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