

**How virtual meetings stimulate process innovations in organisations:
Mixed-methods evidence from emergency response providers**

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We have no conflict of interest to disclose.

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*This article has been accepted for publication in
INNOVATION: ORGANIZATION & MANAGEMENT, published by Taylor & Francis.*

Abstract

Although meetings are an omnipresent organisational practice for interactive idea generation, we know little about how the switch to digital forms affects innovation-oriented behaviours in meetings. This sequential mixed-methods study explores the role of virtual meetings in the generation of process innovations in the Ministry of the Interior of the city-state Hamburg in Germany during the first year of the COVID-19 pandemic. Based on observations, informal interviews, documents, group discussions, and an online survey, we combine qualitative and quantitative methods to develop, test, and elaborate on a conceptual model. The model describes how and why the virtual meeting format relates to meeting performance and facilitates process innovations in organisations. Our findings show that virtual meetings are perceived as equally burdensome, but more effective than face-to-face meetings. We explain this finding by identifying three shared affordances of virtual meetings: effortless attending, sequential speaking and liberated interacting. We theorise that the mechanisms behind the shared affordances in virtual meetings are process constraints, which turn out to be enabling limits for creative collaboration. We conclude that virtual meetings (unintentionally) bring about brainstorming facilitator rules, spur organisational creativity, and therefore turn out to be an (underestimated) practice for stimulating process innovations.

Keywords: computer-mediated interaction; digitalisation; public sector; mixed-methods; taking charge behaviour; videoconference; virtual collaboration

Introduction

A typical space for employees to engage in innovative behaviour are meetings (e.g. Meinecke et al., 2020). Meetings are indispensable for creative collaboration (Rollof, 2009) as they can be ‘a forum for creative thinking, debate, discussion, and idea generation’ (Mroz et al., 2018, p. 484). However, social distancing and forced remote work during the COVID-19 pandemic interrupted the routine of face-to-face meetings (Hacker et al., 2020). Most organisations started using videoconferencing extensively, also described as the ‘Zoom revolution’ (Tomlinson & Black, 2021), not knowing how this will affect their operations. Indeed, the influence of these new work practices on productivity, creativity, and innovation have yet to be established (Kniffin et al., 2021).

The sparse available evidence is contradictory to some extent. It suggests that virtual meetings are shorter (Denstadli et al., 2012) and perceived as more effective (Standaert et al., 2021) than face-to-face meetings, but also that virtual formats are more exhausting (Bennett et al., 2021) and lack the by-products of face-to-face meetings, such as spontaneous by-the-side conversations (Hacker et al., 2020). The widespread phenomenon of ‘videoconferencing fatigue’ (i.e., exhaustion from videoconferences; see Bennett et al., 2021) is detrimental for the sustained attention necessary for creative collaboration (van Oortmerssen et al., 2015), which led to the assumption that virtual meetings are less suitable for idea generation and exchange (Thompson, 2020). These cursory results suggest that virtual meetings work differently than face-to-face meetings do. However, innovation scholars and practitioners alike require answers to the subsequent research question: *How and why do virtual meetings, especially during mandatory work from home, affect innovative behaviours of employees?*

We investigated this question over a 13 month period of field work at a public sector organization. We utilize a sequential mixed-methods design with both exploratory and explanatory data integration (Harrison et al., 2020). Our qualitative data indicates that

organizational members propose more process innovations during general meetings when they are held digitally as opposed to face-to-face; a finding which is largely confirmed by our organization-wide survey with N=537 participants (exploratory integration). Subsequent qualitative examination helps elucidate the quantitative results (explanatory integration) by revealing how the constraints imposed by virtual meetings, such as sequential speaking, act as enabling limits (Ortmann & Sydow, 2018) for generating innovative ideas. We discuss these constraints as technological affordances (Volkoff & Strong, 2017) that enable organizational members to take charge, present process innovations, and develop new working methods, which was of vital importance during the pandemic.

The remainder of the paper proceeds as follows. We start with a brief review on virtual meetings and innovation in the public sector. After introducing our methodological approach and empirical context, we report on the sequential analyses and results. The study closes with a concluding discussion.

Literature review

Virtual meeting revolution

Virtual meetings are characterised by technology-mediated interactions and real-time communication of multiple, distributed meeting participants. Before the COVID-19 pandemic, organisations used virtual meetings mainly for intraorganisational projects and managerial issues (Denstadli et al., 2012). During the pandemic, videoconferencing became the standard communication channel (Hacker et al., 2020; Tomlinson & Black, 2021) and challenged the conviction that face-to-face meetings are ‘the most effective way through which to do business’ (Denstadli et al., 2012, p. 66).

Virtual meetings require more structure and preparation (Allison et al., 2015). They save time, as they reduce travel stress and are usually shorter than face-to-face meetings

(Denstadli et al., 2012). In a recent survey study of a large US IT company, Standaert et al. (2021) found that virtual meetings were perceived as well suited for idea generation by meeting initiators. They allow multi-channel communication, such as verbal conversations in the virtual room and written chat-communication run simultaneously. While this can be challenging if the two conversations drift apart, the chat is an alternative for people who might have language or cultural barriers or are less comfortable speaking up, proposing ideas, or giving feedback (Allison et al., 2015).

In virtual meetings, the more distant perception of others leads to less pressure to conform, and thus frees members to express more ideas than they would in a face-to-face setting (Thompson, 2020). Virtual meetings make cross talk impossible, which forces meeting members to listen to individual contributions of less vocal participants (Thompson, 2020). However, virtual meetings are prone to other forms of distractions, such as surreptitiously doing other tasks on the computer like writing emails or playing computer games.

Process innovations in constrained environments: The case of public organisations

The scope for creating novelty in public organisations is clearly limited, especially in emergency response providers, such as police or fire brigades. Work processes are ‘largely predetermined by the law and are not subject to change efforts by organizational members’ (Homberg et al., 2019, p. 29). Public servants operate within a set of strict requirements and legal guidelines, mostly following a zero-error culture (Homberg et al., 2019). Novel ideas in public organisations stress the value aspect of novelty by emphasising fitness for purpose. They mainly concern processes rather than product innovations and aim to solve pressing problems, but do not usually strive for radical innovations (Potts & Kastle, 2010). We argue that such incremental ideas, which seem less ingenious, still require innovative behaviour, as

they challenge what seems predefined and taken for granted in an organisation.

The amount of formalisation and legal regulation makes public organisations an extreme case for exploring innovation-oriented behaviour. Still, the research on creative practices in and of organisations establishes opposing views about such limitations, which define ‘the balance of freedom and constraints in the creative process’ (Lampel et al., 2014, p. 478). While some call for freedom, others regard constraints as an enhancement of organisational creativity (e.g. Rosso, 2014). Constraints are defined as externally imposed factor limiting innovative behaviour (Acar et al., 2019), for example, limited resources or time pressure, which affect the everyday working life of the vast majority of organisations. These constraints can be adjusted, promising that the creation of novelty can be organised or at least promoted to some extent. We assume that meetings as practices can enable or constrain groups to generate novel ideas because we regard ‘creativity as a practised social process’ (Fortwengel et al., 2017, p. 5). However, apart from a few exploratory investigations (Bürkland et al., 2019; Redlbacher et al., 2022), the influence of meetings, particularly virtual meetings, on the creation of novelty in organisations remains understudied so far. We address this gap by exploring the potential of the more formalised ‘virtual meetings’ (noun) as organisational structure and of videoconferencing (verb) as omnipresent organisational practice for creating novelty.

Research context and approach

Research context

We conducted our study at the Ministry of the Interior and Sports of the city-state Hamburg in Germany. It is an umbrella organisation with more than 16,000 staff members in five subdivisions: police force, fire brigade, state office for the protection of the constitution, resident registration offices, and office for internal administration and planning. Since

November 2018, we have collaborated with the Ministry's cross-office innovation hub. At the onset of the COVID-19 pandemic, the Ministry of the Interior needed to digitalise the workplace to ensure the safety of its workforce while keeping the situation on the street under control during the lockdowns. Germany initiated two lockdowns during 2020. Both were similar in terms of restrictions and included mandatory work-from-home rules and the shutdown of all public venues, which are not essential for daily life (e.g., bars, restaurants, theatres, cinemas; see Hattke & Martin, 2020 for a detailed description of the measures during the first lockdown). Accordingly, the administrative staff in our case organization had to work from home during the lockdowns and did not even return to office in substantial numbers in-between lockdowns. Thus, the pandemic increased the need for process innovations, but limited the possibilities for face-to-face exchange. However, the Ministry lagged behind with its digital transformation and did not provide much flexibility to work from home. The switch to work from home was a big leap for the authority, as 'working with Skype' was an urgent matter of the cross-office innovation hub of the Ministry before the pandemic. Since the pandemic, virtual meetings – including various formats such as daily staff meetings or interdepartmental meetings – have become ubiquitous in daily operations.

Sequential mixed-methods design

The study follows a sequential mixed-methods design (Harrison et al., 2020). It stands in a pragmatist tradition that prioritizes the usefulness of knowledge over a 'pure' paradigmatic approach (Feilzer, 2010). Relating the qualitative and quantitative data was crucial for the development of hypotheses and construct selection (exploration) as well as the interpretation of results (explanation). The integration of different research methods counterbalances both the problem of generalizability in qualitative research and the lack of rich contextual information in quantitative inquiries (Johnson & Onwuegbuzie, 2004). Data collection lasted

13 months and contains three main phases (see Figure 1). Phase 1 consists of a qualitative content analysis of internal documents, informal interviews, and meeting observations. Phase 2 deployed a survey to test the hypotheses by means of a quantitative analysis. Phase 3 substantiated and refined our interpretations through a content analysis of the feedback we obtained during panel discussions and informal interviews.

*** Insert Figure 1 about here ***

Pivotal in sequential mixed-methods designs are connections between the different data (Harrison et al., 2020). We connected phases 1 and 2 by discussing the results presented in the interim report and juxtaposed them to other data from within the Ministry. A think tank discussion with 15 members started an interactive reflection and elaboration of the results. The kick-off discussion was followed by two meetings with five human resources managers from different, as well as four meetings with the State Councillor, one of the top three executives of the Ministry of the Interior. Based on their feedback to the qualitative results, we crafted a survey to test the hypotheses. For connecting phases 2 and 3, we presented an abstract of the results from the interim report and the survey at a virtual podium discussion with over 90 leaders from the first and second management level of the Ministry of the Interior. For about 45 minutes, the leaders discussed how virtual meetings, in contrast to face-to-face meetings, enable or constrain idea generation. The panel discussion and further informal interviews guided our interpretation of the results, which details the technological features of virtual meetings as causes for increased innovation-oriented behaviours of meeting participants.

Empirical analyses

Phase 1: qualitative exploration

Qualitative data collection

The research project started with the observation of five Skype meetings of a cross-office Corona-working group in March and April 2020. Various documents such as working papers, PowerPoint-presentations, meeting minutes, were shared and analysed. A rich source was the COVID-19 BIS weblog, which was the first digital cross-office format for members of the Ministry of the Interior. Its goal was to increase knowledge exchange across the Ministry's divisions during the first lockdown. The motto was 'What are you experiencing right now in your daily work when having to deal with these corona times? What can we learn from it?' From April to July 2020, 49 employees participated anonymously in the weblog, and added up to 67 pages of weblog entries. The employees answered the four questions of the COVID-19 weblog on courage, meaningful change in the organisation, own initiatives, and barriers. Two coders analysed the texts according to a qualitative content analysis (Mayring, 2004) and wrote an interim report to summarise the experiences and critiques of the employees during the first lockdown. We further conducted 16 informal interviews with key contacts, such as the Head of Personnel Development of the Ministry. These semi-structured interviews were used to discuss our codes and to clarify the meaning of special terms such as 'situation' in the context of emergency response providers.

Qualitative data analysis

The qualitative analysis revealed the urgent need for innovative behaviour under lockdown conditions and we identified three key results for generating process innovations. *First*, many employees reported positive experiences and opportunities for *process innovations* that had not existed before the Corona pandemic. As an example, a public servant wrote on the weblog: 'We [have] set up many things [...] that would have been unthinkable before, at least

here in our workplace'. Many employees were pleased with a new openness towards novel ideas: 'I am encouraged that we have implemented novel ideas quickly and swiftly to protect employees and customers, and that this has been positively received'. Thus, there was more discretion for employees of different hierarchical levels during than before the pandemic to contribute to novelty. This was also described by a leader, who felt encouraged by the creative ideas from his/her followers: 'Everyone has come up with something'. Another observation was that novel ideas were not only generated but also implemented: 'This time is not so fraught with resistance to innovations. Innovations are accepted and embraced'. Another comment supported this statement, emphasising the value aspect of novel ideas, that is, the fitness of purpose: 'We still function, just differently'.

Second, the Ministry of Interior quickly adopted virtual tools, and emphasised the high *functionality* of virtual meetings:

Using Skype conferencing and, thus, being able to participate in meetings not simply over the phone but also to actively invite and engage in exchanges is a meaningful change or addition to my current daily work.

The functionality of regular meetings was evaluated as better when they were held digitally than face-to-face. *First*, the people needed to make progress participated in the virtual meetings; *second*, important information was digitalised, which simplified knowledge exchange:

For once, everyone actually took part in the meetings. Some were present in person, while others were connected via Skype, so we could move our issues much better and faster. The cross-departmental meetings were also attended by everyone, and the people concerned saved travel time, as we worked all over Hamburg. This way, we could always obtain information directly from the people. You did not have to play the multiplier repeatedly, and we were able to bring about decisions more quickly. We were also faster because we always had our laptops with us and could write down our topics straight away and possibly exchange them. I digitise my thoughts much more.

Third, virtual meetings were described in the weblog as more disciplined and *efficient* than common face-to-face meetings: ‘I perceive Skype conferences as much more structured and freer of useless verbal contributions’, which ‘reduced meeting time by 50%’. In addition, virtual meetings led to ‘savings in travel time’ between the offices.

Connecting qualitative and quantitative phases

The qualitative findings align with research showing that virtual meetings are perceived as better structured and less time consuming (e.g. Denstadli et al., 2012). The attitude towards virtual meetings seemed to have changed in the Ministry during the first lockdown: ‘Now that the possibilities are seen, there is a new open-mindedness. It is no longer something onerous that is prescribed to me’. Thus, ‘meetings also work wonderfully online and are more efficient’. We observed that virtual meetings were perceived as having higher meeting functionality (more effective) and less meeting burden (more efficient) than face-to-face meetings. We view both aspects as elements of perceived meeting performance: meeting functionality and meeting burden. Accordingly, our first hypothesis is

H1: Individuals perceive higher meeting performance in virtual meetings than in face-to-face meetings.

Further, the mandatory work from home seemed to have promoted process innovations, as noted by the statement, ‘We can be much more flexible than we have assumed’. We thus expect a relationship between perceived meeting performance and the generation of process innovations in the organisation. We assume that when employees evaluate meeting functionality as high and meeting burden as low, the chance of them proposing ideas and contributing to the development of process innovations increases. Such behaviour is understood as innovative behaviour, which is defined as ‘intentional behaviours of individuals to produce and implement new and useful ideas explicitly intended to benefit the individual, group or organisation’ (Bos-Nehles et al., 2017, p. 1232).

In our public context, we operationalise the generation of process innovations as innovative behaviour, when public servants pitch, generate, and recognise ideas and engage in improving organisational structures and practices. Taking into account the specificity of the public organisation and our focus on process innovations we chose the scale of taking charge behaviour (TCB) as it is explicitly directed towards the ‘improvement of organizational structures, processes or routines’ (Homberg et al., 2019, p. 2). In our case, this translates to incremental process innovations, such as the attention of all parties involved in virtual meetings or digitalisation and immediate sharing of meeting notes to increase knowledge sharing. From this, our second hypotheses follows

H2: Individuals who perceive higher meeting performance engage more in generating process innovations.

Selecting constructs and developing survey items

Based on the results of the qualitative analyses, we developed the measurements for the standardized survey. We assess *meeting virtualization* by asking respondents to indicate how often they coordinate with colleagues via virtual meeting software (e.g. Skype) on a five-point frequency scale (1 = never... 5 = daily). In addition, we ask on a five-point Likert scale how the overall frequency of meetings had changed since the offset of the pandemic (1 = strongly decreased... 5 = strongly increased). We further follow Rogelberg et al.’s (2010) advice to measure meeting quality and meeting load in tandem when assessing *meeting performance*. In line with our qualitative reasoning, we operationalise meeting performance as meeting functionality (i.e. the contribution to employees’ job fulfilment) and meeting burden (i.e. the amount of time and effort required). In the absence of established scales, we adapt a validated two-dimensional rule performance measure (van Loon et al., 2016). Three items address the functionality of meetings (e.g. ‘The meetings which I attend in my core

activities have a clear function for my job activities’) and three items capture the burden of meetings (e.g. ‘The meetings which I attend in my core activities cause much delay’). To operationalise the *generation of process innovations*, we chose the construct of TCB. We measure TCB using four items from the scale by Homberg et al. (2019). An example item is ‘I try to bring about improved procedures in my workplace’. Last, respondents indicate perceived meeting performance and TCB on a five-point Likert scale (1 = disagree... 5 = agree; see the overview of all the items in the Appendix). Figure 2 links the measurements with the two hypotheses and the stepwise tests of the mediation paths.

*** Insert Figure 2 about here ***

We further integrate socio-demographic characteristics that may cause variations in latent variables. Next to respondents’ gender and age, we consider the type of employment (career civil servant or public employee), leadership responsibility (yes or no), frequency of citizen contact, and type of contract (full-time or part-time). After designing the questionnaire, we asked 12 colleagues to rate our survey in terms of face validity and incorporated the feedback in the final version of the survey.

Phase 2: quantitative analysis

Quantitative data collection

To enhance the limited generalisability of our qualitative results, we initiated an online survey during the second lockdown in mid-December 2020 to test the hypothesized relationships. Supported by the Corona-group and more think tank members, we relied on a snowball sampling technique for distributing our survey within the Ministry of the Interior.

The survey was further promoted on the starting page of the Ministry's intranet. The link was open for nearly two months between December 2020 and February 2021. The final sample comprised 537 observations (see Table 1). The gender ratio is approximately balanced: 55% male, 45% female, and 2 persons diverse. The average age of the respondents was 46 years. Most employees (84%) worked full-time. Seventy percent reported working as civil servants and thirty percent as employees. About half of the respondents (46%) had regular contact with citizens. Of the respondents, one-third (32%) said they worked as leaders. The data is representative for the Ministry of the Interior regarding respondents' age and type of contract (full-time vs. part-time). However, women and public employees (as opposed to tenured civil servants) are overrepresented in our sample. The descriptive statistics show that, on average, respondents had virtual meetings several times a week during the pandemic (mean=3.540) while the overall meeting frequency had slightly declined (mean=2.760). Further, respondents perceived their meetings as rather functional (mean=3.585), not as overly burdensome (mean=2.760), and took charge by suggesting new processes and improved procedures (mean=3.557).

*** Insert Table 1 about here ***

Quantitative data analysis

Because of the mandatory work from home, the need to use digital communication tools such as Skype for meetings has increased. Before COVID-19, 93% of the respondents rarely or never used digital conferencing tools, but during the pandemic, this share decreased to 21%. The percentage of employees who used conferencing tools such as Skype daily or several times a week increased from 4% to 57% as well. The result that 78% of respondents use digital conference tools reinforces statements such as 'an incredible amount now takes place

via Skype or teleconferencing’.

Measurement model. We conducted a confirmatory factor analysis of AMOS for all multi-item constructs. Covariances among error terms (between 4.339 and 13.354) and path coefficients between the items and the latent variables were acceptable (between .658 and .887; $p < .01$). The results indicated model fit (DF = 32; CMIN/DF = 2.097 with $\chi^2(p) = .000$, CFI = .988, GFI = .976, RMSEA = .045 with PCLOSE = .678). Reliability tests yielded coefficient alphas between .802 and .903 (Table 1). Since the analysis relies on cross-sectional survey data, it is necessary to control for inflation owing to common method variance (Spector, 2006). We checked for common method bias by conducting Harman’s single-factor test (.354) and a common latent factor test (.090). Both values indicate that our data are acceptable regarding common method bias. In the final step, we imputed the latent variables and standardised all variables with five-point scales to render their effect sizes comparable in the path model.

Path model. We tested the regression paths using the SPSS PROCESS (Hayes, 2013). Table 2 depicts the estimated effects for the relationship between meeting virtualization and TCB (Model III), mediated by meeting functionality (Model I) and meeting burden (Model II). The model without covariates shows that virtual meeting frequency significantly relates to meeting functionality ($\beta = .330$; $p < .01$), but not to meeting burden ($\beta = .004$; $p > .05$). Further, the direct paths between virtual meeting frequency ($\beta = .136$; $p < .01$) and meeting functionality ($\beta = .253$; $p < .01$) to TCB were significant, while meeting burden had no significant relationship with TCB ($\beta = .070$; $p > .05$).

*** Insert Table 2 about here ***

These main effects remain consistent in models with socio-demographic control variables. Model I indicates that leaders reported higher meeting functionality ($\beta = .231$; $p < .05$), but the additional variance explained was rather small (adj. $R^2 = .138$; Δ adj. $R^2 = .029$). As shown in Model II, an increase in overall meeting frequency ($\beta = .263$; $p < .01$) and regular citizen contact ($\beta = .100$; $p < .01$) increased the perceived burden of meetings. Further, men reported a lower meeting burden than women did ($\beta = -.198$; $p < .05$). Only these covariates partially explain the variance observed in meeting burden (adj. $R^2 = .098$; Δ adj. $R^2 = .098$).

Model III shows that respondents reported higher TCB if they were male ($\beta = -.236$; $p < .01$), younger ($\beta = -.019$; $p < .01$), public employees ($\beta = .187$; $p < .05$), or when they had leadership responsibility ($\beta = .355$, $p < .01$). However, the hypothesised variables of virtual meeting frequency and meeting functionality explain the majority of the variance observed in TCB (adj. $R^2 = .167$; Δ adj. $R^2 = .067$). The total effect of virtual meeting frequency on TCB is significant in the regression without ($\beta = .220$, $p < .01$) and with socio-demographic covariates ($\beta = .182$, $p < .01$).

Connecting quantitative and qualitative phases

The respondents who had virtual meetings more frequently rated their meetings as more functional. Regarding the conduct of the meeting, the meeting results were significantly better than for those who predominantly participated in face-to-face meetings. This result fits with the statement that ‘the arrangements via digital contacts have become faster’. However, we find that the perceived (time) effort of meetings remained similar irrespective of the share of virtual meetings—which contradicts the literature (e.g. Denstadli et al., 2012). Thus, the results only partly confirm our first hypothesis, as only meeting functionality and not meeting burden is affected by the virtualization. The perception of meeting burden differed between the sexes, that is, men felt less burdened. We can only speculate about the reasons, but

perhaps women perceive virtual meetings as more burdensome because they take more time to prepare for them than their male colleagues do. Alternatively, the difference could have been caused by gender-specific reporting behaviour (Heisig & Kannan, 2020) or gender differences in worries, distress, and perceptions during the pandemic (Eurofond, 2020). Summing up, the survey reveals *that individuals who attended relatively more virtual meetings reported higher meeting functionality but similar meeting burden as individuals whose share of virtual meetings remained similar.*

A second essential finding is that respondents who collaborate digitally with others several times a week, or daily, rate themselves as significantly more innovative as their colleagues who stated they digitally collaborate never, rarely, or monthly. This may be partly due to COVID-19 because the people who have recently started to work from home have had to redesign significantly more processes than many employees on the street level, who continue to follow most of their familiar routines. At the same time, this result could also be an indication that digital collaboration offers more room for new ideas and the improvement of existing processes and structures. The following statement indicates that the broader participation in virtual meetings could be a main reason for this: ‘Everyone is there on time and it is more structured’. It is also possible that people work together in a more concentrated way and that the shares of speech in the meeting are more evenly distributed, as the following statement suggests: ‘Everyone has brought themselves to discipline’. Respondents who were younger or had one of the following characteristics, namely, public employees, leaders, or males, reported more innovative behaviours. These differences seem partly plausible, as younger employees are often more open or engaged in generating process innovations. Further, public employees often possess different job assignments than career civil servants, which might incentivise those with less job security to engage more. The result that leaders self-assess their behaviour as more innovative aligns with role expectations towards leaders

to improve organisational processes (Vogel & Werkmeister, 2021). Overall, meeting functionality explained the majority of the variance observed in the dependent variable, which partly supports our second hypothesis. Put differently, *individuals who attended relatively more virtual meetings and/or reported higher meeting functionality reported greater engagement in generating process innovations.*

Phase 3: qualitative explanation

Qualitative data collection

The final, explanatory step, seeks to identify reasons for the interpretation of the survey results that virtual meetings are more innovation-oriented than face-to-face meetings. The following citations originate from informal interviews and a podium discussion with over 90 leaders at the first and second management levels of the organisation. By discussing questions such as what happened once they started to use virtual meetings and what did virtual meetings enable them to do, we learned about the features of virtual meetings, which are a likely cause for the observed differences in innovation-oriented behaviours.

Qualitative data analysis

Based on the statements, we were able to discover the shared affordances of virtual meetings (Volkoff & Strong, 2017). These shared affordances go beyond the general affordance of videoconferencing such as enabling a collective with appropriate capabilities to experience real-time interaction and communicate in a virtual space. By using the affordance lens, we no longer separate user and technology artefact but instead integrate technology and collective actions (Majchrzak, et al. 2013). The leaders emphasised that virtual meetings, compared with face-to-face meetings, provided the following three benefits.

First, expanding the circle of meeting participants is easier, as virtual participation requires no travelling and can be easily arranged: ‘You can be more flexible and sometimes

add other hierarchy levels. The inhibition threshold is lower because you can join a virtual meeting more flexibly'. We call this affordance of virtual meetings "effortless attending". By effortless attending, virtual meetings increase the permeability of the hierarchy and lead to more interaction among the members, which seems beneficial to organisational creativity.

Second, the (audio) transmission capabilities in videoconferencing technology structure verbal contributions by, for example, only allowing sequential speech. In virtual meetings, people need to be prepared, as talking time is precious: 'I have introduced a limit to speaking time. We have a clock. Therefore, a maximum of three minutes per participant. It is not always used, but is a sign that you have to be brief'. We call this affordance of virtual meetings "sequential speaking". By sequential speaking, virtual meetings increase attention and foster more substantive communication.

Third, virtual meetings allow multi-channel communication and offer more possibilities to engage in idea generation.

Actually, these virtual meetings are interesting because you have different communication formats. One person who does not want to speak always has the opportunity to communicate opinions via chat. This is also used relatively intensively, according to the idea "Oh, I am not going to say anything now, because it is too exhausting for me, but I will write a short comment in the chat".

There also seems to be fewer power plays in virtual meetings: 'The communication style changes because you can simply speak to each other as equals'. We call this affordance "liberated interacting". By liberated interacting, virtual meetings increase active participation and facilitate inclusion of "quiet" persons. Some leaders see potential disadvantages in this development and call for additional substitutes for the missing 'by-the-side conversation':

Where there is no posing in meetings, there is no informal exchange, which sometimes solves problems. Where information is provided briefly, for example, in meetings, the quick information/conversation in passing, or when standing in the doorway of other

offices, is omitted if no conscious substitutes are created for such face-to-face communication.

To summarise, shared affordances of virtual meetings such as effortless attending, sequential speaking, and liberated interacting can allow more members to participate in idea generation in the context of process innovations. While effortless attending and liberated interacting open up more interaction possibilities, sequential speaking limits interaction dynamics between meeting participants. While the empirical findings indicate that the shared affordances might seem to facilitate creative collaboration, we are interested to understand why the bundle of affordances facilitates innovative behaviour.

Integration of qualitative and quantitative results

We theorize that the mechanisms for creative collaboration behind the shared affordances in virtual meetings are process constraints (Acar et al., 2019), which turn out to be enabling limits for creative collaboration (Ortmann & Sydow, 2018). These enabling limits have a similar effect as facilitator rules in brainstorming. Facilitator brainstorming rules are as follows stay focused on the task (do not tell stories, do not explain ideas), keep the brainstorming going, and encourage others to contribute (Putman & Paulus, 2009, p. 24, 39). Paulus et al. (2006) found that these facilitator rules increased brainstorming performance in groups by 79%.

Our empirical results indicate that virtual meetings are more effective and efficient because meeting members are on time, prepared, and keep their contributions brief. Participants self-assessed that they engaged more in generating process innovations and experienced less posing or side conversations in meetings. This seems consistent with the first and second facilitator rule of ‘staying focused on the task’ and ‘keep the brainstorming going’. The common situation in which only the speaker is hearable and all others are muted leads to a situation of quiet interaction without any interfering noise. Speakers can easily

have the impression that others are listening, which could increase their attention and motivate them to share ideas (Putman & Paulus, 2009). If no other forms of digital distractions (e.g. emails, gaming, etc.) draw attention away, the shared affordance sequential speaking in virtual meetings could result in raising the group's attention. Further, the use of time limitations for speakers - which seems more common in virtual meetings - ensures that the meeting process continues in an interactive manner.

The third rule 'encourage others to contribute' is implemented in virtual meetings by the shared affordances of effortless attending and liberated interacting. "Others" can be more easily integrated in discussions, if the meeting takes place online and allows effortless attending. In addition, the possibility of multi-channel communication in virtual meetings can lead towards a more balanced interaction style and might also promote the generation of novel ideas, as free-flowing, more inclusive communication between colleagues promotes idea generation (Redlbacher et al., 2022). Our study reveals that shared affordances of videoconferencing are experienced as (helpful) process constraints (e.g. Acar et al., 2019). In summary, process constraints that were initially considered coercive restrictions can also be regarded as enabling constraints that spur the collective generation of process innovations.

With our study we provide a new way of seeing virtual meetings by identifying shared affordances (Volkoff & Strong, 2017) of virtual meetings in the context of process innovation in public organisations. By focussing on affordance actualization (Majchrzak et al. 2013), we identified three mechanism for creative collaboration: effortless attending, sequential speaking and liberated interacting. In doing so we provide practical insights to organizations attempting to improve their innovation processes through effective use of videoconferencing. When actors become aware of the possibilities presented by videoconferencing technology they are enabled to consciously articulate the expected outcome when using the technology.

Conclusion

The COVID-19 pandemic led to an organization change from meeting face-to-face in the office to meeting virtually while working from home with videoconferencing technology. While most employees were not aware of the benefits of videoconferencing, they started to actualize the affordances of virtual meetings during the pandemic. Our research expands on knowledge at the nexus of virtual collaboration and innovative behaviours by elaborating on how features of virtual meetings can promote the generation of process innovations. Our findings provide evidence for the influence of virtual meetings on innovative behaviour, thereby complementing the research on the influence of meetings on organisational and team performance (e.g. Kauffeld & Lehmann-Willenbrock, 2012) or individual well-being (e.g. Rogelberg et al., 2010). Contrary to the widespread assumption that virtual meetings are less effective than face-to-face meetings for creative collaboration, our mixed-methods study suggests that virtual meetings are not only a forum for pitching and recognising ideas but also qualify as a practice to generate novel ideas in organisations. Our findings show that, in the context of minor process innovations, the potential of virtual meetings to stimulate the generation of novel ideas has been underestimated. The process constraints of virtual meetings, such as sequential speech, can enable work forces to generate novel ideas, at least for minor process innovations. Our research confirms the suitability of videoconferencing for idea generation (e.g. Standaert et al., 2021).

Of course, our study is not without limitations, which point to directions for future research. The security authority is a highly bureaucratic and mature organisation, which lags behind in digitalisation and, like other public administrations, has a reputation of being innovation-averse (Potts & Kastle, 2010). Novel ideas in bureaucratic organisations emphasise value over novelty and concern incremental rather than radical innovations, which limits our findings' generalisability. Our point of departure is the research cooperation with

the innovation hub, which might have biased the contents of the collected documents towards intrinsically motivated employees within the security authority. However, as the survey was also promoted on the landing page of the intranet, all employees had the chance to participate anonymously.

Our study did not differentiate between various virtual meeting modes – e.g. team meetings vs. interdepartmental meetings – nor did it assess objective performance in virtual meetings, but only collected self-assessed evaluations about their own engagement in the generation of process innovations. Further, we acknowledge the nested nature of meetings and stress that even within one organisation the regular meeting formats such as team meetings might differ substantially in regard to their possibilities for deciding on process innovations. Following current studies about team work (e.g. Whillans et al., 2021) the degree to which constraints of meetings can facilitate innovative behaviour might also differ depending on the type of interaction, ranging between task, process, and relationship interactions. An experimental design to compare different modes of meetings could substantiate our findings of the unique enabling constraints in the various virtual meeting formats. Further studies are needed to compare different modes of meetings and control for contextual factors such as group size, familiarity between meeting participants (pre-existing ties), shared history and hierarchical structures within the group, interaction focus, self-selection, and intrinsic motivation.

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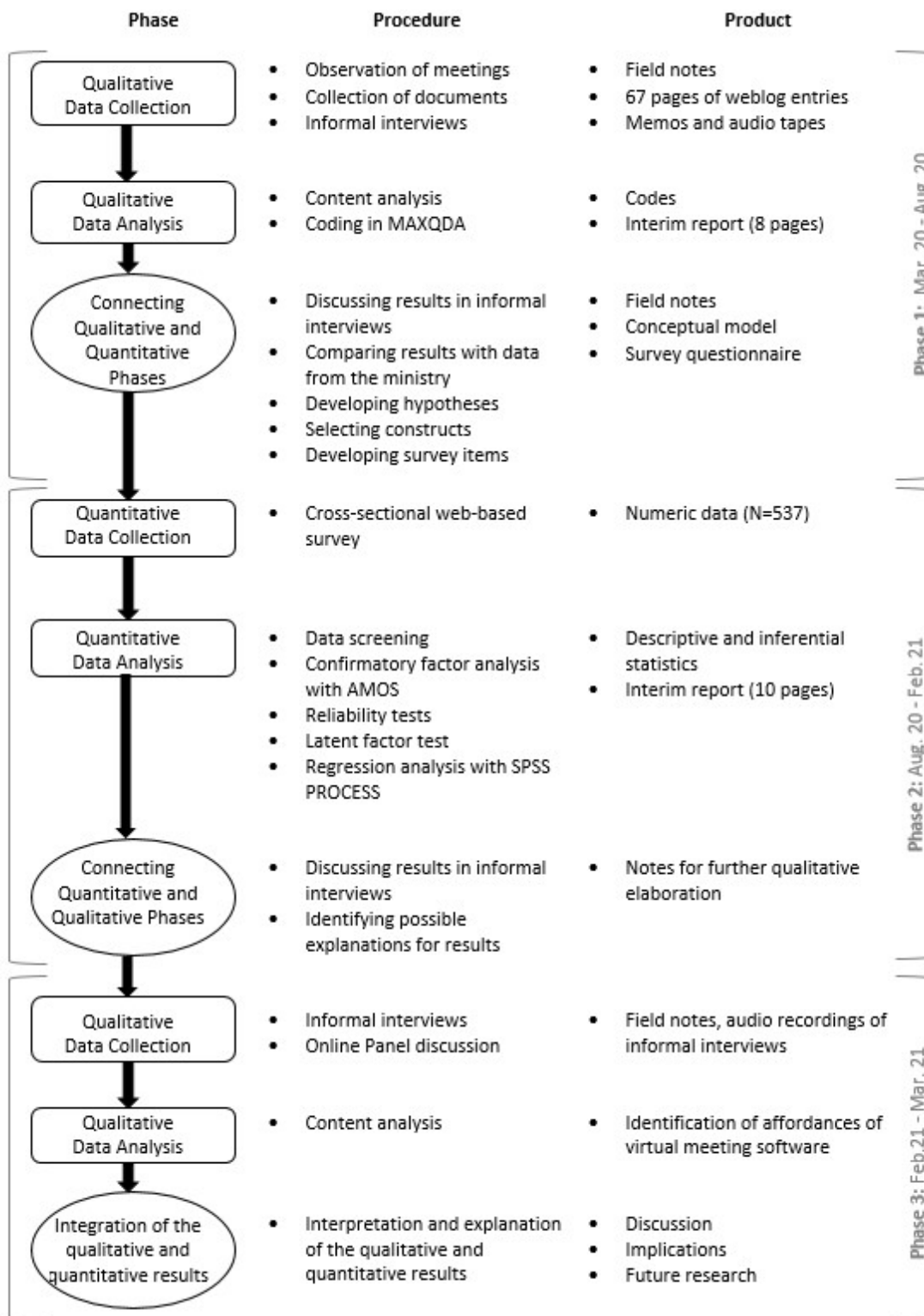
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Figures and Tables



Phase 1: Mar. 20 - Aug. 20

Phase 2: Aug. 20 - Feb. 21

Phase 3: Feb. 21 - Mar. 21

Figure 1: Sequential mixed-methods design: phases, procedures and products.

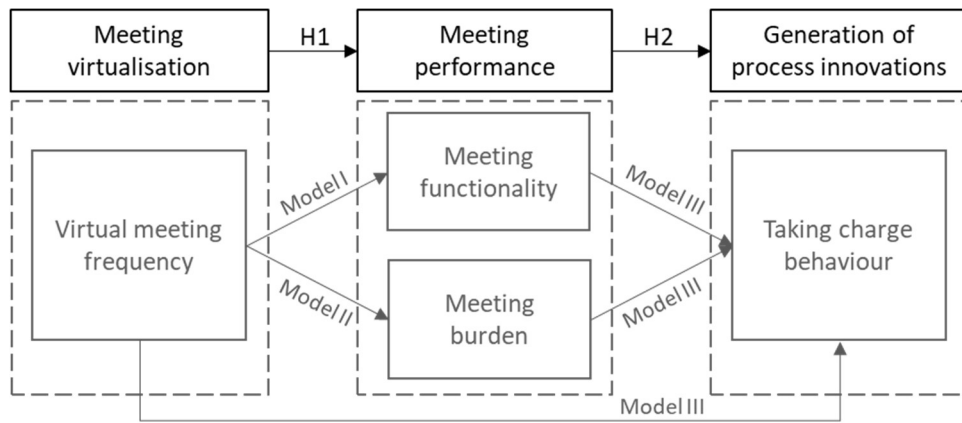


Figure 2. Hypotheses, measurements, and stepwise test of mediation paths.

Table 1. Descriptive statistics and correlations.

| | Mean | SD | Correlations | | | | | | | | | | | |
|------------------------------------|--------|-------|--------------|-------------|-------------|------------|-------------|------------|------------|------------|------------|-------|------------|--|
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | | |
| 1 Virtual meetings | 3.540 | 1.287 | <i>n/a</i> | | | | | | | | | | | |
| 2 Meeting functionality | 3.585 | .961 | .332** | <i>.894</i> | | | | | | | | | | |
| 3 Meeting burden | 2.404 | .875 | .041 | -.182** | <i>.802</i> | | | | | | | | | |
| 4 Meeting frequency | 2.760 | 1.019 | .250** | .158** | .261** | <i>n/a</i> | | | | | | | | |
| 5 Taking charge | 3.557 | 1.025 | .208** | .227** | .011 | .140** | <i>.903</i> | | | | | | | |
| 6 Gender ^a | .450 | .498 | -.112** | .012 | -.119** | -.037 | -.109* | <i>n/a</i> | | | | | | |
| 7 Age | 45.560 | 9.717 | -.012 | .052 | -.006 | .014 | -.136** | -.064 | <i>n/a</i> | | | | | |
| 8 Occupational status ^b | .300 | .458 | -.215** | -.014 | -.040 | .055 | .014 | .193** | .051 | <i>n/a</i> | | | | |
| 9 Leadership position ^c | .320 | .467 | .176** | .159** | -.011 | .057 | .182** | -.111** | .216** | -.098* | <i>n/a</i> | | | |
| 10 Citizen contact | 2.740 | 1.422 | -.212** | -.131** | .117** | -.152** | .001 | -.073 | -.104* | -.068 | -.068 | .027 | <i>n/a</i> | |
| 11 Contract ^d | .160 | .377 | -.170** | -.093* | -.063 | -.093* | -.039 | -.289** | -.068 | .058 | -.154** | -.011 | | |

Note. N = 537; ** $p < .01$; * $p < .05$; Cronbach's alpha is on the main diagonal (*in italics*); n/a = not applicable; a. 0 = male, 1 = female; b. 0 = civil servant, 1 = public employee; c. 0 = no, 1 = yes; d. 0 = full-time, 1 = part-time.

Table 2. Ordinary least squares regression results.

| | Model I ^a | | | | Model II ^b | | | | Model III ^c | | | |
|-------------------------------------|----------------------|------|--------|-------|-----------------------|------|--------|-------|------------------------|------|--------|-------|
| | Coeff. | s.e. | t | p | Coeff. | s.e. | t | p | Coeff. | s.e. | t | p |
| Constant | .000 | .041 | .000 | 1.000 | .000 | .043 | .000 | 1.000 | .000 | .041 | .000 | 1.000 |
| Virtual meetings | .330** | .041 | 8.091 | .000 | .004 | .043 | .096 | .924 | .136** | .044 | 3.102 | .002 |
| Meeting functionality | | | | | | | | | .253** | .046 | 5.549 | .000 |
| Meeting burden | | | | | | | | | .070 | .043 | 1.631 | .103 |
| <i>adj. R</i> ² | .109 | | | | .000 | | | | .100 | | | |
| Constant | -.696* | .337 | -2.064 | .040 | -.279 | .345 | -.808 | .419 | .113 | .334 | .337 | .736 |
| Virtual meetings | .296** | .045 | 6.599 | .000 | -.043 | .046 | -.942 | .346 | .113* | .046 | 2.462 | .014 |
| Meeting functionality | | | | | | | | | .237** | .045 | 5.243 | .000 |
| Meeting burden | | | | | | | | | .042 | .044 | .951 | .342 |
| Meeting frequency | .059 | .042 | 1.426 | .155 | .263** | .042 | 6.195 | .000 | .064 | .043 | 1.505 | .133 |
| Gender ^d | .132 | .087 | 1.526 | .128 | -.198* | .089 | -2.227 | .026 | -.236** | .086 | -2.747 | .006 |
| Age | .003 | .004 | .608 | .543 | -.001 | .004 | -.158 | .874 | -.019** | .004 | -4.471 | .000 |
| Occupational status ^e | .112 | .093 | 1.200 | .231 | -.093 | .095 | -.974 | .331 | .187* | .092 | 2.031 | .043 |
| Leadership position ^f | .231* | .091 | 2.524 | .012 | -.162 | .093 | -1.736 | .083 | .355** | .091 | 3.917 | .000 |
| Citizen contact | -.038 | .030 | -1.272 | .204 | .100** | .030 | 3.267 | .001 | .020 | .030 | .684 | .494 |
| Contract ^g | -.108 | .114 | -.946 | .345 | -.057 | .117 | -.465 | .628 | .132 | .112 | 1.172 | .242 |
| <i>adj. R</i> ² | .138 | | | | .098 | | | | .167 | | | |
| Δ <i>adj. R</i> ² | .029 | | | | .098 | | | | .067 | | | |

Notes. N = 537; ** p < .01; * p < .05; *a.* dependent variable: meeting functionality; *b.* dependent variable: meeting burden; *c.* dependent variable: taking charge behaviour; *d.* 0 = male, 1 = female; *e.* 0 = civil servant, 1 = public employee; *f.* 0 = no, 1 = yes; *g.* 0 = full-time, 1 = part-time.

Appendix A: Content Analysis of Qualitative Data

| Example quotes | Open coding | Theme |
|--|-------------------------------------|---|
| <ul style="list-style-type: none"> - What I find particularly positive is that despite this unique situation in the authority, many things run smoothly. - I was pleasantly surprised by the rapid changes, especially in the digital area and in working hours. - The rapid implementation of digital communication and meeting formats is certainly essential. This would normally have taken years. | Fast adaptation in the authority | Mostly positive work experiences during the Corona-pandemic |
| <ul style="list-style-type: none"> - I am encouraged by the comradely and considerate behaviour of my colleagues. Despite all the worries, there is a mood of “we'll manage”. - I am encouraged by the cohesion with the employees, from the cleaning lady to the foreman. Since we only ever talk to the management level via Skype, the cohesion is already there in this direction as well. - I am encouraged by the cohesion in my team. | Supportive cohesion | |
| <ul style="list-style-type: none"> - Particularly on the subject of home office, I observe that employees there are also trusted more. I think we have already taken the first good step towards trust-based working time. I see particular advantages in the fact that workplaces are now becoming more and more modern and flexible. Leadership through trust is allowed to develop. - I also think that we are finding new and good ways of leadership, communicating a lot with each other via Skype. That works really well. - Trust has grown. | More trust | |
| <ul style="list-style-type: none"> - While we moved the use of telephone and video conferencing as a Think Tank topic only a short time ago, the use of the same has now become a matter of course. Even the die-hards suddenly could not escape the new technology. The normative force of the factual had caught up with (or overtaken) them. - Everyone has taken part in Skype conferences by now, so it has become something commonplace. We have reconsidered traditional behaviour and are already seeing savings in travel time. We have generally acquired a different basic attitude towards digital issues. Before, it simply didn't affect many, now the possibilities are seen, there is a new open-mindedness. It is no longer something onerous that is prescribed to me. - And really all people have Skype installed and can use it. | New use of digital tools | Changes in collaboration processes |
| <ul style="list-style-type: none"> - I am observing home office as a meaningful change at my service right now. - I am encouraged in this situation by my direct superiors, who make it possible for me to work from home - and in an uncomplicated and unbureaucratic way. That takes some of the pressure off. - I am encouraged that as a high-risk patient I was able to switch to a home office so quickly and without bureaucracy, and that I can still make a meaningful contribution to my work every day, while also getting things done at work that would otherwise have fallen by the wayside. | New possibilities to work from home | |
| <ul style="list-style-type: none"> - I am encouraged that we have implemented novel ideas quickly and swiftly. - There is less resistance to innovations. Innovations are accepted and embraced. - We [have] set up many things [...] that have been unthinkable, at least here in our workplace. | Fast implementation of novel ideas | Generating process innovations |
| <ul style="list-style-type: none"> - Everyone has come up with something. - Although we all lack face-to-face interaction, we use the Skype facilities to exchange ideas. | Creative collaboration | |

| | | |
|---|-----------------------------|---|
| <ul style="list-style-type: none"> - In the course of this crisis, suggestions for improvement are coming from the staff, especially in the digital area. | | |
| <ul style="list-style-type: none"> - Using Skype conferencing and, thus, being able to participate in meetings not simply over the phone but also to actively invite and engage in exchanges is a meaningful change or addition to my current daily work. - For once, everyone actually took part in the meetings. Some were present in person, while others were connected via Skype, so we could move our issues much better and faster. The cross-departmental meetings were also attended by everyone, and the people concerned saved travel time, as we worked all over Hamburg. This way, we could always obtain information directly from the people. You did not have to play the multiplier repeatedly, and we were able to bring about decisions more quickly. - Thus, if someone is on a business trip, they may be able to attend an important meeting according to the principle of prioritisation; if they are at home in their free time, they could at least attend individual meetings of particular importance. In this way, issues can be moved more quickly and reliably, and the elimination of travel time frees up working time for important activities. | <p>Everybody present</p> | <p>high functionality of virtual meetings</p> |
| <ul style="list-style-type: none"> - An incredible amount now takes place via Skype or telephone conferences. Everyone is there on time and it's more structured. - I perceive Skype conferences as much more structured and freer of useless verbal contributions | <p>Better structured</p> | |
| <ul style="list-style-type: none"> - I have also come to appreciate the effectiveness of the telephone conferences. Everyone exhorted themselves to discipline. - However, we were able to hold the daily service meetings via Skype. There, we disciplined ourselves from one day to the next, also in terms of expressing ourselves. We reduced the meeting time by 50% with it. The social had to develop first, but we were highly effective. We came together in no time. | <p>Higher discipline</p> | |
| <ul style="list-style-type: none"> - Numerous projects were tackled that had somehow been on the back burner for years and we were able to implement them within a very short time. - Our regular meetings via Skype worked really well. | <p>Better performance</p> | |
| <ul style="list-style-type: none"> - Regular meetings also work wonderfully online and are more efficient. - Departmental meetings of police stations spread over several addresses can now be reliably held with the help of the very good video conferencing systems, eliminating unnecessary travel time. - I also had the feeling that the telephone conferences were comparatively short. They tended to get to the point, which I consider positive. - We save 45 minutes per day by using Skype as opposed to normal meetings. | <p>Save time</p> | <p>High efficiency of virtual meetings</p> |
| <ul style="list-style-type: none"> - It was previously inconceivable that we could achieve a response time and decision-making behaviour of 12 to 36 hours - even for major decisions with a lasting effect. Anyone who is familiar with the otherwise weeks-long coordination processes and consideration of the most diverse sensitivities is amazed at what can suddenly be decided at the working level. - Skype conferences audio, screen sharing we all work together whether in the home office or at the office and get results faster. - With Skype, we have opened up new ways of communication, which we will perhaps also use in the future, in order not to be on site at every appointment, but perhaps also to communicate and exchange ideas in this fast way. | <p>Faster communication</p> | |

Appendix B: Items of the Scales

| Scale | Estimate^a | Items |
|--------------------------------|-----------------------------|--|
| Meeting functionality | | Please indicate in how far you personally agree with the following statements about regular meetings. The work-related meetings I attend during the COVID-19 pandemic... |
| <i>1 strongly disagree ...</i> | .821 | ... have a clear function for my job activities. |
| <i>5 strongly agree</i> | .825 | ... contribute to the goal of my job activities. |
| | .837 | ... help me do my job well. |
| Meeting burden | | Please indicate in how far you personally agree with the following statements about regular meetings. The work-related meetings I attend during the COVID-19 pandemic, ... |
| <i>1 strongly disagree ...</i> | .692 | ... cause much pressure at work. |
| <i>5 strongly agree</i> | .736 | ... take a lot of time to comply with. |
| | .859 | ... cause much delay. |
| Virtual meetings | | |
| <i>1 never ...</i> | n.a. | 'How often do you use digital conference software (e.g. Skype) to collaborate with your colleagues during the COVID-19 pandemic?' |
| <i>5 daily</i> | | |
| Taking charge | | 'Please indicate how much you personally agree with the following statements. During the COVID-19 pandemic... |
| <i>1 strongly disagree ...</i> | .791 | ... I try to bring about improved procedures in your workplace. |
| <i>5 strongly agree</i> | .809 | ... I try to institute new work methods that are more effective. |
| | .811 | ... I try to implement solutions to pressing organisational problems. |
| | .848 | ... I try to introduce new structures, technologies, or approaches to improve efficiency. |

Notes. N = 537; a. Standardised estimate according to confirmatory factor analysis.