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Caroline Fischer | John Siegel | Isabella Proeller | Nicolas Drathschmidt

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Resilience through digitalisation: How individual and organisational resources affect public employees working from home during the COVID-19 pandemic

Caroline Fischer [iD][a], John Siegel[b], Isabella Proeller[c] and Nicolas Drathschmidt[c]

[a]Department of Public Administration, University of Twente, Enschede, Netherlands; [b]Department of Public Administration, Berlin School of Economics and Law, Berlin, Germany; [c]Department of Economics and Social Sciences, University of Potsdam, Potsdam, Germany

ABSTRACT
This article examines public service resilience during the COVID-19 pandemic and studies the switch to telework due to social distancing measures. We argue that the pandemic and related policies led to increasing demands on public organisations and their employees. Following the job demands-resources model, we argue that resilience only can arise in the presence of resources for buffering these demands. Survey data were collected from 1,189 German public employees, 380 participants were included for analysis. The results suggest that the public service was resilient against the crisis and that the shift to telework was not as demanding as expected.

Introduction

In early 2020, the COVID-19 pandemic spread rapidly across the world. To prevent virus transmissions, governments issued compulsory guidelines, such as social distancing, closing schools and daycares, and working from home. Therefore, COVID-19 has affected numerous areas of civil servants' working life (OECD 2020). Rapid changes in digitalising public administrations were made under substantial political pressure, especially in countries with lower degress of digitalisation before the pandemic (Wegrich 2020; Mergel 2019). For example, processes were revised and reduced (e.g. digital signatures were enabled where that was not the case before), citizens were able to file applications online (e.g. Corona fast-track aid), and digital infrastructures were rapidly built (e.g. web clouds for schools) (European Commission 2021; McKinsey 2020). However, it remains an open question whether the public service was resilient against this crisis situation and able to perform effectively while working remotely, and which antecedents affected individual and organisational resilience during the time of virtual work from home.

It has been shown that public employees might experience adverse effects from teleworking due to leaders' lack of skills in leading virtual teams and fewer opportunities for social interactions (Vries, Tummers, and Bekkers 2019). The challenging situation of a lockdown and the shift of caretaker responsibilities to parents in the home office might add to these effects (van der Meer et al. 2020). We argue that the fast transition to teleworking, and, more broadly, flexibility in working models, during the COVID-19 pandemic serves as a specific and meaningful test of individual and organisational resilience in the public sector. Therefore, we pose the following research question:

How do individual and job resources impact public employees' as well as organisations' resilience during the COVID-19 pandemic regarding the ability to work from home?

We define resilient organisations or individuals as those who 'keep[s] errors small and improve[s] workarounds that allow the system to keep functioning' (Weick and Sutcliffe 2007, 14) in a demanding and unexpected situation. We argue that public service resilience consists of both an organisational and an individual dimension and that resilience arises when employees as well as their organisations can cope with demanding and unexpected situations. Hence, we consider public service resilience to be a multi-level-concept. We use the job demands-resources model (JD-R model, Bakker and Demerouti 2007) to explain how individual and organisational resilience are formed. We argue that job and personal resources make employees resilient against situations of crisis, such as the COVID-19 pandemic, (job demands) and able to cope with personal constraints (personal demands).

To answer the research question, an online survey was designed and survey data were collected from 1,189 German public employees between August and October 2020. Survey data are analysed using two-step factor score regression.

This study contributes to the literature in two important aspects. *Firstly*, we add to the literature on performance in public organisations under the special contextual conditions of working remotely and during a crisis. To do so, we apply a multi-level approach to public service resilience. In that, we also answer recent calls for integrating levels of analysis in public administration research (Jilke et al. 2019; Roberts 2020). *Secondly*, our analysis furthers the conceptualisation of resilience. This study provides a comprehensive theoretical explanation for the impact of demands arising in a situation of crisis and change, and resources to cope with them. We employ the JD-R model to explain varieties of resilience as an outcome and thereby theoretically advance both concepts.

The remainder of this article is structured as follows. First, we clarify the conceptual space of resilience and teleworking and provide the current state of research. Second, we explain how personal and job demands, arising from the pandemic and related measures, and personal and job resources interact and impact individual and organisational resilience in times of crisis. Third, we summarise how we tested the suggested theoretical model. Fourth, we present the results of our analysis. In the concluding section, we point out implications for further research and managerial practice.

Resilience and telework

The COVID-19 pandemic demanded rapid changes under substantial political pressure. Thus, it presented a challenge perceived as 'outside of the set of disturbances a system is designed to handle' (Woods, Leveson, and Hollnagel 2017, 3), a surprising danger that was not foreseen by the organisations to that degree. Hence, the public service was forced to go beyond standard operating procedures to handle this situation. While the pandemic was and is first of all a disaster concerning health, measures introduced to tackle the pandemic also affected the whole public service in its core operation mode: the way public organisations and their staff work.

Resilience

A construct often discussed regarding crises, disasters, and their management is resilience (Dayton et al. 2004; Williams et al. 2017). The literature still does not agree on whether resilience is the ability to deal with a crisis, the process of managing it, or an outcome of successful crisis handling (Boin and van Eeten 2013). We position ourselves at the outcome-end of this continuum and define resilient organisations or individuals as those who 'keep[s] errors small and improve[s] work-arounds that allow the system to keep functioning' (Weick and Sutcliffe 2007, 14) in a demanding and unexpected situation. Hence, we see resilience as an outcome based on certain abilities and the process that deals with a situation of crisis (similarly Meek and Marshall 2018).

While other authors define the capacity to react in a crisis as resilience (e.g. Akgün and Keskin 2014; Termeer and van den Brink 2013), we argue that such a capacity is more an antecedent of resilience than resilience itself. We postulate that the same is true for resilience as a process (e.g. Sutcliffe and Vogus 2003; Sun et al. 2011), which describes 'adversity management' (Boin and van Eeten 2013) and crisis management behaviors rather than resilience itself. As Boin and van Eeten (2013, 430) note, 'it is hard to recognise resilience in action. We do not know resilience when we see it – rather, we assume it must have been there if an organisation survives a crisis or disaster.' Hence, from a measurement point of view, it is also a pragmatic decision to use an outcome as a proxy for resilience.

Furthermore, the literature disagrees about the level resilience arises on and whether it is a multi-level or single-level concept (Linnenluecke and Griffiths 2010). We combine both approaches and consider individual and organisational resilience, as well as the interaction between the two forming public service resilience. We argue that an organisation can only be as resilient as its staff, but organisational resilience can also foster individual resilience.

Additionally, in this study we analyse precursor instead of recovery resilience. In the literature, both are distinguished according to when an organisation or person reacts and adapts to a challenging situation. Recovery resilience means bouncing back *after* a crisis (for example after an act of terrorism or a natural disaster; Kendra and Wachtendorf 2003), implying that during the crisis a particular system was not able to act and after the crisis it returned to the pre-crisis status quo. Precursor resilience, in contrast, means accommodating change without catastrophic failure and absorbing shocks *during* a situation of crisis (Foster 1993), implying that a system is quickly able to learn so that it can still act in a situation of crisis (Meek

and Marshall 2018). We argue that teleworking public employees and their organisations can potentially maintain public service delivery despite the lockdown and its limitations. Thereby, public service resilience is created and a further catastrophic failure, hence collapse of the public service itself, is inhibited. Thus, resilience retains the capacity to deliver public service (Lodge and Wegrich 2014) and is in that regard similar to the concept of robust systems and robust governance (Ansell, Sørensen, and Torfing 2021).

Potentials and challenges of telework

Forced by the social distancing rules, public employers banned staff from offices and asked them to work from their homes whenever possible. During the pandemic, this setup was regularly termed working in and from the 'home-office' (Brenke 2016). In the literature, these workplace arrangements are also referred to as teleworking, telecommuting, or remote working (Eddleston and Mulki 2017). The main difference between those terms is their focus on different aspects of such arrangements, like the location or the use of technology as a central enabler (Allen et al. 2021; Yeh et al. 2020). Based on the regularity with which and the location where telework is performed, taxonomies have been developed differentiating between fixed-site work, mobile telework, and flexiwork (Garrett and Danziger 2007). The arrangements during the pandemic largely corresponded to fixed-site work, namely home-office or telework.

In public administrations, telework arrangements were not widely used before the pandemic. While such arrangements were increasingly debated and introduced as innovations, their implementation lagged behind other sectors (Brenke 2016; European Commission 2020) and remained a marginal setup in public organisations. That resonates with the rather low status of digitalisation in the public sector in general (Jakob and Krcmar 2018).

Following the concept of 'new work' (Bergmann 2019), the 'smart' use of technology and automated and reduced processes should allow for increasing autonomy, self-fulfilment, and job-satisfaction, ultimately leading to higher performance and, therefore, resilience in times of crisis. However, recent studies show that public employees working remotely do not have higher levels of job motivation than employees working on-site (Caillier 2012). Additionally, Vries, Tummers, and Bekkers (2019) find that teleworkers in the public sector experience negative effects from working from home; they feel isolated and are less committed to their organisation.

Mohalik et al. (2019) identify social, organisational, technology-related, financial, and personal factors affecting the adoption and success of telework in the public sector. They find that teleworking may damage an employee's image due to reduced visibility to co-workers and supervisors. Employees may perceive a particular need to be present in the office to perform specific tasks. However, Vries, Tummers, and Bekkers (2019) show that leaders caring about a high-quality relationship with their teleworking employees can reduce the negative effects of working from home, namely professional isolation.

These ambiguous results for telework outcomes in the public sector are in line with more general, non-sector confined studies on the effects of telework for individuals and organisations. In a meta-analysis, Harker Martin and MacDonnell (2012) found a small but positive relationship of teleworking to productivity, retention, organisational commitment, and performance. They also found that these relationships were

moderated by age and hierarchical level. Similarly, a meta-analysis by Boell et al. (2013) emphasised underlying contradictions and paradoxes of telework. In general, these results imply that while telework holds potential for positive individual and organisational effects, those effects are highly contingent on individual and organisational factors.

Such factors are employees' boundary management and preferences. Boundary theory (Clark 2000) describes strategies along the spectrum of integrators and segmentators that people use to order and simplify their worlds into work and family spheres. Boundary work affects how individuals handle both spheres' responsibilities and build workplace identities and relationships. A study on forced fixed telework arrangements found that the shift to telework inevitably required employees to (re-)perform identity work (Tietze and Musson 2010). Private and professional identities are up for re-definition, hence, a major change has to be handled.

The setting of solely working from home, as it became more common during the pandemic, proved to be particularly risky for work-family conflicts and over-working (Eddleston and Mulki 2017). People with a preference for segmentation strategies regarding work-family boundaries, with a dedicated office space and fewer household members, were more successful in maintaining their work-nonwork balance (Allen et al. 2021). Regarding stress factors caused by telework, Weinert, Maier, and Laumer (2015) found that isolation and information asymmetry were the most influential factors for perceived work overload and the intention to (dis-)continue telework. Autonomy, on the contrary, helped to ease perceived work overload.

Theoretical model

The job demands-resources theory falls under the category of occupational stress models that explain strain at the workplace (Demerouti and Bakker 2011) and are ultimately related to organisational outcomes (Qiao, Schaufeli, and Taris 2011; Lopez-Martin and Topa 2019). We adopt the theory's rationale to explain multi-level resilience. First, we theorise that resilience and strain are related concepts in the sense that emotional wellbeing and continuous performance at the workplace demonstrate whether an individual is resilient against unexpected situations (Weick and Sutcliffe 2007). Second, we argue that organisational resilience can be theorised in analogy to strain on the organisational level too. An overload of tasks to cope with, no longer becomes manageable and may lead to paralysis and an inability to react on the organisational level. Again, continuous performance along with the ability to communicate within the organisation and with stakeholders represents a resilient organisation (Hawes and Testa 2020).

We integrated communication in the concept of organisational resilience, as public service delivery depends heavily on communication. Ongoing communication, for example, signals the stability of feedback loops and organisational learning. Moreover, research has shown that effective communication is particularly needed when flexible work designs are employed, because ineffective communication otherwise creates a lack of knowledge and/or too frequent interruptions at work (Hoeven and Zoonen 2015). Additionally, as establishing boundaries between an organisation and its environment is more complex in virtual teams, to maintain its employees' work engagement

and identification, internal and external communication has to be stable (Shaik, Makhecha, and Gouda 2021). Here, the communication dimension specifically adds to the idea of precursor resilience, hence absorbing shock and maintaining service delivery during a crisis instead of persevering in a crisis without maintaining service and bouncing back after the crisis (Arjen and van Eeten 2013). Hence,we suggest that organisational resilience is more than the sum of individuals' resilience and – if it is distinguishable from individual resilience – also determined by organisational factors directly.

Central to JD-R theory is the assumption that employees' work contexts can be described in terms of demands and resources. These demands and resources occur on two levels: the job and the individual level. While job demands include work aspects that drain energy (e.g. role ambiguity, work pressure), job resources refer to work aspects that help employees handle their daily work (e.g. autonomy and support by the supervisor and co-workers). In contrast, personal demands are 'requirements that individuals set for their own performance and behavior that force them to invest effort in their work and are therefore associated with physical and psychological costs' (Barbier et al. 2013, 751), such as workaholism, emotional instability, or perfectionism. Personal resources refer to positive self-beliefs and individuals' ability to control and impact their environment, such as self-efficacy, optimism, and self-esteem (Hobfoll et al. 2003).

Demands are not necessarily negative, however, but turn problematic when meeting them requires too much effort and employees cannot recover (Bakker and Demerouti 2007). Resources can help to buffer negative results of job demands (Bakker 2015). For example, support from supervisors can help employees deal with high workloads.

In a crisis situation, first of all, job and individual demands increase because, for example, employees are required to fulfil more worktasks in a shorter timeframe or with a reduced resource base. We argue that resilience during such a crisis arises in the presence of available resources to handle these rising demands. We use JD-R theory as an overarching framework to explain how demands and resources add to how individuals and organisations cope with situations of crisis, rather than as an explanation for single suggested hypotheses. Instead, we have chosen our independent variables, i.e. demands and resources, based on the state of research regarding coping with situations of crisis, as well as on the assessment of work-related and personal issues that specifically arose from the COVID-19 pandemic and related policies. We also adapt the notion of personal demands and argue that, following the definition of Barbier et al. (2013), not only psychological constraints form personal demands but also constraints related to the individual situation concerning family, health or other demographic factors. They can especially be seen as personal demands in a situation of crisis that systematically disadvantage individuals based on these criteria.

Below, we will describe in detail which specific demands and resources we have extracted from the literature as having the potential to affect public employees and their organisations during the COVID-19 pandemic.

Job demands

We have identified and included the following three aspects as job demands to be considered in our model: an increase in home office worktime, direct interaction with citizens for service provision, and a supervisory status.

The COVID-19 pandemic has forced public employees to work from home and deal with related demands. We suggest that it is more demanding for an employee to work from home for the first time or significantly more than before, because work routines have to be adapted (Goh, Gao, and Agarwal 2011). Potentially, an adequate workplace may also not be available at home (e.g. ergonomically-designed desk and chair, lighting, ICT infrastructure; Janneck et al. 2018; Tavares et al. 2020).

Furthermore, some jobs and tasks are more easily transferable to the home workplace than others (Boell, Cecez-Kecmanovic, and Campbell 2016). Especially employees interacting with citizens or other clients rely on digital processes to communicate with citizens when social distancing is required. Hence, digital public encounters are required but could be inhibited by missing digitalised processes and public service platforms. Additionally, it has been shown that frontline employees are confronted with an increased availability and transparency of digital public service encounters (Breit et al. 2020), which might further add to work strain.

The pandemic might also create communication difficulties between mobile workers, teleworkers and co-workers in the office, because they cannot easily meet in shared spaces (Hislop 2007). In that regard, we also expect supervisors to be more strongly affected by the COVID-19 pandemic, because supervisory tasks rely heavily on communication and interaction. Furthermore, supervisors might feel the need to solve problems their employees are experiencing in this time of change, which adds additional tasks to their to-do list and increases time pressure (Goldsby et al. 2020). Therefore, we postulate:

H1a: The more hours employees worked from home during the pandemic compared to before, the more demanding their job and the lower their individual and their organisation's resilience.

H1b: Employees working on tasks requiring direct interaction with clients are confronted with higher job demands than employees without these interactions and have lower individual resilience, leading to lower organisational resilience.

H1c: Supervisors are confronted with higher job demands than employees and have lower individual resilience, leading to lower organisational resilience.

Personal demands

As important personal demands on individuals working from home, we consider gender, number of children and age as three factors to be included in our model.

Social distancing due to the pandemic forced employees to work from home, blurred boundaries between private and professional life, and forced individuals to care about their family's health and safety and compensate for missing childcare and schooling (Caligiuri et al. 2020). We suggest that these demands regarding an adequate work-life balance are higher for women and people with more children, because

women are still primary caretakers in many families (Horne et al. 2018) and more children require more care. Further, for women, higher demands in teleworking settings have been reported with regard to higher physical and mental exhaustion than for their male co-workers (van Roekel et al. 2020).

We also suggest that older individuals might have been more deeply concerned about health and safety issues. Therefore, the COVID-19 pandemic might be more demanding for them. Apart from that, age is found to correlate with digital competencies required to master work from home (Ertl, Csanadi, and Tarnai 2020). The switch to more digital work and a virtual work environment might constitute a higher demand for older employees, especially in regard to their potentially lower openness to new technologies (as was requestested e.g. for video-conferencing) or confidence in using digital technology. Therefore, we propose:

H2a: Female gender is associated with higher personal demands, leading to less resilience.

H2b: The more children an employee has, the higher their personal demands and the lower their resilience.

H2c: Older employees are confronted with higher personal demands and have a lower resilience.

Job resources

Job resources are usually related to workplace autonomy, leadership, and organisational culture. In addition, we have included an organisation's resource base as the fourth dimension of job resources in our model.

Autonomy refers to discretionary powers and freedom with respect to work goals, setting priorities, shaping task elements, and determining the order and pace in which tasks are executed (Morgeson and Humphrey 2006). Boyd et al. (2011) showed that perceived job autonomy is positively related to wellbeing, because autonomy gives employees energy to work in accordance with their values, goals, and interests. This implies that they are better equipped to utilise their full potential.

Furthermore, research on remote working shows that support from supervisors increases well-being (Dawson-Howard, Standen, and Omari 2013) and, vice versa, that employees might experience adverse effects from teleworking due to leaders' lack of skills leading virtual teams (Vries, Tummers, and Bekkers 2019). Therefore, the sudden separation from the workplace and their employees due to remote work might demonstrate whether leaders are able to adapt to virtual leadership and look after their team in such a crisis (Franken, Plimmer, and Malinen 2020). Although the degree of virtual work in teams and organisations differs, Gilson et al. (2015) point out differences between leading virtual teams and on-site leadership. The former, for example, needs more coordinating tasks by supervisors while enhancing cooperation and team building as well as communication (Liao 2017).

A challenging situation, such as rapid changes in work models due to the COVID-19 pandemic, forces organisations to experiment and learn quickly. Such a situation is always prone to failures, but also an opportunity to learn from these errors. When an organisation frames them as a learning device (Keith and Frese 2005), it fosters

a productive error management culture and thus a sense of security and support for learning, space for experiments, and a diversity of perspectives (Frese and Keith 2015). Van Dyck et al. (2005) describe such an error culture as including practices such as actively communicating errors, sharing knowledge about and helping with errors, and purposefully correcting errors. We argue that such an organisational culture will foster the ability to react to external change in a resilient way.

In a crisis situation, an organisation must rely on additional resources that can be used to handle new challenges by maintaining existing processes. Resources in that regard could include financial resources, personnel, knowledge and skills, and (technical) infrastructure. Such organisational slack serves as a buffer against environmental shocks because additional resources allow for discretion and flexibility (George 2005). In contrast, resource constraints lower the probability of an organisation's survival (Musso and Schiavo 2008). We argue that in times of crisis, organisations have to keep up existing processes and innovate simultaneously, requiring more resources to keep things ticking than in less uncertain times.

H3a: The higher employees' job autonomy, the higher their individual and organisational resilience.

H3b: The higher employees' trust in and satisfaction with leadership, the higher their individual and organisational resilience.

H3c: The more positive the organisational error culture, the higher employees' and organisations' resilience.

H3d: The more resources available in an organisation, the higher employees' and organisations' resilience.

Personal resources

Personal resources are usually related to employees' motivation and skills. For the specific context of our study, we have differentiated between proactive behaviour, digital competencies, and commitment to change as three dimensions to investigate personal resources in our model.

When organisations are forced to introduce innovative solutions in challenging situations, they need employees who take initiative 'in improving current circumstances or creating new ones, [who] [...] challenge the status quo rather than passively adapting to present conditions' (Crant 2000, 436). Hence, proactive behavior is needed (Tuan 2017). We suggest that proactivity makes employees better able to cope with a challenging situation, because they are able to identify and solve problems (Suseno et al. 2019) and are willing to invest extra effort in doing so (Thompson 2005).

Digital literacy or digital competencies at the workplace refer to knowledge and skills needed to perform tasks at the digital workplace, such as using specific software or digital communication channels. While the literature emphasises the importance of public employees' digital competencies (Dickinson et al. 2019), public sector training has not been adapted fundamentally to prepare employees for a digital workplace (van der Wal

2020). However, digital competencies are especially needed when employees are forced to work with new technology from one day to the next. We argue that employees who have been equipped with that knowledge and skills have been better able to adapt to remote work.

Furthermore, in the circumstances around the COVID-19 pandemic, public organisations needed to change work models and service delivery. Employees' willingness and ability to adapt to such a major change is mainly driven by their commitment to change (Swailes 2004). That is, a change-oriented mindset binds an individual to a course of action deemed necessary for the successful implementation of a change initiative (Herscovitch and Meyer 2002). We suggest that employees who are able to cope with change in a productive way are more resilient in situations of crisis and can better adapt to new circumstances.

H4a: The more proactive individuals are, the higher their individual resilience.

H4b: The higher employees' digital competencies, the higher is their individual resilience.

H4c: The higher employees' commitment to change, the higher is their individual resilience.

Figure 1 drafts these hypotheses in an overarching model. In the following chapter, we will describe how this theoretical model is tested.
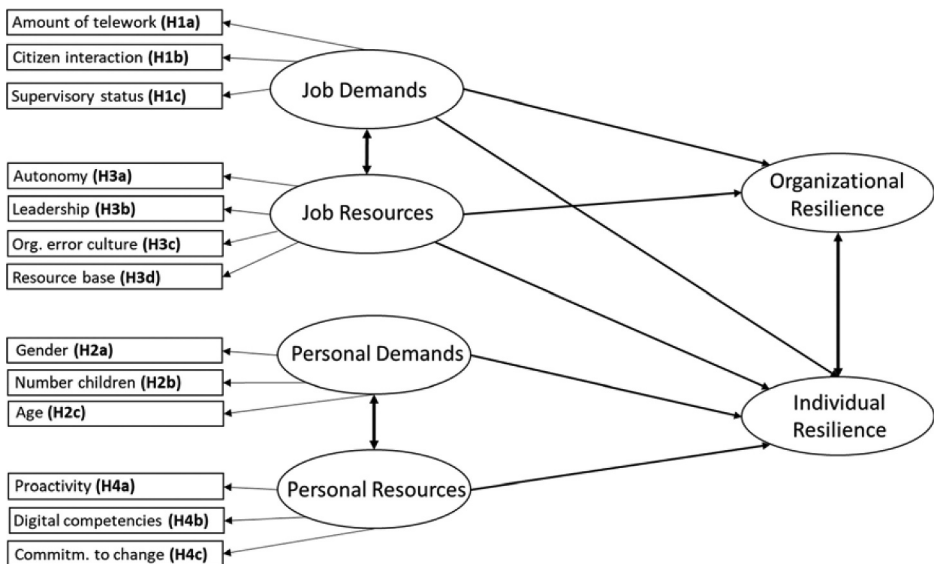

Figure 1. Theoretical model interrelating job and personal demands, job and personal resources, and individual and organisational resilience. Amount of telework is the delta of home-office work hours before and during the pandemic.

Methods and data

Data from 1,189 public employees were collected to analyse their individual and organisational resilience and respective antecedents during the COVID-19 pandemic. The online survey was conducted between August and September 2020 in four German public organisations on different federal levels and in different public sector fields (see Supplementary C for characteristics of the organisations). All four organisations represent the core administration and the 'diversified and plural institutional landscape' (Grossi and Reichard 2008) of the German public sector. Whereas one of the Länder and one of the local government agencies cover a broad range of tasks, the other organisations on each level have a limited range of tasks they are responsible for. Supplementary D shows that in all these organisations a switch to mostly digital communication channels happened during the pandemic.

The data contain many unsystematic missings. Due to listwise case deletion in OLS regression, the sample in our five models decreases to 380 cases. However, Table 1 shows the characteristics of the whole and the reduced sample and illustrates that demographics' distribution remains constant. Hence, although we drastically reduced our sample, we expect that no bias was created.

All variables used in this study are constructed as factor score regression predictors and grounded in both our literature review and the preceding preparatory interviews conducted to prepare the collection of survey data to provide a better fit to the specific context. Their consistency was inspected using Cronbach's alpha, which exceeded the value of .70 as an indicator for sufficient reliability (Bernardi 1994), except for the scale on commitment to change (see Supplementary G). All items except the organisational resource base were measured on a 5-point Likert scale or as absolute measures (e.g. age, number of children).

In accordance with our theoretical understanding of resilience, we operationalised the construct as the desired outcome at the individual and organisational levels in times of crisis. Organisational resilience was measured through performance and the capacity to maintain communication channels. With regard to performance, participants were asked to rate their organisation's performance in comparison to the pre-COVID-19 situation in order to assess the continuity of organisational capabilities. Similarly, participants were asked to rate whether internal and external organisational communication became better or worse than before the pandemic.

Individual resilience was operationalised with measures of individual performance, stress, and job satisfaction. We considered a resilient public employee to be one who demonstrated continuous performance, whose stress perception did not increase, and who was satisfied with his or her work situation. Hence, related to all variables included in the constructs of individual and organisational resilience, we asked all participants to compare the respective factor during and before the COVID-19 pandemic and to report whether their performance increased, decreased or remained stable, for example. More detailed operationalisations of all studied variables are listed in Supplementary A.

Apart from the suggested independent variables, our study controls for the four organisations in which data were collected to take the German multilevel governmental system into account. Due to the highly decentralized local government in Germany, public administration has to make efforts to achieve coordination and other

Table 1. Sample description (whole sample and subsample used in regression models).

	initial sample			subsample		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Age	956	43.6	11.5	380	43.6	11.2
Female	959	.65	.48	380	.57	.50
Supervisory status	1,189	.23	.42	380	.31	.46
Citizen interaction	1,189	.51	.50	380	.61	.49
Fixed-term employment	861	.08	.27	380	.09	.29
Surveyed organisations	Org1 Org2	Org3	Org4	Org1 Org2	Org3	Org4
freq.	400 156	501	132	135 38	170	37
%	33.64 13.12	42.14	11.10	35.53 10.00	44.74	9.74

organisational challenges (Kuhlmann and Heuberger 2021). To control for this issue, we decided to include data from four different public organisations on different administrative levels (Supplementary C).

Data were analysed using factor analysis and multiple OLS-regression. An exploratory factor analysis (varimax rotation with orthogonal factors) was first performed to confirm the suggested latent dimensions. It was expected that the components would not be correlated. A correlation matrix for all items used to measure either personal resources, job resources, organisational resilience, or individual resilience was inspected and showed very mixed patterns of correlations (Supplementary E).[1] Nevertheless, assumptions for factor analysis were fulfilled for every suggested latent construct. Initial exploratory factor analyses (EFA) on the constructs related to job resources, personal resources, and individual and organisational resilience perfectly represented the measured scales (see Supplementary F for details on our EFA results).

Because our dataset consisted of many latent constructs, a large number of parameters and ordinal variables stand in complex multilevel and higher-order relationships to each other. Therefore, the sample size should have been extraordinary large to meet the criteria for adequate structural equation modelling (SEM). Since we also observed violations against distributional assumptions, asymptotic SEM approaches could not be applied to our analysis (Chin and Todd 1995). Instead, and to still represent the structure of the latent constructs in our model, we used a two-step factor score regression to test our hypotheses (Hoshino and Bentler 2011). First, a maximum likelihood estimation (with Satorra-Bentler estimator to account for nonnormality) in a confirmatory factor analysis was conducted (latent constructs revealed acceptable levels of model fit, see Supplementary G). Using the regression predictor to compute factor scores, we performed OLS-regressions to test our hypothesis. We decided to use factor scores to better represent the effect of each manifest value within the latent constructs. Nevertheless, one has to bear in mind that the regression predictor could be biased, but still provides more validity regarding the true factors than the Bartlett extraction method (Devlieger, Mayer, and Rosseel 2016). In the process of extracting the factor scores, the original range of our likert scale is changed with regard to the variance in the data, producing standardised scores similar to a Z-score metric, where values range from approximately −3.0 to +3.0 (DiStefano, Zhu, and Mîndrilă 2009), thus leading to a negative minimum in the latent constructs. Descriptive statistics for these factor scores are shown in Supplementary B.

Regression diagnostics revealed acceptable statistics for common OLS-regression assumptions: the requirements for normality, linearity, and homoscedasticity, as well as multicollinearity, were met.[2] Additionally, *Harman's Single-Factor Test* was conducted to examine the risk of common method variance. The single-factor solution with the items from our measurement model, in contrast to multiple factors, only accounts for 29.5% of variance within the data. Hence, the risk of common method variance can be considered low. Combined with our ex-ante precautionary measures within the survey (e.g. by randomizing items and carefully reminding the participants that we protect their data security and anonymity to prevent social-desirability), this offers evidence against common method bias within our data set.

Results

The analysis of antecedents of individual and organisational resilience showed that none of the suggested demands and resources impacted the overall constructs. Instead, we determined all dimensions operationalising either individual or organisational resilience differently. Hence, results were more meaningful when analysing these dimensions separately.

Individual resilience

The analysis of *individual resilience* (Table 2) shows that, first of all, the three dimensions comprising the construct (performance, job satisfaction, stress) are correlated to each other. Interestingly, the novelty of teleworking (delta telework) does not influence individual performance, but does influence job satisfaction (b = .091, p = .014) and stress of employees (b = .097, p = .040). Although significant effects are found for the two latter outcomes, effect sizes are very small.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Similarly, the need to interact with citizens has a negligible influence on individual performance (b = .087, p = .034), and no significant influence on satisfaction or stress. However, individual performance is lower when a person holds a supervisory status (b = −.116, p = .009). Hence, the majority of the suggested *job demands* did not remarkably decrease individual resilience, and H1a and H1b have to be rejected. Only H1c can be confirmed by the data with regard to an impact on individual performance.

When it comes to *personal demands*, the female gender surprisingly leads to increased performance in this situation of crisis (b = .137, p = .001). Similarly, age has a positive influence on individual performance (b = .103, p = .025) and job satisfaction (b = .135, p = .001). In contrast to our assumptions, the number of children an employee has to take care of does not have a remarkable influence on any of the dimensions forming individual resilience. Therefore, neither of our hypotheses on individual demands (H2a, H2b, H2c) can be confirmed by the data.

Our analysis found that only two of the suggested *job resources* fostered individual resilience. Satisfaction with and trust in one's supervisor were found to positively influence job satisfaction (b = .287, p = .000). Higher autonomy and control, similarly, were found to be positively related to individual performance (b = .116, p = .019). Error culture could not be shown to influence any of the measured dimensions of individual resilience. In contrast, the resource base of an organisation (ICT infrastructure, ICT-related training, knowledge and skills,

staffing in general, financial resources) was found to negatively influence individual performance, instead of fostering it (b = −.136, p = .016). Hence, hypotheses H3a (autonomy) and H3b (leadership) are confirmed by the data, but hypotheses H3c (error culture) and H3d (resources) have to be rejected.

Concerning *personal resources*, our analysis found, as suggested, that digital competencies have a moderate positive influence on individual performance (b = .166, p = .001). However, proactivity is the major driver of continued performance during these times (b = .305, p = .000). In contrast to our assumptions, commitment to change shows only a minor positive relationship with job satisfaction (b = .080, p = .026) but has a significant negative influence on stress (b = −.209, p = .000). Hence, commitment to change seems to foster job strain. Therefore, hypotheses H4a (proactivity) and H4b (digital competencies) are confirmed by the data, but H4c (commitment to change) has to be rejected.

Organisational resilience

Table 2 shows the results of the analysis for *organisational resilience*. Again, both dimensions of resilience (performance and communication) are correlated with each other. While organisational performance is heavily influenced by two dimensions of individual resilience (individual performance: b = .179, p = .000; job satisfaction: b = .395, p = .000), communication is not.

Apart from this major influence of individual resilience on organisational resilience, the job demands and resources analysed in our study do not affect organisational performance or capacity to communicate internally and externally. Again, suggested *job demands* (hours of work at home, citizen interaction, supervisory status) reveal no negative influence on organisational resilience. Hence, again, H1a, H1b, and H1c have to be rejected.

Concerning *job resources*, this analysis finds neither a direct influence of a positive error culture nor of a job's autonomy or the resource base (general financial resources and personnel, as well as ICT-related resources) on organisational resilience. While the data suggest that satisfaction with and trust in leaders positively influence individual resilience (see Table 3), we find a negative influence on organisational performance (b = −.114, p = .037). Therefore, and somehow different from our findings on individual resilience, hypotheses H3a (autonomy and control), H3c (error culture) and H3d (resources) have to be rejected. The results with regard to H3b (leadership) are inconclusive, therefore the hypothesis is only partly confirmed.

Altogether, our analyses show that, in contrast to our expectations, working from home is not heavily demanding for public employees, independent of their age, gender, and caretaking responsibilities, as well as work tasks that require the interaction with citizens. Only a supervisory status is found to have a negative relationship with individual resilience. However, we find some antecedents that add to a higher individual resilience, such as individual proactivity, digital competencies, satisfaction with and trust in leaders, and the sense of autonomy and control one perceives in one's job. Individual resilience, and especially individual job satisfaction, determine organisational performance as one important part of organisational resilience in times of crisis.

Table 2. Regression table on determinants of individual resilience.

	(1) Ind. Performance		(2) Job Satisfaction		(3) Stress	
	β	p	β	p	β	p
Job demands						
Amt. of telework (Δ)	.058	.179	.091*	.014	.097*	.040
Citizen interaction	.087*	.034	-.065	.065	-.008	.862
Supervisory status	-.116**	.009	-.067	.080	.065	.180
Personal demands						
Age	.103*	.025	.135***	.001	.015	.769
N of children	-.044	.287	-.063	.075	-.043	.345
Female	.137**	.001	.047	.194	-.058	.205
Job resources						
Error culture	.031	.527	-.021	.609	.076	.150
Autonomy & control	.116*	.019	.065	.128	-.031	.567
Leadership	-.070	.215	.287***	.000	-.104	.092
Resource base	-.136*	.016	.072	.139	-.013	.833
Personal resources						
Digital compet.	.166***	.001	-.010	.815	.110*	.037
Comm. to change	.002	.955	.080*	.026	-.209***	.000
Proactivity	.305***	.000	-.044	.303	-.084	.124
Organisational resilience						
Communication cap.	.009	.847	.062	.145	-.044	.421
Org. performance	.182***	.001	.361***	.000	-.053	.381
Individual resilience						
Job satisfaction	.042	.497			.463***	.000
Ind. performance			.031	.497	.151**	.009
Stress (rev.)	.125**	.009	.285***	.000		
1.org	.000	.	.000	(.179)	.000	.
2.org	.143**	.004	-.058	.269	.006	.913
3.org	.220***	.000	-.052	.269	.012	.843
4.org	.186***	.000	-.018	.665	.036	.509
N	380		380		380	

(Continued)

Table 2. (Continued).

	(1) Ind. Performance		(2) Job Satisfaction		(3) Stress	
	β	p	β	p	β	p
adj. R^2	.422		.572		.304	
df_m	20		20		20	
df_r	359		359		359	
F	14.86		26.29		9.28	
RMSE	.299		.503		.889	

Standardised beta coefficients; p-values in parentheses

Table 3. Regression table on determinants of organisational resilience.

	(1) Org. Performance		(2) Communication Cap.	
	β	p	β	p
Job demands				
Amt. of telework (Δ)	.025	.549	.005	.907
Citizen interaction	−.036	.374	.014	.749
Supervisory status	.039	.351	.002	.970
Job resources				
Error culture	.038	.420	.081	117
Autonomy & control	−.015	.757	.014	.789
Leadership	**−.114***	.037	.115	.055
Resource base	.053	.325	.099	.092
Organisational resilience				
Communication cap.	**.262***	.000		
Org. performance			**.314***	.000
Individual resilience				
Job satisfaction	**.395***	.000	.094	.142
Ind. performance	**.179***	.000	.081	.10)
Stress (rev.)	−.027	.555	−.046	.358
1.org	.000	.	.000	.
2.org	.076	.122	.041	.445
3.org	.081	.130	.082	(.158
4.org	.008	.875	.080	.129
N	380		380	
adj. R^2	.433		.322	
df_m	14		14	
df_r	365		365	
F	21.71		13.87	
RMSE	.466		.445	

Standardised beta coefficients; *p*-values in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Discussion and conclusion

Resilience in times of crisis

From these results, we derive three important findings of this study: (1) supervisors have been more challenged by the crisis than their employees. At the same time, satisfaction with leadership was found to be an antecedent of employees' resilience with regard to job satisfaction. Therefore, the public sector needs to focus on providing supervisors with skills to lead virtual teams and make them feel more comfortable with leading remotely. (2) The more autonomously employees are able to work, the better they perform while teleworking and the better they are able to cope with a crisis situation. Hence, leadership should enable and grant greater degrees of work autonomy. (3) Digital competencies add to individuals' resilience when forced to work from home and switch to mostly digital communication channels. However, the high impact of proactivity implies that dealing with such novel situations is not only a question of skill but also of will.

All in all, the results suggest that the public service was resilient during the crisis. Hence, the shift to telework was not as demanding for public employees as expected. Similar results were for example delivered by Plimmer et al. (2021). Although the status quo of public sector digitalisation in Germany and public employees' use of technology

to ease their work was relatively low before the pandemic (Mergel 2019; Hofmann and Ogonek 2018; Jakob and Krcmar 2018), it has been sufficient to switch to working models based on telework.

Looking more closely at these findings, we obtain a differentiated picture of public service resilience during the COVID-19 pandemic that is based on digital work. Previous research has indicated that digitalisation and improved (ICT) resources within the public sector would lead to increased performance (Byrd et al. 2008) and improved resilience (Chewning, Lai, and Doerfel 2013). However, the results of our study suggest that in times of crisis and extensive work from home, the mere provision of digital infrastructure does not yet produce resilience. Similar results have already been found in regard to digitalisation efforts independent of crisis situations (Heeks 2003; Anthopoulos et al. 2016). We therefore connect to the assumption that ICT is an important component of improved performance, although it is crucial to contextualise it, i.e. to analyse ICT together with e.g. employee traits, competencies, and leadership (Kuusisto 2017).

This is underlined by the fact that we were able to highlight that the COVID-19 pandemic and related shifts in work models are a matter of leadership. We find that, on one hand, trustful leadership contributes to a higher resilience of public employees (similar results have been found in the private sector i.e. Lamprinou, Tasoulis, and Kravariti 2021; and in regard to similar outcomes, such as job crafting: Luu 2021; or work engagement related to change: Ancarani et al. 2021), but the leaders themselves are rather challenged (similar results, e.g. for school principles: Pollock 2020; or in regard to leading in turbulent times: Ansell, Sørensen, and Torfing 2021).

Additionally, middle managers in public sector organisations are operating in a thankless 'sandwich' position even under normal conditions (van der Weide and Wilderom 2004), and the pandemic has probably worsened the various dilemmas they find themselves in. This applies particularly to the need to respond immediately to the practical implications of the lockdown while having almost no tools at hand to do so, such as providing technical equipment, changing organisational guidelines, or training staff, while simultaneously having to get used to working from home themselves, facing increasing pressure, information asymmetries, and challenges in their private lives.

With regard to the positive role of autonomy, the crisis opened a window of opportunity for change and for overcoming telework-related barriers of the past, such as mistrust, traditional 'presence culture', and restrictive – primarily internal – regulations (Kaplan et al. 2018; Kim, Mullins, and Yoon 2021). However, it must not be ignored that previous research has identified autonomy not only as a driver and enabler of successful teleworking arrangements but also as a potential source of distress (Boell et al. 2013). Similarly, our result that commitment to change enhances individual job strain during the crisis should be considered. This kind of commitment might, for example, result in more engagement in additional tasks, and therefore to increased working hours or more time pressure. These downsides of employee commitment are also found in the literature on general commitment (Panaccio and Vandenberghe 2009). Especially continuance commitment is found to have negative consequences for employees' well-being: committed employees experience higher stress levels, work family conflict, and have a lower satisfaction (Meyer et al. 2002).

Regarding the effects of proactivity on resilience, apart from looking at digital competencies only, it seems that those who demand a more open, innovative, or responsive mindset in public management could feel affirmed. However, employees who are highly committed and proactive might also have to be guarded against over-working, for example, by ensuring sufficient personnel, by training them to recognise and accept their limits, and by communicating an organisational culture that does not reward excessive overwork.

Theoretical contributions

Our results imply that organisational resilience cannot only be studied on the meso-level but has to take individual employees into account as well. In the future, multi-level concepts of resilience should be employed to study how organisations cope with crisis situations. We found that organisational resilience with regard to performance maintenance is primarily driven by individual resilience. Hence, organisations that want to foster their resilience have, first of all, to focus on their employees and enable them to cope with a crisis. While the concept of resilience is often analysed on a single level in the literature (Hartmann et al. 2020), our results corroborated the relevance of both the individual and organisational levels to obtain a more comprehensive picture of public service resilience. In this respect, we add to recent discussions on integrating levels of analysis more deeply in public administration research (Jilke et al. 2019).

Moreover, using resilience as an outcome-level variable enabled us to analyse the antecedents of such a desired state for individuals and organisations that can guide further organisational development. In our study, we were able to identify a first set of antecedents, and in this way, contribute to a better understanding of how organisations become resilient. While our results could shed more light on the high relevance and specific antecedents of individual-level resilience and its potential dimensions, the results and potential explanations on the organisational level are less conclusive. Our results corroborate the notion that organisational resilience is more than the sum of each individual's resilience. However, we could not yet identify key drivers – except for leadership support and trust – that determine resilience on the organisational level. Nevertheless, this is an interesting starting point for a potential explanation as well, since it triggers the question about the possibility that seemingly obvious and often discussed antecedents (such as technology and infrastructure, for example, Duchek 2020) might not be decisive – or at least not in the way commonly understood – in times of crisis and/or telework.

By using the JD-R model to explain how resilience arises, we expand the model and apply it to a specific crisis situation. We use resilience as a novel outcome variable within the concept and argue why resilience should be included on that side of the equation rather than as a resource. Moreover, we conceptualise a multi-level outcome variable within the JD-R model and thereby acknowledge that individual level out-comes alone might not be central outcomes for organisational and management studies in contrast to psychology.

Limitations and future research

In terms of the search for a better understanding of resilience both at the micro (individual) and meso (organisational) levels, the appropriateness of the (expanded) JD-R theory also needs to be considered critically. Typical demands and resources studied in JD-R research have not been found to impact resilience. However, Hakanen, Bakker, and Turunen (2021) recently showed, too, that one of the main resources within the JD-R model – autonomy – is not a major predictor of work engagement compared to other job resources.

Particularly organisational resilience was not determined by the analysed influence factors alone in our study. This implies that alternative factors should be taken into account that go beyond the scope of the employed set of variables, which was naturally limited to achieve a parsimonious model and data collection, and probably also beyond JD-R theory. For example, stances on organisational strategy and innovation, past experiences with crisis, or flexibility in organising should be analysed in future research.

Moreover, there is still no consensus in research about the role of *personal* demands and resources. Xanthopoulou et al. (2007) show a mediating role of personal resources, whereas other studies assume a moderating or direct impact (Xanthopoulou et al. 2009). While we used personal demands and resources as direct influence factors, that approach might also come with some limitations.

In terms of our empirical methodology, the unprecedented situation under scrutiny here raises some doubts about a predominantly quantitative, hypothesis-testing research design. This study also relies on self-reported data, which might be biased through socially desirable answering behavior. While interview data have been used to develop the theoretical model and choose the analysed variables, hypothesis testing relies on cross-sectional survey data. An integration of reliable performance data is necessary in future research instead of mere perceptions by the employees and managers themselves.

Furthermore, the results cannot be considered to be representative of the German public sector, not to mention that of other countries. We collected data in four selected organisations that are neither representative of the German public administration in general nor necessarily typical of their field. Thus, the results are probably biased with regard to the openness of the organisations – a price that had to be paid for short-notice field access.

Even if it can be criticised that our understanding of individual and organisational resilience is too outcome-oriented and narrow, as it is linked to a rather classical operationalisation of performance in terms of quantity and quality of outputs, the problem remains that the concept of resilience needs better operationalisation and differentiation. We hope to offer a starting point with our integration of the concept of resilience as an outcome variable within the JD-R model.

Finally, another aspect should be considered: our data refer to the first, relatively short lockdown in Spring 2020. The second test for resilience – at both levels – was the lockdown in Winter 2020/21, where it seemed like some organisations reacted differently, paying more attention to service provision and asked less staff to work from home. Although our findings indicate no influence of teleworking at all, there might have been the impression that teleworking did not work that well or that there was a strong need for more on-site interaction. However, during the following lockdowns,

the public service was probably better prepared and less surprised. Even if our results show few effects for the first stage of the pandemic, the picture might change looking at how the overall response to the crisis evolves in the future.

Practical implications

Nonetheless, some practical conclusions can be drawn from our findings. First, we can see that leadership actually matters, particularly under critical conditions. Maybe it is less trivial to say, however, that leadership can be effective under such circumstances and contribute to resilience only if particular attention is paid to improving communication, building trust, and promoting an open and innovative as well as pragmatic mindset that does not punish errors (Ansell, Sørensen, and Torfing 2021).

Second, if we stress the relevance of individual work autonomy, staff need to be empowered and enabled to cope with the increasing responsibility, bringing the issue of qualification into focus. This applies not only to the digital skill set but also to delegating and letting go of controlling leadership styles.

Third, and apart from effecting cultural change, the positive impact of proactivity implies a need to come up with practical suggestions for what proactivity actually means and how to foster that behavior. An organisation's systematic self-reflection in terms of its responsiveness, adaptiveness, and other dynamic capabilities could be useful to show employees that proactivity is desired.

Fourth, the mere concentration on technology and infrastructure in governmental telework practice (Joice 2007) is insufficient as proactive work behaviour, digital competencies and autonomy are main determinants of resilience especially on an individual level. Additionally, our data implies that public administration should concentrate on virtual leadership and maintenance of communication in a telework setting to be resilient as an organisation. Practitioners should also take into account the positive effect of switching from office to telework settings on job satisfaction in order to remain attractive as a public sector organisation and employer.

All in all, our results suggest that the public service was resilient during the pandemic and that the shift to telework was not as demanding as expected. We think that the public service can draw some self-confidence from these results concerning its ability to change and adapt to situations of crisis.

Notes

1. Job and personal demands are measured using single items and absolute scales; hence, a generalization to latent constructs was not necessary.
2. A RESET test showed that our regression models were sufficiently specified (Ramsey 1969). Likewise, the explained variances (adjusted R squared) indicated that our models predicted the estimated values adequately (see Tables 3 and 3). Beforehand, we identified five outlier and highly influential cases through measures (Belsley, Kuh, and Welsch 1980). After removal of these cases, our model showed no noteworthy change in the estimators, but highly improved model fit. We observed neglectable deviance from a normal distribution by inspecting residual plots, although Shapiro-Wilk-tests failed for all regression models. However, this test is highly sensitive to ties in data and normality violations at the top and bottom of the distribution (Royston 1989). Heteroscedasticity of the estimated residuals was confirmed by White-tests instead of Breusch-Pagan-tests because of their less strict requirements for normality (Evans 1992). Partial residual plots for all independent variables showed linear relations in our models.

Furthermore, multicollinearity was not present, as the variance inflation factors were below ten for all constructs (Salmerón, García, and García 2018).

Disclosure statement

No potential conflict of interest was reported by the author(s).

Notes on contributors

Caroline Fischer is an Assistant Professor at the University of Twente (Netherlands). In her research, she focuses on digitalisation, human resource management, knowledge management and organisational learning.

John Siegel is Professor of Public Management at the Berlin School of Economics and Law and Adjunct Professor at the University of Potsdam (Germany). His research focuses on strategic management and HRM in public administration.

Isabella Proeller holds the Chair of Public and Nonprofit Management at the University of Potsdam (Germany). Her work focuses on strategic management and reforms in the public sector.

Nicolas Drathschmidt is a research and teaching associate at the University of Potsdam (Germany). He is interested in research on digitalisation, administrative burden and red tape.

ORCID

Caroline Fischer iD http://orcid.org/0000-0001-5870-4498

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