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Infrastructuring for organizational resilience: Experiences and perspectives for business continuity

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Abstract. This workshop discusses organizational resilience and resilient infrastructures by uniting researchers, professionals, and experts from various disciplines. Workplace studies and organizational settings have always been an integral theme in computer-

supported cooperative work (CSCW) research. This workshop hopes to broaden this research horizon by overlapping the multidisciplinary perspectives of resilience and crisis research with human-computer interaction (HCI), CSCW, organizational, and business studies. The COVID-19 pandemic and the subsequent physical and social constraints have been detrimental to the activities of different organizations, especially to small and medium enterprises (SMEs). SMEs must recognize and search for opportunities to adapt to this crisis by developing resilient organizational infrastructures. These adaptations can be crucial to overcoming the current disruptions challenging the continued existence keeping in view the intrinsic diversification of various business and industrial sectors. How organizational infrastructures can be designed to instill resilient properties like adaptive capacity, self-adjustment and continuity? We intend to focus on bringing this discussion under the umbrella of CSCW to explore the potentials of collaboration and cooperative work in organizational infrastructure. Through this workshop, we offer research prospects by applying organizational resilience theories to study organizational infrastructure and infrastructuring activities, which can be used for their prospective transformations into resilient infrastructures.

Introduction

With rapidly increasing disasters such as climate change and escalating cyber-crimes due to the digitally exposed nature of modern business, crisis is inevitable. The on-going COVID-19 pandemic has further escalated business concerns by altering daily routines and work practices around the world, ultimately disrupting how organizations conduct business. Especially notable is the small and medium enterprises (SMEs) sector that is extremely vulnerable in times of crisis and is often the least prepared of all the organizational sectors (Jones & Proverbs, 2008).

SMEs are integral to the modern economy and make up a significant portion of the world's businesses. In the European Union (EU), for example, 99% of all the enterprises are SMEs (European Commission, 2017). Due to their significant role in economic activity, SMEs are considered a key driver for the growth and economic development of countries, especially by stimulating innovation, job creation, and social integration of local communities (European Commission, 2017). An SME in the EU is defined as an organization with less than 250 employees and less than (or equal to) a €50 million turnover, whereas in the United States, SMEs are classified as firms having fewer than 500 employees (OECD, 2005). Despite having different definitions across economies, SMEs are noted for their liabilities of "smallness" and they often operate in uncertain environments (Damanpour, 1992). Further, in contrast to large organizations, SMEs are peculiar due to more superficial organizational structures, limited financial assets and funds, centralized decision-making, and the high reliability of employees' ability to get their job done (Thong & Yap 1995).

Crisis literature entails that SMEs do not have the resources and technical systems often equated with resilience capabilities amidst the ever-increasing threat of natural and human-made disasters. Despite being agile and flexible, SMEs may need to become more strategic driven in their approach to managing threats and extreme events (Sullivan-Taylor & Branicki, 2011). This ideology of organizational transformation is coordinated with the expectation in CSCW as calibrated in the reflections on 25 years of ethnography in CSCW research by Blomberg and Karasti (2013). The authors reflected on developing new concepts to help workplace and organizational studies understand collaboration in complex, widely distributed, temporally expanded, and large-scale settings. These settings are analogous to the challenges imposed on business organizations in emergent scenarios or recent times with an on-going pandemic, multiple phases and forms of lockdowns, and further limitations.

The lack of adequate preparation and resources exposes SMEs to threats and disruptions that may jeopardize organizational sustainability and individual welfare (Edward, 2010; Barnett & Pratt, 2000). Bhamra et al. (2011) connect the concept of sustainability with resilience. Holling (1973) introduced the term 'resilience' from an ecological context, and since then, it has been applied to various contexts and application domains. While the term may be defined in different ways depending on context, the concept of resilience revolves around the ability of the subject to return to a stable state after a disruption. However, the organizational point of view holds the idea of resilience, signifying its application to both individual and organizational responses to disturbances and threats (Bhamra et al., 2011; Braes & Brooks, 2010). It can be further defined as an organization's capability to prevent, respond effectively to, and survive an unforeseen situation. The ability to anticipate, adapt to, and take advantage of long-term trends, opportunities and challenges and potentially thrive in an environment of change and uncertainty. Also, fundamental learning from past disruptive or disastrous events is crucial for an organization's business continuity (Egner et al., 2015).

Under the lens of infrastructuring and comprehensive range infrastructure research in CSCW, the work infrastructure of an individual or an organization is the entirety of devices, tools, technologies, standards, conventions, and protocols on which the individual worker or the collective rely to carry out the tasks and achieve the goals assigned to them. (Pipek and Wulf, 2009). According to Star and Bowker (2002), infrastructures have a spatial and temporal reach and scope, are embedded in other social and technological structures, shape and are shaped by conventions of practice, and, most notably, are invisible and become visible upon breakdown. These intrinsic peculiarities of an infrastructure substantiate several aspects of an organization. Simultaneously, the notion of breakdown is inclined to the idea of disruption and change, hence indicating the context of resilience. According to Kjeld Schmidt (1994), the formal organization is merely a governance structure of certain aspects of cooperative work's multifaceted realities. Likewise,

the organizational infrastructures constitute overlapping layers of cyber, knowledge, information, communication, technological, collaborative, work-oriented, etc. infrastructures. A substantial amount of research in CSCW excavate the inner workings of cyber, information, and knowledge-intensive infrastructures, which are directly and indirectly applicable to organizational infrastructures (Korn et al., 2017; Ribes & Lee, 2007; Karasti et al., 2010; Karasti & Blomberg, 2017; Randall et al., 2015; Ribes, 2014; Pipek & Wulf, 2009, Bietz et al., 2012).

Different components within an organizational infrastructure are integrated through standardized interfaces enabling the work practitioners to channel merits like openness and heterogeneity (Hanseth & Lundberg, 2001), versatility and reflexivity (Pipek and Wulf, 2009), longevity and stability (Zimmerman & Finholt, 2007) and expertise sharing (Ley et al., 2014). Information technology (IT) adoption can make businesses adaptive and flexible, which is also coherent with the concept of organizational resilience (Pipek and Wulf, 2009; Ley et al., 2014). However, small enterprises do not clearly and fully understand the weakness of their IT capability, and this reason often decreases their willingness to adopt information technology (Chang et al., 2010, Lewkowicz & Liron, 2019).

Infrastructures can also be explored from the viewpoint of disruption or change (Wiedenhöfer, 2011; Soden & Palen 2016). Infrastructures remain transparent (and mostly invisible) once established, "reappearing" only at moments of upheaval or breakdown (Jackson at al., 2007). This inherent imperceptibility in infrastructure ensures continuity and flexibility in activity spheres. However, when a point of infrastructure is reached due to disruption or breakdown, it temporarily generates a stronger implicit tie between the activity spheres, causing the infrastructure to become an apparent resonating change in a stronger sense of urgency regarding infrastructure improvements (Ludwig et al., 2018). Many infrastructuring processes and phenomena emerge from the installed base (from what is already there) and are strongly influenced by the network of existing dependencies (Karasti et al., 2018). These infrastructuring features articulate the inherent traits of organizational resilience like vulnerability, situation awareness, and most importantly, adaptive capacity to respond to change, disruption, or breakdown (McManus et al., 2008; Hollnagel et al., 2011; Soden & Palen 2016; Coaffee & Clarke, 2017). The manifestations of organizational resilience and organizational infrastructures have overlaps and present unbound research opportunities towards developing robust, flexible, and adaptable infrastructures. The workshop aims to help build a richer understanding of issues related to the analysis and design of resilient infrastructures:

- (1) bringing the discussion on organizational resilience under the umbrella of CSCW to explore the potentials of collaboration and cooperative work in organizational infrastructures

(2) discussing salient features of organizational infrastructures concerning resilience theories

(3) the issues, theories, and methods to improve organizational infrastructures make them self-adjusting and evolving networks of activities, knowledge, tools, services, etc.

Topics and Participation

To achieve these aims, the workshop will involve a collective sharing and analysis of case studies and experience from HCI, CSCW, business studies, organization theory, SME research, digital transformation, crisis informatics, and resilience research. We invite participants to submit short position papers between 2-4 pages comprising one or more case studies, empirical research, or at least some description of infrastructure or organizational setting that the workshop participant is familiar with and can discuss at the workshop. The position paper should also include some analysis of that setting. We hope to articulate research dimensions around organizational infrastructuring that is akin to the research arenas in organizational resilience.

The short position papers will be distributed to all the participants before the workshop to allow preparation beforehand and to foster intense discussions at the main event. The organizers will facilitate discussion by providing some prominent and overlapping themes identified in advance from the papers. To create a productive setting in the workshop right away, we would like to encourage you to reflect on the following issues: field of your research or/and development, SME or organizational context of the case study, the understanding of resilience strategies, theories, the concept of infrastructure, infrastructuring and methods concerning your research. We hope to address topics (questions) within this work such as (but not limited to):

- Barriers to resilient infrastructures
- Infrastructural evolution over time
- Disruption, change, and innovation as stimuli for infrastructural evolution
- Impact of resonance activities on organizational resilience
- Improvised collaborations for organizational resilience
- Collaborative organizational resilience
- Collaboration in coping and recovery work
- Collaborative innovation through and by infrastructural inversion
- Implications of digital transformation on organizational infrastructure
- Implications for resilient organizational infrastructure design
- Strategies for continuity in crisis
- Role of situation awareness in business continuity

- Digitalization and the increasing vulnerabilities in organizational infrastructure
- Internet of things for improved organizational resilience
- Infrastructural obsolescence

Workshop Schedule and Structure

The temporary event structure of our two-days interactive workshop will be as follows (might be changed based on the number of participants or in case of pandemic restricted online event):

Workshop initiation: The co-organizers will make the first pitch with a formal outline of the workshop, goals, and expected outcomes.

Interactive case study analysis: The presenters will present their case studies for discussion and brief meta-level analysis within the group in an interactive exercise. This exercise aims to familiarize the group with individual experiences and open discussion towards topics to be considered in later sessions. Intuitively, this does not allow in-depth exploration of the instances but is meant to build up subject motivation with the group while discovering rigorous discussion themes.

Interactive brainstorming session: We will then continue by picking as a group issues that warrant further discussion. We will brainstorm multiple exploration dimensions for the chosen topics and discover open questions, inclusion, and exclusion criteria for a thorough discussion.

Breakout group discussion: In the afternoon, we will break into smaller groups. Each group will be assigned a topic and will be moderated by a smaller set of co-organizers. The issues will be explored in slightly more depth, again running them through the example set of case studies and considering the different aspects that emerge.

Plenary session: We will get together after the group work, reporting shortly about the groups' different discussions and outcomes.

Wrap-up: The co-chairs will present concluding remarks and the takeaways from the workshop.

The organizers will also discuss the possibility of a joint publication with the participants to make the findings available for the CSCW research community. The event structure is not distributed between the working hours, refreshments, and lunch breaks. This information will be disseminated to the participants before the workshop, depending upon the workshop's mode (In-venue or online).

Workshop targets:

- Case studies of the participants will be explored.
- Key issues and workable concepts will be identified.

- A joint publication will be planned.

Duration of the workshop: Two day split sessions on 7th and 8th June (four hours each day with breaks), within conference preferred timeslots i.e., 3 -7 pm CET

Workshop format: Digital via Zoom and interactive tools like Miro etc.

Means of recruiting and selecting participants:

The call for participation will be advertised through the conference website (<https://bcmecscw.kompetenzzentrum-siegen.digital/>) and social media channels. The advert will also be sent to respective mailing lists. A Workshop website will be established where the workshop proposal is posted together with position papers and other workshop information. Position paper submission will be via email.

Maximum number of participants: 15

Workshop Organizers

These co-organizers have already committed to the workshop. We have pending requests from international organizers, which will be included in the camera-ready version and website.

Hussain Abid Syed (corresponding chair) is a Ph.D. researcher in the BMBF junior research group KONTIKAT at the University of Siegen, Germany. He is a computer scientist with a specialization in software technology and data science. His interests include human-machine interaction (HCI), computer-supported-cooperative work (CSCW), model-driven software development (MDSO), and machine learning (ML). He is keen on the application of computing techniques and software technologies for the enhancement of organizational resilience. His current research focus is to tailor resilience practices to the context of small and medium enterprises. He collaborates with the enterprises employing qualitative and quantitative research methods to generate steady requirements for resilient infrastructures.

Marén Schorch is a Postdoctoral Researcher and leader of the BMBF junior research group KONTIKAT at the University of Siegen, Germany. She is a sociologist specializing in qualitative research methods and disaster research. Her current research deals with continuity and (digital, social, economic) change, and emergency preparedness. She has published a wide range of articles on her varied research, co-edited the book "Learning and Calamities. Practices, Interpretations, Patterns." (Routledge 2015), co-organized several workshops such as on ECSCW 2020 and 2011, CSCW 2014 and CSCW 2017, COOP 2016 and GROUP 2016, held two masterclasses at ECSCW 2019 and also acts as AC and reviewer for those conferences (ECSCW, CSCW, CHI etc.).

Sam Addison Ankenbauer is a writer and qualitative researcher. His interests broadly investigate how technologies can mediate traditional spaces and how these physical spaces are currently adapting to newer technologies. His current research explores the tensions between technologies, physical spaces, and the people who utilize technologies and inhabit spaces. Sam is a doctoral student at the University of Michigan School of Information. He is also the author of *The Wailing for Liverpool* University Press.

Sohaib S. Hassan is a member of the BMBF junior research group KONTIKAT at the University of Siegen, Germany. He is a Postdoctoral Researcher at the School of Economic Disciplines, University of Siegen. He is also the Research Coordinator & Advisor at SME Graduate School, Faculty III, University of Siegen. His research interests include Strategic Management, SMEs, Innovation, Digital Transformation, Business Continuity Management

Martin Stein is a Post-Doc researcher at the Fraunhofer Institute for Applied Information Technology FIT, Germany and managing director of open.INC, a startup focussing on IIoT-solutions. He received his PhD from the School of Economic Disciplines at the University of Siegen in the department of Information Systems and New Media. His research is centred around the topics of mobility support, complex information processing and visualization and participatory design. In his most recent work, he focuses on the impact of industrial internet of things (IIoT) technologies on the organizational setting and qualifications needs of SMEs. He (co)-authored several conference and journal papers, including publications at ACM CHI Conference on Human Factors in Computing Systems, ACM Transactions on Computer-Human Interaction, International Journal of Human-Computer Studies, International Conference on Supporting Group Work, Conference on the Design of Cooperative Systems (COOP). Further, he served as associate chair for MobileHCI Late Breaking Work 2017 and as reviewer for, e.g. JCSCW, ACM CHI, ACM CSCW, ECSCW, COOP and IS-EUD.

Konrad Meisner is a Ph.D. student at the university of Siegen at the Chair for Entrepreneurship and Family Business and a junior researcher at the KontiKat researcher group. He worked in strategic management in an SME, preparing innovation and business development on a long-term orientation. He further on studied SME Management with a focus on family businesses. His current field of research lies within the digitalization of SMEs and family business, innovation management and gender-studies.

Sascha Skudelny is a research fellow at the Institute for Media Research and the iSchool at the University of Siegen. He studied media sciences and human medicine and is doing his doctorate at the Institute for Microsystems Technology. His

publications and research focus on security communication, collaborative technologies, process and communication modeling of complex systems, user experience/usability design and social media analysis/social network analysis as well as business resilience management and social (governance) resilience management.

Helena Karasti is Professor in the Department of Digital Design at IT University (ITU) of Copenhagen, Denmark. Her research interests include infrastructuring, information/knowledge/research infrastructures, critical data studies, and integrations of ethnography and design. She has widely published in the fields of Computer Supported Cooperative Work (CSCW), Participatory Design (PD) and Science and Technology Studies (STS). She leads the Responsible Infrastructuring research group at ITU.

Volkmar Pipek is a Professor of CSCW and HCI at the University of Siegen, Germany, and has widely published books and articles in CSCW, with a specific interest in infrastructuring. He is also the co-leader of the project "INF-Infrastructural Concepts for Research in Cooperative Media" at the Collaborative Research Centre 1187: Media of Cooperation and mentor of the BMBF junior research group KONTIKAT at the University of Siegen.

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