Scoping Review: Digitalisation in the organisational culture of safety and security agencies

Thomas Kox
Weizenbaum Institute
thomas.kox@weizenbaum-institut.de

Patricia Schütte
Bergische Universität Wuppertal
schuette@uni-wuppertal.de

Sebastian Rohwedder
Weizenbaum Institute
sebastian.rohwedder@weizenbaum-institut.de

Till Büser
Weizenbaum Institute
till.bueser@weizenbaum-institut.de

ABSTRACT

Digitalisation has a significant impact on most aspects of society. State agencies with safety and security tasks have to develop effective strategies to manage the opportunities and risks associated with technological innovations and increased networking. Emerging digital technologies have the potential to affect work practices and thus the organisational culture of such agencies. To examine the extent to which scientific research has addressed the impact of digitalisation on organisational culture so far, a systematic scoping review was conducted. Preliminary results show that the overall research topic is still in an exploratory phase and studies are primarily from the global north. The analyses show that the majority of studies focuses on artefacts around information data leading to respective work practices around data work.

Keywords

Organisational Culture, Digitalisation, Artefacts, Work Practices

INTRODUCTION

Since the advent of digital technologies and computers, digitalization has been a much-discussed development. New information and communication technologies, technical infrastructures and systems, changes in computing power, possibilities and capacities for data collection, processing, analysis and interpretation, artificial intelligence (AI), etc. are combined with significantly expanded corridors of connectivity, networking and exchange in working and living environments. Processes of digital change target all levels: Society and social subsystems, organizations and individuals. In times of the COVID-19 pandemic, these conditions seemed to offer both solutions and options for retreating from the pandemic-influenced world of presence into digital spheres and virtual spaces. In addition to the above-mentioned developments in society as a whole and the relatively dynamic development of technology and services (e.g., IT, AI), the digital transformation has been on the political agenda in several nations for several years and is embedded in a formal framework, for example, in Germany with the constantly updated "Implementation Strategy of the Federal Government". It is therefore no surprise that the field of government agencies including those responsible for public safety and security (in Germany subsumed under the collective term 'authorities and organizations with security tasks' (in German "*Behörden und Organisationen mit Sicherheitsaufgaben*"; BOS) are also under the influence of digital transformation processes (Schütte & Kox, 2022). Recent security-related developments (e.g., cybercrime, digital networking of offender groups), BOS and their representatives, politics, media, and academia (see e.g., Epple & Ludewig, 2019; Hüttelmaier & Käser, 2020) act as 'drivers' with regard to the discussion about the importance of digitalization or the digital transformation of BOS. This is often accompanied by promises or even pledges: Modernity of the organization (and its external image) and achievement of a current 'state of the art', preservation and optimization of the ability of BOS to act under the requirements of digitality and the handling of digital media, (improved) implementation of the mission, various further development potentials, promotion of innovativeness and flexibility, (better and closer) networking

for example in inter-agency cooperation (bitkom, 2020). Over the last years, a lot has happened in the digital transformation of German BOS. A rough insight into different government websites (e.g., of state police forces) contain references to state-specific programmes and master plans for digitalization that clearly show the development stages of the past and coming years. These include the expansion of digital radio and IT infrastructures, the purchase of additional mobile devices (e.g., smartphones for the North Rhine-Westphalian police), the inclusion of digital analysis approaches (such as social media analytics, big data analysis) and the 'purchase' of online specialists who, as 'Intel Officers', provide the police with important real-time information from the social media and other internet sources in particular during ongoing operations (Ministerium Landes Nordrhein-Westfahlen, 2021; Niedersächsisches Ministerium für Inneres und Sport, n.d., 2019). Non-police BOS such as fire departments, aid organizations or the Federal Agency for Technical Relief (THW) are also actively working on their digital transformation. Virtual Operation Support Teams (VOST) have already been established since 2017 as support structures in operational situations and docked with the THW (Fathi et al., 2018). In addition, almost all BOS use social media and operate their own social media accounts (Deutsches Rotes Kreuz, 2018). Innovative efforts are being made to implement new technologies to deal more efficiently with information on future developments in acute operations. Despite these developments, the status of the digital transformation of BOS still leaves room for improvement. It seems that digital transformation is not discussed much together with BOS and infrastructures and equipment are presented as expandable. Overall, there is a certain dissatisfaction with the state of digitalisation in the German BOS with the use of social media as an exception that is now more or less a normal part of communication (blaulicht.digital, 2020). Bureaucratic principles such as written form, file knowledge and rule-boundness offer stable structures for docking digital approaches. However, they may also sometimes slow down decisions, which favour a rather incremental organisational development, which appears to be less compatible with a technology development that brings new offers to the market in a very short time, while previous versions of tools and systems have not yet passed the bureaucratic decision-making processes. The development of operational routines with new technologies takes time. As long as they are not yet a normal part of practice and preparation in calm times, they cannot become a natural tool for acute situation management in turbulent situations, as they increase uncertainty more than they reduce it. The lack of techniques to quickly deal with or practice dealing with new technologies in the organisation delays the utilisation of new technologies (Schütte & Kox, 2022).

OBJECTIVE

Against the background of these considerations, the question arises as to what extent digital technologies are already anchored in the BOS. This question can be theoretically embedded the investigation of organizational culture (e.g., Bellot, 2011; Berg & Wilderom, 2004; Schein, 2010). This approach is not always very clear and free of criticism. Nevertheless, it can be stated that organizational cultures exist, are inherently fuzzy and socially constructed, are a product of groups not individuals, relatively unique to each organisation and subject to continual change (Bellot, 2011).

Schein (2010) assumes that organizational culture emerges at three different levels of an organization. He refers to the top and most visible level as the *artefact level*. This level includes everything that is directly visible, audible and tangible, such as dress code, architecture, office design, technologies, stories and documents, but also behavior patterns. The second level refers to *espoused values*, i.e. the organisations' stated values and rules of behaviour. The values are based on fundamental shared *basic assumptions* that are subconscious or unconscious, barely visible or observable and are almost impossible to research. In addition, van den Berg and Wilderom (2004, p. 571) "*define organisational culture as shared perceptions of organizational work practices*". They see *work practices* as a better means of capturing organisational culture, as these differ significantly more between organisations than values. Adopted from Schein (2010) and van den Berg and Wilderom (2004) we distinguish hereinafter between artefacts and work practices, which are defined as follows:

- *Artefacts*: This category refers exclusively to the field of digital technologies. Artefacts include hardware and software, technical systems, data, means of communication, etc.
- *Work practices*: This refers to activities of organizations and individuals that involve action, execution of processes, individual routines and techniques, etc. related to or shaped by digital technologies.

In order to systematically map the research done in this area, a scoping review (Tricco et al., 2018) was conducted. The following research question was formulated: *How are digital aspects i.e., artefacts and practices included in studies of BOS cultures?*

METHODS

Eligibility Criteria

Against the background of the questions and assumptions outlined above, scientific papers were included in the review process that relate and examine aspects of digitality and levels of organizational culture (e.g., technologies as artefacts, practices, values) in BOS. The papers needed to be: published in scientific journals, peer reviewed, published between the period of 2010 and 2023, social-scientific studies on the topic of organisational culture, written in English, focused on BOS (i.e., police, firefighters, emergency response) as well as focused on artefacts, techniques, practices included in studies of BOS cultures.

Papers were excluded if they did not fit into the conceptual framework of the study: opinion papers, journalistic articles, reviews and comments, technical analytics and discussions (engineering, computer science, etc.), only deal with the specifics of cyber-crime and internet-security, pure presentation of technologies/tools for an abstract addressee in the security field, or papers that discuss organizational change only as part of simulation experiments. Also excluded were studies that deal with organizations that: either cannot be seen as BOS, like actors of pre-hospital care, hospital care and emergency units, or are composed of several organizations and transcend national borders, as is the case with international police organizations, or were 'born' in digital era and are naturally influenced by digital aspects, e.g. Virtual Operation Support Teams (VOSTs). As Cobb et al. (2014, p. 890) point out: "*Empirical research on historical disaster events shows response efforts taking four different organizational forms: established, extending, expanding, and emerging. Emerging organizations are ones that have no pre-existing structure and come together as individuals who begin to connect and coordinate their work*".

Information Sources

To find the relevant academic articles the reviewers searched in the open data bases *Web of Science*, *SCOPUS*, *EBSCO* and initially *Google Scholar* for texts published between January 2010 and August 2023. During the search process, *Google Scholar* was dismissed as a source because of the platform's character limit per search and inconsistency in the results displayed on the first ten pages. On the three remaining platforms, the results were chosen when they featured the words of the search string in the title or the abstract and were published by academic, peer-reviewed journals.

Search

The reviewers formulated the search string in three parts, covering the themes BOS, digitalization and workplace culture respectively. The parts that were connected with AND operators consisted of related words that were connected with OR operators. For the term BOS the reviewers differentiated between police organizations and non-police organizations as described above, resulting in two different search strings. The final search strings for police and non-police are shown in Table 1 using SCOPUS as an example. Please note that the original search also included the terms in German. As there were no additional results, the terms are not listed here for space considerations.

Table 1. SCOPUS Search Strings

Sub-Search	Database	Search String
Police	SCOPUS	police OR "law enforcement" AND "organizational culture" OR "work practice" OR "work routine" OR "value system" OR "behavioral norm*" AND digitali* OR technolog* OR "artificial intelligence" OR "machine learning" OR "virtual reality" OR "augmented reality" OR "social media" OR "ICT"
Non-Police	SCOPUS	"fire brigade" OR "fire department" OR "fire services" OR "firefighter" OR "emergency service" OR "emergency response" AND "organizational culture" OR "work practice" OR "work routine" OR "value system" OR "behavioral norm*" AND digitali* OR technolog* OR "artificial intelligence" OR "machine learning" OR "virtual reality" OR "augmented reality" OR "social media" OR "ICT"

Selection

After removing duplicates, the refined search on *SCOPUS*, *Web of Science* and *EBSCO* concluded in a selection of 94 academic peer-reviewed papers (identification phase) that were then screened for suitability by all four reviewers (see Figure 1).

The first screening each reviewer read all abstracts and marked them as either fitting (n= 27), unfitting (n= 43) or in need of further discussion (n= 24). During this process, inclusion and exclusion criteria were iteratively formulated in more detail to make them clear to all participants. After individual review, the results were contrasted and discussed in the team. The 51 papers that were not unanimously excluded after their discussion were included in the next screening process that consisted of parsing the entire text for suitability. During the collection of said literature, 9 research papers of the 51 research papers were not openly available nor accessible through institutional affiliations. These papers were excluded from the investigation. In similar fashion to the first screening, the remaining 42 papers were read by each reviewer and marked as either fitting or unfitting (screening 2). After reading the entire text, two of the previously fitting papers were excluded and 14 of the papers that still needed discussion were excluded as well. Of the 26 remaining papers, 6 were still in need of further discussion, as the reviewers were in disagreement about their inclusion. After this process three more texts were excluded, leaving n=23 as the total amount of papers to be fully analysed. In the fourth step (inclusion), each of the included full texts were assigned to at least two different reviewers who first read and evaluated each text individually before discussing with the second reviewer.

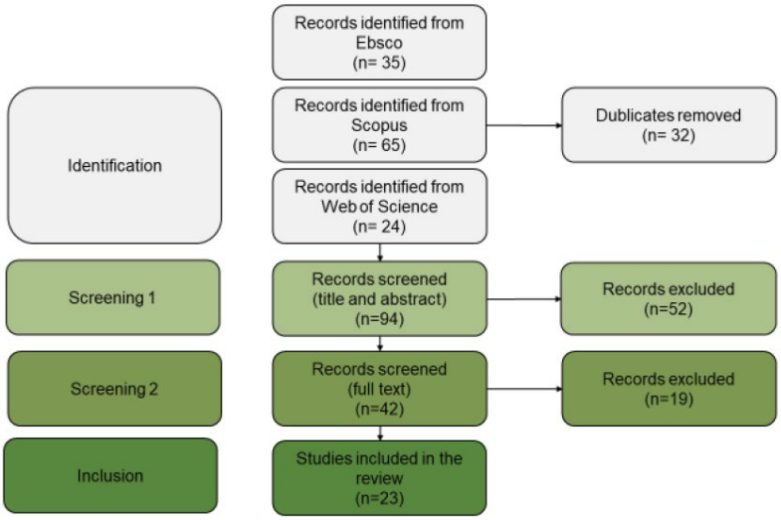

Figure 1. Visualization of the search process with information on excluded texts

Data Charting Process and Data Items

To ensure the most comprehensive data collection possible, an Excel table was developed during the screening steps which all reviewers filled in with categories or variables to be extracted. The categories which are also commonly used in other review procedures are: year of publication, author(s), country, topic (here: police or non-police), focus / aim of the study, study design / methodology, sample / setting / organization type, data collection, results, and limitations. The data in these categories is particularly suitable for text-related, descriptive and quantitative analyses. Some categories such as year of publication, author(s) or keywords are directly extractable from the texts. Other categories such as country or sample / setting can be derived using simple text analysis. The categories artefacts and work practices were derived by the reviewers based on the research question of the scoping review and the theoretical aspects of organization culture. To identify artefact categories, the reviewers assigned a potential artefact label to each text they read. Artefacts were relatively unambiguous in their identification and similar labels were assigned by both reviewers most of the time. In a next step, the reviewers created umbrella terms or overarching categories for all identified artefacts. As work practices are often discussed much less specifically in the texts, a consensus was reached between the reviewers through discussion. This is followed by a more in-depth interpretation of the relationship between the levels in relation to organizational cultural significance and an answer to the research question posed above.

RESULTS

Table 2 lists all 23 reviewed articles together with the listed keywords derived directly from the text. The table provides an initial overview of the different topics, contents and methodological approaches used. Some artefacts and working practices are also already sketched out. By further analysing the texts in depth, we identified 11 of the 23 papers as reporting solely on police organizations, 11 that reported on the various non-police organizations and one paper that focused on both police and non-police organization. A comparison of the geographical distribution of the study areas shows that the majority (seven) of the studies were conducted in the US, five in Sweden and three in the UK. The other study areas include the Netherlands (two), Canada, Italy, Denmark, Germany, Australia and India (one each). No studies that have been included in this review have been published on Africa or South America. In terms of the methods used, 18 studies can be categorised as qualitative approaches (10 of which were ethnographies) and six as quantitative approaches. Three of the 23 papers are a mix of both methods, while two can be described as conceptual papers. Themes, geographical distribution and methods show no noticeable trend over time, with no year having an extraordinary impact on the number of papers published. It should be noted, however, that as one could expect the two conceptual papers are among the first three papers published.

Table 2. List of reviewed papers and listed keywords.

Reference	Keywords
Abrahamson & Goodman-Delahunty, 2014	police · information sharing · impediment · culture · infrastructure
Bergstrand & Landgren, 2011	crisis management · information systems · video communication · information environments · in-situ documentation · situation awareness
Borglund et al., 2012	hybrid environment · IT use · police work · police investigations · prostitution · Synergy-4
Borglund & Nulden, 2012	persona · scenario · design of information technology · emergent use of IT
den Hengst & Staffeleu, 2012	-
Dovigo & Redaelli, 2010	control room · emergency calls · ethnography · ethnomethodology · knowledge management · technology blending
Fischer et al., 2015	tabletop · disaster response · ethnography · collaboration · situation awareness · uncertainty · crisis informatics
Forsgren et al., 2018	policing · social media · activity theory · work activities
Guzik et al., 2021	policing · technology · organisational routines · body worn cameras · socio-materiality
Jensen et al., 2021	ambulances · electronic health record · cultural anthropology · emergency medical services
Landgren & Bergstrand, 2016	situation rooms · coordination · collaboration · work-practice · ethnography · crisis response
McQuade, 2016	-
Piza & Moton, 2023	systematic social observation; police discretion; police decision-making; closed-circuit television (CCTV)
Reuter et al., 2019	head-mounted displays · smartphone · rescue dog units · emergency management · collaboration · empirical study · prototype · evaluation
Robinson et al., 2015	computer supported cooperative work (CSCW) · emergency response · human infrastructure · improvisation
Samuelsson & Berner, 2013	ambulance care · telemedicine technology · ethnography · Sweden · science and technology studies (STS)
Schlosser & Matthews, 2022	CCS concepts· participatory design· design method· secondary video· head-worn display· augmented reality· emergency medical services
St. Denis et al., 2014	crisis informatics· emergency management· public information· social media· trusted volunteers

Tyagi & Dhar, 2017	-
Verhulst & Rutkowski, 2018	group support systems · sociomateriality · affordances · constraints · imbrication · collaborative technology · high reliability organizations
Wilson-Kovacs, 2021	-
Zhang, Joy, et al., 2021	CCS concepts· documentation; data work; electronic health record; teamwork; decision making; distributed cognition; emergency medical services; pre-hospital care; video analysis
Zhang, Sarcevic, et al., 2021	-

In the following we describe the results of the text analysis with regard to artefacts and working practices using the created umbrella terms or overarching categories: In total, nine overarching categories of artefacts have been identified by the reviewers, which are listed in Table 3 alongside the references. These include i) data storage and exchange technologies like cloud storage, ii) data visualisation and analysis technologies such as computer-generated diagrams, interactive maps or figures crafted on whiteboards, iii) information and communications technology (ICT) devices such as cell phones, computers or radio , iv) news and public information sources like news websites or other publicly available information, v) other social and infrastructure data like road traffic data, vi) social media, vii) surveillance technology such as Closed Circuit Television (CCTV) or body worn cameras, viii) various telemedicine technologies including electronic health records, and ix) virtual reality (VR) and augmented reality (AR) technology such as smart glasses or augmented bird tables.

Table 3. Overarching categories of identified artefacts.

Overarching artefact category	References
Data storage and exchange technologies	Guzik et al., 2021
Data visualisation and analysis technologies	den Hengst & Staffeleu, 2012; Fischer et al., 2015; Landgren & Bergstrand, 2016; McQuade, 2016; Tyagi & Dhar, 2017; Verhulst & Rutkowski, 2018
ICT devices	Abrahamson & Goodman-Delahunty, 2014; Bergstrand & Landgren, 2011; Borglund & Nulden, 2012; den Hengst & Staffeleu, 2012; Dovigo & Redaelli, 2010; Verhulst & Rutkowski, 2018
News and public information sources	Landgren & Bergstrand, 2016
Social and infrastructure data	Borglund et al., 2012; Landgren & Bergstrand, 2016
Social media	Bergstrand & Landgren, 2011; Forsgren et al., 2018; Robinson et al., 2015; St. Denis et al., 2014
Surveillance technology	Borglund et al., 2012; Guzik et al., 2021; McQuade, 2016; Piza & Moton, 2023
Telemedicine technologies	Jensen et al., 2021; Samuelsson & Berner, 2013; Zhang, Joy, et al., 2021
VR and AR technology	Fischer et al., 2015; Reuter et al., 2019; Schlosser & Matthews, 2022; Zhang, Sarcevic, et al., 2021

With regard to work practices discussed, in total, six overarching categories of practices have been identified by the reviewers, which are listed in Table 4. These include i) administrative work including resource management and shift planning, ii) community engagement including public communication, iii) data work including information gathering, information processing and information sharing, iv) dispatch and control, v) inter- and intra-agency cooperation and collaboration, and vi) surveillance including investigations in hybrid environments.

Table 4. Overarching categories of identified work practices.

Overarching practice category	References
Administrative work	Borglund & Nulden, 2012; Fischer et al., 2015; Schlosser & Matthews, 2022; Wilson-Kovacs, 2021
Community engagement	Forsgren et al., 2018; Guzik et al., 2021; St. Denis et al., 2014
Data work	Abrahamson & Goodman-Delahunty, 2014; Bergstrand & Landgren, 2011; Borglund et al., 2012; Guzik et al., 2021; Jensen et al., 2021; Landgren & Bergstrand, 2016; Piza & Moton, 2023; Robinson et al., 2015; Samuelsson & Berner, 2013; St. Denis et al., 2014; Tyagi & Dhar, 2017; Verhulst & Rutkowski, 2018; Zhang, Joy, et al., 2021; Zhang, Sarcevic, et al., 2021
Dispatch and control	Dovigo & Redaelli, 2010; Landgren & Bergstrand, 2016
Inter- and intra-agency cooperation and collaboration	Borglund & Nulden, 2012; den Hengst & Staffeleu, 2012; Fischer et al., 2015; Guzik et al., 2021; Jensen et al., 2021; Landgren & Bergstrand, 2016; Reuter et al., 2019; Zhang, Sarcevic, et al., 2021
Surveillance	Guzik et al., 2021; McQuade, 2016; Piza & Moton, 2023

Artefacts around information data could be summarised into a) information-gathering technologies, b) information analysis technologies and c) information visualisation and communication technologies leading to respective practices around data work. When looking at the multitude of work practices researched, data work stands out with more than half of the reviewed literature focusing on this practice. Many of the work practices identified are direct communication processes, either within the agency, between agencies or with/to third parties. There are also work practices that can be categorised as (computer-aided) information processing in the broadest sense, which can be summarised under the umbrella term computer supported cooperative work (CSCW). Finally, it should be emphasised that the categories listed in Table 3 and Table 4 are work in progress and represents preliminary evaluations. There is not always a clear distinction between the categories as they are themselves still under evaluation.

CONCLUSION

After presenting the main steps of the scoping review and addressing some initial findings, this paper draws the following conclusions. We give initial answers to the research question by giving a first descriptive assessment of the literature included in the review and provide an outlook on the next research steps.

The articles examined show that digital aspects have found their way into studies dealing with BOS and their work cultures. The analyses show that the majority of the reviewed studies are qualitative approaches including especially ethnographic studies. This could indicate that the overall research topic is still in an exploratory phase, i.e. there are many blind spots that require an open approach. It is also striking that the reviewed studies are primarily from the global north. The in-depth text analysis show that the majority of studies focuses on artefacts around information data leading to respective work practices around data work.

The team of reviewers assume that digital technologies have arrived in organizations as artefacts, but to a lesser extent in practices, espoused values or even basic assumptions. In other words, in seams that compared to analogue technologies such as pen and paper, axes, guns or water hoses, digital technologies have not yet become fully culturally embedded. Yet, our preliminary analysis has so far only focused on the categories of artefacts and practices, while other categories related to organizational culture have not yet been investigated and are the subject of the next steps.

ACKNOWLEDGMENTS

The contribution of Thomas Kox, Sebastian Rohwedder and Till Büser was part of the joint project "Weizenbaum Institute for the Networked Society" (FKZ 16DII131), funded by the German Federal Ministry of Education and Research.

REFERENCES

Abrahamson, D. E., & Goodman-Delahunty, J. (2014). Impediments to information and knowledge sharing within policing: A study of three canadian policing organizations. SAGE Open, 4(1). https://doi.org/10.1177/2158244013519363

Bellot, J. (2011). Defining and Assessing Organizational Culture. Wiley Periodicals, Inc. Nursing Forum, 46(1), 29–37.

Berg, P. T. van den, & Wilderom, C. P. M. (2004). Defining, Measuring, and Comparing Organisational Cultures. Applied Psychology: An International Review, 53(4), 570–582. https://doi.org/10.1111/j.1464-0597.2004.00189.x

Bergstrand, F., & Landgren, J. (2011). Information systems in crisis. https://doi.org/10.1016/B978-1-84334-647-0.50007-2

bitkom. (2020). Positionspapier. Digitalisierung für die Öffentliche Sicherheit—Beschaffung, Innovation, Funktionalität und Sicherheit ins Gleichgewicht bringen. https://www.bitkom.org/sites/default/files/2020-07/200710_positionspapier_digitalisierung-fur-die-offentliche-sicherheit.pdf.

blaulicht.digital (Ed.). (2020). Digitale Transformation in der zivilen Gefahrenabwehr. https://www.blaulicht.digital/wp-content/uploads/sites/6/2020/09/Studie-Digitale-Transformation-in-der-zivilen-Gefahrenabwehr.pdf

Borglund, E., & Nulden, U. (2012). Personas in Uniform: Police Officers as Users of Information Technology. AIS Transactions on Human-Computer Interaction, 4(2), 92–106. https://doi.org/10.17705/1thci.00041.

Borglund, E., Öberg, L.-M., & Slumpi, T. P. (2012). Success Factors for Police Investigations in a Hybrid Environment: The Jämtland Police Authority Case. International Journal of Police Science and Management, 14(1), 83–93. https://doi.org/10.1350/ijps.2012.14.1.264

Cobb, C., McCarthy, T., Perkins, A., Bharadwaj, A., Comis, J., Do, B., & Starbird, K. (2014). Designing for the deluge: Understanding & supporting the distributed, collaborative work of crisis volunteers. Proceedings of the ACM Conference on Computer Supported Cooperative Work, CSCW, 888–899. https://doi.org/10.1145/2531602.2531712

den Hengst, & Staffeleu, E. (2012). Different Information Organizations to Produce the Same High Quality Intelligence: An Overview of the Police Forces in the Netherlands1. Policing: A Journal of Policy & Practice, 6(2), 187–193. https://doi.org/10.1093/police/pas005.

Deutsches Rotes Kreuz (Ed.). (2018). Web 2.0 und Soziale Medien im Bevölkerungsschutz. Teil 1: Wissenschaftliche Erkenntnisse über die Nutzung von Sozialen Medien in Krisen- und Katastrophenlagen aus Perspektive des Deutschen Roten Kreuzes.

Dovigo, F., & Redaelli, I. (2010). Knowledge Management in Locating the Patient in an Emergency Medical Service in Italy. COMPUTER SUPPORTED COOPERATIVE WORK-THE JOURNAL OF COLLABORATIVE COMPUTING AND WORK PRACTICES, 19(5), 457–481. https://doi.org/10.1007/s10606-010-9118-7

Epple, G., & Ludewig, F. (2019). Sicherheit im Einsatz durch Open Source Intelligence in Einsatzleitstellen“ (SENTINEL. Polizeispiegel, 20–22.

Fathi, R., Tondorf, V., Schulte, Y., Schütte, P., & Fiedrich, F. (2018). Lageinformationen aus den sozialen Netzwerken: Virtual Operations Support Teams (VOST) international im Einsatz. Notfallvorsorge, 49(2), 4–12.

Fischer, J. E., Reeves, S., Rodden, T., Reece, S., Ramchurn, S. D., & Jones, D. (2015). Building a birds eye view: Collaborative work in disaster response. Conference on Human Factors in Computing Systems - Proceedings, 2015-April, 4103–4112. https://doi.org/10.1145/2702123.2702313

Forsgren, E., Gritt, E., & Allen, D. (2018). Investigating the influence of social media on police activities. International Conference on Information Systems 2018, ICIS 2018. https://www.scopus.com/inward/record.uri?eid=2-s2.0-85062559566&partnerID=40&md5=8fd5e9898d1d4ac109e3c37164256717

Guzik, K., Sesay, A., Oh, O., Ramirez, R., & Tong, T. (2021). Making the material routine: A sociomaterial study of the relationship between police body worn cameras (BWCs) and organisational routines. POLICING & SOCIETY, 31(1, SI), 100–115. https://doi.org/10.1080/10439463.2019.1705823

Hüttelmaier, T., & Käser, B. (2020). Bevölkerungsschutz 4.0. Risiken und Chancen von IT-Systemen im Einsatz. Bevölkerungsschutz, 2, 43–45.

Jensen, F. B., Ladefoged, K. T., Lindskou, T. A., Søvsø, M. B., Christensen, E. F., & Teli, M. (2021). Understanding the effect of electronic prehospital medical records in ambulances: A qualitative observational study in a prehospital setting. International Journal of Environmental Research and Public Health, 18(5), 1–9. https://doi.org/10.3390/ijerph18052330

Landgren, J., & Bergstrand, F. (2016). Work practice in situation rooms – An ethnographic study of emergency response work in governmental organizations. Lecture Notes in Business Information Processing, 265, 157–171. https://doi.org/10.1007/978-3-319-47093-1_14

McQuade, B. I. (2016). Police and the post-9/11 surveillance surge: "Technological dramas" in "the bureaucratic field". Surveillance and Society, 14(1), 1–19. https://doi.org/10.24908/ss.v14i1.5291

Ministerium Landes Nordrhein-Westfahlen. (2021). Digitalisierung. https://polizei.nrw/digitalisierung.

Niedersächsisches Ministerium für Inneres und Sport. (n.d.). Digitale Polizei. https://www.mi.niedersachsen.de/startseite/themen/it_bevollmachtigter_der_landesregierung/masterplan_digitalisierung/digitale-polizei-168213.html.

Niedersächsisches Ministerium für Inneres und Sport. (2019). 13 „Intel Officer" als Verstärkungen für die niedersächsische Polizei. https://www.mi.niedersachsen.de/aktuelles/presse_informationen/13-intel-officer-als-verstaerkungen-fuer-die-niedersaechsische-polizei--174810.html.

Piza, E. L., & Moton, L. N. (2023). Proactive monitoring and operator discretion: A systematic social observation of CCTV control room operations. Journal of Criminal Justice, 86. https://doi.org/10.1016/j.jcrimjus.2023.102071

Reuter, C., Ludwig, T., & Mischur, P. (2019). RescueGlass: Collaborative Applications involving Head-Mounted Displays for Red Cross Rescue Dog Units. COMPUTER SUPPORTED COOPERATIVE WORK-THE JOURNAL OF COLLABORATIVE COMPUTING AND WORK PRACTICES, 28(1–2), 209–246. https://doi.org/10.1007/s10606-018-9339-8

Robinson, J. J., Maddock, J., & Starbird, K. (2015). Examining the role of human and technical infrastructure during emergency response. ISCRAM 2015 Conference Proceedings - 12th International Conference on Information Systems for Crisis Response and Management, 2015-January, 311–320. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84947760505&partnerID=40&md5=cba7772ff45b065cc245f4307f4c2206

Samuelsson, T., & Berner, B. (2013). Swift Transport versus Information Gathering: Telemedicine and New Tensions in the Ambulance Service. Journal of Contemporary Ethnography, 42(6), 722–744. https://doi.org/10.1177/0891241613488941.

Schein, E. H. (2010). Organizational culture and leadership (4th ed.). San Francisco.

Schlosser, P., & Matthews, B. (2022). Designing for Inaccessible Emergency Medical Service Contexts: Development and Evaluation of the Contextual Secondary Video Toolkit. Conference on Human Factors in Computing Systems - Proceedings. https://doi.org/10.1145/3491102.3517538

Schütte, P., & Kox, T. (2022). Vor die Lage – Jetzt und morgen. Herausforderungen von BOS im Umgang mit neuen Technologien und Digitalisierung. In A. Fekete (Ed.), Kritische Infrastruktur und Versorgung der Bevölkerung (pp. 5–25). Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-662-65047-9_2

St. Denis, L. A., Palen, L., & Anderson, K. M. (2014). Mastering social media: An analysis of Jefferson County's communications during the 2013 Colorado floods. ISCRAM 2014 Conference Proceedings - 11th International Conference on Information Systems for Crisis Response and Management, 737–746. https://www.scopus.com/inward/record.uri?eid=2-s2.0-84905841710&partnerID=40&md5=55681700a6280d3fd6882933645e1192

Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., … Straus, S. E. (2018). PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of Internal Medicine, 169(7), 467–473. https://doi.org/10.7326/M18-0850

Tyagi, A., & Dhar, R. (2017). Knowledge Sharing as a Mediator between Organization Culture and Police Investigation Performance-Moderating Role of Technology: A Study of Tourist Destinations of Uttarakhand, India. POLICING-A JOURNAL OF POLICY AND PRACTICE, 11(2), 185–201. https://doi.org/10.1093/police/paw042

Verhulst, M. J., & Rutkowski, A.-F. (2018). Decision-Making in the Police Work Force: Affordances Explained in Practice. GROUP DECISION AND NEGOTIATION, 27(5, SI), 827–852. https://doi.org/10.1007/s10726-018-9587-5

Wilson-Kovacs, D. (2021). Digital media investigators: Challenges and opportunities in the use of digital forensics in police investigations in England and Wales. Policing, 44(4), 669–682. https://doi.org/10.1108/PIJPSM-02-2021-0019

Zhang, Z., Joy, K., Upadhyayula, P., Ozkaynak, M., Harris, R., & Adelgais, K. (2021). Data Work and Decision Making in Emergency Medical Services: A Distributed Cognition Perspective. Proceedings of the ACM on Human-Computer Interaction, 5(CSCW2). https://doi.org/10.1145/3479500

Zhang, Z., Sarcevic, A., Joy, K., Ozkaynak, M., & Adelgais, K. (2021). User Needs and Challenges in Information Sharing between Pre-Hospital and Hospital Emergency Care Providers. AMIA ... Annual Symposium Proceedings. AMIA Symposium, 2021, 1254–1263.