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RESEARCH ARTICLE

Transforming Dead Knowledge into Living Help: Balancing Hope, User-Ambivalence, and Expertise in Fire Safety Digitization

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Abstract

Many industries worldwide are digitizing professionals' expertise to boost productivity, enhance collaboration, and improve knowledge sharing. The current spread of increasingly capable AI technologies has accelerated this transformation further. But such changes are not without challenges. This research article explores the challenges of digitization in fire safety based on ethnographic fieldwork at the Danish Institute of Fire and Security Technology (DBI). The case focuses on fire safety professionals who must relinquish expertise early in digitalization processes, and traces some of the tensions between the imperative of user involvement in digitalization vis-à-vis the need for expertise and caution in fire safety. I argue that digitization first "transforms" (Knox et al. 2007) and later "informates" (Zuboff 1988) expertise, posing the risk of destabilizing industry hierarchies and reshaping how fire safety professionals perceive expertise and responsibility. This anticipated disruption fosters a user-ambivalence among the professionals, ultimately leading to project stagnation and unrealized promises.

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Digitization, Expertise, Professionals, User-ambivalence, Organizational ethnography.

Clashing Ideals in Digitization: Balancing User Involvement and User Exclusion

In late 2022, the software company OpenAI launched its large language model and chatbot, ChatGPT, which quickly caused a boom in astonishingly intelligent and generative digital technologies while also creating shock waves across entire industries and business fields (Witte 2023). In the blink of an eye, computers and devices could generate, curate, and share text, conversations, and creative content, which had previously been considered an exclusively human capability. The reactions to the sudden availability of powerful artificial intelligence (AI) tools were a mix of fear and joy, not least among professionals who argued that AI would either come to take jobs or radically boost job performance (Cox 2023; Brower 2023; Retkowsky, Hafermalz, and Huysman 2024). The recent development in how digital technologies and AI transform work and workplaces appear as the latest chapter in a longstanding preoccupation across industries worldwide with how business performance is best coupled with the digitized ability to generate, share, and externalize knowledge successfully (Susskind and Susskind 2015).

The recent development of digital, generative technologies like Chat GPT, and the subsequent discussions, wonder, and worry that it has caused, has made me want to write this article, drawing on my PhD fieldwork and dissertation on digitization in a professional organization (Karsten 2021). I carried out longitudinal, anthropological fieldwork at the Danish Institute of Fire and Security Technology (hereafter referred to as DBI), where I traced digitization of fire safety expertise and investigated how knowledge-intensive organizations practice digitization. Ethnographic studies highlight the importance of considering intra-organizational negotiations, complex organizational contexts, and professionals' practices when developing and implementing digital technologies (for instance, Baba 1999; Orlikowski 2007; Pors 2018; Jørgensen, Gad, and Winthereik 2023). In line with such studies, I argued that professional expertise is influenced by and changes during digitization, and that organizational and professional notions of what constitutes such expertise and how it is practiced also affects digitization (Karsten 2021). Now, one might think that an ethnographic case of digitizing fire safety represents a niche case, but I see very similar discussions unfolding now, as I did then among the professionals I followed. The concerns were – and still are – centered around expertise;

to what extent such expertise is destroyed, replaced, enhanced, or entirely reinvented by digital technologies, and what may happen when particular forms of expertise are digitally exported to non-expert end-users.

In any case, digitization and the creation of increasingly intelligent machines present contemporary organizations with the possibility to transform and move knowledge across contexts and, importantly, with the prospect of high value generation (Brynjolfsson and McAfee 2016: 57-70). But doing digitization also presents organizations and professionals with the challenges of what kinds of knowledge and data to *include* and *exclude* in the creation of digital technologies (Gregg 2015). Drawing on anthropological fieldwork among fire safety professionals at DBI, this article explores how professionals deal with such questions of inclusion and exclusion of knowledge and expertise – and users – as part of strategic, organizational digitization efforts. However, despite the seeming focus on end-users, this ethnographic case is not a typical one about *digitalization*; that is, how technology transforms the everyday or working lives of a given group of end-users in the "receiving end" of a digital transformation (for instance, Pors 2015; Vikkelsø 2005; Suchman 1995; Cefkin, Thomas, and Blomberg 2007). It is neither about the "messengers" in *digitization* – that is, the software developers and their coding practices – or the cultural rationales unfolding in programming (for instance, Akrich 1992; Otto, Salka, and Blok 2023; Jørgensen, Gad, and Winthereik 2023). Rather, this article seeks to contribute with an ethnographic record about those I call "first-senders" (as opposed to the term "end-users"); that is, people who must let go of something in the very beginning of digitization. The first-senders are professionals, who are in a love-hate relationship with digitization. On one hand, they wish to tap into the potentials of digitization and digitalization, yet, at the same time, they find it unsettling and unsafe to encode parts of their expertise into digital tools. The aim of this article is to show what happens among first-sender professionals involved in cutting loose and letting go of some of their expertise for digitization to succeed. With this focus, I wish to consider some of the difficult choices they are faced with in driving digitization. For instance, what do you do in digitization when you find that the ethos of software development prescribes user involvement (cf., for instance, Drazin 2012), while the entire ethos of the expertise you hold prescribes caution and some degree of exclusion, because so much can go wrong (with potentially deadly outcomes in a very literal sense) if something is misunderstood, miscalculated, or misused?

In what follows, I engage with such ambivalences from different ethnographic vantage points. Starting from a broad perspective, I shall present the organizational context of DBI and an industrial view on the hopes and aspirations about the effects of digitization. This empirical context is important to keep in mind as the article delves deeper into the

empirical layers, particularly by way of describing two different meeting situations at DBI, each speaking directly to the effects of digitization. By presenting this empirical "stretch" from macro to micro, I seek to show how the hopes envisioned at an organizational and industrial level face challenges in materializing among the first-sender professionals in the digitization team. While they strive to succeed with the project goals and organizational strategies of digitization, the team simultaneously struggle with the implications of the digitization they are pushing for.

By combining various empirical layers, I argue the following about digitization in organizational and professional settings. First, digitization carried out in knowledge-intensive organizations entails a challenging dilemma and tension between user involvement (to create the best solutions) and user exclusion (to create the safest solution). Second, digitization in such settings may lead to a reshuffling and possibly destabilization of established knowledge hierarchies, which carries an uncomfortable risk of making the very people carrying out such digitization redundant over time. Thus, the ethnographic case of fire safety digitization demonstrates that, for digital transformations to succeed in a given organization or industry, much hinges on our ability to understand the organizations executing such digitization and to empathize with the professions who have to act as first-senders in such processes.

Ethnographic Engagements and Research Design

This article draws on empirical material from anthropological fieldwork carried out from April 2017 to January 2019 at DBI and among clients and collaborators. I conducted the fieldwork as part of my doctoral thesis focusing on how DBI digitized expertise and knowledge in the Danish architecture, engineering, and construction (AEC) industry (Karsten 2021). As an industrial PhD student supported by the Innovation Fund Denmark, I was employed by DBI, and, as such, my interlocutors were also my colleagues, meaning that I was always both an outsider (as a researcher) and an insider (as a colleague) (Järventie-Thesleff et al. 2016; Hepsø 2013). I draw on conceptualizations from George E. Marcus (2009, 2000) in arguing that fieldwork took shape as a collaborative and complicit endeavor across multiple sites and within contested spaces with colleagues. My colleagues were more than just interlocutors, as they engaged in my research as collaborative, intellectual counterparts who also brought their own critical sensibilities into the projects I traced (Marcus 2001: 524), resulting in a shared endeavor among us where we tried to understand the processes of digitization within DBI and beyond.

Consequently, I co-produced the digital products which were also the "things" I studied and traced (Marcus 1995). My working alliances and collaborations with colleagues formed a prerequisite for fieldwork

and data collection (Jöhncke 2018; Lassiter 2005). It unfolded in multiple ways: I conducted focus group interviews and smaller usability tests of the products, which were to be used in the further development of them. I helped plan and execute internal events on digitalization to spur interest in the topic and support internal capability building. I shared draft versions of manuscripts later to be published as part of my dissertation, bounced ideas with colleagues about analytical insights, and received suggestions for reading this or that article about topics which they thought I might find interesting in relation to my research.

I also traced digitization across multiple sites and among multiple people across various phases from planning, programming, budgeting, and testing, to strategizing, marketing and external engagement, and user testing. I conducted 40 semi-structured interviews with colleagues and collaborators both within and outside DBI on the topic of digitization and digitalization in the AEC industry. I carried out participant observation at DBI and at sites where my colleagues were involved in digitization and digitalization efforts: at countless project meetings, at activities such as team building, hackathons, or social gatherings focusing on digital technologies, at global business expos on digitization, and during "*office days*," where I would have informal talks with colleagues by the coffee machine or work on a paper and write emails at my desk next to my colleagues who would be doing smoke simulations or writing fire safety strategies on their computers.

In the following, we turn to the ethnographic case. I begin with a description of DBI as an organization, including what it entails to be a fire safety professional, before I zoom in on how those organizational and professional features frame and shape digitization.

Organizing and Practicing Fire Safety: Saving Lives and Assets for More Than a Decade

DBI is a 100-year-old knowledge-intensive company offering consultancy, research, and technological services to public and private companies, institutions, and authorities within the fields of fire safety and security. Its stated purpose is to help save lives and assets, more recently by supporting the green transition through ensuring fast yet safe technology deployment. DBI is also a GTS-institute (in Danish, *Godkendt Teknologisk Service*, which translates into Approved Technological Service) approved by the Danish Ministry of Higher Education, which means that it must remain an independent, not-for-profit organization impartial of any business or political interest (GTS 2025). DBI's nearly 400 employees craft, draft, produce, disseminate, and sell information, knowledge, and expertise about fire safety and security. They work with teaching and training; fire testing of all kinds of products ranging from building materials to batteries; product certification of, for instance, building

materials; accredited inspections of fire installations and fire detection systems; fire investigations of fire origins; security and resilience consulting and fire safety consulting. Across these areas, numerous research and development activities take place, including the digitization projects I traced during fieldwork.

Many of DBI's employees take great pride in their work and find it very meaningful in a societal perspective. Fire safety, I was reminded again and again, is tricky, important, and critical to ensure. For the fire safety professionals at DBI, it presents a mixed discipline of planning for and mitigating risks, while also ensuring that it works as seamless and smooth as possible and links effortlessly with the overall infrastructures. Like infrastructures (Bowker and Star 1999), fire safety demands constant, close, and continuous collaboration and negotiation between the involved parties, as well as coordination between, for instance, consultants, construction workers, fire brigades, authorities, and facility managers across the construction industry. As I joined their project meetings and client visits, I experienced how the fire safety professionals spend a great amount of time during such meetings and collaborations on framing their knowledge in a particular way through dialogue with their clients and collaborators (Karsten 2020a). In such dialogue, they explain regulations, align opinions in project teams, and negotiate safety and risk assessments – not only among colleagues, but also between collaborators such as the emergency services and clients. They work according to the regulatory requirements and guidelines on fire defined by the Danish Building Code from 2018, referred to as "*BR18*" among the professionals.

Practicing fire safety is, thus, about translating and applying the rules and guidelines from BR18, making the right calculations and shaping it all into safe designs via assessments, interpretations, and past experiences. Fire safety expertise builds on embodied accumulations. My colleagues taught me that the more you have experienced, seen, and tried, the more you know about when to follow the rules and when to deviate from them to accommodate needs and wishes from, for instance, architects, fire brigades, authorities, and building owners. Here, context is of key importance, because a given context of a building or a design determines what the fire safety professionals will chose to include or exclude in their risk assessment. Each context may be constructed slightly differently, but still in alignment with a shared opinion among the fire safety colleagues, continuously negotiated and established through discussions, negotiations, and exchange of perspectives. Consequently, a belief exists among the fire safety professionals and more generally at DBI that fire risk assessments and the construction of the corresponding, proper contexts should only be carried out by trained, knowledgeable experts. To them, fire safety is a matter of life and death, and they do not take their responsibility lightly.

Such belief unfolds in an organization with a century long history of working closely with key stakeholders in sustaining foundational fire safety standards. To this day, DBI still has close ties and collaborations with, for instance, authorities and insurance companies on setting these safety standards. Indeed, some insurance companies will not provide insurance to their clients if they do not adhere to DBI's guidelines. DBI has for the past several years focused increasingly on boosting satisfaction among clients and collaborators and on increasing transparency of their knowledge and expertise. In this endeavor, digitization and digitalization became crucial.

Moving Towards More Digitized Fire Safety Practices to Help Non-Expert Users

When I started fieldwork at DBI in 2017, the organization had just begun its more strategic efforts with digitizing fire safety knowledge in various ways. The innovation officers and managers, project managers, and research consultants had developed ideas of digitalized fire safety solutions intended to help fire safety non-experts, such as architects or building technicians, in their decision-making process during building design phases. I learned that the hope among this group of employees and the envisioned goal was to bring fire safety knowledge closer to those really needing it to help avoid too many design flaws, construction delays, and ultimately catastrophic fires.

DBI's strategic focus on tapping into the digital transformation to help make fire safety more accessible, understandable, and applicable for fire safety non-experts aligns with more widely held notions in the global fire safety industry that access to more knowledge among non-experts via digital tools can reduce "human factors" and flaws and, thus, mitigate mistakes, hazards, accidents, and budget overruns (Corrigan et al. 2018; Smith and Tardif 2009). For more than a decade, computer-assisted drawing programs (such as Revit) and computer-integrated constructions of multi-dimensional models (referred to as BIM-models; that is, Building Information Modelling) have been seen as key to improve collaboration, coordination, and communication in the AEC industry (Smith and Tardif 2009: 27; Turk 2016: 275). The focus on the perceived benefits of increased digitalization and widespread use of algorithms and generative design solutions reflect the AEC industry's predominant preoccupation with overcoming problems such as low productivity and delays (Hardin and McCool 2015), poor communication and collaboration across organizations (Sacks et al. 2018), and budget overruns (Georg and Tryggestad 2009). Similarly, in other industries such as health, law, and education, technological ubiquity and deployment of increasingly intelligent machines promise to increase efficiency and accuracy, boost innovation, create more controlled and frictionless operations, speed up

work processes, reduce administrative tasks, and hinder human errors and misunderstandings (Susskind and Susskind 2015; Kinder-Kurlanda and Boos 2017: 198).

Despite the great ideas and good intentions of the innovation officers and managers, the fire safety professionals working on a daily basis with these topics were not very involved in the hatching of the digitization ideas. They were brought into the project loop at later stages, when the money for the projects had been granted, and the projects were running on full speed. Two of the fire safety professionals who joined the project team around the same time as I did were Erik and Petra, who had worked at DBI for several years and had quite extensive experience in fire safety. Their skepticism and concern as fire safety professionals was quite palpable to the rest of the project team, consisting of a mix of two external software developers, a seasoned innovation manager named Hans, the project manager Sofie, and myself. Erik and Petra questioned what the consequences of distributing fire safety knowledge widely would be without the possibility to follow up with further explanations. What unforeseen mistakes and miscalculations might arise? They worried that the digitization projects would initiate a form of "cannibalization," which would essentially "cut off the very branch they were sitting on." Yet, they also saw possibilities, promises, and potentials in the project, which might support their work and DBI's purpose. A key motivation for them and their fellow colleagues was the possibility in converting what they called "dead knowledge" in 2D-drawings or long text documents in PDF-formats, which are rarely possible to interact with or adjust, into what they dubbed "living knowledge" in more interactive 3D-models or in tools allowing more direct engagement with the content. Erik, Petra, and Hans all believed that by creating "living knowledge" through digitalization, fire safety knowledge could be made more accessible and, thus, understood, applied, and used more widely among non-experts like architects, building technicians, or authorities in need of accessing and applying such knowledge. This would, in their opinion, result in better services, safer designs, and help boost learning and knowledge sharing about fire safety within any team or company using these digital tools.

Two concrete projects were developed as part of the overall effort. One project focused on trying to transform the fire safety chapters in BR18 into a tool named *Lookup* (see Image 1). The tool was intended to work as an interactive rule book and knowledge sharing platform among collaborators, who could make notes, add bookmarks, and compile custom-made checklists and specification lists containing the relevant sections of BR18 needed for a given building case. Erik and Petra knew most of the regulations and guidelines by heart, and their personal notes, scribbles, and bookmarks helped them navigate through the complex body of regulations, rules, and guidelines. However, their clients and collaborators often struggled to navigate the same rules and regulations,

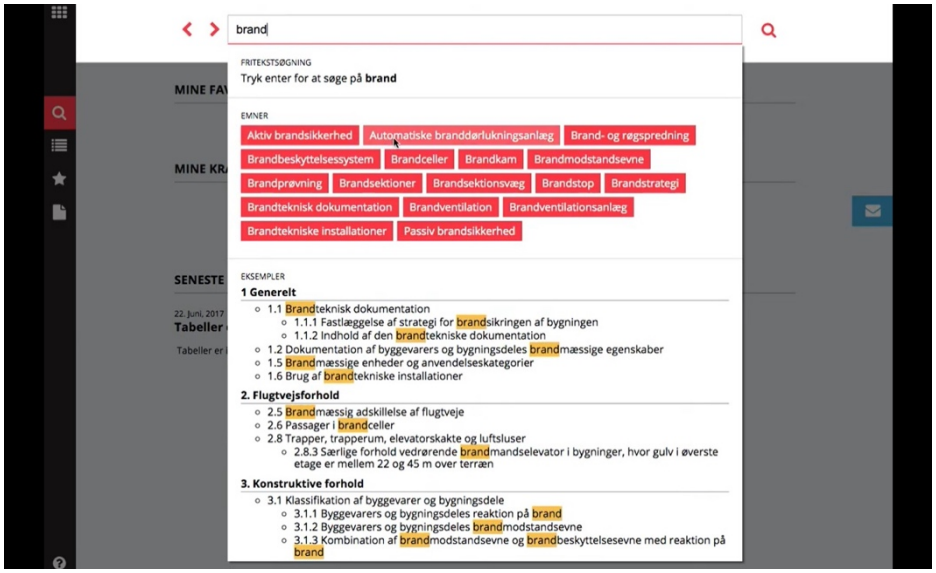

Image 1: The Lookup program. Screenshot by author. 2020.

let alone to interpret them and apply them correctly and with a satisfactory result in the design. Thus, to Petra and Erik, the *Lookup* tool seemed a perfect supporting tool to help alleviate these challenges faced by non-expert users.

The other digitization project was named *Plugin* (see Image 2). It concerned the development of a digital software that was to function as a plugin for computer-assisted drawing programs. *Plugin* was intended as a decision-support tool that would help, for instance, architects in assessing whether a given design would be sufficiently safe based on algorithmic assessments trained on input from BR18 and DBI guidelines. The end goal was to have a plugin for 3D-drawing programs like Revit, designed to assist fire safety non-experts such as architects and building technicians working in small or medium-sized enterprises with no in-house or limited access to a fire safety expert. The plugin would allow them to make basic risk assessments of their designs much earlier in the design process than was currently possible. In the development of the program, it was pivotal for Erik and Petra that the very advanced fire risk assessments would still be made by a fire safety professional and *not* a software program. Thus, the tool was initially developed only for more simple construction types.

The basic promise of digitization, which Hans, Sofie, Erik, and Petra, as well as and their colleagues at DBI, subscribed to, was that digital tools could relatively easily transform organizational practices and knowledge about fire safety into digital information bits that could be externalized and made into information. The information would travel to new, possibly very different, contexts as detached knowledge, removed from DBI and the originating context in which it was created. Such externalized information bits could then be readily grabbed by clients and collaborators, thus creating value in their own, respective projects. Digital systems were, thus, seen as a gateway to ensure that organizational

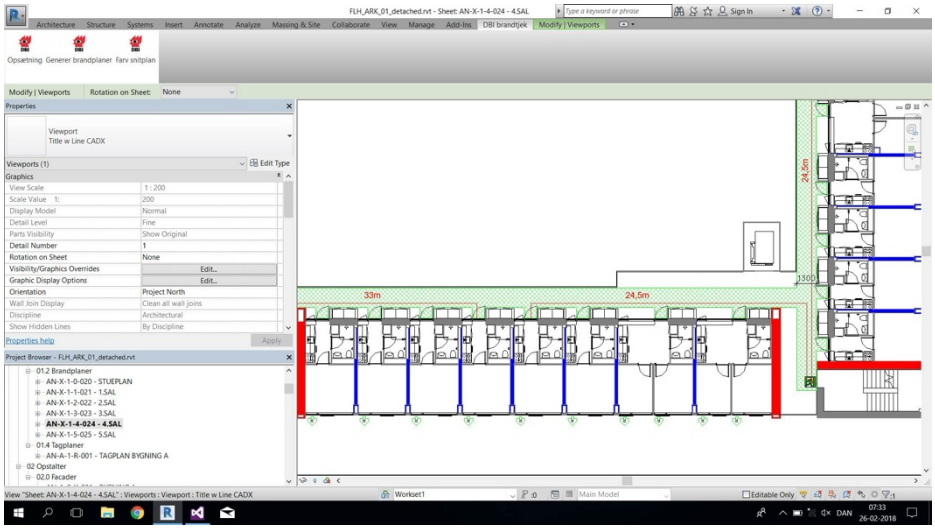

Image 2: The Plugin tool. Screenshot sent to author, taken by programmer in the team. 2018.

knowledge could be "captured" and owned as products (Adelstein 2007: 861-862), which could then be exported, shared, and purchased across the AEC industry in Denmark as means to establish joint practices for knowledge sharing across boundaries in and between organizations.

My colleagues in the digitization team explained to me that the *Lookup* and *Plugin* tools were key examples of the digitization they tried to succeed with in their work. The tools exemplified their aspirations and dreams of changing how fire safety knowledge could be brought closer to users who needed it the most. Deeming professional knowledge suitable for digitization in the first place – as DBI and the team did – rests on the cultural assumption that knowledge can be condensed and moved across distances for external commoditization and usage (Hepsø, Monteiro, and Rolland 2009). To understand such assumption about the transformative capacities of digitization, I turn to the idea of "transformation" proposed by anthropologist Hannah Knox and colleagues (2007).

In their studies on the development and implementation of digital enterprise resource planning (ERP) systems in corporations, Knox and colleagues show how information becomes re-synthesized and reorganized to produce managerial "knowledge," which can later be used to perform tasks and make strategic decisions about organizational paths and changes (Knox et al. 2007: 22). Their idea about how digitization transforms knowledge is based on the reasoning that "real world" phenomena become abstracted into data, which get turned into information. Information is then mobilized as knowledge that returns to transform the real world with the intention of creating value of some sort; for instance, generating profit (Knox et al. 2007: 27). Knox and colleagues' idea of transformation highlights what digitization does, and, importantly, what it promises to deliver in organizations such as DBI; that is, assisting in compressing a phenomenon like fire safety into a digital, abstract

format. This promise rests on the assumption that information from, for instance, BR18 and related guidelines can be transformed into bits of digital information, which can then be transformed into knowledge via different features in digital tools like *Lookup* and *Plugin*. The returned value of such transformation would be improved levels of knowledge and timely knowledge sharing about fire safety, ultimately generating value for end-users in terms of, for instance, adherence to budgets and ensuring sufficient safety levels for buildings.

However, despite the hopes and intentions behind digitization, the team continued to face recurrent challenges. One of these was the difficulty of striking a productive balance between clashing ideals of user involvement and user exclusion, while another challenge was a creeping discomfort about the potential reshuffling of professional hierarchies due to this digitization.

Driving Digital Transformations with Constraints and Restrictions

One year into the fieldwork, I attended a meeting on a crisp December morning at the DBI headquarters in the Greater Copenhagen Area. The meeting signaled a critical milestone in the digitization projects, because it was one of the semi-annual reference group meetings with our external expert group. The meeting was led by Sofie and Erik, and Hans and Petra were there as well. The reference group consisted of five members who represented main Danish architecture companies. All the reference group members had extensive experience with working in computer-assisted drawing programs such as Revit and AutoCAD, but none of them were experts on fire safety matters. So far, the group had discussed *Plugin* and its progression, and now they turned to focus on the status for the development of the *Lookup* program. Erik explained the overall purpose of *Lookup* to the group:

> Instead of having the entire guideline in a dead pdf as a kind of publication, we've put it into this html-format and made the content searchable. You can add notes to the text, and what's most important is that you can share knowledge internally at your workplace or organization. You can knowledge share your notes and your "List of Demands" for different buildings with colleagues and collaborators. In that way, you can use the tool to build knowledge exchange and knowledge sharing.

The group members listened to Erik as he spoke and restated the overall purpose and intended value-creation of the digital tools. They nodded in agreement. Issues such as knowledge sharing, collaboration, and remembering which parts of the regulations must be applied were major concerns previously raised by the members of the group. Peter, a senior architect from a leading Danish architecture company, now asked with hope in his voice: "Will there be links to DBI's recommendations and

assessments? Whenever we call you, you say that 'You have to check in appendix this or that'. It would be *a lot* easier, if you just linked directly to that in the tool!" Erik nodded and replied:

> That could be one way to do it. We're nowhere near that stage yet. Right now, *Lookup* is a platform, and we're trying to figure out if this could be a way for you to work with fire safety. And it is indeed possible that we'll have a full library where you can check whichever information, guideline, or regulation you want.

Morten, who sat across from Peter, also worked in another leading design company where he oversaw their internal digitization efforts. He nodded and echoed Peter's concern:

> Well okay, that's all very cool. But that still does not solve our problem. Sometimes those regulations and guidelines are just too abstract and disconnected, because what does the text actually mean? What precautions must be made more specifically? What must be done in terms of design and structural aspects? That's why we use your examples and guidelines so much. We need things to be contextualized and explained further. The regulations and even the guidelines on how to understand those regulations are too vague! We can make nothing out of it, and then we'll have no benefit of a tool like this! We need someone who can interpret all the bullshit for us. We need explanations and help with understanding the implications!

Erik replied attentively and chose his words carefully: "That could be one way of doing it… Definitely… But that's not what's most important for us. What we're asking about now is what features you'd like, and…."

A third external participant, Søren, seemed annoyed by Erik's reply and the prospect of using a tool that would present fire safety regulations without accompanying, integrated help. Søren came from a small architect company with no immediate in-house subject matter expert on fire safety, and he had been a keen supporter of the project from the beginning. He interrupted Erik during his explanation and asked in disdain:

> So, wait, there will be no premade checklists or "lists of demands" that will help me or enable me to say: "Okay, show me everything on housing, show me everything on hotels?" Lists where DBI indicates which paragraphs, pieces of regulations, or other stuff to include or consider in relation to a given building?

Sofie looked frantically at her colleagues, then her notes, then back at her colleagues, and said feebly: "Uhm, no...?" Søren scowled and replied, clearly taken aback by Sofie's reply: "So, what… you want us to search for all of this information ourselves anyway?" Petra came to Sofie's rescue and argued:

> It could be something that would be added over time! Maybe you have some fire safety experts at your company who can make those specification lists, and these lists will be the baseline for how you assess fire safety in buildings in your company or your project team. You would be able to access documents in which your in-house fire safety experts have added their comments, assessments, and previous experiences in relation to a piece of regulation. And since those checklists are made digitally, they can follow a construction project throughout the building process and across your company. But DBI will not make any predefined, ready-to-use specification lists.

Søren maintained his disbelief:

> Because!? It would be worth its weight in gold to be able to retrieve the top five – or how many it is that you have? – categories that you see people are looking for and then make them available for us in that tool...!

Erik replied:

> This is not very different from when you query in a pdf-document. We all know how to do that, and the program highlights the words you searched for. But the feature with the specification list is our way of suggesting how organizations can share more knowledge internally and make it accessible to all in the organization. We have no ambition to be the arbiter of taste and tell you what is right and what is wrong. But we do wish to support knowledge exchange about fire. And it's always tricky to teach old dogs new tricks. You and your colleagues will have to change and start doing things differently.

Listening to Erik's explanation, my thoughts drifted to an internal department meeting a few weeks before the current reference group meeting, where the *Lookup* and *Plugin* tools had been discussed among the fire safety professionals. Here, Erik had stressed the value of more widely accessible fire safety knowledge and of improved knowledge sharing, both within DBI and among external fire safety non-experts. A colleague had looked deeply troubled and asked:

> Wait, does that mean that others will be able to see what we write and read our comments and memos in the handbook text? I mean, those outside: our clients? Because what I write, my memos, my notes in those texts, they're only for internal use. I write very specific stuff in those notes, stuff that only I understand, and not general stuff!

Erik promised reassuringly that knowledge sharing would be for internal use only within their department or within project teams, and that their

clients would have to create their own knowledge sharing spaces within the program.

Back at the reference group meeting, the discussion kept going about the features of the digital tools. The architects asked repeatedly for features in the *Lookup* tool that would, in their opinion, improve and enhance their ability to better navigate, understand, and apply BR18 and its guidelines. Erik and Petra kept avoiding the requests voiced by Søren, Morten, and Peter, who represented one of the core user groups which DBI sought to develop digital tools for. To Erik, Petra, and their fire safety colleagues, their contextualized interpretations and applications of rules should *not* be disentangled from the specific context by means of, for instance, pre-made specification lists or case-specific checklists that anyone outside DBI could use in entirely different contexts for entirely different purposes. A mantra among them was that "each construction is an entirety that we assess in the given context in the given situation." Petra explained to me one afternoon, as we got ourselves a coffee in one of the office common areas, that it would not be wise to simply release and give away solutions in the tool, because that would compromise their professional liability. Also, she feared that clients would be able to hold her and her colleagues responsible for the content generated in the program. For Petra, it was crucial to ensure that the potential end-users would not trust the tools too much and over-emphasize the solutions or suggestions provided by either *Lookup* or *Plugin*.

Six months after the reference group meeting, Sofie, the project team, and a few senior managers were still discussing what architects wanted the tools to be able to do, despite the clear wishes stated in sessions such as the reference group meeting. In a status meeting held with the sole purpose of deciding on the next strategic step for the two digital tools, Erik argued:

> I don't want to ask the users about the content of this program, because we can easily vouch for that. I want to focus on the added value that this program provides for them. It's no use to ask the users what they want, because we don't know yet what we can give them. And what will we do with all the stuff that we allow them to wish for if we ask them? We don't want free rein, because then we'll never reach our end goal. We're mainly dealing with the question of whether the features that we've put in the program are relevant for their work.

Hans was also at the status meeting. Like Erik and Petra, he had been involved in the development of the tools from quite some time. But unlike his colleagues, Hans did not have a background in fire safety, but in economics, and he had worked as an innovation manager in R&D for decades. This meant that his standpoint towards user involvement was

quite different from Erik and Petra's view. Hans very much wanted to engage with the users as soon as possible:

> I disagree with you, Erik. I think that the next step is to test among the users whether this way of thinking that we're putting forward and this kind of logic fit with their way of working. We might have our ideas as experts about what kind of knowledge they need, but that's not necessarily what is needed and gives value right now among the users.

It was agreed in the status meeting that more user research was needed to decide what the end-users wanted.

A few weeks later, Sofie dropped by my desk with an excited look on her face:

> I just came back from a visit to an architectural firm. I got to talk with their lead architect, and I told him about *Plugin* and *Lookup*, and he was absolutely thrilled about the idea and was practically shouting for what we're working on here. I think it's really great, really amazing, to see that the need for the tools is really there in the architectural firms. There is a real need among architects for this, which they have expressed, like this guy today, and we are responding to it!

Despite Sofie's excitement and engagement, the *Lookup* and *Plugin* projects were terminated a year later towards the end of the fieldwork due to a lack of internal conviction in project success.

What we have witnessed in the above, I suggest, is that, in their work on *Lookup* and *Plugin*, Sofie, Erik, Petra, and Hans focused on issues of *digitalization*, understood as processes where technologies must be implemented in organizations and adopted to end-users (Plesner and Husted 2020: 7). Their focus was exclusively on how to create digital products that would be absorbed by the end-users, and how the latter would need to change their working habits. In this way, Sofie and the team sought to involve users in various yet quite restricted ways to fulfil that purpose. However, I find that the ethnography of the two meetings shows that what challenged them in their endeavor was *not* issues of digitalization; that is, end-user adoption. Indeed, it did challenge them to the extent that the users were asking for product features that Erik and Petra were not ready to give them such as, for instance, curated lists and suggestions for interpretations. But the answer to why they were not willing to do so and to engage in such user involvement, but rather kept bouncing back to user exclusion, lies not in issues of digitalization, but in issues of *digitization*. Unlike digitalization, *digitization* refers to the processes of converting analogous knowledge into digital information by means of binary numbers and algorithms (Plesner and Husted 2020: 7).

In the last section of this article, I shall elaborate on this point. My argument is that, due to how digitization initially *transforms* (Knox et al. 2007) and subsequently *informates* (Zuboff 1988) data and fire safety knowledge, the process of digitization interferes with and destabilizes the fire safety professionals' understanding of what constitute fire safety expertise, and who should be charged with such grave responsibility. This reshuffling of expertise and of end-user responsibilities holds the key to understanding their user-ambivalence and their need to impose a certain level of user exclusion.

The Professional Concerns and Consequences of Transforming Expertise

Returning to Knox and colleagues (2007), their concept of transformation highlights how the constitution of professional expertise changes with the transformations that digitization causes (Knox et al. 2007: 27). This is key to understand the fire safety professionals' misgivings about digitization as well. The classic, traditional notions of expertise as knowledge gained through apprenticeship, trial experimentation, and practical experience and delivered through face-to-face, in-person interactions change with digitization, as expertise now denotes the mastery of large amounts of data and the ability to manipulate objectified abstractions (Knox et al. 2007: 36; Susskind and Susskind 2015: 33-34, 114-117). Professional expertise post-digitization is no longer mainly about how to produce, apply, and sell knowledge face-to-face; it is also – among many things – about how to gain the ability and authority to perform contested and contingent transformations (Knox et al. 2007: 37), and how to gain mastery of the data in their disciplines and establish new relationships with their machines (Susskind and Susskind 2015: 37). The introduction of digital tools like *Plugin* and *Lookup* not only threatens to dilute the fire risk assessments in ways that may have devastating consequences if the outputs generated by the tools are applied in wrong ways. The tools also signal a shift in how and whether the fire safety professionals at DBI can continue to claim excellent mastery of fire safety expertise in the industry, when such knowledge is suddenly changed.

To further understand such a shift and professional discomfort, it is useful to consider social psychologist Shoshana Zuboff's work. Decades before Knox' study, Zuboff (1988) explored the impact of information and communication technologies (ICT) on information, power, and authority among professionals. Zuboff found that, on the one hand, ICT "automates" work practices and knowledge held by employees in organizations, which ensures continuity and control over processes (1988: 8). But, at the same time, ICTs also "informates," which means that the technologies generate information about the practices, knowledge, and procedures it automates, and through which an organization accomplishes its work (1988: 9). Prior

to digitization and automation, such practices are oftentimes opaque in the organization, but, by means of *informating*, such knowledge is made visible (1988: 10). This means that information and knowledge on work practices are suddenly created, made visible, and rendered accessible not only to managers, but also to employees, who can now take more control over their work. Authority, in other words, is redefined and traditional hierarchies unravel (1988: 6, 400-401). Considering Zuboff's points with DBI in mind, we may also include clients, collaborators, and other non-expert end-users to whom the fire safety professionals' work and expertise are suddenly made visible and accessible by means of digitization. The nervous comment made by one of Erik and Petra's colleagues about who would be able to read their comments speaks directly to this shift. What makes Petra and Erik concerned about a possible "cannibalization" is also that, suddenly, everyone can become fire safety experts by means of digital tools due to how these informate their knowledge and expertise.

Following Knox and Zuboff, I thus argue that digitization and its inherent externalization of expertise entails the risk of destabilizing existing fire safety hierarchies in the Danish AEC industry. If everyone can suddenly navigate fire safety regulations effortlessly and apply interpretations more skillfully, where does that leave Petra, Erik, and DBI's expertise and historical industry position? Indeed, digitization reshuffles previously fixed distributions of authority and changes the parameters of what expertise looks like, which introduces new needs to skillfully master processes of transformation in new ways (Knox et al. 2007: 27). In the context of digitization, expertise is not only about how to produce and apply knowledge. It is also about how to gain new forms of expertise and authority in carrying out contested and contingent transformations (Knox et al. 2007: 37). DBI may have a century of expertise to draw on when it comes to fire safety "classic style", and they have for long been masters of fire safety contextualization. But, at the time of fieldwork, they were still novices when it came to mastery of digital transformations of fire safety. The transformations unfolding through the *Lookup* and *Plugin* projects present fundamentally different ways of working with and wielding knowledge by informating the fire safety professionals' expertise, which may be scrutinized by clients and collaborators, who must now re-legitimize such expertise through their use of the digital tools. Consequently, established professional hierarchies are destabilized due to digitization, which introduces new risks such as rendering core professions redundant. And then we are right back at the present-day discussions and concerns about the sweep of AI and its impact on jobs, professions, and organizations, which I introduced in the beginning of this article.

Conclusion

What does an ethnographic case of digitizing fire safety in Denmark have to do with digital transformations, the sweeping impacts of AI, and the reconfigurations of expertise and professions in organizations? Perhaps surprisingly, quite a lot. Building on ethnography spanning 20 months of anthropological fieldwork at the Danish Institute of Fire and Security Technology, this article has presented empirical excerpts and delved into the work of a group of fire safety professionals, who had to let go of bits of their expertise and knowledge as part of a digitization effort, if it was to succeed. This complicated relation entailed a range of challenges and fraught dilemmas among the fire safety professionals. On this basis, I argue that what makes digitization in knowledge-intensive organizations difficult is a significant tension between balancing the imperative of user involvement in digitalization with the imperative of expertise caution in fire safety (or other kinds of domain knowledge) and, consequently, the need for a certain degree of user exclusion. I further argue that, due to how digitization *transforms* knowledge and expertise and then *informates* such knowledge and expertise, it fundamentally risks interfering with the ways in which professionals understand expertise and responsibility. Such anticipated destabilization of professional hierarchies combined with the inherent user-ambivalence carry the risk of ultimately putting digitization efforts to a hold and resulting in unrealized promises.

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