Employee-driven Digital Innovation in Healthcare – A Scoping Review

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Abstract

The healthcare sector faces increasing pressure to improve efficiency, reduce costs, and enhance quality of care. In achieving these goals digital innovations are crucial, yet healthcare organizations struggle to fully benefit from them. Traditional innovation processes often fail to tap into frontline workers' knowledge and expertise. This study explores employee-driven digital innovation (EDDI) in healthcare, highlighting its potential for healthcare organizations to leverage frontline workers' valuable insights to initiate and successfully implement digital innovations. With our literature review, we provide an overview of current instances of EDDI in healthcare and related innovation outcomes. We offer insights into extant research foci, bridging related literature streams, and addressing a fragmented knowledge base. For healthcare practitioners we offer nine enablers of how to initiate digital innovations with the help of ordinary healthcare employees. Our discussion of the literature emphasizes the benefits of involving employees in digital innovations and offers directions for future research.

Keywords: Information Systems Innovation, Digital Innovation, Employee-Driven Digital Innovation, Healthcare, Literature Review

1. Introduction

The healthcare sector is under increasing pressure to improve its efficiency and reduce costs while at the same time ensuring and improving the quality of care. Toward that end, all across the healthcare sector, organizations seek to innovate their organizational structures, routines, and care services (Cohen et al., 2021). A critical step in creating and implementing sustainable innovations and thus supporting the future success of healthcare organizations has been the inclusion of digital technologies (Kelly & Young, 2017; Tumbarello et al., 2018); a phenomenon information systems (IS) research refers to as digital innovation. Yet, many healthcare organizations fail to initiate digital innovations and harvest their full potential. Only few have a sustainable strategy for digital innovation (Khuntia et al., 2021). In the U.S., 64% of healthcare providers rate themselves behind their digital health initiatives (Levin-Epstein, 2019).

Innovation processes (digital and non-digital) within healthcare organizations are typically characterized as being driven and developed by upper organizational levels and implemented by dedicated internal units (e.g., IT departments) (Cadeddu et al., 2023). This can result in disregarding frontline workers' (i.e., employees that are directly involved in providing healthcare services to patients) first-hand knowledge of internal processes and ultimately lead to healthcare organizations missing out on enormous opportunities for (digital) innovation (Kelly & Young, 2017). Research, for example, hints that including employees in the innovation process can improve the quality of healthcare service delivery (Mu et al., 2018) and ultimately contribute to increased patient satisfaction, reduced expenses, and increased organizational performance (Hong & Lee, 2018).

IS research has long been aware of the benefits of involving end users such as employees in digital innovation processes (Kohli & Melville, 2019). More recently, this has led to the emergence of a nascent IS research stream termed employee-driven digital innovation (EDDI). However, a recent review of that literature stream revealed that the healthcare sector is heavily underrepresented and only cursory mentioned within the EDDI literature (Opland et al., 2022). At the same time, the peculiarities of the healthcare sector as an innovation ecosystem (e.g., strong professional hierarchies and high levels of regulation) call into question the transfer of knowledge on EDDI from other domains to the healthcare sector. In the healthcare sector, research on digital innovations has primarily focused on innovation stakeholders other than employees (Cadeddu et al., 2023), while research on employee-driven innovation has paid only limited attention to the role of digital technologies in the (employee-driven) innovation process (Cadeddu et al., 2023). Literature that explicitly features EDDI in healthcare is scarce and spread across multiple related

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literature streams, leaving us with a scattered knowledgebase and open questions of transferability. With this work we aim to address this issue by focusing on how EDDI has been discussed at the intersection of healthcare and IS. Hence, we pose the research question: *What is the current state of research of employee-driven digital innovation in healthcare?*

To answer our RQ and to enhance our understanding of how EDDI can facilitate innovations in healthcare, we conduct a scoping literature review of 35 research articles concerned with EDDI in healthcare. Our results shed light onto EDDI processes in healthcare, including innovation outcomes, and how employees of healthcare organizations are commonly involved in what phases of the EDDI process. By deeply engaging with the pertinent literature, we also reveal extant research foci and synthesize enablers for EDDI in healthcare. Our work makes several contributions to research and practice. We synthesize literature on EDDI in healthcare and integrate findings on enabling EDDI in healthcare. Thereby, we bridge the gap between several related literature streams. and outline directions for future research that provide researchers interested in investigating EDDI in general and in healthcare in particular with promising starting points for further research on the topic. Overall, we aim to address open questions of transferability from EDDI in other domains to the healthcare sector. For research we contribute an overview of current instances of EDDI in healthcare and derive research gaps that warrant further attention. For healthcare practitioners we provide nine enablers of how to initiate digital innovations with the help of ordinary healthcare employees.

2. Background

Literature on EDDI in healthcare is scarce and scattered across research stream. To comprehensively describe the EDDI in healthcare landscape, we situate our study in the nexus of three research streams on (1) digital innovation in healthcare, (2) employee-driven digital innovation and (3) employee-driven innovation in healthcare (see Figure 1).

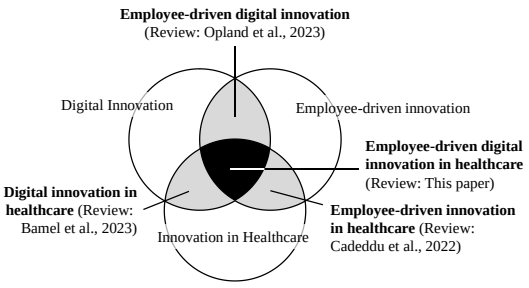

Figure 1: Position of our study in the literature

2.1 Digital Innovation in Healthcare

First, our paper relates to literature on digital innovation in healthcare. Given growing pressure to improve efficiency, reduce costs, and enhance care quality, healthcare organizations are striving to innovate their structures, routines, and services (Cohen et al., 2021). Innovation in healthcare generally aims to achieve four goals coined the *Quadruple Aim*: Enhancing patient experience, improving population health, reducing costs, and improving work life of healthcare providers (Olayiwola & Rastetter, 2021). By enabling novel outcomes and improved organizational performance, digital innovations, provide a ready platform to support the quadruple aim (Bamel et al., 2023). The healthcare sector offers a broad scope for implementing digital innovations to transform activities from patient consultation to diagnostic procedures to knowledge sharing (Cobianchi et al., 2020). Research has extensively investigated enablers of digital innovation in healthcare such as leadership or reorganization of work processes (Bamel et al., 2023). Regarding employees, enablers such as "employee involvement" (White, 2009) or "staff competencies" are also discussed (Bamel et al., 2023), yet rarely are at the focus of studies. Often employees' view in transforming healthcare services is overlooked (Guse et al., 2022). Research on digital innovation in healthcare mostly focuses on innovation stakeholders other than employees (e.g., upper management; Bamel et al., 2023), often resulting in innovation processes that reflect a "compliancy-driven approach" and are demanding for employees (Cadeddu et al., 2023). Therefore, this research has not reaped the potential of employee-driven innovation.

2.2 Employee-Driven Digital Innovation

The second research stream our paper relates to is that of employee-driven digital innovation (EDDI). Generally, EDDI refers to the involvement of ordinary employees in the innovation process to generate, develop, and implement new digital products, services or processes. A core tenet of EDDI is that for the involved employees, innovating is not part of their core job function (e.g., compared to employees in R&D departments or dedicated innovation labs) (Opland et al., 2022). EDDI can be initiated in three ways (Cadeddu et al., 2023; Høyrup, 2012). First, it can be a *top-down* decision by management to start an innovation project, where employees are instructed to participate and provided with resources to develop and implement the innovation. Second, it can be *hybrid*, meaning that the innovation process is initiated by employees but early formalized and supported with resources by upper

management. Third, EDDI can emerge *bottom-up* from employees in a spontaneous way to solve inefficiencies in their current work (e.g., creating workarounds).

Employees can be involved in different steps of an EDDI journey. To conceptualize the EDDI process steps, we adopt the theoretical framework by Opland et al. (2022), a digital innovation framework that is adjusted to focus on employees' roles in the innovation process and how digital tools can support employees in the innovation process. The framework (see Figure 2) proposes five phases that interact with the internal organizational environment (e.g., culture) and the external competitive environment (e.g., consumer market): (1) *Generation and Mobilization*, which encompasses the creation of new ideas and the process of gathering support for them within the organization; (2) *Advocacy and Screening*, which involves making a case for the idea and assessing its feasibility and potential impact; (3) *Experimentation*, where the idea is tested through pilot projects or prototypes to learn how the idea might work in practice; (4) *Commercialization*, where a plan is developed to bring the idea to market or implement it in the organization; (5) *Diffusion and Implementation*, where the idea is broadly implemented across the organization and further refined based on feedback and experience from the initial implementation. In reality these five steps do not have to appear in sequential order, nor do all innovation processes involve all steps (Opland et al., 2022).

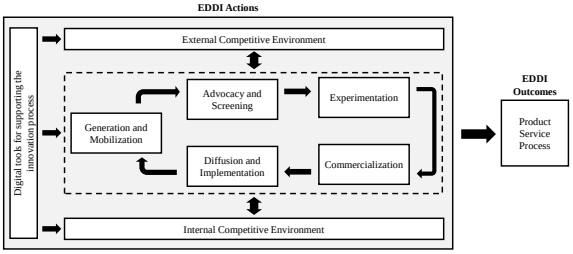

Figure 2. Theoretical framework of EDDI from Opland et al., 2022

In a recent review, Opland et al. (2022) synthesized the landscape of research on EDDI. Out of the 58 studies they investigated, only one study explicitly focuses on EDDI in healthcare (Lahtinen et al., 2017), suggesting that little research has been done on EDDI in healthcare specifically. Moreover, it is questionable whether existing findings on EDDI can be transferred easily to the healthcare sector. While most EDDI processes originate in private organizations (Opland et al., 2022), the healthcare sector is shaped by public organizations (Bysted & Hansen, 2015). Furthermore, the healthcare sector as an innovation ecosystem has some unique characteristics such as a "strongly hierarchical nature" combined with "tradition-based, implicitly and explicitly accepted strong professional hierarchies that cannot be overridden." (Pikkarainen et al., 2017, p. 5). These reasons inhibit the easy transfer of knowledge on EDDI from other domains to the healthcare sector.

2.3 Employee-Driven Innovation in Healthcare

Lastly, our paper relates to research on employee-driven innovation in healthcare. In healthcare organizations, employees such as doctors play a crucial role in driving innovation (e.g., through the development of new treatments and devices) (Thune & Mina, 2016). Being the ones that regularly interact directly with patients, employees have a unique perspective and understanding of the challenges and needs within their healthcare organization, making them valuable sources of ideas and solutions (Cadeddu et al., 2023). Compared to (upper) management or patients, employees gain direct insights into all facets of the care process. They can identify areas for improvement and develop innovative solutions to enhance the efficiency, accuracy, and quality of healthcare delivery (Hong & Lee, 2018). Due to these benefits, research recognizes the importance of involving employees in innovation processes in healthcare. Accordingly, employees have been included in creating innovations ranging from simple process improvements to more complex technological advancements (Cadeddu et al., 2023). However, most of these created innovations have not been digital products. Digital products differ from non-digital innovation products in that they are per se often more easily influenced by employees (Opland et al., 2022), yet their creation may require specific "digital skills" (Pikkarainen et al., 2017). Moreover, especially IT in healthcare organizations is often highly regulated. While research on employee-driven innovation in healthcare accounts for the central position of healthcare employees in the innovation process, this research does not account for the unique nature of digital innovation.

Each of the three literature streams related to our study provides possibly valuable insights into EDDI in healthcare; yet each stream also neglects specific factors that may inhibit transferability of knowledge. By positioning our study in the nexus of research on digital innovation, employee-driven innovation and innovation in healthcare, we draw on facets of each of these streams to ultimately provide a comprehensive description of the EDDI in healthcare landscape and discuss transferability of research.

3. Literature Review Approach

3.1 Data Collection

We conducted a scoping literature review (Paré, 2015). In our review we followed the PRISMA

guidelines (Page et al., 2021). Figure 3 shows our literature review process. On January 22nd, 2024, we searched six major scientific databases that included journals from innovation, medical informatics, and IS research to ensure we capture all relevant literature. For the search string we selected key words based on main concepts in the EDDI literature and the healthcare context. We did not limit the year to ensure we also capture early instances of EDDI.

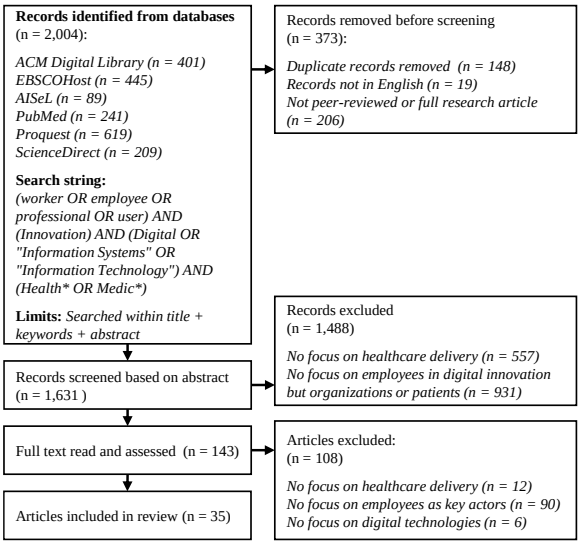

Figure 3: Literature review process

During abstract screening we used two predefined exclusion criteria as outlined in Figure 3. For the full text assessment, two authors independently screened all full texts and assessed their relevance based on each article's focus on healthcare delivery, to what degree employees were included as key actors in the phases of the EDDI process (Opland et al., 2022), and the focus on digital technologies. We collated the assessments in the whole author team, discussed and resolved discrepancies, and kept 35 papers for analysis.

3.2 Data Analysis

To analyze the relevant literature, we conducted a manual concept-centric data analysis approach informed by Webster & Watson (2002). Besides metadata on each study (e.g., medical domain), our analysis focused on gaining a deeper understanding of the described EDDI processes. We first investigated basic characteristics of each described EDDI process, including the type of relevant healthcare organization, geographical region, duration of the EDDI project, and what kind of digital tools were applied to support the EDDI process. Next, we investigated what kind of and how many employees were included in the EDDI process. Furthermore, we investigated the sources of the EDDI processes (i.e., bottom-up, top-down or hybrid) (Cadeddu et al., 2023).

After gaining a basic understanding of the EDDI processes, we sought to delve deeper into specific characteristics. Thus, we coded several information deductively, based on established perspectives and frameworks on employee-driven innovation in healthcare (Cadeddu et al., 2023) and EDDI (Opland et al., 2022). Specifically, we investigated each article's innovation outcome (e.g., product, process, service) (Cadeddu et al., 2023), as well as which of the objectives from the Quadruple Aims each article addresses (Olayiwola & Rastetter, 2021). Furthermore, to identify the areas in which EDDI is the most active in healthcare IS, we situated each study in one of the five EDDI phases (Opland et al., 2022). Next, we coded for the four approaches to the EDDI process as suggested in literature (Cadeddu et al., 2023): (1) Participatory approaches, which aim at providing employees with an opportunity to discuss ideas for innovation; (2) Design tools such as design thinking or user-centered design to provide a structure for the ideation and design process; (3) Competition-based approaches such as innovation hackathons; (4) Quality improvement methods such as the Plan Do Act Study cycle to structure the innovation process.

We finished our data analysis with an open coding of two important aspects: The perspective from which the innovation process is discussed (e.g., management strategies) and implications for EDDI in healthcare. Based on our combined open and deductive coding of relevant concepts, we compiled the contents of our concept matrix into frequency tables, which form the first part of our results. Regarding the open coding of EDDI perspectives and main implications for EDDI in healthcare, we collated all identified codes, iteratively refined them within the author team to synthesize them into six main research foci of EDDI in healthcare and nine applications areas for EDDI that relate to the internal organizational environment.

4. Results

4.1 Types of Studies & EDDI Context

An overview of the studies *methodological approaches* is presented in Figure 4 (a). Regarding the *medical domains* of our studies, most studies either do not focus on a specific domain (n=3) or conducted EDDI projects across multiple medical domains and treatment processes (n=30). Some studies delved into specific medical domains such as infectiology (Day et al., 2023).

The different *geographical regions* of the described EDDI processes are shown in Figure 4 (b). Two studies did not focus on a specific region (Garmann-Johnsen et

al., 2018; Norman et al., 2010). Regarding the pertinent *healthcare organizations* Figure 4 (c) shows that most studies were situated in public (n=16) or private hospitals (n=6), with some studies featuring specialized organizations or multiple providers. The *duration of the EDDI processes* varied greatly. Durations of the featured EDDI processes ranged from two days (Day et al., 2023) all the way to 19 years (Essén & Lindblad, 2013). Regarding the number of involved stakeholders, virtually all EDDI processes were conducted in teams, with team sizes ranging from 14 to over 300 (Marent et al., 2023; Yang et al., 2020). As shown in Figure 4 (d) , most studies (n=27) did not apply any *digital tools* to specifically support the EDDI process. Three studies specifically developed EDDI tools, including an innovation orchestration framework (Pikkarainen et al., 2017) and two mobile platforms for knowledge sharing (Prentiss et al., 2017) and to enable collaboration (Robu & Lazar, 2021), respectively. Out of the five studies that discuss the use of EDDI tools, three apply tools to allow employees—particularly those who are less technologically-inclined (e.g., physicians; Al-Mondhiry et al., 2022; Bansler, 2021)—to effectively build prototypes (Day et al., 2023), while the other two apply tools to allow effective collaboration, including tools to facilitate hackathons (Day et al., 2023) and to build online communities (Yang et al., 2020).

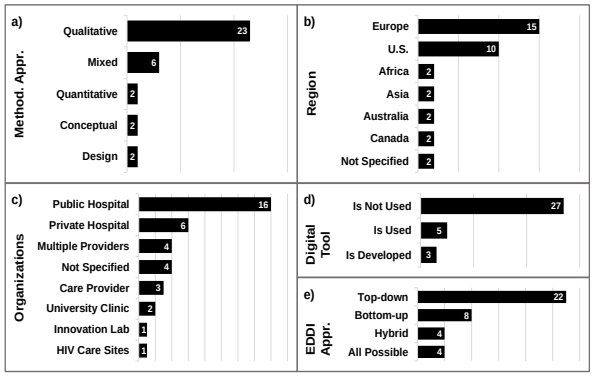

Figure 4: Overview of studies' (a) methodological approaches, (b) regions, (c) organizations, (d) digital tool use, and (e) approach to EDDI

4.2 Employees' Involvement in EDDI in Healthcare

As depicted in Figure 5 (a), in our identified literature, various employees were incorporated into EDDI processes in healthcare. The most *included type of employees* were physicians (n=19), closely followed by nurses (n=15). Less featured employee groups included administration employees (n=6), management (n=5), clinicians or community health workers (n=4 each), as well as IT staff (n=2). Besides these groups, studies sometimes featured employee groups specific to their investigated innovation product. For example, in discussing a patient scheduling module, Litwin (2011) includes support staff that handle scheduling the clinic into their EDDI process. Four studies focus on either no particular employee group or just broadly on "healthcare professionals" (Norman et al., 2010).

Studies also vary in how many *different employee groups* they include into their EDDI processes. Figure 5 (d) contains an overview of the number of different employee groups included. While most studies include only a singular group of employees (n=14), some studies focus on two (n=8), three (n=4) or even up to four employee groups (n=7). Those studies that featured multiple groups of employees focused primarily on one employee group, while also taking other employee groups into account. For example, in their study, Day et al. (2023) focus primarily on community health workers (CHWs) as the prospective users of their innovation (a texting-based intervention for voluntary medical male circumcision postoperative care). Accordingly, they mostly concern themselves with including CHWs into all phases of the innovation process, while upholding "consistent stakeholder engagement" with clinicians and management.

We also evaluated of the *source of the presented EDDI processes* as shown in Figure 4 (e). Only few studies mentioned that the process was started by frontline-employees in a hybrid manner (n=4) or entirely bottom-up (n=8). For four articles all stages were possible as these dealt conceptually with EDDI (Gui et al., 2020), discussed structures to support employees innovation, or with employee motivation (Dias & Escoval, 2014; Santarsiero et al., 2022).

4.3 The EDDI Process

Studies varied in the *featured digital innovation outcomes*. Most studies featured an external organizational focus by studying products (n=23) as main innovation outcomes, with examples being apps (e.g., for palliative care support (Al-Mondhiry et al., 2022)), healthcare IT (e.g., a digital platform for HIV care) or systems spanning multiple healthcare providers (e.g., extensions of an EHR system (Kawamoto et al., 2021)). Seven papers also focused on services as outcomes, with a focus on patient service improvement (e.g., by enabling patient journey modeling (Curry et al., 2007)) or specific problems in the care delivery process (e.g., scheduling of surgeries (Aakhus et al., 2018)). Only eight studies featured internal processes as digital innovation outcomes. Moreover, only the study by (Cannavacciuolo et al., 2023) focuses solely on a process as innovation outcome; in this case organizational changes required to enable effective

telemedicine project implementation. The remaining studies focused on developing a product or service and at the same time, organization-internal processes are changed to account for the new product or service. For instance, in the study by (Gui et al., 2020), an EHR system is developed (product); at the same time, organizational workflows (processes) are adapted so that every employee could help to improve the system and feels validated in their efforts to do so.

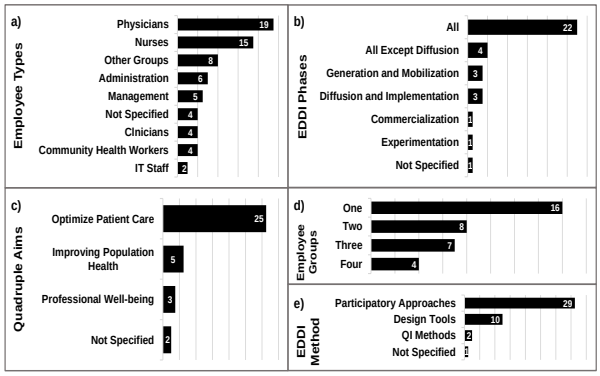

Figure 5: Overview of studies' (a) type of employees, (b) EDDI phases, (c) addressed Quadruple aims, (d) number of different employee groups included, and (e) key methods for EDDI

Of the five phases of the EDDI framework in most cases articles report on all *phases of the innovation process* (n=22) and describe a full innovation journey from the initiation to the final implementation. An overview is presented in Figure 5 (b). Furthermore, four articles report on all phases but diffusion and implementation. Articles that focus on single phases were comparingly low (Generation and Mobilization n=3; Experimentation n=1; Commercialization n=1; Diffusion and Implementation n=3). None of the articles focuses solely on the phase advocacy and screening.

Looking at the articles through the lens of the *Quadruple Aim* framework (see Figure 5 (c)) shows most studies develop innovations that aimed at optimizing patient care (n=25); for example, a calendar facilitating scheduling of surgeries for patients (Aakhus et al., 2018) or web and mobile apps for telemedicine (Cannavacciuolo et al., 2023). Five articles reported on innovations that aim at improving population health by developing products and services that could be used beyond the care service process. For example, articles focus on implementing welfare technologies in care services as part of a wider for improving patient outcomes (Litwin, 2011). Three articles paid attention to improving the work life of healthcare providers. For example, in an EHR introduction project, physicians were trained to adjust the system based on their needs to overcome local challenges (Bansler, 2021). No article aims at reducing costs primarily.

Different *key methods for EDDI* are mentioned in the articles as shown in Figure 5 (e). An article could report on more than one key method. Of all articles, most (n=29) mentioned participatory approaches such as interviews (Litwin, 2011), regular meetings (Pikkarainen et al., 2017), workshops (Dugstad et al., 2019), surveys (Gui et al., 2020), or dedicated places such as innovation labs (Santarsiero et al., 2022). Quality improvement (QI) methods such as the vision, valley, victory process (Al-Mondhiry et al., 2022) or Plan-Do-Study-Act cycle (Curry et al., 2007) are only used in two articles. Design tools such as human centered design (Day et al., 2023), user-centered design (Kawamoto et al., 2021), or design thinking (Day et al., 2023; Norman et al., 2010) are employed in several articles (n=10).

4.4 EDDI in Healthcare Research Foci

The open coding of the EDDI aspects discussed in each article resulted in six main research foci. Most articles discussed *management strategies* (n=20). This encompassed analyzing structured processes' feasibility for innovation processes such as regular design episodes (Aakhus et al., 2018), iterative cycles (Al-Mondhiry et al., 2022), process frameworks (Curry et al., 2007), or systematic inclusion of user feedback (e.g., workshops) after development (Dugstad et al., 2019). Further topics are innovation orchestrators (Pikkarainen et al., 2017) or champions (Cannavacciuolo et al., 2023) to lead the innovation process and creating collaborations within and outside the organization (Dugstad et al., 2019). In addition, the impact of providing enabling infrastructure (e.g., digital innovation tools) (Kawamoto et al., 2021) resources (e.g., time to innovate) (Santarsiero et al., 2022), and mentors with high IT skills (Bansler, 2021) is examined. Relatedly, articles focus on *initiation strategies* (n=6) that relate to identifying orchestrators or an innovation team to initiate the innovation process (Kawamoto et al., 2021; Pikkarainen et al., 2017) and providing dedicated spaces for employees such as innovation labs (Santarsiero et al., 2022) or enterprise social media (Garmann-Johnsen et al., 2018).

Further articles discussed aspects related to *organizational culture* (n=6), which encompass the analysis of the social organizational environment in promoting innovation (e.g., open-minded, supportive co-workers, idealistic internal entrepreneurs) (Ajer & Øvrelid, 2023), the encouragement received by management (Yang et al., 2020) and the establishment of core values such as two-way knowledge exchange, respect, and equity focus (Al-Mondhiry et al., 2022).

Another focus is *innovation dynamics* (n=6), which relates to process fluctuations and interactions as a main focus (Essén & Lindblad, 2013), the interactions

between the internal and external organizational environment (Santarsiero et al., 2022), and changes in requirements from employees and events (Aakhus et al., 2018).Moreover, articles look at *employee roles* (n=5) and examined employee factors related to employees' motivation to be involved in the innovation process (Dias & Escoval, 2014; Essén & Lindblad, 2013), skills required for innovation (e.g., adaptation, communication and cooperation, IT skills) (Dias & Escoval, 2014), skills development (e.g., individual or standard training, planned job rotation) (Bansler, 2021), triggers for innovation (e.g., due to the introduction of new IT or insufficient training programs) (Gui et al., 2020), how employees perceive the innovation process and intermediary outcomes (e.g., beneficial or stressful), and characteristics that lead to innovative work behavior (Zaza et al., 2023).

Another research focus is *knowledge sharing* (n=10), where studies examined how employees can be enabled to share their ideas through platforms that manage the knowledge sharing process (e.g., enterprise social media) (Norman et al., 2010; Prentiss et al., 2017) or how hackathons can help to acquire and share knowledge (Day et al., 2023). One article discusses the need for transparency of how ideas are translated into digital practices (Marent et al., 2023).

4.5 Enablers for EDDI in Healthcare

The open coding of implications for enabling EDDI resulted in nine aggregated implication areas that relate to the internal organizational environment (Kohli & Melville, 2019; Opland et al., 2022). (1) For managing EDDI, our reviewed literature suggests to use a structured, iterative method to guide innovation process (Al-Mondhiry et al., 2022). Examples include the use of human-centered design (Day et al., 2023), preparatory measures for the EDDI process such as innovation team establishment (Dugstad et al., 2019), and the use of employee-generated key performance indicators for proper goal setting (Hügle & Grek, 2023). (2) The articles emphasize the establishment of an innovation culture guided by trust development, two-way knowledge exchange, respect, and equity focus (Al-Mondhiry et al., 2022), idealistic entrepreneurship, and management support (Ajer & Øvrelid, 2023). (3) Several studies suggest setting up working groups for innovation (Day et al., 2023; Kawamoto et al., 2021), including a leadership council (Al-Mondhiry et al., 2022), creating special interest groups on different clinical topics (Litwin, 2011), or groups to support employees such as innovation labs (Santarsiero et al., 2022). These groups should be endowed with decision authority and budget to prevent delays through formal decision processes (Bansler, 2021). (4) Promoters of innovation (e.g., physician champions) should be provided with additional resources and power to lead innovation projects (Cannavacciuolo et al., 2023; Curry et al., 2007). (5) If external technology providers are part of the innovation project, organizations should request constant support from them to adjust the provided technology according to employee needs and provide employees with additional training (Cannavacciuolo et al., 2023). (6) To facilitate the innovation process, research recognizes that digital tools (e.g., enterprise social media) should be used for several reasons: to enable employees to share knowledge for ideation (Prentiss et al., 2017), to discuss and prioritize ideas (Garmann-Johnsen et al., 2018), to give feedback on the current innovation project (Norman et al., 2010), to track the progress of the current development (Robu & Lazar, 2021), and to build their own local solution (e.g., of an EHR system) (Bansler, 2021). (7) Empower employees to initiate EDDI processes by providing them with tools (Bansler, 2021), time, authority, and spaces to innovate (Gui et al., 2020; Litwin, 2011), mentors with a good level of IT skills (Bansler, 2021), or investing in digital innovation skills (Dias & Escoval, 2014). Other articles also mention the importance of ensuring employees' satisfaction and mental well-being as these are important predictors of innovative behavior (Day et al., 2023; Yang et al., 2020). (8) Identify employees that want to actively contribute to the innovation process and employees that want to passively communicate their needs (García-Rayado & Callens, 2024). (9) Studies recommend to establishing a quick approval process (Yang et al., 2020).

5. Discussion and Research Agenda

Based on our synthesis of the literature review, we now discuss several key findings and resulting avenues for future research on EDDI in healthcare.

5.1 Digital Tools

Compared to aspects discussed in a current review on EDDI (Opland et al., 2022), we find a relatively low use of digital tools to support innovation phases in healthcare. Although these studies give first insights into how digital tools can support specific EDDI phases, more research is needed to determine how digital tools can be best used to support the whole EDDI process in healthcare. For example, future research could determine the usefulness and impact of digital tools on performance for the innovation process. Moreover, research can focus on building essential components for designing digital tools. Especially, since healthcare comes with a rather hierarchical structure for decision

making, an important field of inquiry for EDDI in healthcare could examine, how digital tools can tackle this issue, for example by accelerating approval processes for innovations (Pikkarainen et al., 2017).

5.2 Employee Skills & Job Characteristics

In the general employee-driven innovation discourse, an important topic is creating explanations of what drives, motivates or shapes employees' involvement in innovation (Bäckström & Bengtsson, 2019). However, this research stream does not include skill development for innovation, which was an aspect that was highlighted in our results in the theme *employee roles*. As EDDI research generally does not focus employee skill development either (Opland et al., 2022), this finding might indicate that particularly in healthcare, EDDI might need certain skills for innovation. Hence future research should pay more attention to how employees' innovation skills can be improved for EDDI and compare skills necessary in healthcare with innovation skills in other industries. In the healthcare context, particularly knowledge of technology implementation and development processes could be relevant. However, by now only few approaches for skilling employees are present in the literature (e.g., through training with development platforms; Bansler, 2021). Ultimately, future research should explore more ways, how to build technological skills of healthcare employees to empower employees to add ideas related to digital technologies and possibly implement their own solutions.

Additionally, we find that other aspects impacting employee innovative work behavior such as job autonomy, job standardization, role clarity, decentralization of decision making, or incentive structures have not received much attention in EDDI in healthcare. This is unfortunate as these aspects might play a notable role in healthcare which, for example, comes with high autonomy of employees but also restrictive compliancy and decision structures (Pikkarainen et al., 2017). Future research can add especially well to EDDI in healthcare by comparing different job aspects of employees within healthcare organizations and with organizations from the private sector. This might yield deeper insights into what drives and hinders EDDI in healthcare.

5.3 Organizational Performance Measures

An important research theme in employee-driven innovation is innovation performance, referring to innovation outcomes' impact on organizational performance (Bäckström & Bengtsson, 2019). Although most of the studies in healthcare focused on optimizing patient care as innovation goal, indicators to measure performance are absent from the current EDDI in healthcare literature. To be able quantify the impact of EDDI in healthcare and show the effectiveness of different EDDI methods, future research should look at how to measure performance of EDDI outcomes in healthcare. For that future research might consider either healthcare-specific performance indicators, or adapt performance metrics from digital innovation (Kohli & Melville, 2019), like number of patents, internal metrics (e.g., productivity, process redesign, process simplification), or external metrics (e.g., market share).

5.4 Bottom-Up Enablement

Like in employee-driven innovation in healthcare, the majority of innovations featured in our review are initiated top-down. This was interesting to observe, as it is in contrast to the prevalent bottom-up method symbolic for the strong employee involvement in EDDI. This finding might be explained by the hierarchical structure of healthcare, which relies on formal approval processes (Cadeddu et al., 2023). Therefore, the healthcare sector may simply not inherently afford environments where employees can easily initiate digital innovation processes. Given the recognized benefits of bottom-up EDDI processes, we think that a crucial avenue for future research is to find out how to effectively create and support environments that empower employees in healthcare organizations to start digital innovation processes. Also, although the prevalent focus on top-down EDDI innovation in healthcare already acknowledges employees as innovators, it might indicate a lack of trust in employees' agency. Future research could thus examine the influence of the organizational hierarchy and of upper management trust in employees' ability to innovate and identify trust building measures to enable EDDI in healthcare.

5.5 Contributions and Limitations

Our study contributes to research and practice in various ways. For EDDI research, we add knowledge on the internal organizational environment in EDDI by outlining implications for building EDDI structures and processes in organizations. In doing so, we synthesize research on EDDI in healthcare and answer calls for research that ask for understanding how the internal organizational environment can afford employees to add their knowledge to initiate digital innovations. Moreover, based on our synthesis of research on EDDI in healthcare we offer avenues for future research. For practitioners we offer nine enablers of how digital

innovations can be initiated with the help of ordinary healthcare employees. These enablers can inform how to build support structures for frontline employees by providing employees with the time and authority to innovate, creating groups to support employees with resources and skills, establishing a culture of openness and knowledge exchange, and employing digital tools (e.g., enterprise social media) for ideation and giving feedback on current innovation ideas and projects. Further, our findings can provide directions to inform training programs for employees to build their digital skills and help them communicating their needs and ideas for digital innovation.

Our study is not without limitations. First, our key word choice might have limited the breadth of the retrieved articles. During our review we learned that different terms for including employees in innovation processes exist. Future research can extend the current review by also looking into fields that refer to employee inclusion with different concepts, such as "front-line innovators", "staff-led improvement efforts", and "healthcare insider innovations". Second, our study is limited by the choice of predetermined concepts dealing with the internal organizational environment. Future research could consider additional concepts that relate to EDDI such as factors of the external competitive environment or specifically focus on EDDI outcomes to extend the knowledge around EDDI in healthcare.

6. Conclusion

Including employees in the innovation process is a key step to further facilitate innovation in healthcare organizations. Our research agenda shows that there are several research gaps that should be addressed to enable healthcare employees to add to digital innovation. Moreover, our synthesis of the literature highlights that employees in healthcare organizations can contribute to digital innovation in many fruitful ways, if they receive proper organizational support and training. In managing innovation in healthcare, organizations should hence empower employees and create structures to establish opportunities for EDDI.

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