Technological Forecasting & Social Change 217 (2025) 124156

Contents lists available at ScienceDirect

Technological Forecasting & Social Change

journal homepage: www.elsevier.com/locate/techfore

Navigating meaningful work: Exploring the impact of mobile telepresence robots on healthcare professionals

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ARTICLE INFO

Keywords:
Mobile telepresence robots
Meaningful work
Healthcare
Human-robot interaction

ABSTRACT

This study investigates how mobile telepresence robots (MTRs) intersect with healthcare professionals' agency and organizational structures to influence meaningful work practices. Addressing the challenge of integrating robotics into healthcare, we employ a qualitative field study across a nursing home, two hospitals, and private clinics in southern Spain, drawing on 25 interviews, observations, and secondary data. The findings reveal that MTRs simultaneously offer opportunities (e.g., enhancing remote care delivery) and threats (e.g., reducing face-to-face interactions), creating paradoxical tensions between distance and proximity. A conceptual framework proposes that technology appropriation and innovation are key mechanisms for navigating the paradox between distance and proximity, thereby enhancing meaningful work. These mechanisms require support from organizational structures, such as technical support, to navigate this paradox. This study contributes to understanding the dual implications of robotic technologies in healthcare by highlighting the interplay between agency and structure, offering practical insights for thoughtful technology implementation that promotes meaningful work.

1. Introduction

Healthcare often attracts workers motivated by a strong sense of purpose and the desire to find meaning in their work (Restauri et al., 2019). Meaningful work, defined as work that provides purpose and fulfillment through worthwhile contributions (Mortimer, 2023; Bailey et al., 2024), is associated with higher job satisfaction, engagement, and performance (Michaelson et al., 2014; Russo et al., 2025). Recent studies in organizational management emphasize job design, ethical leadership, organizational commitment, social impact, and employee well-being as key dimensions for cultivating work meaningfulness and highlight the need for innovative solutions to sustain it amidst ongoing technological and societal transformations (Batuchina et al., 2025; Lysova et al., 2023; Michaelson et al., 2014). Meaningful work is shaped by the interplay between structure (i.e., patterns of social organization) and agency (i.e., individual capacity for action), as described in Giddens' structuration theory (Giddens, 1984; Laaser and Karlsson, 2022). This dynamic explains why meaningful work is "experienced at the agent level but shaped by wider dynamics at the structural level" (Laaser and Karlsson, 2022, p. 798).

Healthcare workers often derive meaning from connections, contributions, and recognition in their work (Pavlish and Hunt, 2012; Horowitz et al., 2003). Meaningful work influences older nurses and nursing assistants' motivation to remain in the workforce and delay retirement (Sousa-Ribeiro et al., 2024). However, external factors can obstruct this sense of meaning, leading to emotional strain and burnout, which may compromise the quality of care (Pérez-Francisco et al., 2020; Portoghese et al., 2014). For instance, a recent study found that while most neurosurgeons consider their work meaningful, excessive administrative burden contributes to burnout and attrition, whereas strong departmental relationships enhance meaningful work and retention (Mackel et al., 2025). Promoting meaningful work in healthcare is therefore critical to protect both staff well-being and care quality.

Digital transformation (DT) is reshaping healthcare, driven by digital technologies designed to enhance efficiency and address societal challenges, particularly after the COVID-19 pandemic (Dantas and Nogaroli, 2021; Naik et al., 2022; Constantinides, 2024; Basile et al., 2024). One notable innovation is the introduction of service robots, which are digital technologies that support or replace humans in performing tasks (Šabanović, 2010; Kraus et al., 2021). For example, mobile telepresence

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https://doi.org/10.1016/j.techfore.2025.124156
Received 18 April 2024; Received in revised form 26 March 2025; Accepted 12 April 2025
Available online 30 April 2025

robots (MTRs), i.e., wheeled, remotely operated devices, enable remote interaction and mobility, offering benefits in telemedicine and care delivery (Holland et al., 2021; Lee and Takayama, 2011). Despite these benefits, MTRs raise concerns about their impact on meaningful work by altering traditional roles, interactions, and spatial arrangements (Boada et al., 2021; Beane and Orlikowski, 2015). Smids et al. (2020) highlight the paradoxical effects of robots. While they can create opportunities by enhancing efficiency and access to care, they may also represent a threat by removing the relational and emotional dimensions that are key to meaningful work.

However, research on DT in healthcare has largely overlooked its impact on professionals' work meaningfulness (Kuoppakangas et al., 2023), particularly the paradoxical effects of MTRs. While studies have explored MTRs in real work environments, investigating use cases, users' attitudes, and acceptance of core functionalities (Cesta et al., 2016; Koceski and Koceska, 2016; Lee and Takayama, 2011), they often overlook meaningful work. Research suggests that introducing mobile telepresence technologies creates complex shifts in work coordination and employees' emotional engagement (Beane and Orlikowski, 2015; Nicolini, 2007). However, how MTRs simultaneously represent opportunities and threats to meaningful work remains underexplored. Addressing this research gap before MTRs are widely used in healthcare settings is relevant, as robot design and deployment often prioritize technical capabilities over social concerns (Seibt et al., 2018). To bridge this gap, this study examines how MTRs shape meaningful work for healthcare staff, guided by the following questions:

(i) How do mobile telepresence robots (MTRs) impact on the meaningfulness of work for healthcare staff, and how can the interplay of organizational structures and healthcare staff agency help in managing this impact?

Thus, to answer the research questions, this qualitative research utilized triangulated data obtained from observations, interviews, archival data, and focus groups involving healthcare professionals in nursing homes, hospitals, and private clinics. The study provide two main contributions. First, it grounds MTR use in healthcare within the frameworks of technology appropriation (Leonardi et al., 2010) and structuration theory (Giddens, 1984), revealing how these robots create paradoxes of distance and proximity that impact meaningful work. It identifies technology appropriation as a key mechanism, with individual agency driving innovation and adaptation while organizational structures either enable or constrain these efforts. Second, the research extends knowledge on human-robot interaction and meaningful work by empirically supporting Smids et al.'s (2020) proposal that robots can simultaneously threaten and enhance work meaningfulness. Finally, the study provides practical insights on how to enhance the meaningfulness of work when utilizing MTRs in healthcare, offering guidance on their implementation and effective use. Thus, this research not only sheds light on the nuanced and paradoxical ways MTRs influence meaningful work in healthcare but also provides actionable insights for balancing technological innovation with the preservation of human-centric values.

2. Theoretical background

2.1. Meaningful work in healthcare shaped by structuration

Management scholars have extensively studied meaningful work, often framing it as a sense of calling or purpose that employees associate with their professional roles (Lysova et al., 2023). Recent literature reviews and special issues on this topic have demonstrated an increasing academic interest (Tan et al., 2023; Bailey et al., 2019a, 2019b; Thompson and Bunderson, 2019; Blustein et al., 2023; Lysova et al., 2023; Lozovetska et al., 2024). While some research highlights individual-level factors influencing meaningful work (Thompson and Bunderson, 2019), fewer studies focus on organizational factors, leaving significant gaps in understanding why individuals perceive their work as more or less meaningful (Bailey et al., 2019b). Regarding technology, some studies have explored its impact on meaningful work, for example, by creating a meaning crisis (Kim and Scheller-Wolf, 2022), affecting feelings about collaboration (Sadeghian and Hassenzahl, 2022), or work achievement (Scripter, 2024). A recent study found that increased robotization consistently reduces the perceived meaningfulness of work and autonomy, particularly for workers involved in routine tasks (Nikolova et al., 2024). However, extant studies do not investigate the paradoxical effects that digital technologies may provoke on meaningful work. Meaningful work scholars encourage future research to explore how it evolves in response to future challenges and changing contexts, such as shifts between onsite and remote work (Arora and Garg, 2024; Lysova et al., 2023; Michaelson et al., 2014).

The interplay between agency and structure is key to understanding meaningful work in the context of technological innovation. Structuration theory proposes a framework for understanding the relationship between individuals and the structures within which they operate (Giddens, 1984). According to structuration theory (Giddens, 1984), structure and agency are mutually constitutive components of the same concept. Structures, i.e., rules and resources that guide and constrain human behavior, are not static entities but are constantly reproduced and transformed through the actions of individuals to suit the specific needs of their local contexts (Giddens, 1984; Leonardi et al., 2010). Conversely, individual actions are influenced by these structures, as individuals draw upon social norms, roles, and resources to make decisions and navigate social life. Individuals draw upon existing structures to guide their actions, but in doing so, they also reproduce and potentially change those structures through their practices. Therefore, agents have a transformative capacity to alter structures (Giddens, 1984). In this study, organizational structures (e.g., training programs and technical support systems) are viewed as dynamic outcomes of ongoing interactions between healthcare staff and the organizational context, rather than static frameworks as typically presented in organizational theory.

Structuration theory is not specifically a theory of organizational change, but it offers a framework for understanding how social structures are sustained, reproduced, and altered (Gurd, 2008). Some have recognized that this theory provides a valuable framework for thoroughly understanding management and organizations (Feldman and Orlikowski, 2011; Jarzabkowski, 2008; Pozzebon and Pinsonneault, 2005; Whittington, 2015). Using structuration theory to study managerial topics has helped focus on what managers do rather than what organizations possess, revealing how the resulting strategies both limit and enable actions, as well as the consequences of these actions (Jarzabkowski, 2008; Whittington, 2015). Structuration theory, therefore, is a flexible research approach that provides a specific vocabulary and methodological principles based on process-oriented and practice-based foundations (Feldman and Orlikowski, 2011; Langley, 2007; Lukka and Vinnari, 2014). Within the technological domain, Giddens' framework has helped to understand that technological artifacts are shaped by and shape human practices (Orlikowski, 1992). For example, Orlikowski (2000) demonstrated how technology-in-practice evolves as organizational actors reinterpret and adapt technological systems. Despite its utility, structuration theory has faced criticism because some scholars (e.g., Archer, 1995) argue that it overemphasizes agency, potentially underestimating the enduring constraints of structural factors. For instance, the strict regulatory environment in healthcare and conflicting institutional logics may impose structural constraints on the adoption and implementation of MTRs (Hidefjäll et al., 2023; Schiavone and Simoni, 2019). It is crucial to recognize not only the organizational structures within settings, such as a nursing home, but also the institutional logics that support and legitimize these structures. Therefore, while this study focused on meso-level structures that can often be managed, it recognizes the impact of macro-level structural dimensions.

Organizational structures and agency play a key role in shaping individual experiences of meaningful work by influencing the *practices* within which workers operate (Geist-Martin and Scarduzio, 2011; Laaser and Karlsson, 2022). While individuals develop subjective

perceptions of meaningful work based on their personal values, vision, and sense of purpose, these perceptions are also conditioned by the objective environment of the workplace (Laaser and Karlsson, 2022; Lysova et al., 2019). For instance, Kuoppakangas et al. (2023) found that employees in a healthcare-related DT initiative experienced enhanced meaningfulness when their ideas were valued and when the co-creation process transparently demonstrated how and why certain contributions were incorporated into future initiatives. These findings highlight how organizational structures shape meaningful work by promoting practices that align individual agency with supportive structures. Therefore, practices that promote meaningful work emerge when individuals exercise their agency within supportive structures. Conversely, practices that inhibit meaningful work often reflect a misalignment between individual aspirations and the organization's structural constraints.

In healthcare, practices that enhance connections, contributions, and recognition help align individuals' personal values with their work responsibilities, promoting meaningful work (Pavlish and Hunt, 2012; Pavlish et al., 2019; Horowitz et al., 2003). Connections involve building relationships with patients and families, contributions refer to visible improvements in patients' conditions, and recognition reflects an explicit acknowledgment of staff efforts. On the other hand, organizational constraints that limit these elements can diminish meaningful work. However, individuals can actively navigate or transform restrictive structures through their practices, influencing how work is experienced (Laaser and Karlsson, 2022). As Leonardi (2013) notes, changes in work practices reshape people's understanding of a technology's potential, revealing new applications and possibilities. Structures of technology use emerge through iterative engagement with specific affordances, shaping future interactions and redefining work practices (Orlikowski, 2000). Thus, the ability of technology to influence social structures depends on how individuals use its features to drive change.

2.2. MTRs in healthcare and their paradoxical effects

Digital technologies can transform the nature of healthcare practices, simultaneously creating both distance and closeness by introducing new feelings of connection while maintaining physical separation (Rauch et al., 2022). For example, MTRs afford mobile telepresence for telemedicine and family member communication, but, at the same time, they reduce human contact. Human contact is the primary source from which the dimensions of meaningful work in healthcare emerge, i.e., connections, contributions, and recognition (Horowitz et al., 2003; Pavlish and Hunt, 2012; Pavlish et al., 2019). Therefore, digital technologies, such as MTRs, can simultaneously help and hinder the creation of connections, contribute to patient well-being, and gain recognition through different technological solutions (Dal Mas et al., 2023; Dionisio et al., 2023). Hence, DT may affect the meaningfulness of work in healthcare in multifaceted ways, being both a threat and an opportunity for meaningful work (Smids et al., 2020).

One approach to alleviate the paradox of distance and proximity when applying MTRs in healthcare could involve appropriating the same technologies that initially contributed to the paradox's emergence (Leonardi et al., 2010). Technology appropriation involves individuals integrating technology into their practices, often in ways unintended by the technology's designers (Leonardi et al., 2010). When users see that specific features of technology provide affordances for them to act, they will appropriate those features (Leonardi, 2013). This means that users will only start utilizing specific capabilities of technology when they perceive that the technology's affordances enable them to accomplish something meaningful. In the context of MTRs, their affordances include features such as mobility, telepresence, and communication capabilities. The appropriation of technology empowers employees to tailor their roles according to their needs and preferences, potentially fostering a deeper sense of meaningfulness in their work (Xu et al., 2023). When applied to technology appropriation in the workplace (e.g., Kummitha, 2020), structuration theory (Giddens, 1984) may help to elucidate how employees interpret, adapt, and integrate technology into their work routines. As it considers both the enabling and constraining effects of social structures and technology on individual behavior, structuration theory offers insights into the complex process through which technology shapes and is shaped by the social context (Giddens, 1984). Thus, structuration theory can be a relevant lens for understanding technology appropriation and extending current knowledge on how it may influence meaningful work.

3. Method

In the pursuit of understanding how technology influences the meaningfulness of work for healthcare staff through the case of MTRs, the aim is to study the practices that support meaningful work in different types of healthcare settings and identify how such robots may influence them within the dynamic interplay between organizational structures and employee agency. For this purpose, the study uses a qualitative method to observe and inquire about practices (Bueger and Gadinger, 2018). A qualitative research approach enables an in-depth exploration of complex phenomena (Rousseau et al., 2008) and, therefore, is useful for examining the dynamics of healthcare settings. To study the impact of robots on meaningful work, Smids et al. (2020) propose conducting empirical case studies in workplaces where the integration of robots is forthcoming. Thus, this study was part of a larger exploratory assessment that was designed to evaluate the safety and effectiveness of MTRs in healthcare before integrating them into daily work practices. The larger assessment created test environments with healthcare staff, in which two different MTRs were examined weekly at a nursing home in southern Spain: HumanoidMTR and MachineMTR (pseudonyms). HumanoidMTR (Fig. 1) is characterized by a humanoid form with a touchscreen at the torso, a shotgun microphone, speakers, and a webcam. MachineMTR (Fig. 2) has a touch display, multiple cameras, speakers, and a microphone. Despite the differences in form, both robots can afford mobile telepresence and thus be categorized as MTRs. However, the findings of this study revealed no differences between MTRs related to their potential impact on meaningful work. Additionally, the study involved interviews with healthcare personnel from two hospitals in southern Spain and independent professionals

Fig. 1. HumanoidMTR being tested at the nursing home.

Fig. 2. MachineMTR being tested at the nursing home.

working in private clinics across several regional cities. The study followed a theoretical sampling approach (Corbin and Strauss, 2015), which involves selecting participants based on their potential to provide insights that contribute to refining the study's theoretical understanding (i.e., the impact of MTRs on the meaningfulness of work for healthcare staff and how the interplay of organizational structures and staff agency shapes this impact). Therefore, healthcare professionals exposed to the MTRs through testing or video demonstrations were recruited. Including healthcare staff from these three settings, i.e., nursing homes, hospitals, and private clinics, allowed a more thorough exploration of the research question. Nursing homes are part of a larger healthcare ecosystem, and insights from clinicians in hospitals and private clinics can provide different perspectives on the care continuum and enhance our grasp of the meaningful work-related implications of MTRs in healthcare.

3.1. Data collection

Primary data collection relied on a total of 25 formal semi-structured interviews and observations (Eisenhardt, 1989). First, over four weeks (April 2022), daily work practices that did not involve MTRs were observed in the nursing home to understand common practices better. Reflective field notes were taken. In parallel, the MTRs were tested in the nursing home once or twice weekly. The researchers announced the MTR tests to several healthcare employees, providing information about the purpose and procedures of the tests. During the tests, the MTRs were set up and operated, and staff were encouraged to assist by using the MTRs to interact with residents or other employees. Observations were conducted during these sessions to gather insights into participants' reactions and informal comments. After each test, nursing home staff were invited to participate in semi-structured interviews. Healthcare workers who directly participated in the MTR tests and expressed willingness to share their experiences were eligible for inclusion. The inclusion criteria for the interviews with nursing home staff were (1) active participation in the MTR tests and (2) availability to participate in an interview session. Exclusion criteria included staff members who did not directly interact with the MTRs during the tests or were unavailable for interviews due to scheduling conflicts. Eight interviews, typically 20–30 min (due to time constraints of healthcare staff), were conducted in the nursing home with different healthcare workers with various occupations (Appendix A). A protocol was followed for conducting the semi-structured interviews (Appendix B), which aimed first to unveil meaningful work practices and then to understand how MTRs may be used in such settings, how they might promote or inhibit meaningful work, and how to implement them.

Later, over four weeks (May 2022), 17 semi-structured interviews, each typically lasting 30 min, were conducted with healthcare professionals working in two hospitals and several private clinics, representing various occupations (Appendix A). Given their availability for interviews, there were more physiotherapists and psychologists. A MachineMTR was not yet being used in daily practices at either of the two hospitals, but it was present on the premises. Recruitment involved both onsite and online approaches. Researchers visited the hospitals three times a week to conduct onsite interviews. Healthcare professionals were invited to participate after being introduced to the MachineMTR, which was present on the premises, and exposed to a video recording of tests with the HumanoidMTR. On the other hand, participants from private clinics were recruited for online interviews conducted via Zoom. Video recordings showcasing the use of both MTRs were shared to familiarize participants with the robots before the interviews. Thus, the inclusion criteria for the interviews with hospitals and private clinic staff were (1) healthcare professionals employed at the participating hospitals or private clinics, (2) willingness to engage with the study, which included exposure to MachineMTR and/or video demonstrations of MTRs, and (3) availability to participate in an interview session. Exclusion criteria included staff members who were unavailable for interviews, unwilling to engage with the MTRs (physically or via video), or not employed at the selected hospitals or private clinics.

The interview protocol, implemented with nursing home staff, was used in this phase to ensure consistency. However, the phrasing of the questions varied to show a prospective approach for these healthcare workers from hospitals and private clinics who have not yet used the robots but will eventually do so. Table 1 provides an overview of the data collected.

The secondary data consisted of two focus groups conducted in the nursing home as part of the larger assessment mentioned earlier. Each session lasted 40 min, one with four staff members and one with four elderly residents, seeking to analyze the benefits and burdens of both robots. Similarly, archival data from three media articles related to the MTR project at the nursing home, as well as five emails exchanged between HumanoidMTR developers and the nursing home director, served as secondary data to gain further insights into the perspectives of nursing home residents and top management, which were later triangulated with the interviews and reflective field notes.

3.2. Data analysis

We adopted an abductive approach (Dubois and Gadde, 2002) as our analytical strategy. The fundamental tenet of this method is that knowledge is sought through a non-linear process of integrating observations, empirical insights, and ongoing consultation of pertinent literature (Dubois and Gadde, 2002). This involved making ad hoc use of research on meaningful work and paradox literature without attempting to create preconceived notions about the link between MTRs, paradoxes,

Table 1
Data sources.

Type of data	Description	Purpose
Semi-structured interviews	8 with nursing home staff 9 with hospital staff 8 with private clinic staff Total of 25 interviews.	Unveiling meaningful work practices, understanding how MTRs can be utilized in such settings, and exploring how they may promote or hinder meaningful work, as well as how to effectively implement them.
Observational data	For 4 weeks, observation of daily activities in the nursing home. For 4 weeks, MTRs being tested once or twice per week in the nursing home.	Understand the daily work practices and social dynamics at the nursing home and gain insights into the informants' reactions and informal comments during MTRs' tests.
Archival data	3 media articles related to the MTRs project at the nursing home. 5 emails that were exchanged between HumanoidMTR developers and the nursing home director.	Gain more insights into the perspectives of nursing home residents and top management later, to triangulate them with the interviews and reflective field notes.
Focus groups	One focus group with 4 healthcare workers and one with 4 nursing home residents.	Assess the strengths and weaknesses of both MTRs.

and meaningful work in healthcare. Our early-stage discoveries in the nursing home prompted us to shift the primary focus of our research to incorporate second-order dimensions of meaningful work. This made it possible for evidence and theory to develop simultaneously and in interaction, leading to the development of a pertinent and thoroughly supported framework for theory elaboration (Dubois and Gadde, 2002). This allowed us to focus on the practices that enable connections, recognition, and contributions. We interviewed informants from hospitals and private clinics to understand how these were affected by the potential use of MTRs, and later triangulated the data from these informants with the findings from the nursing home.

After transcribing all the interviews and collecting the reflective field notes and secondary data transcripts, we followed an abductive coding approach in Nvivo (Gehman et al., 2018). The data interpretation encompassed methods like constant comparison, replication logic, pinpointing key aspects presented in the nursing home, and identifying shared themes with the rest of the interviews to enable a more elevated level of abstraction (Eisenhardt, 2021). To illustrate, the data of hospital participants confirmed emergent connections between the three meaningful work dimensions and the use of MTRs, allowing data validation (Eisenhardt, 1989). The analysis involved comparing the new concepts with existing literature and examining their similarities and differences (Eisenhardt, 1989). Therefore, we reviewed the literature on meaningful work and found that the use of emerging technologies for telepresence has paradoxical effects, which aligns with our data. However, aspects of technology appropriation emerged in the interviews, which allowed us to explore it as a tool for navigating the paradoxical effects and, therefore, as a necessary construct for the proposed framework.

We also took several steps to ensure our results' reliability and the data's caliber, ensuring our research complies with credibility, transferability, dependability, and confirmability assessment criteria (Lincoln and Guba, 1985). Credibility was enhanced by cross-referencing multiple primary and secondary data sources to identify recurring patterns consistently. Likewise, for credibility and dependability, peer debriefing involved seeking feedback from co-authors of this study and fellow researchers from the larger assessment who were not directly involved in this meaningful work-related investigation, providing an external perspective on the findings. To make our findings applicable to various situations, we have provided comprehensive descriptions of our methods, data collection, and contextual details, offering sufficient information for others to utilize. To secure the confirmability of our research, we transcribed and summarized the content of the in-depth interviews, allowing all researchers to access the information objectively.

4. Findings

This section presents the findings that answer the research questions (i.e., how do MTRs impact the meaningfulness of work for healthcare staff, and how can the interplay of organizational structures and healthcare staff agency help manage this impact?). To answer the first research question, section 4.1 elucidates the practices and sources of meaningful work for healthcare staff (i.e., contributions, connections, and recognition), and section 4.2 clarifies how these practices and sources are affected by MTRs, representing both a threat and an opportunity. Then, to answer the second research question, section 4.3 describes how technology appropriation unfolds, which involves the active agency healthcare professionals in appropriating MTRs within their work environments. Lastly, section 4.4 focuses on the organizational structures needed to support the sources of meaningful work for healthcare staff.

4.1. Healthcare work meaningfulness

Findings show that healthcare staff experience meaningful work when involved in practices like engaging with family members, bonding with patients, impacting their well-being, observing how they improve, and receiving their emotional appreciation and acknowledgment of visible health improvement. This data aligns with the main sources of meaningful work in healthcare, i.e., connections, contributions, and recognition (Pavlish and Hunt, 2012; Pavlish et al., 2019; Horowitz et al., 2003), which are used as second-order dimensions (Table 2). Data

Table 2
Meaningful work sources in healthcare settings.

Second-order dimensions	First-order categories	Evidence example	Evidence support[a]
Connections	*Bonding with patients*	*-They vent with us, there I feel very useful […], being able to help in that aspect and transmit tranquility and that they vent, for me is very gratifying (P14).*	*
	Engaging with family members	*-If you feel comfortable with the family, you can intervene, and they ask you what you think [about the patient] (P2)*	*
Contribution	*Impacting patients' well-being*	*-You see that you have changed their lives because pain changes your life, and when you take away someone's pain, you change their life, it is very satisfying (P22)*	**
	Observing how patients improve	*-When they are discharged, there is an evolution, and you can see things that are improving (P23)*	**
Recognition	*Receiving patients' acknowledgment of visible health improvement*	*-What I like is working with patients. It's fast, they give me good feedback, I feel good, it makes me proud (P11)*	*
	Receiving patients' emotional appreciation	*-When he finished the treatment, he hugged me […] it was a very emotional moment (P18)*	*

[a],**Evidence supported across the data sources; *Evidence supported by the interview data.

from nursing home, hospitals, and private clinics revealed the three dimensions of meaningful work. However, only informants from the nursing home mentioned engaging with family members and receiving their emotional appreciation, because families are more involved in residents' daily lives than patients' families in hospitals and private clinics, given the relatively short timeframe these patients spend in such environments.

4.1.1. Connections

Findings reveal insights into the significance of interpersonal connections for meaningful work in healthcare. Informants emphasized the profound impact of dedicating time to patients, fostering bonds that transcend mere treatment. Communication emerged as a key component in nurturing these connections, with healthcare workers acknowledging their therapeutic role beyond administering medications. They expressed fulfillment in providing emotional support, facilitating patient expression, and fostering a sense of relief and connection. Moreover, informants from the nursing home emphasized the importance of engaging with patients' families, citing moments of shared understanding and empathy as particularly meaningful.

4.1.2. Contributions

The study revealed interesting insights into healthcare workers' perceptions of meaningful work, particularly when they observed tangible improvements in patients' well-being. Participants highlighted the gratification derived from witnessing patients' physical, social, and psychological progress. The visibility of these contributions to patients and fellow clinicians emerged as a key aspect in shaping the perception of work as meaningful. Participants emphasized the importance of observing patients' progress, underlining the motivation derived from seeing the positive impact of their interventions firsthand.

4.1.3. Recognition

The findings suggest a relationship between meaningful work and patients' acknowledgment of visible health improvements. Informants emphasized the importance of patients recognizing their own progress, highlighting the subjective nature of this acknowledgment beyond objective measures. Participants from the nursing home noted the impact of recognition from family members, who often observe changes in residents' well-being over time. Despite cognitive impairments hindering direct expressions of gratitude from nursing home residents, family members provide valuable feedback, expressing appreciation for the care provided. Additionally, patients' emotional appreciation and expressions of gratitude were highlighted as influential factors in shaping healthcare workers' perceptions of meaningfulness. Participants from hospitals and private clinics recounted instances where patient feedback, whether through gratitude, gestures of affection like hugs, or tangible gifts, profoundly impacted their sense of fulfillment and purpose.

4.2. How MTRs impact meaningful work

The findings reveal various ways in which MTRs can be either beneficial or detrimental, depending on how they may potentially influence employee practices and promote or inhibit meaningful work (Table 3).

4.2.1. Potential ways in which MTRs may promote meaningful work

Some informants mentioned that using an MTR could enable them to *reach inaccessible patients* who would otherwise be impossible to reach, given the long distances or time constraints. For example, healthcare professionals located in the capital city could assess patients located in a rural area clinic:

"If this professional behind [the MTR] is someone from Barcelona and I can't access that doctor because my conditions don't allow it, it's a wonderful opportunity to be treated by that professional anyway. I think it is the greatest

Table 3
MTRs as a threat and an opportunity for meaningful work.

Second-order dimensions	First-order categories	Evidence examples	Evidence support[a]
Potential ways in which MTRs may promote meaningful work by creating proximity	*Healthcare staff focus on job-related tasks*	*- [if using the robot] I don't have to hold the screen, and I can attend to other tasks; I can put the robot in front of the patient and do other tasks (P13)*	**
	Healthcare staff reaching remote patients	*- It can be used in certain situations where contact is not possible (P12)*	**
	Healthcare staff can educate patients	*-Assigning the patient some exercises from the robot, and he sees them […] to talk to them and guide them so that they can do it on their own (P22)*	*
	Healthcare staff having a first diagnosis	*-A previous evaluation or analysis can be interesting because it is not necessary to be physically with the patient (P15)*	*
	Healthcare staff not having to waste time and energy communicating with patients	*-For isolation situations, it takes a lot of time to put on the PPE [Personal Protective Equipment] just to go in and do something, so with the robot's camera, one can assess how it is currently […] (P24)*	*
	Healthcare staff using the MTR as an assistant for mundane tasks	*-To accompany patients to the room, that they can fill out some questionnaires prior to going to the consultation, if it takes this [task] away from me, it makes me lose less time on things that can be more automatic and must be done (P8)*	*
	Healthcare staff using the MTR as a tool for therapy sessions	*-It should have a device to measure pulse or, with the camera, that it has applications like the ones we have on mobile phone to measure joint range (P20)*	*
Potential ways in which MTRs may inhibit meaningful work by creating proximity	*Healthcare staff spending less time with patients and family members*	*-Being able to bring each patient closer to their family filled you a lot with moments that you had to live and listen to because you had them in front of you, but now that'll be over (P17)*	*
	Healthcare staff not being able to touch patients	*-I don't see it as useful for the treatment because I don't know how I would physically treat a patient with the robot (P15).*	**
	Healthcare staff losing the opportunity to	*- I would miss the part about social contact, talking, touching, or*	**

(continued on next page)

Table 3 (*continued*)

Second-order dimensions	First-order categories	Evidence examples	Evidence support[a]
	communicate with non-verbal language Healthcare staff worried as MTRs scare residents	*listening face-to-face (P16).* *-It would shock them because they are old, and if a robot comes to wake them up, it would be strange for them (P6)*	*

[a] ** Evidence supported across the data sources; * Evidence supported by the interview data.

potential that the robot has" (P10).

Findings also showed that some physiotherapists saw an opportunity to *instruct*, *monitor*, and *educate* patients through MTRs. Usually, these professionals need to manipulate patients physically. However, there may be patients who only need to follow an exercise program; thus, therapists could use an MTR to show them how to perform exercises or monitor them remotely. Moreover, some informants expressed interest in using MTRs for initial encounters with patients who might require the clinicians' first diagnosis to proceed with in-person treatment. The emergency room (ER) was mentioned as a place where MTRs could add value because patients might need an assessment from a clinician with a specific medical specialty who might not be physically present.

Likewise, some informants, particularly nurses in hospitals and nursing home staff, mentioned that using MTRs for communicating with patients in different rooms could help them avoid unnecessary movements and *optimize their time and energy* at work. This is because they are sometimes required to walk from, e.g., the infirmary room to the patient's room to exchange a few words, and this is perceived as unnecessary time and energy consumption. When asked why they were not called on the phone, a hospital nurse (P14) mentioned that patients need to see the nurse's face to feel calmer. Therefore, these nurses proposed ways to appropriate MTRs, given the affordances of the screen to show the nurse's face and mobility to reach the patient's room. According to some informants, MTRs may minimize unnecessary travel and thus allow healthcare workers to dedicate more time to tasks that yield greater value.

Participants proposed interactions in which MTRs could assist with tasks unrelated to mobile telepresence *to liberate them from mundane tasks*. Thus, by examining the MTRs' affordances, they envisioned various ways to utilize this technology for tasks that do not necessarily promote meaningful work. For instance, some informants proposed that MTRs could *act as assistants for routine tasks*, such as finding each patient to ask what they would like to eat daily, assuming that the MTRs could be guided by intelligent automation.

Participants proposed different ways to use the MTRs by considering how MTRs could be a better alternative. For example, some physiotherapists mention that the MTRs could be useful *for video recording therapy sessions* instead of using a mobile phone. In this type of interaction, MTRs turn into a novel tool for work that will help them improve patients' well-being by supporting general tasks during therapies and optimizing time, e.g., by video recording themselves giving instructions for an exercise and playing the video on the MTR for the patient while they go somewhere else to check a different patient. In the nursing home, healthcare workers proposed to use MTRs for bingo sessions or similar ludic activities.

4.2.2. Potential ways in which MTRs may inhibit meaningful work

Findings show there is concern that MTRs could result in healthcare staff *spending less time with patients and family members*, thus diminishing opportunities for connections, contributions, and recognition. If MTRs facilitate video calls between residents and family members autonomously or semi-autonomously, healthcare workers lose the opportunity to connect with these actors as they will no longer be present throughout the video call. Some participants from the nursing home mentioned that even when they disliked overseeing the video calls between residents and family members, they did enjoy the interactions that emerged and the opportunity to bond with family members. It was an opportunity for family members to ask healthcare staff about the residents' well-being and recognize them for their work. On a similar note, participants from the hospitals and private clinics expressed apprehension about *losing the personal touch and intimate moments* shared during face-to-face interactions,

"It [using the MTRs] makes me think that it is not necessary to be directly with the patient, and that attacks a lot of what I believe in because I really feel the face-to-face contact, looking at their faces and humanizing the care, is what gives me the most satisfaction" (P19).

Moreover, the inability of MTRs to facilitate physical contact between healthcare staff and patients *may hinder the effectiveness of treatment*, particularly for interventions that require tactile interaction. Participants voiced skepticism about the feasibility of using MTRs in scenarios where physical touch is integral to patient care. For instance, most physiotherapists stressed that they must touch the patient to gain their trust,

"They [patients] don't trust you if you don't touch them. If I have a session and I don't touch the person, that patient looks at me strangely" (P25).

Furthermore, participants expressed worries about the potential *loss of opportunities for communication* that MTRs might entail. They emphasized the importance of social contact, verbal communication, and nonverbal cues in building trust and understanding patient needs. Concerns were raised about the potential *distress that MTRs may cause to residents*, particularly older individuals who may find the presence of robots unsettling.

When participants proposed other features and uses for MTRs, they typically mentioned situations in which MTRs interacted with patients while healthcare personnel performed other tasks elsewhere. For example, a participant (P19) proposed that MTRs play a video recording of healthcare personnel speaking to the patient to provide instructions during a therapy session, while MTRs' camera records what the patient does. Ideally, this use case would allow healthcare staff to focus on other care tasks and check the video recording of the patient later. Nonetheless, participants recognize that the interaction with this patient would be lost if they left a video recording playing.

4.2.3. The interplay between threats and opportunities associated with MTRs for meaningful work

Table 4 summarizes how the identified scenarios for MTRs in healthcare can be a threat and an opportunity for meaningful work *based on the paradox of distance and proximity* that such technologies can evoke. On the one hand, the findings show that MTRs may create distance and thus inhibit meaningful work when facilitating communication between nursing home residents and family members because the staff eliminates the practice of managing video calls, which implies less human contact with residents and family members and thus less time to connect and to get recognition for facilitating family communication. On the other hand, this situation may create proximity and thus promote meaningful work by allowing healthcare staff to do their core job tasks, i.e., caregiving practices. Moreover, findings show that the implementation and use of MTRs to facilitate communication between healthcare staff and patients may inhibit meaningful work given that the lack of face-to-face consultation results in a feeling of dehumanized interactions in which connecting with patients, contributing to their well-being, and receiving forms of affection seems more challenging. Nevertheless, it may also promote proximity and, thus, meaningful work by enabling healthcare workers to reach and positively impact a higher number of remote patients with less time and energy consumption. As clearly put by an informant:

"The robots would help me to assist more people at a distance or in

Table 4
Ways in which MTRs represent a threat or an opportunity for meaningful work in healthcare.

Scenarios	Ways in which MTRs may promote proximity and thus enhance meaningful work (Opportunity)	Ways in which MTRs may create distance and thus inhibit meaningful work (Threat)
MTRs facilitating remote communication between nursing home residents and family members	By being displaced by MTRs in the video call task, healthcare staff can now contribute directly to patients' well-being by doing job-related tasks, bonding, and being recognized for these core healthcare tasks.	Healthcare staff may lose the opportunity to engage with family members, no longer contributing indirectly to patients' well-being by helping them connect with family members through video calls, and thus will not be recognized for that.
MTRs facilitating remote communication between healthcare staff and patients	MTRs can be used for medical consultations where physical contact is less relevant, allowing healthcare personnel to engage with and positively impact more patients in remote locations with less effort.	Bonding and contributing to patients' well-being may be less effective when physical contact is not possible, which also eliminates the opportunity to physically acknowledge healthcare staff, such as by shaking hands or hugging.
MTRs assisting with tasks not related to mobile telepresence	Participants are frustrated by mundane tasks because they divert time and energy away from core clinical activities. Thus, MTRs could be operated by intelligent automation to fulfill these mundane tasks.	Some non-clinical and mundane tasks involve interactions with patients and family members. Therefore, if these tasks are automated with MTRs, healthcare staff will lose the chance to connect, contribute, and be recognized by them.

difficult areas. For that part, due to the number of people that I can help remotely, it can give me a feeling of satisfaction or fulfillment, but the direct relationship with the patient, I don't think it would give it to me, and maybe it would make it a bit worse because, in the end, as a health worker I like direct contact with the patient" (P16).

Furthermore, participants expressed dissatisfaction with organizational tasks diverting from essential clinical duties. Thus, they propose ways to appropriate MTRs, often assuming robots have intelligent automation and are not remotely controlled to manage these tasks. However, automating these tasks with MTRs may lead to healthcare staff missing opportunities to engage, make meaningful contributions, and receive recognition from patients and families.

4.3. Healthcare employees' agency and technology appropriation

Our findings reveal the role of healthcare employees' engagement with adapting technological tools (i.e., MTRs) towards meaningful work. This section shows how technology appropriation unfolds and explains healthcare employees' active role in adapting and integrating new technologies, especially MTRs, for meaningful work. The tests with an MTR, HumanoidMTR, started at the nursing home four months before data collection for this study. Initially, HumanoidMTR was introduced as a robot that could aid healthcare staff with multiple tasks, e.g., autonomously announcing the day's menu. However, healthcare workers were interested in using HumanoidMTR for mobile telepresence to facilitate remote communication between residents and their family members. Thus, HumanoidMTR's affordances for communication and mobility were identified by nursing home staff to appropriate the technology for a different task. During the COVID-19 pandemic, some staff members had to organize video calls via mobile phones or tablets for the nursing home residents to communicate with their families. This became their primary practice, as there were too many residents and a shortage of healthcare staff. This practice was problematic and monotonous, as healthcare workers had to schedule the call with the family, hold the device throughout the call, and address any technical issues that arose. However, as the media articles stress, maintaining human contact between isolated residents and their environment is critical. Although HumanoidMTR was still intended to aid in other tasks, such as announcing the menu, it was considered that mobile telepresence was more relevant to alleviate the burden on healthcare workers of facilitating video calls for residents, even after the COVID-19 pandemic's lockdown. Therefore, the tests began with HumanoidMTR for the mobile telepresence task, and MachineMTR was included.

After repeated tests with HumanoidMTR and MachineMTR, the nursing home participants suggested new ways to utilize MTRs, leveraging their features like audio output, touch screen display, and mobility to reduce unnecessary travel and save time for more valuable practices. For some participants, such features enable mobile information dissemination and data collection. These participants imagined that residents could hear and view information on the screen about the daily menu, for example, as the MTRs move around the nursing home and residents enter their individual choices via the touch screen. They envisioned MTRs assisting with non-clinical duties, aiming to alleviate these mundane practices, like locating each resident to bring them to therapy sessions,

"The physiotherapist has a list of people who come to rehabilitation every day. She has to go upstairs every day and let them know. They sometimes forget, so there should be a mechanism that allows [the MTRs] to go to a room and say 'Dolores Fernández has physiotherapy' and then it is not necessary for a person to go up and down" (P7).

Participants emphasized the challenge of balancing administrative tasks with more meaningful tasks related to direct patient care, prompting exploration of MTRs as potential solutions,

"[MTRs] could accompany the patients to the room, help them fill out the data protection law questionnaires before going to the consultation, that could make me waste less time on things that are a little more automatic that must be done" (P9).

Informants from the nursing home, hospitals, and private clinics expressed frustration with organizational responsibilities detracting from meaningful clinical duties and proposed MTRs managing such practices. Consequently, this illustrates the active agency healthcare professionals demonstrate in appropriating MTRs within their work environments.

4.4. Organizational structures for implementing MTRs in healthcare settings with meaningful work in mind

This section presents findings on organizational structures for implementing and using MTRs to promote meaningful work (Table 5), i.e., a seamless and safe experience, proper infrastructure, technical support, and a training system.

4.4.1. Seamless and safe experience

Findings revealed that MTRs could enable meaningful work only if they afford smooth and safe navigation with uninterrupted communication. A smooth navigation implies that both onsite and remote users, i.e., healthcare staff, family members, and patients have a seamless experience in which the remote user can navigate easily, and onsite healthcare staff only provide the bare minimum of supervision to be able to focus on their core work tasks. In other words, the analysis revealed a preference for MTRs to have autonomous navigation, which entails little or no assistance from healthcare workers located in healthcare facilities. Moreover, a seamless experience entails effective communication, meaning that all users must be able to see and hear clearly. Otherwise, medical assessments are compromised, which is highly relevant for telemedicine.

Even when MTRs may be advantageous for healthcare workers, if

Table 5
Structures to implement MTRs and promote meaningful work.

Second-order dimensions	First-order categories	Evidence example	Evidence support[a]
Seamless and safe experience	*Assuredness of the robot's well-functioning*	*-I would need confidence that the robot will perform its function (P6)*	*
	Patients/residents/ family members' well-being	*-It should do everything it can to increase the quality we offer our patients (P5)*	
Proper infrastructure	*Technical infrastructure*	*-A good internet connection (P9)*	*
	Adequate spaces	*-That there were architectural barriers in some places (P18)*	
	Assigned spaces	*- An appropriate, quiet environment (P20)*	
Technical support	*Facilitate help and use*	*- That there is technical support, and that it is easy to use, especially for elderly people (P11)*	*
Training system	*Adequate training*	*- A course to know how to handle it, a tutorial, a training (P10)*	*
	Usage formalities	*- It would require initial learning time and adaptation time to develop protocols (P15)*	*

[a]** Evidence supported across the data sources; * Evidence supported by the interview data.

such robots are not beneficial for patients and family members, the meaningfulness of work may not be promoted. In other words, findings show that even if healthcare workers can be freed from some routine tasks thanks to the MTRs, they are more likely to feel that their work is meaningful if they witness the improvement in the well-being of patients and their families through the use of MTRs.

4.4.2. Proper infrastructure

The healthcare setting's infrastructure plays a key role in the context of MTRs and meaningful work. First, the analysis showed that having wireless internet in all rooms and hallways is imperative for remote users to navigate between different rooms. However, navigating a healthcare facility can be problematic due to safety and privacy concerns. An informant (P13) proposed establishing lanes or designated areas to comply with safety measures, which could be paired with MTRs equipped with autonomous navigation, allowing remote users to avoid compromising safety for onsite users. Furthermore, infrastructure also involves spaces dedicated to the storage and use of MTRs. For example, nursing homes might benefit from dedicating a room for video calls because older adults may be hearing-impaired and, thus, unable to communicate effectively in crowded rooms. It was further pointed out that organizing consultation schedules implies that MTRs need to become integrated into the healthcare IT system. Data and systems integration may also be required for data protection issues, which informants highlighted as a relevant topic in healthcare.

4.4.3. Technical support and training system

Participants emphasized the importance of adequate training in managing MTRs to maintain trust among patients and their family members, and thereby ensure meaningful work. They emphasized the importance of thorough instruction from robot providers to ensure proficiency in operating the robots, highlighting concerns about potential embarrassment and loss of patient confidence if they were unable to use the technology effectively. Furthermore, participants advocated for comprehensive training programs provided by the technical teams of robot providers, encompassing the operational aspects and protocols for handling potential failures. They recognized the importance of maintaining constant communication with robot providers and prepared for contingencies. Some informants emphasized the need for dedicated time to undergo such training, even if it entails temporarily stepping away from healthcare tasks.

4.5. The interplay between organizational structures and healthcare staff agency

Table 6 summarizes findings on how healthcare employees' agency and organizational structures contribute to promoting meaningful work through connections, contributions, and recognition. Employees actively adapt and integrate MTRs to enhance patient and family interactions, streamline non-clinical duties, and alleviate administrative burdens. Simultaneously, organizational structures such as seamless navigation systems, proper infrastructure, and training and support programs enable the implementation of MTRs for meaningful work. Together, these factors illustrate the interplay between individual agency and organizational structures in fostering meaningful work in healthcare settings.

5. Discussion

This qualitative research utilized triangulated data obtained from interviews and focus groups involving healthcare professionals in nursing homes, hospitals, and private clinics and observational and archival data to understand how MTRs impact the meaningfulness of work for healthcare staff and how the interplay of organizational structures and healthcare staff agency can help in managing this impact.

Findings showed that the three dimensions of meaningful work in healthcare, i.e., connections, contributions, and recognition (Pavlish and Hunt, 2012; Pavlish et al., 2019; Horowitz et al., 2003) are both positively and negatively influenced by MTRs, creating a *paradox of distance and proximity* (Rauch et al., 2022). For instance, MTRs facilitate remote medical consultations, enabling healthcare staff to be somehow proximate and assist more patients with less effort, particularly in cases where physical contact is less critical. However, the lack of physical interaction may create distance and reduce the emotional connection and acknowledgment typically achieved through touch, such as handshakes or hugs. The effective implementation and use of MTRs necessitates thoughtful consideration to manage the contrasting elements that promote and inhibit meaningful work.

The conceptual model presented below (Fig. 3) is grounded in the findings and unravels the ongoing process through which healthcare employees' agency is interrelated with the organizational structures and vice versa in navigating the paradox of distance and proximity provoked by MTRs, and the ongoing outcome of this interplay will affect the dimensions of meaningful work. Thus, in the context of this study,

Table 6
The roles of organizational structures and healthcare staff agency towards meaningful work.

Meaningful work sources	Role of healthcare employee's agency (Innovation and technology appropriation)	Role of organizational structures (e.g., training system)
Connections	*- Appropriating MTRs for facilitating remote communication (e.g., family video calls).*	*- Providing proper infrastructure (e.g., wireless internet, dedicated video call spaces) to support connections.*
Contributions	*- Advocating for features like autonomous navigation to reduce administrative burdens and thus have more time to treat patients.*	*- Integrating MTRs into healthcare IT systems for better data accessibility and task coordination for patient treatment.*
Recognition	*- Demonstrating how MTRs improve patient and family well-being to reinforce the value of healthcare work.*	*- Offering training programs to build confidence in MTR operation and providing ongoing technical support to address failures and ensure effective MTR use.*

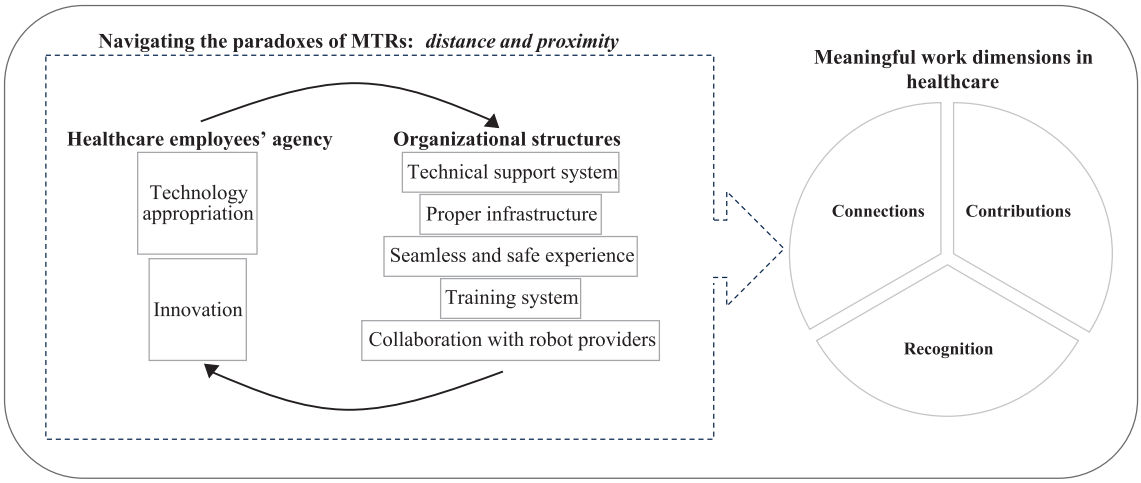

Fig. 3. The roles of structures and agency for meaningful work with MTRs in healthcare.

organizational structures, such as technical support systems, are viewed as social structures in the Giddensian sense. These structures enable healthcare staff to innovate with MTRs while simultaneously being redefined through the staff's appropriation and adaptation of the technology.

The findings of this study align with Rauch et al.'s (2022) research on the paradoxical effects of remote-controlled technologies while extending their work by proposing that *technology appropriation* and innovation serve as coping mechanisms. Thus, appropriating technology can be an additional coping mechanism to render work meaningful by taking a practice-based approach (Leonardi et al., 2010; Orlikowski, 2000), in which the constant use of the technology will help imagine ways in which it can be repurposed to promote the meaningfulness of work. Healthcare staff in this study demonstrated creative approaches to appropriating MTRs to tackle specific challenges. For example, nursing home staff repurposed a HumanoidMTR to facilitate video calls with family members, even though this was not its intended use. Similarly, hospital staff envisioned using MTRs for initial patient assessments, reserving in-person interactions for more critical stages of care. These instances highlight the relevance of technology appropriation in navigating the paradox of distance and proximity (Leonardi et al., 2010), as it enables staff to adapt technology to align with their professional values for meaningful work.

Leonardi et al. (2010) argued that technology appropriation can help navigate paradoxes that emerged thanks to the same technologies. However, this study shows that individuals need not only to utilize the technology with its current capabilities but also to innovate by envisioning new ways in which the technology can be enhanced, adding capabilities that will help promote meaningful work. Even when nursing home participants interacted with both MTRs and therefore engaged with their current features, they still showed interest in appropriating them in ways that involved features that were not integrated into the MTRs by the time of the study, i.e., autonomous navigation, data input through the screen, and localization of specific individuals through facial recognition. Participants from hospitals and private clinics also proposed use cases that involve the above-mentioned features, even when the video recordings only showcase the mobile telepresence features in the video call use case. Therefore, it can be claimed that to navigate the paradoxes that emerge thanks to remote-controlled technologies, i.e., distance and proximity, and, in parallel, promote meaningful work, technology appropriation needs to be accompanied by an ongoing innovation process in which individuals can contribute to the improvement of technology to fulfill their needs.

The findings emphasize the dynamic relationship between agency and organizational structures. Participants envisioned the structures necessary to promote meaningful work when implementing and using MTRs, tailoring them to the specific needs of their local contexts (Giddens, 1984; Leonardi et al., 2010). Given that this study did not involve the constant and naturally integrated use of MTRs in the work of healthcare staff, the structural transformations were explored through future envisioning based on current interactions with MTRs and the affordances perceived by participants. This way, participants proposed rules and resources, i.e., organizational structures, including a proper infrastructure, a technical support system, a seamless and safe experience, and a training system, which in turn will enable technology appropriation and continuous innovation (Fig. 3). These structures may allow meaningful work experiences despite the potential ways MTRs could inhibit meaningful work. In other words, how MTRs represent a threat to meaningful work, e.g., by decreasing face-to-face interactions, cannot be avoided; however, meaningful work can be promoted if adequate structures are put in place and properly shaped by the healthcare staff's agency. Thus, thoughtful implementation and use of MTRs in which healthcare providers promote meaningful work requires identifying and cultivating the appropriate rules and resources, i.e., organizational structures for meaningful work. Structures could be implemented so that healthcare staff are more prone to experience meaningful work when interpreting, adapting, and integrating technology into their work routines. Meaningful work is experienced by individuals on a personal level, but it is influenced by broader structural factors (Laaser and Karlsson, 2022). Therefore, structure creates the objective conditions for promoting meaningful work, and agency enables individuals to repurpose technology and find new ways to use and improve it for meaningful work.

5.1. *Theoretical contributions and practical implications*

The study provided two main contributions. First, in line with the processual approach (Cloutier and Langley, 2020), we ground the use of MTRs in healthcare within technology appropriation (Leonardi et al., 2010) and structuration (Giddens, 1984) by clarifying how they interact and contribute to the concept of work meaningfulness, which has emerged as a key phenomenon within the workplace (Fürstenberg et al., 2021; Rai et al., 2023). Research on telemedicine technology (Beane and Orlikowski, 2015; Nicolini, 2007) reveals a notable shift in the roles of both individuals and technological components. However, the simultaneous representation of MTRs as opportunities and threats to meaningful work remains underexplored. We fill this gap and extend this knowledge by showing that these roles can be shaped by innovating and appropriating technology for meaningful work. The concept of technology appropriation emerges as a key mechanism for navigating the

paradoxes of distance and proximity associated with MTRs, which represent a threat and an opportunity for meaningful work. This study proposes that the agency of individuals allows them to appropriate technology in their constant practices and innovate with new uses and features for meaningful work. In this case, healthcare staff demonstrated the ability to creatively repurpose MTRs and imagine new ways to be used or enhanced to address specific needs, indicating the importance of technology appropriation and ongoing innovation processes to enhance technology capabilities and fulfill evolving work-related requirements. Structuration theory allowed a better understanding of the roles of organizational structures and healthcare employees' agency in applying MTRs for meaningful work in healthcare. Understanding organizational structures through structuration theory as dynamic rather than static highlights the relevance of promoting flexible infrastructures that evolve in tandem with healthcare staff's practices and the introduction of technology. While certain aspects of MTRs may threaten meaningful work, establishing organizational structures, including a proper infrastructure, technical support systems, training programs, and collaborative relationships with technology providers, can mitigate these challenges and create conducive conditions for meaningful work. Furthermore, the study highlights the collaborative relationship between healthcare institutions and technology providers as vital for promoting innovation and maximizing the potential of MTRs to support meaningful work.

Second, we expand knowledge on human-robot interaction and meaningful work by providing empirical evidence in healthcare settings to what Smids et al. (2020) propose, specifically, that robots in the workplace can represent both a threat and an opportunity for meaningful work. The study highlights the dual role of MTRs in healthcare, where they simultaneously offer opportunities and threats to meaningful work. This observation aligns with and extends existing research on remote-controlled technologies (Rauch et al., 2022), emphasizing the importance of understanding the paradoxical effects they may generate, such as creating both distance and proximity in work interactions and recognizing technology appropriation as a coping mechanism. Existing research typically presents a one-sided view of the role of MTRs in healthcare (e.g., Koceski and Koceska, 2016). However, we contribute to the existing literature by discussing and integrating both aspects and present a multifaceted view of how such robots promote and inhibit meaningful work for healthcare staff. By exploring the interplay between MTRs and the dimensions of meaningful work in healthcare, i.e., connections, contributions, and recognition (Pavlish and Hunt, 2012; Pavlish et al., 2019; Horowitz et al., 2003), the study expands our understanding of how technological advancements in healthcare can influence these aspects positively and negatively. As such, our research provides a nuanced and in-depth understanding of the role of MTRs in meaningful work within healthcare. Overall, this study aligns with previous research on robotic and remote-controlled technologies (e.g., Smids et al., 2020; Rauch et al., 2022) by reaffirming that MTRs present both opportunities and threats to meaningful work, challenging single-faceted perspectives (e.g., Koceski and Koceska, 2016). However, this research goes further by uncovering the critical role of healthcare staff agency and organizational structures in appropriating MTRs, highlighting how these elements interact to transform the paradoxes of distance and proximity into opportunities for meaningful work (Leonardi et al., 2010; Orlikowski, 2000). Unlike traditional telemedicine, where interactions are typically mediated by static interfaces, MTRs introduce mobility and dynamic interactivity, which reshape both the nature of professional-patient relationships and work practices (Rauch et al., 2022; Beane and Orlikowski, 2015). By integrating insights from structuration theory (Giddens, 1984), this study provides a nuanced perspective on how the appropriation of technology can mitigate the threats posed by robotic technologies and create novel pathways for enhancing the meaningfulness of work. This builds on prior findings that technologies evolve through iterative engagement by users (Orlikowski, 1992) and are co-shaped by organizational and individual practices (Leonardi et al., 2010). Consequently, this research extends the literature by demonstrating that previous theories, while relevant, require adaptation to account for the unique affordances and challenges introduced by MTRs, particularly in healthcare settings where relational and tactile dimensions are critical to meaningful work (Kuoppakangas et al., 2023; Nicolini, 2007).

Lastly, the study offers practical implications for how work meaningfulness can be promoted when MTRs are used in healthcare, providing direction to implementing and using such robots. The study suggests empowering healthcare staff to exercise agency in appropriating MTRs for their specific needs and contexts. It also explores creative ways of using MTRs to enhance meaningful connections, contributions, and recognition in their work while providing support and resources to facilitate this process. When MTRs' implementation is forthcoming, it may be beneficial to encourage staff to share their insights, ideas, and suggestions for enhancing MTR capabilities and addressing any challenges or limitations encountered in their daily work.

In brief, MTRs threaten to diminish human interaction, compromising the core of meaningful work for healthcare professionals. However, technology appropriation emerges as a key method for managing the contradictions between distance and proximity linked with MTRs, which present both challenges and opportunities for meaningful work. Therefore, the threats are mitigated through implementing organizational structures and the employees' agency in appropriating and innovating MTRs. Strategies to address these threats include investing in training programs to ensure staff proficiency and creativity in using MTRs. Additionally, involving healthcare staff in the iterative development of MTR functionalities can help address potential shortcomings and promote their acceptance. Understanding the consequences of introducing robotics into healthcare is imperative before widespread implementation, aiming to preserve or enhance the quality and effectiveness of healthcare delivery. Thus, this research suggests that despite the multifaceted consequences of introducing MTRs, establishing organizational structures and individuals' agency may enable them to adapt technology in their regular routines and innovate continuously with novel applications and functions for meaningful work.

5.2. Limitations and future research

The study primarily relied on tests to explore the potential impact of MTRs on meaningful work in healthcare. While these controlled scenarios provided valuable insights into the perceived benefits and challenges associated with MTR implementation, they may not fully capture the complexity and nuances of real-life interactions between healthcare professionals, patients, and robotic technology. Therefore, there is a need for future research to empirically validate the findings of this study in genuine healthcare contexts. As service robot technologies continue to evolve and become increasingly integrated into clinical practice, robust empirical studies are required to assess their impact on meaningful work, patient outcomes, and organizational efficiency. Furthermore, future studies could expand this research by incorporating perspectives from healthcare staff with specialties that were not directly included in this study to explore additional factors that may influence the meaningfulness of work.

6. Conclusion

This qualitative study examined MTRs being tested in a nursing home and cross-referenced insights from healthcare workers in hospitals and private clinics. MTRs offer both opportunities and challenges to meaningful work. They enable staff to focus on patient care, especially in remote areas, while potentially distancing them from direct patient interaction. This dual impact aligns with existing research on remote technologies, suggesting that MTRs can simultaneously create closeness and distance. Therefore, effective implementation of MTRs requires managing contrasting elements. The study suggests that appropriating

technology, i.e., MTRs, where healthcare professionals creatively repurpose it to address specific needs, can promote meaningful work. In parallel, structures could be implemented to enable healthcare staff to experience more meaningful work when interpreting, adapting, and integrating technology into their work routines. Therefore, the role of healthcare settings' structures in applying MTRs for meaningful work is to create objective conditions that promote meaningful work, while the agency of healthcare staff allows individuals to repurpose technology and innovate, finding new ways to utilize it for meaningful work.

CRediT authorship contribution statement

Alejandra Rojas: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Conceptualization. **Ismail Gölgeci:** Writing – review & editing, Writing – original draft. **Gabriele Santoro:** Writing – review & editing.

Declaration of competing interest

none.

Acknowledgements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 956745. The content of this publication does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the publication lies entirely with the author(s).

The larger assessment where data collection took place has been funded by the regional projects AT17-5509-UMA 'ROSI' (Plan Andaluz de Investigación, Desarrollo e Innovación - PAIDI 2020, Junta de Andalucía) and UMA18-FEDERJA-074 'ITERA' (Programa Operativo FEDER Andalucía 2014-2020. Convocatoria 2018), by the FEDER/Ministerio de Ciencia e Innovación TED2021-131739B-C21 and PDC2022-133597-C42 projects, and by the DIH-HERO SUSTAIN project (European Union's Horizon 2020 research and innovation programme, under grant agreement No 825003). The authors would like to thank the residents, relatives and professionals at Vitalia Teatinos, for their kind help during data collection.

Appendix A. Interview informants

Occupation	Hospital #1 (In-person Interview)	Hospital #2 (In-person Interview)	Private clinic (Online Interview)	Nursing home (In-person Interview)	Total
Nursing assistant	–	–	–	2	2
Data manager	1	–	–	–	1
Director	–	–	–	1	1
General practitioner	1	–	–	–	1
Nurse	–	2	–	–	2
Physiotherapist	1	2	5	3	11
Psychologist	1	–	3	1	5
Social worker	–	–	–	1	1
Psychiatrist	–	1	–	–	1
Total	**4**	**5**	**8**	**8**	**25**

Appendix B. Interview protocol

Introduction

- A friendly introduction to research, interview purpose, and confidentiality.

Meaningful work

- Tell me about your day. What do you normally do?
- Tell me stories about incidents or times when you felt your work was meaningful or important. And why?
- Tell me stories about experiences that led you to wonder, "Why am I doing this?" And why?

MTRs implementation and use

- What do you think are the possible use cases for MTRs?
- How do you feel about using these technologies for these purposes? Why?
- Do you think MTRs will change your daily practices? How? Why?
- How would you implement it in the workplace?
- Imagine that next week, you will start using the robot for the previously mentioned meaningful task. What does it take from yourself, the team, the residents/patients, and the administration? Why?

How it supports or should support meaningful work

- If you think about the things that make your work meaningful, does this robot support that? Why? How?
- How could you imagine a more meaningful way to use the robot? Why?
- How can this robot help you improve your work with residents and family?
- What can this robot do to make your work more meaningful?
- What should this robot be able to do to make you feel that your work is (more) meaningful? Why?

Closing: Thank the participants for their time.

Data availability

Data will be made available on request.

References

Archer, M.S., 1995. Realist Social Theory: The Morphogenetic Approach. Cambridge University Press.

Arora, N., Garg, N., 2024. Meaningful work in the digital age-a comprehensive review and framework. Hum. Resour. Dev. Int. 1–25.

Bailey, C., Lips-Wiersma, M., Madden, A., Yeoman, R., Thompson, M., Chalofsky, N., 2019a. The five paradoxes of meaningful work: introduction to the special issue 'meaningful work: prospects for the 21st century'. J. Manag. Stud. 56 (3), 481–499.

Bailey, C., Madden, A., Lips-Wiersma, M., 2024. Experiencing meaningful work through worthwhile contributions: a critical discourse analysis. Hum. Relat. 00187267241255581.

Bailey, C., Yeoman, R., Madden, A., Thompson, M., Kerridge, G., 2019b. A review of the empirical literature on meaningful work: Progress and research agenda. Hum. Resour. Dev. Rev. 18 (1), 83–113.

Basile, L.J., Carbonara, N., Panniello, U., Pellegrino, R., 2024. How can technological resources improve the quality of healthcare service? The enabling role of big data analytics capabilities. IEEE Trans. Eng. Manag. 71, 5771–5781.

Batuchina, A., Iždonaitė-Medžiūnienė, I., Lecaj, R., 2025. Multidimensional scale of meaningful work: construction and validation. Front. Psychol. 16, 1578825. https://doi.org/10.3389/fpsyg.2025.1578825.

Beane, M., Orlikowski, W.J., 2015. What difference does a robot make? The material enactment of distributed coordination. Organ. Sci. 26 (6), 1553–1573.

Blustein, D.L., Lysova, E.I., Duffy, R.D., 2023. Understanding decent work and meaningful work. Annu. Rev. Organ. Psych. Organ. Behav. 10 (1), 289–314.

Boada, J.P., Maestre, B.R., Genís, C.T., 2021. The ethical issues of social assistive robotics: a critical literature review. Technol. Soc. 67, 101726.

Bueger, C., Gadinger, F., 2018. Doing Praxiography: Research strategies, methods and techniques. In: Bueger, In C., Gadinger, F. (Eds.), International Practice Theory. Springer International Publishing, pp. 131–161.

Cesta, A., Cortellessa, G., Orlandini, A., Tiberio, L., 2016. Long-term evaluation of a telepresence robot for the elderly: methodology and ecological case study. Int. J. Soc. Robot. 8, 421–441.

Cloutier, C., Langley, A., 2020. What makes a process theoretical contribution? Organization Theory 1 (1), 2631787720902473.

Constantinides, P., 2024. Digital transformation in healthcare: an ecosystem approach. Routledge. https://doi.org/10.4324/978-1-032-61956-9.

Corbin, J.M., Strauss, A.L., 2015. Basics of Qualitative Research: Techniques and Procedures for Developing Grounded Theory, 4th ed. Sage publications, Thousand Oaks, CA.

Dal Mas, F., Massaro, M., Rippa, P., Secundo, G., 2023. The challenges of digital transformation in healthcare: an interdisciplinary literature review, framework, and future research agenda. Technovation 123, 102716.

Dantas, E., Nogaroli, R., 2021. The rise of robotics and artificial intelligence in healthcare: new challenges for the doctrine of informed consent. Med. Law 40 (1), 15–62.

Dionisio, M., De Souza Junior, S.J., Paula, F., Pellanda, P.C., 2023. The role of digital transformation in improving the efficacy of healthcare: a systematic review. J. High Technol. Managem. Res. 34 (1), 100442.

Dubois, A., Gadde, L.-E., 2002. Systematic combining: an abductive approach to case research. J. Bus. Res. 55 (7), 553–560.

Eisenhardt, K.M., 1989. Building theories from case study research. Acad. Manag. Rev. 14 (4), 532.

Eisenhardt, K.M., 2021. What is the Eisenhardt method, really? Strateg. Organ. 19 (1), 147–160.

Feldman, M.S., Orlikowski, W.J., 2011. Theorizing practice and practicing theory. Organ. Sci. 22 (5), 1240–1253.

Fürstenberg, N., Alfes, K., Shantz, A., 2021. Meaningfulness of work and supervisory-rated job performance: a moderated-mediation model. Hum. Resour. Manag. 60 (6), 903–919.

Gehman, J., Glaser, V.L., Eisenhardt, K.M., Gioia, D., Langley, A., Corley, K.G., 2018. Finding Theory–Method Fit: A Comparison of Three Qualitative Approaches to Theory Building. J. Manag. Inq. 27 (3), 284–300.

Geist-Martin, P., Scarduzio, J.A., 2011. Working well: Reconsidering health communication at work. In: The Routledge Handbook of Health Communication. Routledge, pp. 145–159.

Giddens, A., 1984. The Constitution of Society: Outline of the Theory of Structuration. Polity Press.

Gurd, B., 2008. Structuration and middle-range theory—a case study of accounting during organizational change from different theoretical perspectives. Crit. Perspect. Account. 19 (4), 523–543.

Hidefjäll, P., Laurell, H., Johansson, J., Barlow, J., 2023. Institutional logics and the adoption and implementation of remote patient monitoring. Innovation 1–20. https://doi.org/10.1080/14479338.2022.2162907.

Holland, J., Kingston, L., McCarthy, C., Armstrong, E., O'Dwyer, P., Merz, F., McConnell, M., 2021. Service robots in the healthcare sector. Robotics 10 (1), 47.

Horowitz, C.R., Suchman, A.L., Branch, W.T., Frankel, R.M., 2003. What do doctors find meaningful about their work? Ann. Intern. Med. 138 (9), 772.

Jarzabkowski, P., 2008. Shaping strategy as a structuration process. Acad. Manag. J. 51 (4), 621–650.

Kim, T.W., Scheller-Wolf, A., 2022. Technological unemployment, meaning in life, purpose of business, and the future of stakeholders. In: Business and the Ethical Implications of Technology. Cham, Springer Nature Switzerland, pp. 13–31.

Koceski, S., Koceska, N., 2016. Evaluation of an assistive telepresence robot for elderly healthcare. J. Med. Syst. 40, 1–7.

Kraus, S., Schiavone, F., Pluzhnikova, A., Invernizzi, A.C., 2021. Digital transformation in healthcare: analyzing the current state-of-research. J. Bus. Res. 123, 557–567.

Kummitha, R.K.R., 2020. Why distance matters: the relatedness between technology development and its appropriation in smart cities. Technol. Forecast. Soc. Chang. 157, 120087.

Kuoppakangas, P., Stenvall, J., Kinder, T., Lindfors, J., Talonen, A., 2023. Detecting and managing the mechanism of perceived meaningfulness of work and digital transformation in public sector health and social care services. Technol. Forecast. Soc. Chang. 194, 122663.

Laaser, K., Karlsson, J.C., 2022. Towards a sociology of meaningful work. Work Employ. Soc. 36 (5), 798–815.

Langley, A., 2007. Process thinking in strategic organization. Strateg. Organ. 5 (3), 271–282. https://doi.org/10.1177/1476127007079965.

Lee, M.K., Takayama, L., 2011. "Now, I have a body": uses and social norms for mobile remote presence in the workplace. Proceedings of the SIGCHI Conference on Human Factors in Computing Systems 33–42.

Leonardi, P.M., 2013. When does technology use enable network change in organizations? A comparative study of feature use and shared affordances. MIS Q. 37 (3), 749–775.

Leonardi, P.M., Treem, J.W., Jackson, M.H., 2010. The connectivity paradox: using technology to both decrease and increase perceptions of distance in distributed work arrangements. J. Appl. Commun. Res. 38 (1), 85–105.

Lincoln, Y.S., Guba, E.G., 1985. Naturalistic inquiry. Sage Publications, pp. 289–331.

Lozovetska, V., Pavlov, Y., Fedorenko, L., 2024. Meaningful work literature meta-review. Multidisciplinary Science Journal 6.

Lukka, K., Vinnari, E., 2014. Domain theory and method theory in management accounting research. Account. Audit. Account. J. 27 (8), 1308–1338. https://doi.org/10.1108/AAAJ-03-2013-1265.

Lysova, E.I., Allan, B.A., Dik, B.J., Duffy, R.D., Steger, M.F., 2019. Fostering meaningful work in organizations: a multi-level review and integration. J. Vocat. Behav. 110, 374–389.

Lysova, E.I., Tosti-Kharas, J., Michaelson, C., Fletcher, L., Bailey, C., McGhee, P., 2023. Ethics and the future of meaningful work: introduction to the special issue. J. Bus. Ethics 185 (4), 713–723.

Mackel, C.E., Saway, B.F., Alterman, R.L., Spiotta, A.M., Sweet, J.A., Davis, R.B., Stippler, M., 2025. Meaningful work, organizational commitment and administrative burden among attending neurosurgeons. Neurochirurgie 71 (2), 101645.

Michaelson, C., Pratt, M.G., Grant, A.M., Dunn, C.P., 2014. Meaningful work: connecting business ethics and organization studies. J. Bus. Ethics 121 (1), 77–90.

Mortimer, S.A., 2023. What makes work meaningful? J. Bus. Ethics 185 (4), 835–845.

Naik, N., Hameed, B.M.Z., Sooriyaperakasam, N., Vinayahalingam, S., Patil, V., Smriti, K., Saxena, J., Shah, M., Ibrahim, S., Singh, A., Karimi, H., Naganathan, K., Shetty, D.K., Rai, B.P., Chlosta, P., Somani, B.K., 2022. Transforming healthcare through a digital revolution: a review of digital healthcare technologies and solutions. Frontiers in Digital Health 4, 919985.

Nicolini, D., 2007. Stretching out and expanding work practices in time and space: the case of telemedicine. Hum. Relat. 60 (6), 889–920.

Nikolova, M., Cnossen, F., Nikolaev, B., 2024. Robots, meaning, and self-determination. Res. Policy 53 (5), 104987.

Orlikowski, W.J., 1992. The duality of technology: rethinking the concept of technology in organizations. Organ. Sci. 3 (3), 398–427.

Orlikowski, W.J., 2000. Using technology and constituting structures: a practice Lens for studying Technology in Organizations. Organ. Sci. 11 (4), 404–428.

Pavlish, C., Hunt, R., 2012. An exploratory study about meaningful work in acute care nursing: an exploratory study about meaningful work in acute care nursing. Nurs. Forum 47 (2), 113–122.

Pavlish, C.L., Hunt, R.J., Sato, H.-W., Brown-Saltzman, K., 2019. Finding meaning in the work of caring. In: Yeoman, R., Bailey, C., Madden, A., Thompson, M. (Eds.), The Oxford Handbook of Meaningful Work. Oxford University Press, pp. 236–256.

Pérez-Francisco, D.H., Duarte-Clíments, G., Del Rosario-Melián, J.M., Gómez-Salgado, J., Romero-Martín, M., Sánchez-Gómez, M.B., 2020. Influence of workload on primary care nurses' health and burnout, patients' safety, and quality of care: integrative review. Healthcare 8 (1), 12.

Portoghese, I., Galletta, M., Coppola, R.C., Finco, G., Campagna, M., 2014. Burnout and workload among health care workers: the moderating role of job control. Saf. Health Work 5 (3), 152–157.

Pozzebon, M., Pinsonneault, A., 2005. Challenges in conducting empirical work using structuration theory: learning from IT research. Organ. Stud. 26 (9), 1353–1376.

Rai, A., Kim, M., Singh, S.K., 2023. Meaningful work from ethics perspective: Examination of ethical antecedents and outcomes of meaningful work. J. Bus. Res. 169, 114287.

Rauch, M., Ansari, S., (Shaz)., 2022. Waging war from remote cubicles: how workers cope with technologies that disrupt the meaning and morality of their work. Organ. Sci. 33 (1), 83–104.
Restauri, N., Nyberg, E., Clark, T., 2019. Cultivating meaningful work in healthcare: a paradigm and practice. Curr. Probl. Diagn. Radiol. 48 (3), 193–195.
Rousseau, D.M., Manning, J., Denyer, D., 2008. 11 evidence in management and organizational science: assembling the field's full weight of scientific knowledge through syntheses. Acad. Manag. Ann. 2 (1), 475–515.
Russo, A., Zammitti, A., Catania, C., Magnano, P., Santisi, G., 2025. Unlocking the power of meaningful work: elevating engagement and satisfaction in the realm of decent jobs. International Journal of Organization Theory & Behavior 28 (1), 56–70.
Šabanović, S., 2010. Robots in society, Society in Robots: mutual shaping of society and technology as a framework for social robot design. Int. J. Soc. Robot. 2 (4), 439–450.
Sadeghian, S., & Hassenzahl, M. (2022). The "artificial" colleague: evaluation of work satisfaction in collaboration with non-human coworkers. In *proceedings of the 27th international conference on intelligent user interfaces* (pp. 27-35).
Schiavone, F., Simoni, M., 2019. Strategic marketing approaches for the diffusion of innovation in highly regulated industrial markets: The value of market access. J. Bus. Ind. Mark. 34 (7), 1606–1618. https://doi.org/10.1108/JBIM-08-2018-0232.
Scripter, L., 2024. The achievement gap thesis reconsidered: artificial intelligence, automation, and meaningful work. AI & Soc. 1–14.
Seibt, J., Malene, F.D., Christina, V., 2018. Five principles of integrative social robotics. In: Coeckelbergh, M., Loh, J., Funk, M., Seibt, J., Nørskov, M. (Eds.), Envisioning Robots in Society: Power, Politics, and Public Space: Proceedings of Robophilosophy, 2018, University of Vienna, Austria (Pp. 28–42). IOS Press.
Smids, J., Nyholm, S., Berkers, H., 2020. Robots in the workplace: a threat to—or opportunity for—meaningful work? Philosophy & Technology 33 (3), 503–522.
Sousa-Ribeiro, M., Knudsen, K., Persson, L., Lindfors, P., Sverke, M., 2024. Meaning of working for older nurses and nursing assistants in Sweden: a qualitative study. J. Aging Stud. 69, 101230.
Tan, K.L., Sim, A.K., Yap, S.S.N., Vithayaporn, S., Rachmawati, A.W., 2023. A systematic review of meaningful work unifying 20 years of theoretical and substantive contributions (2000−2020). Journal of Advances in Management Research 20 (3), 462–512.
Thompson, J.A., Bunderson, J.S., 2019. Research on work as a calling… and how to make it matter. Annu. Rev. Organ. Psych. Organ. Behav. 6 (1), 421–443.
Whittington, R., 2015. Giddens, structuration theory and strategy as practice. In: Golsorkhi, D., Rouleau, L., Seidl, D., Vaara, E. (Eds.), Cambridge Handbook of Strategy as Practice, 2nd ed. Cambridge University Press, pp. 145–164.
Xu, M., Wang, W., Ou, C.X., Song, B., 2023. Does IT matter for work meaningfulness?: exploring the mediating role of job crafting. Inf. Technol. People 36 (1), 313–331.

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