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Organizational change process for healthcare organizations introducing mobile service robots

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Abstract: Healthcare organizations seeking to integrate service robots face challenges not directly addressed by existing change management literature. These challenges include inconsistencies in robot capabilities, stakeholder expectations, and integration of robots into existing work routines. To address this gap, an extended organizational change process framework is proposed based on findings from a qualitative study, clarifying the role of robot providers to elucidate the actions they may take to implement mobile service robots successfully. Emphasis on collaboration between healthcare organizations and robot providers and the broader involvement of individuals who hold significant influence over the technology's operation in the workplace follows the required socio-technical approach for technology-driven change. This framework aids healthcare organizations in smoother robot implementation, aligning with user needs.

Keywords: service; robots; healthcare; technology; appropriation; change; management; organizational; process.

1 Introduction

The constant arrival of innovative technological advancements is a common and expected aspect of operating in healthcare environments (Langhan *et al.,* 2015). One of the most recent technological innovations in healthcare is service robots. Healthcare organizations strive to be innovative and implement new technologies such as service robotics to be avant-garde and as technological fixes for major social issues (Šabanović, 2010), for instance, in response to longer lifespans and declining birth rates. In healthcare settings, service robots offer advantages like infection prevention, reduced errors, and freeing up staff for other tasks (Holland *et al.,* 2021), bringing potential benefits to the quality and effectiveness of healthcare services (Sætra, 2020). Despite benefits, the innovation

diffusion rate of service robots in healthcare has yet to reach maturity, indicating bottlenecks in successfully integrating service robots into healthcare settings.

A service robot is a physical device that operates partially or fully autonomously, interacting with its surroundings and possibly assisting or replacing humans in practical activities (Holland *et al.,* 2021; Šabanović, 2010). Tuomi and Ascenção (2023) distinguish service robots into three primary categories: robots that focus on mobility, robots that focus on object manipulation, and robots that focus on social interaction. This paper focuses on mobile robots, e.g., robots used for sterilization such as an autonomous ultraviolet-C (UVC) light disinfection robot (Holland *et al.,* 2021). Mobile robots such as the disinfection robot can perform tasks without human interference. For this reason, the implementation of service robots in workplaces, like hospitals, results in modifications to the responsibilities of employees and alters their time and space arrangements (Agreli *et al.,* 2021; Wright, 2023). Studies on service robot adoption in different service contexts, e.g., hospitality, have identified that it is crucial to analyse the core components of service tasks and evaluate their suitability for automation based on the current level of intelligent automation technology to redesign job roles and their associated task descriptions accordingly (Tuomi and Ascenção, 2023). Due to robots' impact on work, these technological innovations can bring about organizational, managerial, psycho-social, and socio-cultural consequences that need additional investigation (Ulhøi and Nørskov, 2021). Therefore, the automation of healthcare tasks must be carefully planned, considering the implications for job redesign.

Robots integrated into healthcare environments might compromise the meaningful aspects of work for healthcare professionals, e.g., bonding with patients (Pavlish *et al.,* 2019), giving rise to ethical concerns regarding depersonalizing care, ultimately diminishing the quality of care and disrupting the roles of workers (Boada *et al.,* 2021). Therefore, automation of service tasks in healthcare poses challenges that have significant implications in organizational, ethical, and social spheres. Even though the organizational adoption of robots has such wide-ranging implications, roboticists typically focus on technological capabilities to make robots attractive to users and rarely profoundly understand the dynamic interaction between society and technology (Šabanović, 2010; Wright, 2023). This lack of understanding may result in implementing service robots based on a weak foundation characterized by a mismatch in the robot's affordances, stakeholders' assumptions, and integration into existing work routines (Wright, 2023). For example, an ethnography in a nursing home where service robots were being used showed that staff were reluctant to use the robots, and when they did, their workload increased, contrary to the initial expectations of top management to reduce staff˝s overtime and allow them to focus on more meaningful tasks (Wright, 2023).

Integrating robots into indoor tasks like cleaning and delivery remains problematic because personnel need convincing through user-friendly interfaces and a tangible demonstration of the robots' value to justify their adoption (World Robotics 2023 – Service Robots, 2023). A well-designed robotic technology will not deliver value if not understood and used. The key to realizing benefits from technology, in this case mobile service robots, is focusing on people embracing and implementing the change (Hiatt and Creasey, 2012). Having a weak organizational foundation for the implementation of service robots may undermine the benefits in terms of quality and efficiency of healthcare practices and ultimately affect the healthcare staff's wellbeing.

How can then healthcare organizations set a solid organizational foundation for implementing service robots and reduce change management issues, e.g., resistance to

change and lack of awareness and training related to technological innovation? Extant literature on the implementation of emerging technologies mainly focuses on manufacturing companies and is usually complemented by frameworks for digital transformation originally developed by consulting companies (Bellantuono *et al.,* 2021). Nonetheless, when healthcare organizations decide to implement service robots, they can draw upon various theories, methodologies, and models from change management literature to guide their organizational change process. However, none of these are directly related to service robot implementation in healthcare.

Whelan-Berry and Somerville (2010) did a comprehensive analysis of change management literature to identify the most frequently proposed steps in the organizational change process, i.e., (1) formulating a clear and persuasive vision, (2) translating the vision of change, (3) ensuring individual employees embrace the change, (4) upholding the momentum of change implementation and (5) institutionalizing the change. The organizational change process framework proposed by Whelan-Berry and Somerville (2010), complemented with insights from some of the most influential change management models, such as those of Hiatt and Creasey (2012) and Kotter (1995), may be of great help for healthcare organizations that plan to implement service robots; however, it remains unclear when and how to tackle the eventual mismatch between the robot's capabilities, the expectations from stakeholders, the service tasks analysis, and the integration of robots in current routines, among other issues that reflect the complexity of the implementation of service robots. Thus, extending this process framework may be beneficial for healthcare organizations to clearly understand the change management strategy they may follow.

This study aims to draw on change management literature to guide the implementation process of mobile service robots in healthcare. The aim is to create a tool for discussion and elucidate the process for healthcare providers to successfully introduce mobile service robots. The study addresses the research questions: How can robot providers help healthcare organizations implement mobile service robots effectively? How can an extended organizational change process framework contribute to understanding the change management strategy in this context? Furthermore, how can the roles of robot designers, developers, and distributors, i.e., robot providers, be clarified within the change management process, filling the existing gap in academic literature?

2 Theoretical background

Organizational change process models commonly start with a solid vision to elucidate the direction in which the company aims to go (Kotter, 1995), for which it is necessary to identify the cause for change and generate a corresponding sense of urgency (Whelan-Berry and Somerville, 2010). How the vision is formulated, such as whether stakeholders are involved in its creation, can influence its approval by employees (Whelan-Berry and Somerville, 2010). This first step is a preparatory period in which the scale of change and the organization's preparedness will be evaluated by considering factors such as the values and backgrounds of affected groups, existing changes, expected resistance, and their history with change (Hiatt and Creasey, 2012). Simultaneously, in this step, it is relevant to secure project resources, evaluate the current team's capabilities, and establish a support structure of influential business leaders needed to guide, authorize, and lead the change (Hiatt and Creasey, 2012).

The second step involves translating the vision to the group and individual level, which entails its extension to various groups to coordinate and connect, facilitating the spread of change throughout the organization (Whelan-Berry and Somerville, 2010). It is recommended that all the available communication channels be used. However, the leaders of the change are the most potent form of communication, as leadership acts as a catalyst for change when leaders actively endorse the change vision (Kotter, 1995; Whelan-Berry and Somerville, 2010). Step three includes making sure individual employees accept the change, for which there are assessing tools to collect diagnostic feedback, such as the ADKAR Model that focuses on individual change based on five elements: Awareness, Desire, Knowledge, Ability, and Reinforcement (Hiatt and Creasey, 2012). The critical tactics for enhancing the implementation of healthcare technology involve gathering input from staff regarding the newly adopted technology, providing adequate education about it, ensuring easy access to information on how to use it, and offering early evaluation and feedback (Langhan *et al.,* 2015), which resonates with the ADKAR Model for diagnostic use. The evaluation of change through tools such as the AKDAR model offers guidance for formulating corrective action plans and activities, e.g., identifying instances where objections to change are not necessarily related to issues with technologies but are manifestations of resistance to change (Hiatt and Creasey, 2012). In this case, it may be beneficial to avoid debating the technological solution and pose questions such as "Do you support this change, or would you prefer to maintain the current state? What would make you genuinely support this change?" (Hiatt and Creasey, 2012). Understanding how the individual employees relate to the change may, therefore, help manage change resistance.

Introducing new healthcare technology in hospitals may face challenges, like low acceptance. Focusing on the system's usefulness or ease of use only tackles factors supporting acceptance, not those causing user resistance. Thus, it is vital to consider perceptions of threat and inequity, i.e., when someone rejects a system due to more work not being matched with a salary increase (Lin *et al.,* 2012). This means that, even when mobile service robots may solve problems and thus be helpful, there may be resistance to change that requires understanding how risky and unfair robots seem to employees.

To maintain the pace of change implementation in step four, the change initiative must receive the necessary attention and resources. Change endeavors need to be more adequately resourced to avoid delays or obstacles in implementation (Whelan-Berry and Somerville, 2010). In this fourth step, training and education serve as the foundation for understanding change and the essential skills for enabling change (Hiatt and Creasey, 2012). The fifth and last step involves institutionalizing the change, meaning that organizations work to integrate the intended change results into the fabric of the organizational culture, operations, and processes (Whelan-Berry and Somerville, 2010). Here, leaders play a crucial role in embedding the change initiative by actively monitoring progress, addressing encountered barriers, creating suitable structures, establishing monitoring mechanisms, and communicating the connection between change efforts and organizational achievements (Whelan-Berry and Somerville, 2010). Employees must clearly understand how changes have positively impacted the organization's performance (Kotter, 1995) so they continue embedding the changes in the corporate culture.

Nonetheless, it is essential to recognize that it is unlikely to find a universal organizational change process model that fits all change initiatives and that it is not a linear and straightforward process but rather an iterative and intricate one (Pasmore *et al.,*

2019; Whelan-Berry and Somerville, 2010). Involving technology may add further difficulties to this non-linear process by requiring collaborative efforts for change management within socio-technical systems. For instance, technology-related change initiatives should be guided by prototyping informed by data and learning instead of unquestioningly adhering to predetermined plans (Pasmore *et al.,* 2019). This means that change management must involve broader inclusion of stakeholders within the ecosystem who play important roles in influencing the functioning of the technology in the workplace (Pasmore *et al.,* 2019). Moreover, technology appropriation must be considered when implementing technology in the workplace. Leonardi and colleagues (2010) described that technology appropriation involves individuals integrating technology into their practices in unintended ways. Users tend to adopt specific technology features when they recognize that these features empower them to act, emphasizing the importance of perceiving meaningful capabilities in technology adoption (Leonardi *et al.,* 2010). Thus, understanding how technology is integrated into healthcare contexts and how it shapes and is shaped by healthcare workers' behaviour and culture is pivotal for a successful implementation. Therefore, embracing the dynamic nature of organizational change, technology appropriation, and acknowledging the absence of a one-size-fits-all model necessitates a shift towards iterative, data-informed approaches and collaborative efforts.

3 Research design

The study employs a qualitative research approach, which is suitable for exploring the perspectives and insights of employees within the context of the company (Gehman *et al.,* 2018). The empirical case is around “RoboProvider” (pseudonym), a company based in Europe that designs, develops, and markets various types of service robots for the healthcare market. Here, we will identify them as robot providers. The primary data collection method used was semi-structured interviews (n=15) conducted in May 2023 with employees of the company that belonged to different teams (customer service, sales, product development and user-experience (UX)) to capture diverse views on the process and strategies for organizational change management for the implementation of mobile service robots in healthcare settings. Participants from these teams were selected using purposive sampling, based on their roles, expertise, and experiences in implementing service robots in healthcare settings, e.g., hospitals.

As the study aimed to understand how robot providers can help healthcare organizations effectively implement mobile service robots as part of the change management process, only the perspective of robot providers was included. Qualitative data collected from interviews were analysed using thematic analysis to identify recurring themes, patterns, and insights within the interview transcripts. In a combination of inductive and deductive analysis that involved consultation of current change management frameworks to facilitate theoretical coding, the researchers proceeded to extend an existing organizational change process framework proposed by Whelan-Berry and Somerville (2010). This modification is based on the insights gathered from the interviews, aiming to provide a tailored approach for implementing service robots in healthcare.

4 Findings and discussion

Primary considerations for implementing mobile service robots in healthcare

Findings show that healthcare providers may address the following considerations beforehand to assess the organization's preparedness for introducing mobile service robots. First, resource allocation must be considered regarding the available time of healthcare staff, which is usually scarce. Some participants mentioned workforce adjustments. Healthcare staff will need to learn how to interact with and oversee robots:

> "Are they ready to say 'we're gonna reserve resources and ask the staff to join in with training and someone else will be taking care of the patients […] every implementation, no matter how intuitive the robot is, takes some extra energy from the staff" (P13).

Moreover, findings show that assessing the financial capacity to acquire, maintain, and upgrade mobile robots is key in the preliminary evaluation as well as considering the necessary infrastructure for robot implementation, e.g., communication networks and other IT systems should be compatible with the service robot technology the organization intends to implement. Equally important is the need to consider compliance with healthcare regulations, data privacy laws, and ethical standards. This includes clarifying ethical dilemmas related to patient acceptance of service robots. Identifying potential risks associated with using service robots, such as technical failures, miscommunication, or patient safety issues, is vital. Findings reveal that these considerations are crucial; therefore, robot providers may offer guidance and advice to healthcare organizations.

Strategic integration

Findings reveal that healthcare providers are advised to take a strategic perspective toward implementing mobile service robots to prepare for the change. For this, it is essential to have clear objectives for the healthcare organization and align the capabilities of the robots with the achievement of these objectives. As elucidated by one participant from the customer service team (P6), if healthcare providers identify, e.g., patient safety as part of their strategy and consider safety improvement through, e.g., infection prevention, then they should investigate how technologies help increase patient safety, and thus, find a robotic solution as a new way of, e.g., disinfecting operating rooms. Some participants emphasized the role of mobile service robots in healthcare settings as tools intended to address existing challenges rather than imposing new issues on patients or staff. Therefore, the goals of healthcare companies and robots must be clear and, if possible, aligned from the beginning. Healthcare organizations typically measure their success based on the quality and effectiveness of healthcare practices, nonetheless, findings show that evaluating their operations with a business mindset is beneficial because it may help healthcare providers understand how mobile service robots can improve business operations and therefore increase revenue.

Strategic integration in operations will require a thorough understanding of the robot’s technical features, stability, and maturity. Some participants mentioned that there could be misunderstandings about the robot's capabilities, i.e., the robot's features, which are often related to promises made in the sales process by the sales representatives.

Therefore, the current robot's affordances to solve problems must be clearly explained to understand if this robot solves the struggle as it is or if changes in the software or hardware would be necessary. In this sense, it should be specified how mature and stable the robot is and its prototyping stage to understand if the robotics company expects feedback from healthcare providers to change robot features or if changes are not welcomed. All these aspects necessitate clear communication between the healthcare organization and robot providers. Furthermore, it is important to have support from all decision-makers when setting the stage for the strategic implementation of mobile service robots. Interviews showed that healthcare is evidence-driven, and if all the very specialized decision-makers do not receive proper information about the robot, they will not be aligned on the implementation strategy.

Optimizing implementation

Several key strategies emerged from our qualitative study in optimizing the implementation of mobile service robots. Firstly, a critical aspect is ensuring openness to robot providers in the healthcare environment. This includes allowing robot providers to collect data and evaluate the site to find the correct compliance between the location and the robots' capabilities. This preliminary analysis will be crucial to future monitoring activities and efforts to increase the use of robots vertically and horizontally, i.e., find new use cases for the robots and increase the use for each use case. A participant elucidated on the initial inquiry that is used to evaluate the fundamental aspects of the healthcare organization's system and context to visualize the next steps for implementation:

> "The physical environment needs to be prepared [...] we can't run the robot if there are thresholds or staircases. Then, the governance within the organization, who's the decision maker who can drive the implementation of it? And then there's the operators, I want to know the people on the floor. And then there's resource availability [...] do they have people that can be trained, do they have staff that can be allocated to run it in the long term?" (P10).

By understanding these fundamental aspects, robotics providers may help healthcare organizations optimize the environments where the robots will operate. This is essential to facilitate robots' mobility, which encompasses various aspects such as mapping the area, determining the level of autonomy, charger placement, storage, and addressing challenges like elevators and uneven surfaces. Some participants highlighted the challenges associated with environmental unpredictability in healthcare settings, particularly hospitals. They emphasized the dynamic nature of hospital environments, where conditions can change rapidly and unpredictably. In the context of integrating mobile service robots, this unpredictability poses significant obstacles to navigation and safe operation. Even when the context is dynamic, a comprehensive understanding of the physical environment enables robotics providers to ensure optimal mobility through robust autonomous navigation.

Job redesign is another vital component. This involves identifying and enhancing processes and workflows, which are crucial for measuring success after the implementation. Some participants mentioned that by understanding their protocols and workflows, they can understand the culture and practices to see if they fit the robot well. Healthcare providers should be able to identify their workflows or routines so that robot

providers can easily understand the value that can be added to these processes by using robots. As mentioned by a participant from the sales team:

> "We can add our product to the workflows that they have and say, well, this is how we can optimize your workflows […] if you have a company that has well-established procedures, then it's much easier to calculate because they know what their costs are. Then, we can say, you have scenario A without the robot and scenario B with it" (P5).

Stakeholder engagement

Findings show that effective communication with stakeholders is key when implementing mobile service robots in healthcare. It is relevant to clearly articulate the goals and objectives of implementing mobile service robots and define the expected outcomes, benefits, and impact on daily workflows to set realistic expectations. Furthermore, it is crucial to address concerns and misconceptions about mobile service robots that stakeholders may have about introducing robots in healthcare. For instance, participants mentioned that users, i.e., healthcare staff, worry about the robot causing physical and emotional distance between them and the patients they are supporting. Findings revealed that the impact on patients is a significant factor in healthcare staff's acceptance of using robots. It was recommended that such concerns be addressed along the design, development, and implementation of mobile service robots in healthcare to adjust the necessary aspects, e.g., robot features or job design.

Involving healthcare professionals in the design, development, and implementation process helps to ensure that the robot aligns with the needs and workflows of the healthcare staff. However, this is a challenge for healthcare professionals because they have a busy schedule and, therefore, limited availability for meeting the robot providers. The limited availability of healthcare professionals entails challenges for the training and education programs. Engaging stakeholders also entails identifying an ambassador to support the implementation. As put by one participant:

> "Dedicated staff members can actually carry this technology inside the organization […] you need that locally. I can tell great stories about the robot, but the moment I leave, if there are no ambassadors to bring in the robot, then they will never use it" (P13).

Some participants mentioned that these internal leaders may be assigned informally due to their professional background and technology interests, and they are usually someone who naturally makes their colleagues listen to them. Ambassadors are usually very critical of technological solutions and are inclined to try new ways of working. These leaders can help motivate end-users, i.e., other healthcare staff, who are obliged by management to take on additional tasks for implementing a robot, to commit, if they do not have an interest in technology.

Evaluating performance and experience

Findings indicated the relevance of measuring success and understanding benefits. Establishing methods to evaluate the effectiveness and impact of service robots in healthcare is necessary to continuously improve their implementation and ensure that

they meet the organization's goals. For this, it is key to collect user feedback after working with robots and establish channels for stakeholders, healthcare staff, and patients to provide feedback on their experiences. This will facilitate robot providers to act on constructive feedback, improve the robot's performance, and address any issues promptly.

Findings helped elucidate that it is not only about putting robots to use, but robot providers also need clients who give thorough feedback and build a strong partnership. However, the adoption of mobile service robots should be based on the real needs of the users. As one participant from the UX team argues:

> "To design something, it takes time […] we cannot just design something you want for entertainment purposes. We have to consider if it is something you really need and why you need it" (P1).

In brief, the findings underline the significance of establishing robust collaboration between robot providers and healthcare organizations, emphasizing the key role of comprehensive feedback and a user-centric approach to ensure the meaningful adaptation of mobile service robots that align with genuine user needs.

Extended organizational change process framework

Table 1 summarizes the findings of this study and integrates them into the organizational change process framework presented by Whelan-Berry and Somerville (2010), combined with insights from prominent change management models like those by Hiatt and Creasey (2012) and Kotter (1995), addressing the challenges related to a potential misalignment between robot's capabilities, stakeholder expectations, service task analysis, and the integration of robots into existing routines. Furthermore, Table 1 highlights the aspects of collaboration between healthcare organizations and robot providers to elucidate the actions they may take to successfully implement mobile service robots. This emphasis on collaboration and extensive involvement of individuals who hold significant influence over the technology's operation in the workplace follows the required socio-technical approach for technology-driven change (Pasmore *et al.,* 2019) and promotes the understanding of how technology shapes and is shaped by healthcare workers' behaviour and culture (Leonardi *et al.,* 2010).

Table 1 Extended version of the organizational change process.

Organizational change process framework (Whelan-Berry and Somerville, 2010).	*Considerations for mobile service robots' implementation in healthcare*	*Collaboration between healthcare organizations and robot providers*
1) Formulating a clear and persuasive vision	•Understand resource allocation (available time of healthcare staff, financial capacity to acquire, maintain, and upgrade the technology, and necessary infrastructure). •Consider healthcare regulations, data privacy laws, and ethical standards. •Have clear objectives for the	•Healthcare providers can ask robot providers for advice on necessary resources and ethical concerns. •Robot providers should thoroughly explain the technical features, stability, and maturity of the robot, that includes the prototyping stage to understand how open the robotics company is

	healthcare organization and align the capabilities of the robots with the achievement of these objectives. •Get support from all decision makers by facilitating evidence-driven information about the robot.	for changing features of the robot.
2) Translating the vision of change	•Clearly articulate the goals and objectives of implementing mobile service robots and define the expected outcomes, benefits, and impact on daily workflows to set realistic expectations. •Prepare and optimize the healthcare environment to facilitate robots' mobility, e.g., mapping the area, determining the level of autonomy, charger placement, storage, and addressing challenges like elevators and uneven surfaces. •Improve processes and workflows by analysing current service tasks and robot capabilities and thus redesigning jobs.	•Healthcare organizations should ensure openness to robot providers into the healthcare environment to extract information, evaluate the site, interact with healthcare staff, and thus find the correct compliance between the location and the robots' capacities. •Healthcare staff should participate in the integration of the robotic solutions into their workflows by providing feedback and contributing to job redesign.
3) Ensuring individual employees embrace the change	•Address concerns and misconceptions about mobile service robots that stakeholders may have about robots in healthcare along the design, development, and implementation. •Collect user feedback from healthcare staff and patients by establishing channels for stakeholders to share their experiences. •Understand whether and how mobile service robots are used in unintended ways. •Identify an ambassador to support the implementation and help motivate users.	•Healthcare organizations may secure effective communication so that robot providers can act on constructive feedback, improve the robot's performance, and address any issues promptly based on users' real needs.
4) Upholding the momentum of change implementation	•Continuous training and education are key to maintaining the pace of change implementation. •It is imperative to allocate health personnel some time available for training so that they feel comfortable using the technology.	•Robot providers should facilitate comprehensive training, maintenance, and technology upgrades as a strategic partner.
5) Institutionalizing the change	•Establish methods to evaluate the effectiveness and impact of mobile service robots on healthcare staff, patients, and the organization to	•Robot providers and healthcare organizations may build a strong partnership to innovate with new ways of creating and measuring

continuously improve their implementation. •Communicate the impact of mobile service robots on the effectiveness and quality of healthcare practices.	successful practices and use cases for the robots.

The initial stage of organizational change, highlighted by Kotter (1995) and Whelan-Berry and Somerville (2010), stresses creating a clear vision and urgency. Here, it is key to have clear objectives for the healthcare organization and align the robots' capabilities with achieving these objectives. Involving stakeholders in vision creation boosts employee support (Whelan-Berry and Somerville, 2010), supported by the findings. The findings emphasized the importance of evidence-based approaches to inform the healthcare staff about the robot's affordances. Securing resources, assessing team capabilities, and establishing support structures with influential leaders are critical milestones in the initial stage (Hiatt and Creasey, 2012). Thus, findings show that healthcare organizations must collaboratively evaluate resource allocation, regulations, data privacy laws, and ethical standards with robot providers.

The second step in organizational change is extending the vision to groups and individuals (Whelan-Berry and Somerville, 2010). This implies that the goals and objectives of implementing mobile service robots must be clearly articulated, and the expected outcomes, benefits, and impact on daily workflows must be defined to set realistic expectations. Thus, the vision is translated into actions that must be based on improving processes and workflows. This enhancement can be done by analyzing current service tasks and robot capabilities and thus redesigning jobs. Here, it is pivotal to prepare and optimize the healthcare environment to facilitate robots' mobility, e.g., mapping the area, determining the level of autonomy, charger placement, storage, and addressing challenges like elevators and uneven surfaces. Therefore, healthcare organizations should ensure openness to robot providers in the healthcare environment to extract information, evaluate the site, interact with healthcare staff, and thus find the correct compliance between the location and the robots' capacities.

Step three of organizational change involves ensuring individual employee acceptance through diagnostic feedback tools that guide corrective actions, addressing technical issues and resistance to change (Hiatt and Creasey, 2012). Such assessment must address concerns and misconceptions about mobile service robots that workers may have about robots in healthcare by establishing channels for stakeholders to share their experiences. Observations are also relevant to identify whether and how healthcare workers are using mobile service robots in unintended ways to explore how this technology is currently aiding staff and how robot providers can act on constructive feedback, improve the robot's performance, and address any issues promptly based on users' current needs (Pasmore *et al.,* 2019). Considering technology appropriation is vital, as users often integrate technology in unforeseen ways based on perceived affordances (Leonardi *et al.,* 2010)

In step four, training and education are fundamental, providing understanding and essential skills for enabling change (Hiatt and Creasey, 2012). Therefore, continuous training and education are vital in maintaining the pace of change implementation. It is imperative to allocate some time for health personnel to be available for training so that they feel comfortable using the technology. As strategic partners, robot providers should facilitate comprehensive training, maintenance, and technology upgrades.

In the final step, organizations emphasize institutionalizing and integrating the change into the organizational culture, operations, and processes (Whelan-Berry and Somerville, 2010). Leaders are essential in this phase, actively monitoring progress, addressing barriers, establishing structures, and communicating the change's connection to organizational achievements (Whelan-Berry and Somerville, 2010). Employees must understand how changes have positively impacted performance (Kotter, 1995), ensuring continued integration into the corporate culture. For this, it is critical to establish methods to evaluate the effectiveness and impact of mobile service robots on healthcare staff, patients, and the organization to improve their implementation continuously. Robot providers and healthcare organizations may build a solid partnership to innovate with new ways of creating and measuring successful practices and use cases for the robots.

5 Conclusion

Healthcare organizations planning to introduce service robots can refer to a range of theories, methods, and tools from change management literature for guidance. However, these resources do not directly address the implementation of mobile service robots in healthcare, leaving questions about when and how to address discrepancies in robot capabilities, stakeholder expectations, service task breakdown, and integration into existing routines, among other complexities in mobile service robot implementation. To address this, we offer an extended version of the organizational change process framework to better understand the change management strategy in healthcare organizations. Additionally, this adaptation clarifies the role of robot providers in the change management process, an aspect currently lacking in academic literature.

Healthcare organizations can use the modified process framework to guide their implementation of service robots, ensuring a smoother transition and better alignment with user needs and goals. Robot designers, developers, and distributors can use the findings to adapt their products and services, e.g., sales and customer service processes, to the specific requirements of the healthcare sector.

While the primary focus was on mobile service robots the findings may also be applicable and generalizable to other types of service robots. However, only the perspective of robot providers was included. Future research should include the perspective of healthcare staff and management to have a deeper understanding of the change management process of implementing mobile service robots.

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References

Agreli, H., Huising, R. and Peduzzi, M. (2021), "Role reconfiguration: what ethnographic studies tell us about the implications of technological change for work and

collaboration in healthcare", *BMJ Leader*, Vol. 5 No. 2, pp. 134–141, doi: 10.1136/leader-2020-000224.

Bellantuono, N., Nuzzi, A., Pontrandolfo, P. and Scozzi, B. (2021), "Digital Transformation Models for the I4.0 Transition: Lessons from the Change Management Literature", *Sustainability*, Vol. 13 No. 23, p. 12941, doi: 10.3390/su132312941.

Boada, J.P., Maestre, B.R. and Genís, C.T. (2021), "The ethical issues of social assistive robotics: A critical literature review", *Technology in Society*, Vol. 67, p. 101726, doi: 10.1016/j.techsoc.2021.101726.

Gehman, J., Glaser, V.L., Eisenhardt, K.M., Gioia, D., Langley, A. and Corley, K.G. (2018), "Finding Theory–Method Fit: A Comparison of Three Qualitative Approaches to Theory Building", *Journal of Management Inquiry*, Vol. 27 No. 3, pp. 284–300, doi: 10.1177/1056492617706029.

Hiatt, J. and Creasey, T.J. (2012), *Change Management: The People Side of Change ; an Introducation to Change Management from the Editors of the Change Management Learning Center*, Second edition., Prosci Learning Center Publications, Loveland, Colo.

Holland, J., Kingston, L., McCarthy, C., Armstrong, E., O'Dwyer, P., Merz, F. and McConnell, M. (2021), "Service Robots in the Healthcare Sector", *Robotics*, Vol. 10 No. 1, p. 47, doi: 10.3390/robotics10010047.

Kotter, J.P. (1995), "Leading change: why transformation efforts fail", *Harvard Business Review*, pp. 59–67.

Langhan, M.L., Riera, A., Kurtz, J.C., Schaeffer, P. and Asnes, A.G. (2015), "Implementation of newly adopted technology in acute care settings: a qualitative analysis of clinical staff", *Journal of Medical Engineering & Technology*, Vol. 39 No. 1, pp. 44–53, doi: 10.3109/03091902.2014.973618.

Leonardi, P.M., Treem, J.W. and Jackson, M.H. (2010), "The Connectivity Paradox: Using Technology to Both Decrease and Increase Perceptions of Distance in Distributed Work Arrangements", *Journal of Applied Communication Research*, Vol. 38 No. 1, pp. 85–105, doi: 10.1080/00909880903483599.

Lin, C., Lin, I.-C. and Roan, J. (2012), "Barriers to Physicians' Adoption of Healthcare Information Technology: An Empirical Study on Multiple Hospitals", *Journal of Medical Systems*, Vol. 36 No. 3, pp. 1965–1977, doi: 10.1007/s10916-011-9656-7.

Pasmore, W., Winby, S., Mohrman, S.A. and Vanasse, R. (2019), "Reflections: Sociotechnical Systems Design and Organization Change", *Journal of Change Management*, Vol. 19 No. 2, pp. 67–85, doi: 10.1080/14697017.2018.1553761.

Pavlish, C.L., Hunt, R.J., Sato, H.-W. and Brown-Saltzman, K. (2019), "Finding Meaning in the Work of Caring", in Yeoman, R., Bailey, C., Madden, A. and Thompson, M. (Eds.), *The Oxford Handbook of Meaningful Work*, Oxford University Press, pp. 236–256, doi: 10.1093/oxfordhb/9780198788232.013.14.

Šabanović, S. (2010), "Robots in Society, Society in Robots: Mutual Shaping of Society and Technology as a Framework for Social Robot Design", *International Journal of Social Robotics*, Vol. 2 No. 4, pp. 439–450, doi: 10.1007/s12369-010-0066-7.

Sætra, H.S. (2020), "The foundations of a policy for the use of social robots in care", *Technology in Society*, Vol. 63, p. 101383, doi: 10.1016/j.techsoc.2020.101383.

Tuomi, A. and Ascenção, M.P. (2023), "Intelligent automation in hospitality: exploring the relative automatability of frontline food service tasks", *Journal of Hospitality and Tourism Insights*, Vol. 6 No. 1, pp. 151–173, doi: 10.1108/JHTI-07-2021-0175.

Ulhøi, J.P. and Nørskov, S. (2021), "Extending the Conceptualization of Performability

with Cultural Sustainability: The Case of Social Robotics", in Misra, K.B. (Ed.), *Handbook of Advanced Performability Engineering*, Springer International Publishing, Cham, pp. 89–104, doi: 10.1007/978-3-030-55732-4_4.

Whelan-Berry, K.S. and Somerville, K.A. (2010), "Linking Change Drivers and the Organizational Change Process: A Review and Synthesis", *Journal of Change Management*, Vol. 10 No. 2, pp. 175–193, doi: 10.1080/14697011003795651.

World Robotics 2023 – Service Robots. (2023), IFR Statistical Department, Frankfurt am Main, Germany.

Wright, J. (2023), *Robots Won't Save Japan: An Ethnography of Eldercare Automation*, ILR Press, an imprint of Cornell University Press, Ithaca.