Socio-technical Transformations in Care Practices

Investigating the implementation of social alarm systems in nursing homes

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There is a crack in everything, that's how the light gets in
- Leonard Cohen <Anthem>

万物皆有瑕，光渗而熠之。
Abstract

The worldwide shortage of qualified care workers along with the increasing need for elderly care services has restrained the capacity of nursing homes to offer their residents high-quality care services. Along with digitalization, policymakers believe that technological advancements can improve the efficiency of care and streamline care work, thus helping to alleviate the challenge above. These investments include the creation of new care services by adopting innovations such as social robots, and the update of existing care services by replacing analogue technologies with digital versions, such as social alarm systems. While numerous studies have discussed the implementation of new digital technologies, the digitalization of existing care services has received less attention.

This dissertation conducts empirical investigations on the digitalization of social alarm systems in four Swedish nursing homes. By applying theories of social shaping of technology with a focus on socio-technical transformations in care practices, it asks how implementation of the new social alarm systems is socially shaped in care practices. The social alarm system is an established technology that aims to enable users to call for help in emergencies. Based on a literature review of the central theme (Paper I), the dissertation examines discrepancies between planned and actual implementation outcomes (Paper II), differences within a team during project executing (Paper III), and the relationship between individuals’ actual use of technology and the assumptions inscribed in the system and the diverse care concepts in nursing homes (Paper IV). The methodological basis of the dissertation comprises analysis of implementation documents, observations of healthcare professionals’ daily work, interviews with employees of both technology companies and nursing homes, questionnaires completed by healthcare professionals, and a literature review.

The results reveal that technology implementation is far from predictable outside the care context. During the implementation process, people from different groups have distinct goals, focus on different facets, and develop diverse approaches for integrating the system into daily work. Frontline professionals determine their ways of using the new social alarm system based on their personal and situational understanding of technology scripts and care concepts under given contexts. The results contribute to theoretical clarifications as well as practical possibilities and limitations to guide the implementation of social alarm systems in nursing homes. The findings indicate that the introduction of a digital social alarm system brings various changes. The digitalization of social alarm services in nursing homes can benefit from a clear positioning of the new system, a common ground for sufficient communication between actors involved, and an in-depth interpretation of local environments, as well as flexible and continuous implementation strategies.

Keywords
Science and technology studies (STS); Technology implementation; Digital transformation; Care practices; Nursing homes; Qualitative research
Sammanfattning


Avhandlingen omfattar empiriska studier av implementeringen av digitala larmsystem på fyra vårdboenden och har sitt huvudsakliga fokus på socio-tekniska förändringar i vårdens praktik, hur implementeringen av det nya larmsystemet formas socialt när den kontextualiseras. Larmsystemet är en etablerad teknik som syftar till att göra det möjligt för användare att ringa efter hjälp i nödsituationer. Baserat på en litteraturstudie (Studie I) undersöker bifogade artiklar förväntningarna på den tekniska förändringen uttryckt i roller, genomförandeplaner och strategier (Studie II); skilda uppfattningar inom ett team under genomförandet (Studie III); relationen mellan individernas faktiska teknikanvändning, de antaganden som tillskrivs tekniken från början och föredragande vårdideologi (Studie IV); samt individers roll i hanteringen av det nya systemet och vårdkulturen (Studie IV). En analys av genomförandebidrag, observationer av vårdpersonalens dagliga arbete, intervjuer med människor från både teknikföretag och vårdboenden, frågeformulär med vårdpersonal samt en litteraturöversikt bygger den metodologiska grunden för denna avhandling.

Resultaten visar att ny teknik i vården är långt ifrån förutsägbar eller mätbar utanför den kontext där den implementeras. Under implementeringsprocessen har människor i organisationen olika mål, lägger vikt vid olika aspekter och har olika tillvägagångssätt för att integrera systemet i sitt arbete och sin vardag. Vårdpersonalen använder det digitala larmsystemet utifrån sin personliga och förståelse av tekniken, situationen och vården.

Avhandlingens huvudsakliga bidrag handlar om teoretiska perspektiv såväl som praktiska möjligheter och begränsningar för implementeringen av sociala larmsystem på vårdboenden. Resultaten indikerar att digitaliseringen av redan kända analoga system medför olika förändringar. Digitaliseringen av larmtjänster på vårdboenden kan tjäna på att bättre kontextualisera systemet; flexibla och kontinuerliga implementeringsstrategier; och en gemensam grund för ändamålsenlig kommunikation mellan involverade aktörer.

Nyckelord

Teknik och samhälle studier (STS); Teknikimplementering; Digital transformation; Vårdpraktiker; Vårdhem; Kvalitativ forskning.
List of Appended Papers

Paper I

Paper II

Paper III

Paper IV

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Division of Work

Paper I
The study design was developed by Fangyuan, Sanna and Britt. The literature collection and evaluation were performed by Fangyuan and Sanna. Fangyuan analysed the results and wrote the manuscript under the supervision of Sanna and Britt.

Paper II
The study design was developed by Fangyuan, Andrea and Britt. The data collection was performed by Fangyuan. Fangyuan evaluated, analysed the results and wrote the manuscript under the supervision of Andrea and Britt.

Paper III
The study design was developed by Fangyuan, Sanna and Britt. The data collection and evaluation were performed by Fangyuan. Fangyuan analysed the results and wrote the manuscript under the supervision of Sanna and Britt.

Paper IV
The study design was developed by Fangyuan, Sanna and Britt. The data collection and evaluation were performed by Fangyuan. Fangyuan analysed the results and wrote the manuscript under the supervision of Sanna and Britt.
Other Scientific Contributions Not Included in This Thesis

Journal Article

Peer-reviewed Conference Proceedings


Peer-reviewed Conference Abstracts
Preface and Acknowledgements

With research backgrounds in product design, human factors, and ergonomics, I was always wondering how products and related services were implemented and experienced in users’ living environments. My curiosity about this topic drove me to start my PhD journey.

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1 INTRODUCTION

This dissertation explores various socio-technical transformations in care practices during the implementation process of digital social alarm systems in nursing homes. It addresses the central theme from the perspective of social shaping of technology, a theoretical lens that takes account of the practical and the symbolic aspects of technology use, showing how the meanings and materiality of technologies are equally important in understanding how technologies become part of everyday life (MacKenzie and Wajcman, 1999; Silverstone and Haddon, 1996). The motivation behind this exploratory study was primarily to understand how to digitalize existing care services that are using analogue technologies. This is important because the use of digital technologies in nursing homes has become increasingly common, whereas the current research focuses on discussing the implementation of entirely new types of digital technologies rather than the transition of well-established technologies from an analogue format to a digital format. Moreover, the mechanisms and interactions within the processes have received little attention. In this regard, the dissertation helps to contribute to theories studying the social shaping of technology and to create a knowledge foundation upon which the complex reality of digitalizing care services in nursing homes can be deeply understood.

To complete this research task, I empirically explore the implementation and the use of the most common technology in nursing care in Western countries: the social alarm system. This system aims to empower users to seek assistance from their relatives or care workers in urgent situations. Developed in the 1970s, the system has been acknowledged as fundamental in primary care, and its analogue version is widely used in nursing homes (Sveriges Kommuner och Regioner, 2020a). Choosing it as my empirical focus is advantageous because there is a relatively long history of providing social alarm services in nursing care, and stakeholders such as policymakers have recognized the importance of digitalizing social alarm services. This opens up possibilities for investigating more cases and studying issues that have not been recognized or found in terms of other digital technologies.

The introduction chapter consists of four parts: first, it introduces the conceptual foundations of the dissertation; second, it highlights the purposes of the dissertation, and specifies research questions; third, it defines the key concepts; and finally, it outlines the subsequent chapters.

1.1 Stage setting

The digitalization of care services is central to healthcare being able to meet the challenges of the ageing population and the increased health needs and costs that this entails (Marč et al., 2019). Using digital technology in care practices is described by policymakers as a promising solution for facilitating healthy and active ageing, simplifying care processes, and lowering care service costs. Following this trend, various innovative digital technologies, such as social robots, have emerged,
and different analogue technologies, such as social alarm systems, have been converted into a digital format. Aligning with the emergence of these technologies, the current digitalization of care services mainly includes creating new care services by adopting innovative digital technologies and updating existing care services through wide-scale replacements of previous analogue technologies.

The success of digitalizing care services rests on the extent to which digital technologies integrate into daily care work (Orlikowski, 2000; Timmermans and Berg, 2003). Despite the potential benefits of digitalized services, there are multiple challenges associated with integrating technology into care processes. For instance, cultural clashes in care settings may impede the progress of technology implementation (Pols, 2012). A poorly designed technology may lead to lower user satisfaction, which decreases the technology adoption rate (Al Alawi et al., 2014). Additionally, issues may exist in an implementation project regarding the internal management of enforcement and incentive regulations (Avgar et al., 2018; Kuoppamäki, 2021). The numerous challenges above make technology implementation a daunting task (Murray et al., 2011). Failed attempts in technology implementation projects are common as many projects stop during the pilot period or only meet partial expectations (Kellogg, 2021; Miller, 2021; Uvhagen et al., 2019).

In theorizing technology implementation and integration, scholars have studied how technology relates to the social environments in which technology is used. Earlier investigations view technology as objective, which affects the social environment (e.g., social structure, human actions, and cultural values) in a deterministic manner. Scholars later emphasized the social side of technology implementation, understanding it as the result of people’s social activities and strategic decisions (Orlikowski, 1992a). This dissertation sets the latest perspective – the social shaping of technology – as its starting point (MacKenzie and Wajcman, 1999). This theoretical lens considers both practical and symbolic aspects of the implementation of technologies. It emphasizes the power of social forces (e.g., individuals, social relations, etc.) in defining, modifying, and changing technologies, and acknowledges the technological influences on social environments. Specifically, the social environments are capable of assigning meanings to the technologies and changing the ways they are used in particular contexts. At the same time, the role of technologies in shaping daily practices and processes is active as its introduction brings changes to existing human social relations and structures. That is, the perspective argues that there is a ‘mutual shaping’: while technology is capable of shaping social relations and environments, the technology can be shaped by them as well (Pritchard and Brittain, 2015). Applying this perspective, the dissertation views the technical and social aspects of shaping processes as equally important when implementing technologies in nursing homes. This understanding, on good empirical grounds, allows a deeper and more dialectical understanding of the interaction between technology and social environments. It thus empowers this dissertation to provide systematic insights into daily practices, technology implementation and use, and social relationship and structure during technology implementation processes in nursing homes.

Following the perspective above, the extent to which technology is integrated into daily practices is related to the technology itself and to the social environment in which the technology is implemented. However, implementers tend to utilize the same implementation strategies in different implementation projects and expect the same implementation outcomes regardless of the differences in implemented technologies and social environments. As a result, the excitement concerning digitalizing care services is, to some extent, superseded by complaints and doubt, as many implementation projects fail to move the project forward, or implementation strategies and plans deliver poor outcomes. Evidence suggests that implementers are increasingly referencing the failures in digitalization of care services as obstacles to high-quality care services, and seeking to conduct technology implementations in an appropriate way (Chesbrough, 2019).
While numerous studies have discussed the implementation of completely new types of digital technologies, the implementation of a digital format for existing technologies has received less attention. Yet, following the trend of abandoning analogue techniques and mobile networks, existing care services that are currently using analogue technologies are eager to be digitalized. It is thus important to acquire a rich knowledge base concerning the digitalization of existing care services in cases where technologies are switched from an analogue format to a digital format. Existing literature about implementation evaluations has helped to shed light on the facilitators and inhibitors to technology integration into care practices (Pols, 2017, 2010; Pols and Willems, 2011). However, the knowledge of influential factors in technology implementation is insufficient to reveal the complexities of implementation processes in terms of how technology eventually becomes part of care practices. For instance, how do individuals mitigate the cultural clashes when implementing technology in daily practices? How can expectations of implementation outcomes be aligned? How can support for effective implementation be generated? Many challenges stem from issues beyond figuring out influential factors and merely evaluating implementation outcomes. Meeting these challenges requires studying detailed causes and effects during the implementation process. That is, it is crucial to analyse ‘what happens in a specific context with specific types of technologies, to explore who might benefit from the technology and what kind of practices they participate in creating’ (Pols, 2017). With this in mind, I have chosen to use the social shaping of technology theories to study the conceptualization of technology.

To fill in the gaps mentioned above, the dissertation chooses the social alarm system as an empirical focus and asks: How is the implementation of digital social alarm systems socially shaped in nursing homes? The system, also called a personal emergency response system (PERS), is a widely used technology in Western countries (Heinbüchner et al., 2010; Tinker, 1993). Consisting of alarm buttons, mobile devices, and a control panel, the system can help residents in nursing homes alert healthcare professionals of an emergency requiring immediate assistance. Hence, the social alarm system has a range of benefits such as enhancing remote communication between residents and healthcare professionals, enabling healthcare professionals to call for colleagues’ help when in an emergency, and providing information for care management. Because of these benefits, the system was included in social care services a long time ago to assist older adults in becoming more self-sufficient and to improve assistant nurses’ work efficiency in Swedish nursing homes (Sveriges Kommuner och Regioner, 2020a).

This dissertation makes two-fold contributions to the technology implementation literature. First, it clarifies theoretical possibilities and limitations for the perspective of social shaping of technology to guide the implementation of social alarm systems in nursing homes. Second, it explicitly relates the care practices regarding technology implementation to the dynamics of social environments in nursing homes, and furthermore creates a knowledge foundation that allows an in-depth understanding of the complex reality of digitalizing care services, especially the replacement of analogue technologies, in nursing homes.

1.2 Purposes, objectives, and questions

The dissertation aims to deepen the understanding of how the implementation of digital social alarm systems is socially shaped in nursing homes. By reviewing previous studies and empirically investigating social alarm systems in Swedish nursing homes, I study the emergence and implications of various socio-technical transformations in care practices. This includes particular interests in: findings regarding the integration of social alarm systems in care practices in existing studies; the realization of implementation plans and strategies; the execution of technology implementation within a team; and individuals’ actual use of the system. The interests and purpose of this study can be operationalized by the following four objectives and research questions.
• Paper I: To systematically review the current studies about the integration of social alarm systems in care practices, and identify research gaps for further investigations

*RQ1. What can be learned from previous research about the integration of social alarm systems into care practices?*

• Paper II: To investigate the realization of implementation plans and strategies, and determine the reasons for discrepancies between anticipated and actual implementation outcomes

*RQ2. How are the expectations of the technology implementation plans realized?*

• Paper III: To investigate the differences within a team in relation to executing the system implementation in different phases, and to discuss the implications those differences entail

*RQ3. How is the social alarm system contextualized in nursing homes with respect to differences between middle managers and assistant nurses?*

• Paper IV: To relate the assumption inscribed in the system to different care concepts in individuals’ actual use of technology in nursing homes

*RQ4. How do assistant nurses relate technology scripts to care concepts (i.e., relational care, moral care, and practical care) in their technology use?*

1.3 Definition of concepts

Prior to diving into the dissertation outline, this section elaborates the definitions of some general concepts (key concepts from theories will be explained in Chapter 3). As mentioned, this dissertation is interested in the digitalization of social alarm services in cases where digital social alarm systems replace analogue ones. It looks into how the implementation of digital social alarm systems is socially shaped in nursing homes and concerns various socio-technical transformations in care practices during the process. The concepts here are selected according to these interests and the concerns above.

**Digital technology.** Technologies are technological devices, tools, resources, and systems that generate, deliver, process, or store data (Carayon et al., 2006). In this dissertation, digital technology refers to the technology that relies on the use of a digital mobile network (e.g., 4G network). All digital social alarm systems in our empirical cases utilize 4G mobile networks.

**Analogue technology.** Unlike digital technology, analogue technology works with the support of a network that uses analogue cellular techniques (e.g., 1G). The analogue mobile network was introduced in the 1980s. This is in line with our observations, since all selected nursing homes in this study installed analogue social alarm systems decades ago.

**Digitalization.** Typically, digitalization refers to the process of transforming information from an analogue form into a digital form. In this research, it refers to the implementation of digital social alarm systems in nursing care to support the delivery and production of services.

**Socio-technical transformation.** Socio-technical is a core concept that originated from the perspective of social shaping of technology. It refers to the interrelatedness of social and technical aspects of an organization or a context as a whole. It is usually used in reference to a ‘socio-technical system’, which asserts that people (sociological subsystems) and technologies (technological subsystems) are interdependent and inextricably linked. It also highlights the co-evolution of these
subsystems as well as the fact that the two subsystems must be optimized together for positive practical outcomes. In this dissertation, the term socio-technical transformation refers to the multi-dimensional transitions and changes in sociological subsystems and technological subsystems in the implementation of digital social alarm systems in nursing homes.

*Care services.* This term usually describes a variety of services provided by healthcare professionals with the goal of health promotion, maintenance, and restoration (Last, 1988). Combined with the definition of digitalization above, the digitalization of care services is regarded as the process of implementing digital technologies into various services provided by healthcare professionals. In some studies, this process is also referred to as the ‘digital transformation’ of healthcare.

*Technology implementation/integration.* In an information technology context, technology implementation differs from technology integration. The former term focuses primarily on making a new technology operational, whereas the latter term focuses primarily on combining the new technology with local resources (e.g., existing technologies) to ensure its fully delivered benefits. In this dissertation, technology implementation and integration refer to the same thing – a process that starts with the decision to adopt technology and continues through the routine use of the technology (Klein and Sorra, 1996). This includes, for instance, installing and maintaining a new system in its new environment, ensuring it operates stably, and making sure it runs on a routine basis.

*Social environment/context.* The social environment or social context is regarded as the physical and social conditions in which people live or work (Barnett, E; Casper, M, 2001). In a healthcare context, this includes care institutions that people interact with, the groups that individuals belong to, the colleagues or friends that people have social relationships with, and the beliefs or policies for ordering human work and lives, user practices, etc. (Yen and Leonard, 1999).

*Healthcare professional.* Healthcare professional refers to people with professional education, training or experience who provide care services. In this dissertation, it refers to those who work as nursing home leaders, middle managers, and assistant nurses performing services in nursing homes.

**1.4 Outline of the dissertation**

*Chapter 1 Introduction* provides a brief description of the research field and the purpose of the dissertation. It also briefly introduces the social alarm system, which is my empirical focus in the thesis.

*Chapter 2 Background* introduces the social alarm system and the digitalization of social alarm services in Sweden, and elaborates its governance in Swedish nursing homes and related challenges in its implementation, followed by the reasons for selecting the technology in this research.

*Chapter 3 Theoretical Framework* provides a theoretical background on technology implementation processes and the use of technology in care services from a practice perspective.

*Chapter 4 Methodology* describes the operationalization of the research. Specifically, it explains the research approach, settings and participants, and methods for data collection and analysis, as well as the research trustworthiness.

*Chapter 5 Summary of the Appended Papers* summarizes the appended papers, including the motivations, aims, results, discussion, and contributions.
Chapter 6 Discussion discusses the findings of the appended papers by outlining the dissertation’s theoretical and practical contributions.

Chapter 7 Limitations and Future Work considers the future work and conclusions of the thesis. A discussion on the limitations of methods used in this dissertation is also included.

Chapter 8 Conclusion summarizes the dissertation.
2 BACKGROUND

As described, this dissertation selects a well-known and widely used technology, the social alarm system, as an empirical focus, and concerns its digitalization in Swedish nursing homes. In this chapter, I first outline the constitution and purpose of the system. I then present the current status of the digitalization of social alarm systems in Sweden. Third, I introduce the governance of social alarm systems in Swedish nursing homes, followed by the related challenges in digitalization processes. Finally, I summarize the reasons for selecting this system.

2.1 The social alarm system

Regardless of various technological advancements, the social alarm system remains the main technological innovation widely used in care services (Heinbüchner et al., 2010; Procter et al., 2016). The system has received a lot of attention since being developed in the 1970s. It is also known as Personal Emergency Response System (PERS) in many countries. Western societies acknowledge its benefits to healthcare and encourage older adults and healthcare professionals to use it in healthcare (Heinbüchner et al., 2010).

Despite the differences in appearance, the system usually contains similar components and functionalities. It consists of three parts: alarm buttons for sending out alarms, a base unit for digital transfer, and alarm phones for receiving alarms (Figure 1). The base unit connects alarm buttons and alarm phones to analogue or digital phone networks to ensure the system’s technical operation. In nursing homes, residents can call for assistance by pressing the alarm buttons. By reviewing the alarms received via care phones, healthcare professionals can identify residents’ needs efficiently. Moreover, the system can link other devices (e.g., fire alarms) for monitoring different kinds of emergencies.

The social alarm system has had three generations of device updates (Stokke, 2017). In the first generation, a pull cord is used to activate alarms, and all devices are fixedly installed in the centre of nursing homes or private homes. In the second generation, the unit for sending out alarms is designed as a wearable wristband or pendant. This helps users such as residents in nursing homes to call for help without spatial restrictions. In the latest generation, system compatibility is considered. This means that the social alarm system can connect to other devices such as fire alarms, motion alarms or blood pressure detectors. The most commonly used versions are the second-generation and third-generation devices. In these generations, the social alarm system offers various benefits, such as allowing healthcare professionals to notice emergencies quickly, improving resident-professional communication, and recording alarm information for better care management. Considering these benefits, people regard the system as a basis for safe telecare (Hamblin, 2017; Stokke, 2016).
Today, the social alarm system is undergoing a digitalization with better performance and advanced functions. Specifically, this refers to a shift from mechanical and analogue electronic techniques to digital electronic techniques, following the trend of replacing the analogue telephone network (e.g., 1G network) with a digital telephone network (e.g., 4G network) (Baudin et al., 2020). In doing so, the updated digital social alarm system ensures the stability of signal transfer, and avoids typical issues that are faced by the analogue alarm system such as the ageing of lines and the lack of spare parts.

2.2 The digitalization of social alarm systems in Sweden

Sweden has a longstanding tradition of using social alarm systems in its public social services and community care (Socialstyrelsen, 2021). In Sweden, healthcare is publicly funded. Municipalities are in charge of community and nursing care services. The ageing population and a shortage of healthcare professionals pose challenges to Swedish municipalities (Frennert, 2021). This is one of the reasons that social alarm systems have been widely used in Swedish nursing homes since the early years of the technology, as policymakers have viewed the system as a promising solution for a long time. According to the National Board of Health and Welfare’s statistics, over 170 thousand older adults (over age 65) received social alarm services in 2015 (Socialstyrelsen, 2015). However, most of these systems were installed decades ago, use analogue telephone networks, and are subject to signal faults caused by the ageing of electrical appliances. At the beginning of 2015, 73% of the installed alarms were analogue (Socialstyrelsen, 2015). Along with the revolution of updating the analogue system into a digital version and replacing the analogue network with a digital network, many old social alarm systems required updating into digital versions for stable signal transfer and advanced functionalities.

The Swedish government has proposed ‘vision for eHealth 2025’ to show its ambitions of making Sweden a top country in utilizing digital technologies and eHealth for good and equal health and welfare (Black et al., 2011; Wickström et al., 2017). One goal under the vision is to enhance the efficiency of care that is currently subject to the increasing demands of the ageing population and the shortage of healthcare professionals. Consequently, updating the analogue social alarm system into a digital version is included in political plans. The Swedish government had a call to replace all old social alarm systems with digital versions by the end of 2016. In line with this call, extensive work was done to ensure the digitalization of social alarm systems. For instance, numerous case studies were conducted in different municipalities. Guidelines were published to support and guide the work that the transition entails. Digital social alarm systems were offered to different municipalities and were widely tested in nursing homes for at least one day. A survey conducted in
2.3 The governance of the system in Swedish nursing homes

When digitalizing the social alarm services in nursing homes, multiple actors are involved, including officials in the municipalities, nursing home leaders, middle managers, and frontline professionals (Fahlström, 1999; Government Bill, 1989). The titles of officials in the municipalities include digital strategy manager, innovation manager, and development manager. They usually hold at least bachelor’s degrees in related subjects such as technology innovation and society change. These people are responsible for developing digital strategies for a specific municipality or area. The nursing home leaders are commonly registered nurses or experienced assistant nurses. They take key administrative responsibilities and directly communicate with municipality officials to make development plans for their nursing homes. Their daily work includes leading, following up, evaluating, and improving management activities to enhance staff competence and quality of care. Middle managers take over overall operational duties such as educating frontline professionals. They are positioned in the middle between nursing home leaders and frontline professionals in nursing homes. They are responsible for the delivered care quality and the work environment, and they directly manage caregivers such as assistant nurses. Detailed work includes, for instance, organizing the work environment to avoid heavy workloads for healthcare professionals, and building up a supportive environment for all people in nursing homes. In Swedish nursing homes, frontline professionals often refer to assistant nurses. These professionals may have a college degree, but the employment title is not licensed. To provide nursing care in Sweden, they have received official training and a special diploma.

In the context of digitalizing care services in Swedish nursing homes, people in charge of nursing homes (i.e., nursing home leaders, officials in the municipality) are responsible for the procurement of the system and make decisions about the development plan according to national policies. This means they have powers to decide when to initiate the digitalization, how much money should be used, and which technology company should be collaborated with. In implementation projects,
middle managers are responsible for establishing implementation strategies and building up an implementation environment that allows for the provision of necessary and high-quality healthcare at a profit. Sometimes they are able to co-select the system to be procured and decide on detailed functionalities together with nursing home leaders. Assistant nurses work in the frontline and have direct contact with residents in nursing homes. They follow practical implementation plans and incorporate the new social alarm system into daily work for care provision.

2.4 The related challenges in digitalization processes

As mentioned in section 2.2, the digitalization of social alarm services should be more than technically converting the system from an analogue version into a digital one. It also requires appropriate operations that minimize the potential risks but maximize the benefits of integrating a new social alarm system. This requirement poses multiple challenges in the implementation and use of new social alarm systems in nursing homes.

First, the digitalization of social alarm services in Swedish nursing homes must follow various rules and policies. For instance, according to the regulations about the care of residents – the Social Services Act 2001:453 (Government Bill, 2001) and the Swedish Health and Medical Service Act 2017:30 (Government Bill, 2017) – healthcare professionals have no right to force residents to do things they are reluctant to do. This requirement leads to two implementation tasks, including educating assistant nurses about related regulations and convincing residents to adopt the new system. Furthermore, there are different rules and regulations in place in the respective municipalities and nursing homes. The variety of these regulations raises the threshold of implementing a new system, which challenges nursing home leaders and middle managers to develop an implementation plan.

Second, the digitalization of social alarm services in Swedish nursing homes involves people from diverse groups (see details in 2.3). People from different groups can possess different skills, levels of education and positions in the nursing home. They may have different views regarding both their mission as a participant in the process of change and the amount of space they have for manoeuvring. The conflicting thoughts among different actors may inhibit the progress of service digitalization (Callén et al., 2009; Frennert and Baudin, 2019; Oroviogoicoechea, 2007; Uvhagen et al., 2019). Actors involved must pour additional energy into coordinating such conflicts.

Furthermore, the digitalization of social alarm services in Swedish nursing homes affects both individuals and groups. As users, assistant nurses can have different attitudes, identities and competence levels when incorporating the new system into their care practices. They may also have different learning speeds and divergent interactions with the new system and surroundings. The tension here may lead to the uneven quality of care services, which challenges the realization of expected implementation benefits.

Focusing on individuals, both middle managers and assistant nurses face numerous challenges in the digitalization of social alarm systems in nursing homes. The workload for middle managers is heavy (Björk et al., 2013; Björk and Härenstam, 2016). Taking on the operational responsibilities during the implementation process, middle managers have to consider the requirements in different policies and regulations, the needs of various stakeholders, and the conditions of large professional groups, and deal with the changes all of these entail. Moreover, they have usually received insufficient support from nursing home leaders (Wolmesjö and Thelin, 2014) and collected inadequate feedback from assistant nurses and residents. As a result, middle managers may lack clarity regarding technology implementation, leading to failures or unsatisfactory outcomes in the implementation projects. Assistant nurses, on the other hand, are positioned in the middle between
middle managers and residents in nursing homes. Being subject to both top-town and bottom-up demands, assistant nurses may need additional support to understand and meet these demands, which may cause difficulties in finding appropriate ways to integrate the new system into daily care practices.

2.5 Reasons for setting the system as an empirical focus

There are two primary reasons for setting the social alarm system as an empirical focus for this dissertation. First, as a fundamental nursing care tool, the social alarm system has been widely used in everyday care practices for decades in Swedish nursing homes. Furthermore, Sweden has experienced the digitalization of social alarm services for many years, with political and societal support. This background gives me more cases to investigate and enables me to examine various emerging issues that are not found or discussed in the implementation of other digital technologies. Second, the digitalization of social alarm services can be regarded as a representative case in terms of digitalizing existing care services. Technology updates are becoming more frequent as a result of global competitiveness and changing user demands. With the increasingly common use of technology in care services, the question of how to replace existing older technology with its newer generations one will be central to the digitalization of care services. The findings on testing the social alarm system can thus provide a valuable reference for the digitalization of other similar care services.
3 THEORETICAL FRAMEWORK

The theoretical framework describes the main theoretical perspectives and context in which this dissertation is grounded. In this section, I first introduce the perspective of social shaping of technology and its related key concepts and theories, which shape the main contribution of my dissertation. Second, I shed light on the context of nursing care services, and dig deeper into different care concepts and the specificities of care work. Third, I describe current knowledge about implementing and using the social alarm system in care practices, and justify why it is a complex but crucial theme that requires a deep understanding. A brief integrative summary concludes the theoretical framework.

3.1 Social shaping of technology

In the field of science and technology studies (STS), a number of works have focused on the relationship between technology and social processes. In these works, there is increasing attention on the notion of social shaping of technology (MacKenzie and Wajcman, 1999). The notion was proposed along with the critique of technological determinism, which contends that technological development drives social change and that technologies follow a predetermined course of development. Proponents of social shaping of technology assert that social forces influence technology in terms of its delivered benefits and actual use, and that the social impacts of the technology do not merely depend on the technical properties of the technology (Boczkowski, 2004; Woolgar, 1991a). STS researchers insist that social investigations of the processes and activities in technology implementation will provide valuable insights for those studies that tend to view technology as a ‘black box’ (Latour, 1987; Woolgar, 1991a).

3.1.1 Key approaches to studying social shaping of technology

Different fields widely exploring the social shaping of technology have formed various concepts and perspectives (Mackay and Gillespie, 1992; Ostlund, 2004; Sovacool and Hess, 2017). Some researchers generalize the common analytical approaches in studying the social shaping of technology.

The social construction of technology approach (SCOT) was first proposed by Pinch and Bijker (Pinch and Bijker, 1984). It assumes that instead of being precisely defined by a specific developer or designer, a technology’s form and meaning are shaped socially. SCOT researchers highlight the ‘design flexibility’ and ‘interpretative flexibility’ of a technology (Bijker and Law, 1992; Woolgar, 1991a), believing that the meanings of a technical artefact vary among different ‘relevant social groups’ (Bijker, 1997, 1995; Pinch and Bijker, 1984). Actors involved are not limited to technology developers or designers. Instead, people such as politicians, users, non-users, and installers are also included. According to SCOT studies, these groups interpret the technology differently (Best, 2017;
In light of this, a SCOT analysis is interested in identifying the different interpretations of a technology, figuring out which conflicts emerge among these interpretations, and connecting the identified conflicts to the design features of the technology (Best, 2017; Douglas, 2012; Pinch and Bijker, 1984). The approach is symmetrical in its treatment of technological failure and success, utilizing the same explanation for each (Best, 2017; Bijker, 1997, 1995; Bijker and Law, 1992; Gergen, 2001; Kline and Pinch, 1999). It suggests that there is a ‘process by which closure is achieved among relevant social groups between competing interpretations of the available technological options, so that a particular design becomes taken for granted as the essence of the technology’ (Russell and Robin, 2002).

The domestication of technology is another prominent approach to studying the social shaping of technology. It was first documented by Ruth Schwarts Cowan (Cowan, 1987) for describing the relationship between ‘the consumption junction’ and the development of technology. Over the past decades, many sociology, media, and communications studies have looked into the appropriation and incorporation of digital devices into social settings (e.g. homes and workplaces) (Brause and Blank, 2020; De Schutter et al., 2015; Haddon, 2016; Vuojärvi et al., 2010). For instance, studies about technology implementation have looked into the ‘little arrangement’ among users to adapt technology into domestic settings (López Gómez, 2015). Within such processes, aspects such as ‘ownership’, ‘objectification’, and the ‘incorporation’ of technologies have received significant attention (Callon, 1986a; Mackay and Gillespie, 1992; Silverstone, 2005a, 1993). Unlike studies concerning technology development and design processes, studies adopting this approach focus on the mechanisms in the processes right after technologies are introduced into domestic life (Silverstone, 1993). The mechanisms here refer to various dynamics, interplays, interactions, and changes in activities in relation to technology use, rather than cause-effect relationships between two or more variables. By applying the approach, scholars are empowered to explore how people interpret and define the technical objectives, and make them workable in daily activities, and how technologies shift from an objective and anonymous artefact to an integrated part of users’ daily lives (Birkland, 2013; Brause and Blank, 2020; Caron and Caronia, 2007; Madsen and Krammergaard, 2016).

As a well-known approach to studying social shaping of technology, the actor-network theory (ANT) attempts to describe the social world as a form of continually changing networks that connect different social factors (Latour, 1999, 1991). All of the actants, including humans and non-humans, are given the same credits for and are also connected with links, which sustains both material and semiotic meanings (Latour, 2012, 1992, 1991). The actants are active actors and are linked with other actants while they are engaged in the activities of the networks. The networks only exist through making and remaking, and the links are dynamic in changing meanings (Callon, 1991; Caron and Caronia, 2007; Latour, 1991; Law and Hassard, 1999). The ANT model maps social groups with a neutral network without presumption and interpretation and allows researchers to examine the social phenomena with either a micro or macro lens (Callon, 1986b; Cresswell et al., 2010; Law, 1992). In ANT, technologies are part of the network and have a status equal to that of human actors in relation to other social actors, such as users, designers, policymakers, and budgeters. The approach is particularly useful in unravelling the active role of technology in reality, and addresses issues about how actants in the network generate the final social effects (Cresswell et al., 2010).

In this dissertation, I target the socio-technical transformation in the digitalization of social alarm services in nursing homes. Drawing on the approaches above, I adopt an axiomatic assumption that there is no essential use that is inherent in the technological artefact itself. That is, technologies are isomorphic with their social contexts, and their implementation and use are always an accomplishment that is the result of social practices.
3.1.2 The scripts of technology: technology shaping social contexts

The concept of ‘script’ (Akrich, 1992; Akrich and Latour, 1992) describes the pre-defined assumptions of how technologies should work based on user representations. Designers assume how technology should interact with its users and be used in practice when initiating a design project. These assumptions shape the appearance, component devices, and functionalities of the technology. Hence, technology includes script-like prescriptions that outline how users are meant to comprehend, interact with, and adapt to technology. These prescriptions are defined here as technology scripts (Akrich, 1992).

The development of technology scripts relies on designers’ interpretations of user needs (Akrich and Latour, 1992; Brodersen et al., 2015; Miller, 2021). Designers tend to form their image of users and their interactions with technology through investigations such as market surveys, focus group interviews, and questionnaires. When employed in users’ lives, the technology acts as text and configures the user by encouraging some forms of use, while delimiting others (Woolgar, 1991a). That is, the identities and practices of putative users are defined by designers through the technology scripts that delimit some actions and encourage others (Akrich et al., 2002).

However, in studies about SCOT and ANT, ‘interpretative flexibility’ is proposed to show the problem of assuming that users can be purely configured (Woolgar, 1991b). Scholars argue that some technologies contain ‘strong’ scripts while others contain ‘weak’ scripts as they have divergent strengths in affecting users’ actions (Mort et al., 2019, 2013; Öberg et al., 2018; Risling et al., 2018). However, all scripts cannot determine their users’ practices and the technology’s actual use (Jhams, 2003). It is not uncommon for the initial technology scripts to be negotiated in practice as users can purposely override technology scripts (Stokke, 2019). Examples include users avoiding particular functionalities or skipping certain actions required by the scripts. Such examples are highlighted in studies about the technology domestication process (see the following section).

This dissertation adopts this perspective on technology scripts to determine why and how technology may shape social environments. In Paper IV, the term ‘script’ is specifically used to discuss the differences between the anticipated and the actual use of new social alarm systems in nursing homes.

3.1.3 The domestication of technology: users shaping technology

Originally developed in empirical research in the home settings, domestication theory describes and analyses processes by which technology is accepted, rejected and used in household settings (Bakardjieva, 2006; Silverstone, 1994; Thomas et al., 2005). In contrast to linear perspectives on innovation that understand the roles that technology comes to play in a given situation as predictable and technologically determined (Silverstone, 1993), the core thought of domestication theory is that technology must be appropriated to become meaningful and functional in its implemented contexts (Nelly and Pinch, 2003). The theory refers to the socialization process of technologies as resembling that whereby wild animals become ‘house-trained’ (Lie and Sorensen, 1996). As soon as the technology is employed in the workplace, the socialization process begins. From this perspective, the implications of technology cannot be assumed or predicted because technology continues to be shaped and innovated when being implemented and deployed in everyday practices (Berker et al., 2005; Rodino-Colocino, 2007). Moreover, the technologies are not limited to new innovative technological artefacts, but also include well-established and stable technologies (Nelly and Pinch, 2003). One example is the Model T automobile. Despite the Model T automobile being a well-established technology, like the social alarm system, farmer users change the way it is used when interacting with it (Kline and Pinch, 1999). In other words, the ‘effects’ of technologies such as social alarm systems are not intrinsic properties of the technology, but rather
consequences of the shape and role that the technology takes in a specific social context as people might use it differently and with divergent goals.

Domestication theory explains four dimensions of technology implementation: appropriation, objectification, incorporation and conversion (Haddon and Silverstone, 1995; Lie and Sørensen, 1996; Silverstone, 2005b, 1994). Appropriation refers to the phase in which individuals initially encounter a new technology. Key themes here focus on possession and ownership. Hence, questions during the processes are about how individuals decide to obtain (or not to obtain) a new technology and related services based on interpretations of a variety of resources (e.g. social resources, material resources). However, in our study, the early encounters between the social alarm system and the two groups of people are in work contexts in nursing homes. In these contexts, the ownership of the system will differ from those in home settings. Confusion regarding ‘why this particular system was chosen’ or ‘how the system should be used’ may emerge. Objectification refers to the phases in which technology is spatially and physically located. Related questions are thus what the location of a technology should be and how to locate it. In our case, this is represented in how the social alarm system becomes a physical object in nursing homes. This includes examples such as the distribution and installation of social alarm devices. Incorporation refers to the phases focusing on the temporal organization of technologies. Slightly different from the objectification dimension, which concerns integrating technology physically, incorporation pays attention to how people or contexts shape and reshape technology by organizing it into everyday temporal structures. Hence, combined with the purpose of this study, questions here are about how often, by whom, and when the social alarm system should be used. Conversion refers to the phase in which attention is focused on ‘how people mobilise these technologies as part of their identities and how they present themselves to others’ (Haddon, 2016). Key issues in this phase are thus about how people conduct technology-mediated practices and how they display the practices to others.

Domestication theory was initially proposed to study media and communication technologies, with great focus on technology consumption (Ingram et al., 2007). However, many recent studies in STS adopt the theory to examine the actual use of technology in household settings with insights from ANT and SCOT. Specifically, there are three main concerns: 1) practices among different stakeholders associated with the technology; 2) practices of users assigning meanings to the technology; 3) practices of decision making and learning in relation to users’ cognitive processes (Sørensen et al., 2000).

Domestication theory is one of the main theories employed in this dissertation to study the construction of care practices through which the digital social alarm system gradually becomes a component of daily care in nursing homes. In Paper II, the theory is particularly used to explain why a deterministic view on technology implementation is problematic and why the understanding of the socialization process of technology matters. In Paper III, the theory provides a framework of different implementation phases, showing how middle managers and assistant nurses think and act differently within different periods. In Paper IV, the theory helps to reveal the active role of assistant nurses in redefining technology scripts.

### 3.1.3.1 From technology to social practices

A dynamic relationship between technology and social environments emerges as a result of the domestication process. Engaging the concept of ‘script’ in domestication theory, Pols (2017) elaborates on how complex and dynamic the relationship is in the uptake of technology in daily practices. She further calls for more attention to be directed at the socio-technical aspect of technology implementation, especially on the practices whereby technology is connected to individuals and becomes a part of their lives.
Even if a technology is scripted to perform in a particular way, there is always room for interpretations. That is, when it comes to technology implementation and use, social intentionality under different contexts matters because involved actors adopt, exploit, and generate distinct meanings for the same technology (Bijker and Pinch, 2012). Following this idea, the focus shifts from the technology to different contexts. In the following section, I elaborate on the concepts of care, the specificities of care contexts and the use of technology in such contexts.

3.2 Care concepts and contexts

3.2.1 Key care concepts: relational care, moral care and practical care

Extensive studies have looked into different care settings, focusing on what constitutes good care. Care is defined as ‘experience-based activities generated through three key contradictions: an orientation toward others, a moral strain, and an evidence-based technique’ (Boström, 2014; Nass, 2005). Three concepts are proposed: relational care, moral care, and practical care. These refer to three key aspects of care, including addressing the requirements of residents, treating all residents equally, and finishing care tasks efficiently. In detail, relational care is also understood as person-centred care and patient-led care, with the primary concern being to put residents in nursing homes at the centre of care. Moral care is the idea that everyone should receive care equally and respectfully. Hence, moral care refers to ethical legitimation. Practical care is related to using a measurable variation to provide evidence-based care. It is closely connected, for instance, to cost-effectiveness. When these three aspects of care are balanced in reality, healthcare professionals describe their work as meaningful and satisfying (Ekman et al., 2014; Johannessen et al., 2014; May et al., 2018). In Sweden, the three aspects of care have been incorporated into social care policies. Swedish municipalities are responsible for establishing and providing rules for nursing homes. According to these rules, care should be provided on the basis of the principles of justice and equality (Lettieri et al., 2015). Furthermore, the provision of care should maximize the profit and minimize the potential risks based on measurable evidence. Lastly, care should put the needs of residents at the centre (Cocekelbergh, 2013; Risling et al., 2017; Schrader, 2015). Specifically, relational care is governed by two comprehensive policies: the Swedish Health and Medical Service Act 1982:763 (Government Bill, 1982) and the Social Services Act 2001:453 (Government Bill, 2001). Within the two policies, it is emphasized that care provision should be co-developed by residents, with respect for their autonomy and integrity as a priority. In terms of moral care, in accordance with existing legislation, care should be provided according to an ethical code of conduct that focuses on providing residents with an independent and meaningful existence in safe conditions according to the Social Services Act 2012:3 (Government Bill, 2012). The Swedish Health and Medical Service Act 1982:763 (Government Bill, 1982) emphasizes the importance of offering equal care to all populations, with consideration to personal value and dignity. Practical care is related to the regulations regarding getting daily care tasks done efficiently and productively with the evaluation of measurable variations. For instance, the Work Environment Act 1977: 1160 (Government Bill, 1977) mandates that employers should use the best evidence available to reduce employee illness and workplace accidents.

In this dissertation, the three care concepts are utilized to show that people have different objectives when providing care. Though I understand care may be more complex than these concepts may imply (Pols, 2017), my goal is to show that care can be multiply understood in different contexts, not to present what exact interpretations people have when providing care. In Paper IV, the three concepts are particularly utilized with the same intention. The following section explains the application of these concepts and policies in reality, and answers why the care provision should be understood as a response to situational circumstances.
3.2.2 The specificities of care work and contexts

Although the care concepts and related policies mentioned in Section 3.2.1 are clear, it is difficult to predict how they will be used in care work (Andersson et al., 2018; Fahlström, 1999; Wahlberg and Bjorkman, 2018; Winblad et al., 2017). As various scholars suggest (Krzywoszynska, 2016; Schrader, 2015), 'care is not possible when the practitioners care more about adhering to the rules and procedures than they do about doing the right thing'. This is in line with Mol’s work: care provision is based on experimenting with different ways and determining what works best in each situation (Mol, 2008, 2002; Mol et al., 2010).

In comparison with other services, care work necessitates a personal and binding relationship of duty and commitment between individuals (residents or other healthcare professionals). Care receivers are usually fragile, dependent and incapable of self-management (Ericson-Lidman, 2019; Spangler et al., 2019; Wadensten, 2007), which further makes them reliant on their relationships with care providers. The dependency of care receivers on care providers means that the performance of certain care work may lead to severe outcomes if inappropriate care concepts and related policies are adopted. Taking the ventilator as an example, many nursing homes procured a few ventilators during the Covid-19 pandemic. However, overwhelmed nursing homes may not have enough ventilators for all residents that require respiratory support. In this case, how to distribute the ventilators becomes an issue. Following the regulations regarding moral care, each resident in the nursing home should be treated equally and thereby have the same chance to access the ventilators. Following the regulations regarding practical care, the ventilators should be distributed to the residents with higher expected survival rates. Yet, following the regulations regarding relative care, the ventilators should be used for those who need them most. These three strategies are conflicting and challenge healthcare professionals to make a decision.

Co-production is another characteristic of care work (Mol, 2008; Mol et al., 2010; Mol and Law, 1994). Most nursing home residents are not limited to being recipients of care. They usually play an active role in taking care of themselves (Eriksson, 2014). For example, some residents may contribute to care work by actively using the social alarm system. In this sense, care services are always co-produced between the actors involved. Collaborations among healthcare professionals are also common in nursing care (Buch and Andersen, 2015; Obstfelder et al., 2007). For instance, there are usually two to three assistant nurses in one unit in Swedish nursing homes. They rely on each other to deliver care services (e.g. shifting big residents from the bed to the wheelchair). The collaborations between assistant nurses and middle managers are also intensive. In this dissertation, Paper III shows how assistant nurses and middle managers work in a team to implement the new social alarm systems. The implementation process are, to some extent, impeded as people have different perceptions and behaviours concerning the situation at hand.

Furthermore, care work is overflowing with unpredictability and necessitates flexibility and competence on the part of the healthcare professional (Davies, 1995). Situations change over time and vary from resident to resident, resulting in a complicated relationship that requires healthcare professionals to adjust their pathways for care provision quickly (Allen, 2014). As a result, care work demands a variety of skills, competencies, adaptability, and thinking. This can be exemplified by multitasking in nursing homes. Residents usually wake up around nine o'clock in the morning. During this period, healthcare professionals often need to take care of more than one resident and prepare breakfast for all residents. In this case, they have to assess the priority of these care tasks and plan a related pathway for care provision. However, such a planned pathway has to be changed often, as there are many emergencies in nursing homes.

To summarize, care work is a matter of social relationships that are difficult to define, as the needs of actors involved are continuously changing. This entails that the social environments in nursing
homes are not totally stable, but rather evolve as a result of the agreements and interactions among actors involved in nursing homes (Mol et al., 2010). As mentioned in Section 3.1, technology implementation is constructed from continuous interactions and mutual shaping between the new social alarm system and the social environments. In this sense, the technology implementation in nursing homes can be more complex than that in other settings because of the specificities of care work and the social environments in nursing homes.

In this dissertation, I argue that understanding the various socio-technical transformations in care practices is of help to uncover the complexity of digitalizing the social alarm services in nursing homes. The following section introduces the definition of care practices, explains the benefits of a practice perspective in studying technology implementation in care settings, and briefly summarizes the current knowledge about technology in care practices in relation to social alarm systems.

3.3 Technology in care practices

3.3.1 Practices and technology

There is a consensus within STS research that the concept ‘practice’ has no unified definition. Some scholars refer to it as the ‘experiential and complex phenomenon where individuals interact to provide care’ (Higgs and Narelle, 2014), while others refer to the concept as ‘embodied, materially mediated arrays of human activity centrally organized around shared practical understanding’ (Schatzki, 2001). In this dissertation, my understanding of the concept is generated from organization science, which has a rich tradition of defining the concept of practice in organizations. The term practice, as defined in organization science, refers to ‘the coordinated activities of individuals and groups in doing their “real work” as it is informed by a particular organization or group context’ (Cook and Brown, 1999). This entails that, in this dissertation, care practices are defined as individual and collective activities that are performed in relation to the implementation and use of new social alarm systems under given care contexts in nursing homes.

In theorizing technology implementation in care settings, Pols (2017) argues that what we need to do is to understand ‘what happens in particular circumstances with particular types of technologies, and to figure out who might receive benefits from using the technology’. Applying the definition of care practices used in this dissertation, I suggest that focusing on care practices and the socio-technical transformations within the practices will help to answer the questions above.

By applying the insights from previous literature to this dissertation, I learned that the relationship between a social alarm system and care contexts is dynamic in care practices, and that system implementation cannot be fully predetermined until the system is implemented in nursing homes. Moreover, the implementation of a digital social alarm system in nursing homes makes the existing complex social environments in nursing homes even more complex as it involves innovative thoughts, social relationships, care activities, and actors involved. Specifically, the technology implementation relies on the performance of care practices where actors involved need to adjust the social environments or the new system under particular contexts. That is, there are socio-technical transformations in care practices in which the social alarm system (technological subsystems) and actors involved (sociological subsystems) are optimized and revolutionized together (Aceros et al., 2015; Nelly and Pinch, 2003; Oudshoorn, 2012; Pols, 2017). As a result, this dissertation shifts its focus to the socio-technical transformation in care practices during the digitalization of social alarm systems in nursing homes.
3.3.2 Technology in care practice in relation to social alarm systems

In terms of studies that concern the implementation and use of social alarm systems, scholars agree that it is problematic if middle managers utilize the same implementation strategies in different implementation projects and expect the same implementation outcomes regardless of the characteristics of specific technologies and social environments. In this section, I only briefly introduce the current knowledge about technology in care practice relating to social alarm systems, as further details can be found in Paper I.

In general, when examining the implementation of social alarm systems in reality, researchers have found that social alarm systems can be both enabling and restrictive when it comes to enhancing the efficiency of care provision.

On the one hand, research demonstrating that the system can improve care efficiency and collaboration usually reveals that healthcare professionals find new interaction opportunities which overcome difficulties in associating with residents or colleagues (Baumeister and Leary, 1997; Gjestsen et al., 2017). For instance, Hall et al. (2017) demonstrate how the social alarm system benefits the teaming of healthcare professionals within a team through sharing of real-time information among team members.

On the other hand, studies that highlight how social alarm systems can limit the efficiency of care provision usually mention the different perceptions of received alarms and available resources (Gjestsen et al., 2017; Öberg et al., 2018). For example, Öberg et al. (2018) highlight how healthcare professionals fail to coordinate their work due to divergent perspectives and understandings of the value of the social alarm system. Some healthcare professionals are not likely to take risks in relying on the system, and thereby do not have adequate competence in using the system as they forget required details over time.

Regardless of having the focus on emerging interaction opportunities or different perceptions in technology use and implementation, the literature above views the social alarm system and the environments where the system is implemented as separate and analytically distinct. Although examining the social alarm system as a tool with focuses on influential factors and implementation outcomes is beneficial, the knowledge of influential factors in technology implementation is insufficient to reveal the complexities of implementation processes in terms of how technology eventually becomes part of care practices. Questions such as ‘how do individuals mitigate the cultural clashes when implementing technology in daily practices’, ‘how can expectations of implementation outcomes be aligned’, and ‘how can support for effective implementation be generated’ remain unanswered. On the basis of theories and literature mentioned above, this dissertation believes that examining care practices and treating the system as an integrated aspect of the environment would yield more insights (Peine and Neven, 2019).

To summarize, existing literature about implementation evaluations has helped to shed light on the facilitators and inhibitors to technology integration into care practices. However, the knowledge of influential factors in technology implementation is insufficient to reveal the complexities of implementation processes in how technology eventually becomes part of care practices. It is crucial to analyse ‘what happens in a specific context with specific types of technologies, to explore who might benefit from the technology and what kind of practices they participate in creating’ (Pols, 2017). That is, the focus should be on the contextualization of technology, and socio-technical transformations in practices that take place under specific social contexts.
3.4 Summarizing the theoretical framework

The interest of this dissertation lies in the field of science and technology studies (STS). By applying theories of social shaping of technology with a focus on socio-technical transformations in care practices, the dissertation asks how implementation of the new social alarm systems are is socially shaped in care practices.

Learning from current theories, the research is rooted in the argument that technology interweaves with materials, and human and symbolic elements in social environments, co-constructing the care practices where the relationships among the social alarms and social forces are transformed. The four papers included in the dissertation tackle different aspects of the theme at different levels of analysis. In particular, Paper I aims to understand current knowledge of implementing and integrating the social alarm system in practice in nursing homes. By identifying the research gaps about the central research theme, it provides a basis for further investigations in the following three empirical studies. Paper II explores the realization of implementation plans (e.g., interventions and strategies) throughout the implementation process. It examines how and why the implementation expectations differ from the actual implementation outcomes. The findings highlight the importance of understanding the socialization process by which the social alarm system gradually becomes a constructive component of daily care. In this regard, I shift my analytical focus specifically to the actors involved. Paper III focuses on the execution of technology integration. By discussing the differences between middle managers and assistant nurses in integrating the new social alarm system in different domestication phases, the paper aims to identify challenges in implementation activities that inhibit the project from moving forward and the technology from being integrated. In Paper IV, I build my inquiry on the concept of ‘script’ to understand how the expectations and scripts contained in social alarm systems are adapted into practices under different care concepts (i.e., relational care, practical care, and moral care).

The structure of this dissertation has a progression in line with the processes of implementation projects, wherein the digital social alarm system starts out as a separate artefact and goes on to become a part of care practices (Table 1). In fact, the theoretical focus moves from current knowledge of the system integration into care practices (Paper I) to the realization of implementation plans and expectations (Paper II), to the execution of technology implementation between assistant nurses and middle managers (Paper III), and then to the actual use of the system among assistant nurses (Paper IV).

Table 1. An overview of theoretical focuses in the appended papers

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<th>Paper I</th>
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<td>Main focus</td>
<td>Current knowledge of the system integration into care practices</td>
<td>Discrepancies between expected and actual implementation</td>
<td>Differences within care teams in the execution of technology implementation</td>
<td>The technology scripts and different care concepts in individuals’ system use</td>
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4 METHODOLOGY

This chapter elaborates the approaches, methods, and trustworthiness in this dissertation. First, it explains the overall research approaches. Second, it describes the methods used in the literature review. Third, it represents the methods for data collection and analysis in empirical studies. Last, it discusses the research trustworthiness.

4.1 Research approaches

There are four papers appended in this dissertation. Paper I is a literature review of the integration of social alarm systems in care practices. It identified some research gaps that provide a basis for my further investigations. The remaining three papers are empirical, with the goal of understanding the real complexity of the digitalization of social alarm services in nursing homes.

For the literature review, I intend to provide an overview of the current findings regarding the integration of social alarm systems in care practices. This explorative purpose leads to a broad interest in the presented information on the topic in current literature. The approach of a scoping review is useful when the topic for the literature search is diverse and complex (Peters et al., 2015). Munn et al. (2018) suggest that the scoping review approach can be specifically used to categorize existing evidence within a particular field, understand the ways of conducting research on a given topic, characterize the main themes of a given topic, and identify related research gaps. In this regard, the scoping review approach fits my purpose and interest. Consequently, Paper I adopts the scoping review approach for literature search and analysis.

For the empirical investigations, I intend to provide insights into the socio-technical transformations in care practices through which the social alarm system gradually becomes a part of daily care. That is, I am interested in the complexity of implementation situations. Qualitative approaches are useful when the goal is to gain an in-depth understanding of social phenomena (Denzin and Lincoln, 2011; Silverman, 2020). With an interest in why and how such phenomena occur, qualitative approaches usually investigate subjects’ thoughts and behaviours. They are widely utilized to explore complex situations in which different activities, processes, social relations, or interactions are involved. Scholars employ qualitative approaches when seeking a better knowledge of the investigated phenomena that can take complicated social interactions and processes into account (Edvardsson et al., 2011). Evidence shows that qualitative approaches allow researchers to generate understandings of processes over time, and thereby enable a comprehensive understanding of complex phenomenon such as technology integration in organizations (Silverman, 2020). Accordingly, I follow the recommendations above in order to generate deeper knowledge on technology implementation and its use in nursing care practices. In the dissertation, all empirical studies adopt qualitative approaches to examine and analyse implementation issues and circumstances based on a literature review (see details in Table 2). In addition, quantitative
approaches are useful when the goal is to gain a broad understanding of social phenomena (Brannen, 2005). In the dissertation, Paper II adopts quantitative approaches to obtain a better understanding of general implementation conditions in the selected nursing homes (Table 2).

Table 2. A brief overview of research types and approaches

<table>
<thead>
<tr>
<th></th>
<th>Paper I</th>
<th>Paper II</th>
<th>Paper III</th>
<th>Paper IV</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Database</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Literature</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investigations</td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td><strong>Approaches</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Qualitative</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantitative</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2 Literature review

4.2.1 Search process

The process of research searching in Paper I was based on a combination of the PRISMA extension for scoping reviews (PRISMA-ScR) (Tricco et al., 2018) and Arksey and O’Malley’s framework (Tricco et al., 2018). Following the five steps of the framework, I specified the research questions, and screened and analysed the identified relevant studies steadily. During and after the search process, the PRISMA-ScR was particularly used to ensure the rigor of search process, and the completeness of the final article.

With the aim of developing a deep understanding of the integration of social alarm systems in care practices in existing studies, I set the target literature as empirical studies about integrating social alarm systems into formal healthcare professionals’ care practices. The search terms thus focus on social alarm systems, healthcare professionals, and system integrations. In this regard, major search terms such as ‘alarm system’, ‘emergency response system’, ‘assistant nurse’, ‘nursing homes’, ‘frontline care worker’, ‘digitalization’, and ‘implementation’ were identified through a broad search of alternative and synonymous terms. These terms were then searched for within selected electronic databases. In addition to the primary search, additional searches (e.g., forward citation and snowballing) were conducted to generate comprehensive insights into the central topic.

4.2.2 Data extraction and analysis

In terms of data extraction and analysis, a taxonomy including publication time, source origin, research interest, study purposes, settings, participants, methodology, integration conditions, and key findings was applied. On the basis of the extracted data, I qualitatively conducted the narrative synthesis. The analytical tool used was Nvivo 12. I utilized content analysis (Tricco et al., 2018) to identify key themes under different parameters. For instance, when analysing the key findings, I found that the majority of screened studies discussed the influential factors that might facilitate or inhibit the integration of social alarm systems into care practices. Consequently, a broad theme of ‘influential factors’ emerged within the parameter of ‘key finding’. Through further analysis and coding, a variety of subthemes such as ‘work environment’ and ‘system characteristics’ were identified.
4.3 Empirical investigations

4.3.1 Settings and participants

Four public nursing homes
The empirical investigations were conducted in four public nursing homes in Sweden. These were selected based on whether they had implemented or planned to implement a digital social alarm system within the next six months. This was conducted by reaching out to officials from different Swedish municipalities. Most officials showed an interest, but only a small number of nursing homes qualified for the study. In order to get authorization to conduct the study, we met with nursing home leaders to discuss the details of the study. Four nursing homes were finally selected: two in Stockholm and two in Gothenburg. These all have similar characteristics, such as size and unit functions (Table 3).

Table 3. The selected nursing homes

<table>
<thead>
<tr>
<th>Items</th>
<th>Nursing home</th>
<th>Stockholm</th>
<th>Göteborg</th>
<th>Göteborg</th>
<th>Stockholm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characteristics (number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Units</td>
<td></td>
<td>6</td>
<td>6</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>Seats</td>
<td></td>
<td>59</td>
<td>54</td>
<td>84</td>
<td>122</td>
</tr>
<tr>
<td>Unit functions (number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>For dementia diagnosis</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>For somatic care</td>
<td></td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>People composition (number)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assistant nurses</td>
<td></td>
<td>42</td>
<td>37</td>
<td>51</td>
<td>89</td>
</tr>
<tr>
<td>Middle managers</td>
<td></td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Residents / Unit</td>
<td></td>
<td>9-10</td>
<td>9</td>
<td>10</td>
<td>8-11</td>
</tr>
<tr>
<td>Assistant nurses / Unit / Shift</td>
<td></td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Implementation status</td>
<td></td>
<td>Basic</td>
<td>Basic</td>
<td>Customized</td>
<td>Customized</td>
</tr>
<tr>
<td>Social alarm systems</td>
<td></td>
<td>Finished</td>
<td>Ongoing</td>
<td>Finished</td>
<td>Finished</td>
</tr>
<tr>
<td>Implementation progress</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Healthcare professionals involved
In the dissertation, participants primarily include people from nursing homes such as assistant nurses, middle managers, and nursing home leaders. As described in Section 2.3, assistant nurses are the ones working in the frontline and utilizing the social alarm system to deliver care services to residents in nursing homes. Middle managers are positioned in the middle between nursing home leaders and assistant nurses in Swedish nursing homes. They usually take operative responsibilities and are in charge of practically implementing the system and managing emerging issues. They initiate how the implementation projects should be conducted in detail, and work together with assistant nurses to foster the implementation progression. Nursing home leaders usually take on administrative responsibilities, and do not focus on details in technology implementation. For instance, they decide on the system procurement and the amount of investment for the implementation project. In addition to the nursing home staff participants, I also interviewed some managers and designers from technology companies to understand how a particular social alarm system is supposed to be used.

In terms of participant recruitment, I chose to meet nursing home leaders and middle managers in person, and distribute questionnaires to assistant nurses to obtain consent. Specifically, when
meeting with nursing home leaders and middle managers, I provided research details and asked about their interest in participating in the research. For assistant nurses, I distributed questionnaires in which assistant nurses could show their willingness to be a part of further investigations. ‘Snowball sampling’ was also used, as participants were encouraged to recommend colleagues who could be potential participants (Biernacki and Waldorf, 1981).

All participants were characterized in terms of their own identities in the appended papers. Scholars argue that when participants perform actions and illustrate thoughts, individuals tend to portray themselves as morally and ethically responsible persons in case of potential stigma and critique (Buttny, 1993). Following this argument, drawing on participants’ representations of their identity and actions to characterize them is helpful to gain their trust, and to recognize the reasons underlying their particular actions or activities. In Paper II, the participants’ identities are ‘healthcare professionals who are involved in the implementation process of social alarm systems’. In Paper III, their identities are ‘healthcare professionals who share expertise and experience with colleagues when using the social alarm system’. In Paper IV, their identities are ‘healthcare professionals who incorporate technology scripts into care practices for care provision’. Finally, the way of using participants’ constructions of their own identities allows participants to show the identities they construct for themselves and describe the care contexts in which their identities are constructed, and thereby empowers me to gain a deep understanding of the details of healthcare professionals’ technology use in practice.

4.3.2 Data collection

To meet the research questions in the thesis, I employed different data collection methods in different papers. Specifically, data was collected through questionnaire distribution, individual interviews with different actors involved, observations of implementation work or care services, and local document analysis (Table 4). Paper II focuses on the realization of technology implementation expectations. The questionnaire distribution and document collection helped to understand the general implementation situations, while interviews and observations helped explain why these situations come about. Paper III focuses on differences between middle managers and assistant nurses, and interviews were thus selected to obtain a deep understanding of their perceptions (Sandelowski et al., 1997). Paper IV focuses on assistant nurses’ actual use of the system, so observations and interviews were therefore selected to dig deeper into their activities of technology use (Strauss and Corbin, 1998). The variety of data-collection methods allowed me to gain a deeper understanding of the socio-technical transformations in care practices in terms of implementing the social alarm system in nursing homes.

According to a Swedish policy (Ministry of Education and Research, 2003), the project needed no ethical permission because all data were collected in public areas, and no sensitive or personal information was collected. In terms of data collection, I received both written and oral consent from all participants. Specifically, I communicated with nursing home leaders and middle managers to get permission about entering their workplace and conducting investigations. When distributing questionnaires, I received the signed informed consent form from all participants. When interviewing and observing specific participants, I asked for their permission about recording and note-taking verbally. In terms of data analysis, I used identifiers to mark all participants so as to ensure their privacy and confidentiality.

Table 4. An overview of methods and database

<table>
<thead>
<tr>
<th>Methods</th>
<th>Paper II</th>
<th>Paper III</th>
<th>Paper IV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Observations</td>
<td>- Interviews</td>
<td>- Observations</td>
</tr>
<tr>
<td></td>
<td>- Interviews</td>
<td>- Interviews</td>
<td>- Interviews</td>
</tr>
</tbody>
</table>

26
## Settings

<table>
<thead>
<tr>
<th>Database</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Implementation documents</td>
</tr>
<tr>
<td>- Questionnaires in first round (57)</td>
</tr>
<tr>
<td>- Questionnaires in second round (46)</td>
</tr>
<tr>
<td>- Observation (67 hours)</td>
</tr>
<tr>
<td>- Interviews with nursing home leader (1)</td>
</tr>
<tr>
<td>- Interviews with middle managers (6)</td>
</tr>
<tr>
<td>- Interviews with assistant nurses (7)</td>
</tr>
</tbody>
</table>

## Complementary data for understanding the background

- Interviews with managers in technology company (1)
- Observation
- Product instruction
- Local guidelines
- Education documents
- Interviews with technology designer (1)

## Documents

There are different types of documents involved, including basic organizational information such as contact information for different departments, care work checklists, instruction manuals for both old and new social alarm systems, plans for the digitalization project, educational materials, and reports of reflections on the current operational work. Furthermore, meeting minutes, slides for introducing the new system, and notes from healthcare professionals were collected during observations and interviews. Given the fact that documents are created in social environments, they are thus able to unravel stories worth heeding by verbally presenting thoughts, arguments, interpretations, understandings, and diagrams. As a result, the documents gathered in this dissertation were utilized as resources to gain a better understanding of the contexts and practices of selected nursing homes (Bowen, 2009). The data extracted from the collected documents act as supportive or complementary data. For instance, in Paper II, the documents are used to quickly understand the initial plan and expectations of implementing new social alarm systems. Paper III and Paper IV use the data extracted from documents to become familiar with work routines and regulations.

## Questionnaires

To obtain a better understanding of general conditions in the selected nursing homes, questionnaires were issued. These gathered data on people’s perceptions of the technology as a whole, problems encountered during the implementation, and implementation strategies. These aspects were selected because people who have a positive opinion of technology and can solve emerging problems are more likely to adopt and use it efficiently (Carlfjord et al., 2010; Wongkoblap et al., 2017).

The detailed items in the questionnaire were drawn from validated questionnaires. This was to ensure high reliability in the questionnaire. Specifically, items about individual aptitudes in the social alarm system came from the System Usability Scale (Bangor et al., 2008); items about implementation strategies came from S-NoMAD instrument (Elf et al., 2018). Likert-scale questions (ranging from 1 to 5), closed questions, and open questions were all included in this questionnaire. To ensure authenticity and clarity, the questionnaire was pre-tested with three assistant nurses.
A total of 334 questionnaires were distributed, and 195 (58%) were received back. In Paper I, I distributed the questionnaires in two rounds in order to understand the conditions before and after the digitalization. In the first round, 57 of 79 questionnaires were received, while in the second round, 46 of 77 questionnaires were received. The first-round survey helped me to understand respondents’ perspectives on the older analogue system, while the second-round survey was conducted to understand their perspectives on the new digital social alarm system. In Paper III, I distributed additional questionnaires in the two nursing homes that had not been investigated in Paper I. A total of 92/178 questionnaires were received. Combining these with the second-round questionnaires in Paper II (46/77), I was able to obtain an understanding of the general background information of the selected four nursing homes, such as the perceived system usability and emerging problems during the process.

**Interviews**

The respondents in interviews include staff in technology companies, such as managers and technology designers, as well as staff in nursing homes, such as nursing home leaders, middle managers and assistant nurses. These interviews were focused on elucidating the overarching goal, which is to answer the question of how the implementation of social alarm systems is socially shaped in nursing homes. To capture the socio-technical transformations during the implementation process and underlying issues, I conducted these interviews in different implementation phases (i.e., from pre-implementation to the post-implementation period). The rationale behind interviewing with diverse stakeholders and conducting interviews at different phases is to gain a systematic and comprehensive understanding of the social environments, people involved, the newly implemented social alarm system, and different care practices in selected nursing homes.

The interviews were conducted with distinct purposes, i.e., regarding implementation strategies, project execution, and personal technology use in practice. Regardless of the specific purpose of each interview, I used interview guides to ensure a uniform path for semi-structured interviews (Foddy and Foddy, 1994; Opdenakker, 2006). Within the interviews with the same purpose, respondents were asked similar questions, even though some of these questions varied because of the differences in contexts or implemented systems. There were open-ended questions within the interviews, so that the participants could discuss their experiences and express them themselves. The approach to conducting the interviews followed several guidelines. According to some well-established guidelines (Fontana and Frey, 2005), the interviews start with background questions in relation to respondents’ workplace, daily responsibilities, daily care activities, and practices. This was done to ensure a clear understanding of background information such as daily care routines. Later on, I concentrated on asking probing questions in order to dig into specific themes. This might include, for example, the role and contributions of respondents in the implementation process. Respondents were encouraged to describe their thoughts or experience of these themes by giving examples or telling stories. This approach was chosen because probing questions help to inspire respondents in terms of elaborating or commenting on specific themes, and also because they help ensure response accuracy (Foddy and Foddy, 1994).

A total of 52 interviews were conducted. 45 interviews were recorded and transcribed verbatim while seven interviews were documented through notes as the respondents felt uncomfortable being recorded. Most interviews were conducted in conference rooms, offices, and similar settings within the nursing homes, while three interviews were conducted in online format due to regulations surrounding the COVID-19 pandemic. The length of the interviews ranged from 25 minutes to 2 hours, depending on the purpose of the interview and the respondents’ experience in relation to the specific purpose. The data collection was conducted until saturation was reached and no new information was found.
**Observations**

Since my objective is to understand various socio-technical transformations in care practices when digitalizing the social alarm services, observations were conducted under diverse contexts, including regular meetings, training session, entertainment activities, daily care services, implementation events, and care quality assessments. These different contexts allowed me to gain a systematic view of dynamics and complexity in the implementation process.

Participant observations were selected to ensure a rich understanding of the daily care work in nursing homes where new systems are introduced (Spradley, 2016). I followed the implementation activities of social alarm systems in four nursing homes, healthcare professionals’ actions in integrating social alarm systems in their practices, and the normal care activities of the respondents for over one year. The long-term observation of the respondents’ work in their social settings and contexts enabled a deeper understanding of divergent situations in which the social alarm system is implemented and used.

During the observation, I played a passive role. This means I usually only listened and followed participants without disturbing or supporting their care work. Occasionally I asked participants questions when they were busy to verify that I had correctly understood the issues or situations that were observed. During participants’ breaks, I usually had small talks with them. These small talks helped me to understand the social environments in more depth, and made it easier to answer questions such as how the technology was intended to be implemented and how it was actually used.

As a result, numerous filed notes were taken to describe participants’ practices and work in detail. In most cases, I took notes during the observation, while in a few cases, I had to take field notes after the observation. Photos were taken when the participants granted their consent. All the materials related to observations were carefully stored.

### 4.3.3 Data Analysis

The multiple data-collection methods ensure detailed descriptions of the digitalization processes in nursing homes. In this study, data collected through questionnaires and local documents are primarily regarded as background information. Data collected by observations are primarily used for understanding the actual practices and operations in relation to technology implementation and maintenance. Data collected through interviews are primarily used for understanding the perceptions and reflections among individuals on the system, its implementation and the situations it entails.

All empirical papers follow similar procedures for performing data analysis (Bowen, 2009). Inspired by different theoretical concepts such as technology scripts and domestication, the analysis of data utilizes content analysis approaches. Content analysis is often defined as ‘an approach to making valid and replicable inferences from texts (or other meaningful matter) to the contexts of their use’ (Krippendorff, 2004). It is widely used in qualitative studies for providing a reliable and valid way to uncover the complexities of social environments (e.g., divergent personal perceptions, beliefs and values).

There are three main steps in my data analysis. In the first step, I quickly overviewed all collected data to develop a general understanding of collected materials and to relate them to specific research questions. I then extracted key words or phrases by carefully reading the transcripts and field notes line by line. These words or phrases were extracted due to their potential contributions to answering the research questions in the respective papers. As the overarching research interest is about various socio-technical transformations in the digitalization process, these words and phrases...
are generally related to healthcare professionals' perceptions, emotions, roles, and practices in relation to the implementation of the new social alarm system and the performance of daily care activities. In the second step, I focused on reflecting on the extracted words and phrases, with the goal of finding interconnections among them and categorizing such interconnections. As a result, subthemes emerged during the continuous reflection (Strauss and Corbin, 1998). Each subtheme contains a cluster of words and phrases that represents similar meanings or describes the same events. In the last step, I further reviewed and assessed the identified subthemes to propose final themes that directly illuminate the research questions and purposes. Taking Paper IV as an example, I focused on how assistant nurses incorporate the technology scripts into their care practices with consideration of the quality of care. During the data analysis process, all transcripts, observation notes, and collected documents were reviewed in the early stage. Phrases and texts related to assistant nurses’ perceptions and actions were extracted. They were further grouped into different categories such as ‘disruptions in workflow’ and ‘improved efficiency of information delivery’. The continuous reflections on these categories led to the final themes, which help to describe the actual use of new social alarm systems in their daily practices.

4.4 Trustworthiness of the research

The trustworthiness of the research is considered based on four domains: transferability, dependability, confirmability, and credibility (Lincoln and Guba, 1985).

**Transferability** focuses on the possibilities of applying the current findings to different contexts. Qualitative research has been criticized for its lack of statistical generalization and the difficulties in transferring the findings across contexts (Silverman, 2020). Yet the objectives of qualitative research are usually about analytical generalization. This means that it is interested in idea theory expanding and generalizing rather than merely enumerating frequencies. Despite the fact that qualitative research provides little room for statistical generalization, the variety of contexts and settings investigated improves the robustness and representativeness of the findings (Gehman et al., 2018).

This dissertation addresses problems about transferability by conducting investigations under different contexts and within different nursing homes. Theories and literature are also referenced to show the sustainability of my findings in other contexts. For instance, Paper II highlights the importance of involving frontline professionals (e.g., assistant nurses) in implementation planning. This finding is in line with many studies on the implementation of social alarm systems in countries beyond Sweden. Yet it should be noted that there is always a risk that individual facts are collected and analysed while the truth in general has been overlooked. Consequently, further research is needed to understand the implementation of social alarm systems in additional settings.

**Dependability** focuses on the possibilities of applying the current findings at different times. That is, it is interested in whether other scholars can repeat the research in different periods and find consistent results. The dissertation ensures its repeatability by involving different scholars. Specifically, the research procedure for this dissertation had been thoroughly discussed among group members and carefully documented. Related information (e.g., meeting notes, paperwork, etc.) was stored in a document file that group members can access. Furthermore, scholars from other groups and research institutes were invited to assess and evaluate the findings. Despite the efforts for ensuring the repeatability of the appended papers, I have to acknowledge that investigations conducted at another time could hardly have exactly the same results. This is because people and contexts change over time. For instance, assistant nurses might have different reflections and practices from time to time. However, these results should generally be consistent with the findings in this dissertation.
Confirmability focuses on the potential bias of data analysis and related findings. Qualitative research has been criticized for its subjectivity as results are generated based on the researcher’s interpretations. In order to avoid potential bias, this dissertation outlines the phases of data analysis in a clear and concise manner, and explains the reasons for determining these phases. Moreover, in certain phases, groups members were involved in checking and evaluating the rigour of data analysis. For instance, in Paper I, the identification of key search terms was discussed with other group members. The extraction of data from screened papers was also discussed with and evaluated by co-authors.

Credibility focuses on the accuracy and the truth of the findings. Triangulation is utilized in this dissertation (Patton, 1999; Thurmond, 2001). Specifically, the diversity of data-collection methods, group members, participants, and resources helps to validate my empirical materials. This further ensures the credibility of this dissertation. For instance, one concern of my observations is assistant nurses’ practices of using the new social alarm. By following different assistant nurses over time, I was able to crosscheck whether or not the observed actions or perceptions were consistent for all assistant nurses. Furthermore, during the observations, I kept using small discussions to ensure an accurate understanding of why they conduct specific actions to provide care services through or not through the new system. Moreover, both interviews and observations were used to investigate assistant nurses’ actions and perceptions. In this regard, the data collected through observations can relate to the data from interviews, and help to verify the credibility of my findings.
5 SUMMARY OF APPENDED PAPERS

This dissertation is composed of four papers. They are linked by the overarching research questions: How is the implementation of digital social alarm systems socially shaped in nursing homes? As described, my interest has a progression in line with the implementation processes, wherein the digital social alarm system starts out as a separate artefact and goes on to become a part of care practices. In this section, I briefly summarize the papers and explain the links.

5.1 Paper I: Integration of social alarm systems in care practices in existing literature

The first paper builds the foundation for this dissertation by learning from existing findings of the implementations of social alarm systems in care settings. It reviews the research (from 2009 to 2019) about the integration of social alarm systems into care practices (i.e., how the social alarm systems become part of healthcare professionals’ care practices), with particular focus on the supportive strategies, influential factors, and implementation outcomes mentioned in screened studies.

This paper addresses research question 1: ‘What can be learned from previous research about the integration of social alarm systems into care practices?’ To answer this research question, I employ a scoping literature review about the integration of social alarm systems, with a focus on the care practices among formal healthcare professionals.

An interventionist logic has been dominant in many implementation projects, uncritically believing that technology can promote the efficiencies of care services (Lau et al., 2016; Orlikowski, 1992b). By this logic, the technology implementation process is standardized and linear as technological devices can ‘drop into’ routine use as expected. Scholars from science and technology studies (STS) criticize the logic for its overemphasis on technology as the major driver of change, and its disregard for the contexts in which care practices take place. They call for more studies about how technology is used in daily work from a practice perspective, to show the active role of human agents in defining, configuring, and modifying the actual use of technologies, and thus to present the full picture of technology implementation and use in the work of healthcare professionals.

Under the call, social alarm systems and their implementation have received a lot of attention. A number of socio-technical studies have started to look into how the systems are used in healthcare professionals’ care practices. Though most of these studies concern household settings and informal caregivers (e.g., family members), there are indeed a few studies that shed light on primary care settings and formal healthcare professionals. Scholars maintain that more evidence is required to identify approaches that efficiently and effectively guide formal healthcare professionals in technology use when digitalizing care services, considering their essential roles in care provision.
and the increasing presence of the system in primary care. In this sense, the knowledge of integrating technology in care practices needs to be updated since the work of these authors provides a more comprehensive view of technology integration in formal healthcare professionals’ daily practices.

I discuss three key aspects of technology integration processes in care practices, including supportive strategies, influential factors, and implementation outcomes. Of the screened 25 studies, identified strategies include training, supervision and leadership, staff involvement, and guidelines. Factors related to system integration can be divided into four categories: 1) working environment, 2) system characteristics, 3) operational works, and 4) personal readiness. The implementation outcomes that have been discussed in screened studies include, for instance, privacy, perceptions of the system, and the use of the system. Based on the findings, the paper suggests three research gaps: 1) the contribution of implementation work to the technology integration; 2) the impact of working environments on the execution and operationalization of technology integration; and 3) the social shaping of the social alarm system in practice.

This study enhances the understanding of the integration of digital social alarm systems in care practices by summarizing existing studies and identifying current research gaps. Potential contributions to broader theorizing and practical implications for digitalizing social alarm services are highlighted. The critical analysis translates the findings into different research questions for future investigations (Figure 2).

Figure 2. An overview of connections between the appended papers

5.2 Paper II: Discrepancies between expected and actual implementation

The second paper concerns one gap identified in Paper I: how implementation work (e.g., strategies and interventions) contributes to technology integration effectiveness. It compares the expected and actual implementation outcomes, and discusses their discrepancies and related reasons by tracking the implementation processes over time.

Based on one research gap identified in Paper I, this paper is interested in the phases after the planning of implementation strategies and interventions. By identifying the discrepancies between expected and actual implementation, the paper addresses research question 2: ‘How are the expectations of the technology implementation plans realized?’

In theorizing the failures in implementation projects, previous studies focus predominantly on the outcomes of implementing a specific social alarm system, and the extent to which the outcomes differ from the expectations. It is clear from the research that specific systems work well in specific
situations, but the question of how to translate the findings and apply them in other situations remains unanswered. Studies show that more research is needed to understand why the same system cannot yield similar implementation results in other contexts (Frennert, 2019; Frennert and Baudin, 2019). With growing interest in the question, scholars have started to discuss technology in practice. In general, they suggest that technology should fit daily practices in local environments to be functional, and thus must be ‘tamed’ through careful attention to the details of particular contexts. However, the technology ‘is not meekly put to use (tamed), but is unleashed as well, affecting care practices in unforeseen ways’ (Aceros et al., 2015; Pols and Willems, 2011). Following this view, several socio-technical studies have explored how social alarm systems are ‘tamed’ and ‘unleashed’ in practice, with focuses on stakeholders (van Boekel et al., 2019), use contexts (Mort et al., 2019, 2013; Van Heek et al., 2018), and technology design (Hanley et al., 2018). However, little attention has been paid to how implementation plans and interventions play a role in digitalizing social alarm services in nursing homes.

I employ the domestication theory combined with the logic model to examine the implementation of a particular social alarm system in two Swedish nursing homes. The logic model graphically describes a simplified relationship between the various properties of a technology implementation project (i.e., activities, inputs, mediated outcomes, and final outcomes). By comparing the anticipated and actual implementation outcomes, various discrepancies are identified. I further explore the reasons for such discrepancies by tracking the whole process over time.

Findings show that the discrepancies centred on staff competence, work routines, system readiness, and durations for implementation. This was primarily related to management challenges such as training, procurement, and distribution of responsibilities. The actual implementation process is much more sophisticated than a plan might suggest. To facilitate the implementation, I stress the importance of ensuring well-prepared, continuous adjustments to new practices, and allowing time and space for invisible work that aims to project forward.

This paper has two important contributions: first, it contributes to the existing studies on technology implementation by suggesting that the integration of technology is greatly related to having systematic preparatory work for the implementation, flexible but robust management of occurred changes, and sufficient considerations of invisible work. Second, it has theoretical implications as it combines the logic model with domestication theory and thus helps to better understand the role of implementation strategies when the social alarm system is implemented.

5.3 Paper III: Differences within teams in the execution of technology implementation

The third paper concerns one gap identified in Paper I: how working environments affect the realization of operational work. By specifically focusing on one pertinent point of working environments, teaming, the paper discusses the differences between middle managers and assistant nurses when they domesticate a social alarm system in nursing homes. The paper proposes ‘collective domestication’ to highlight that the current understanding of collective domestication practices within nursing homes is limited.

This paper addresses research question 3: ‘How is the social alarm system contextualized in nursing homes with respect to differences between middle managers and assistant nurses?’ I interviewed assistant nurses and middle managers in the selected four nursing homes to uncover the differences in the perspectives of middle managers and assistant nurses when domesticating the social alarm system in nursing homes.
There are many obstacles to overcome when it comes to applying the social alarm system to care practices. It is argued that the whole process is open, interactive, and iterative, and that the people involved face a variety of changes in relation to a variety of spaces (Oudshoorn, 2012), activities (Beckley, 2003), times (Mol et al., 2010), and goals (Stokke, 2017). In this sense, ensuring the progress of the implementation process relies heavily on the people who are involved. Researchers suggest that attention should be paid to both middle managers who initiate and manage implementation projects and assistant nurses who practically use the system for daily care delivery. They believe that the two groups may benefit from each other’s knowledge, which further fosters the digitalization of social alarm services. However, in recent studies, scholars tend to discuss the interaction between assistant nurses and middle managers, and the relationship between technology implementation and people from a single group. How the two groups work together with respect to differences between each other has received less attention.

This paper looks into the differences between middle managers and assistant nurses when domesticating social alarm systems in nursing homes. It shows how people think and act differently and pursue different goals in divergent domestication phases. A new term, ‘collective domestication’, is proposed to show the limitations in understanding collective practices in technology implementation studies. Despite various differences between the two groups, this paper represents the potential that they can learn from each other and support the progress of technology integration. It highlights the importance of having a collective platform for knowledge and experience sharing.

This paper draws attention to the teaming perspective on the integration the social alarm system in nursing homes. It contributes to the domestication theory by problematizing the role of collective practices during different domestication processes. Additionally, it provides middle managers in nursing homes with recommendations on how to overcome the differences between themselves and assistant nurses when implementing technology in nursing homes.

5.4 Paper IV: Technology scripts and care concepts in individuals’ system use

The fourth paper concerns one gap identified in Paper I: the social shaping of the new system. It explores healthcare professionals’ incorporation of the scripts contained in social alarm systems into their care practices, and discusses how the incorporation is related to different care concepts (e.g., relational care, moral care, and practical care).

This paper addresses research question 4: ‘How do assistant nurses relate technology scripts to care concepts (i.e., relational care, moral care, and practical care) in their technology use?’ This is based on one of the research gaps identified in Paper I. The paper is interested in the later phases in which the technology is being used by assistant nurses in their daily work. To answer the research question, I observed assistant nurses’ daily tasks and conducted semi-structured interviews with assistant nurses in two Swedish nursing homes.

Building on the importance of social environments to the technology integration highlighted in the existing literature, the fourth paper focuses on the actual use of the social alarm system in relation to the culture (i.e., relational care, moral care, and practical care) in nursing homes. Healthcare professionals’ technology-mediated care practices take on meanings regarding the technology, individual actions and perceptions of care provision (Mol, 2008; Pols, 2017). Consequently, studies concerning technology use in care should not start from a preconceived idea of how technology should be used and how care should be provided, but should instead be sensitive to what things
healthcare professionals consider to be right in specific situations. The existing literature on technology use in care has traditionally focused on factors affecting technology integration into practice or unanticipated consequences of technology use. A research gap still remains concerning the process through which technology is used in care practices, and healthcare professionals' considerations of the objectives of care provision during the process. In other words, we lack an in-depth understanding of how healthcare professionals incorporate technology in care practices, with consideration to the quality of care provision.

I start from the concept of 'script', which refers to the expectations that designers embed in the technology how the technology should be used and maintained. The paper examines the characteristics of technology scripts in care practices, healthcare professionals' approaches to incorporating the scripts of technology into their care practices, and the relationship between their approaches and the quality of care. I conduct a five-month investigation on the use of a social alarm system by assistant nurses in two nursing homes in Sweden.

The findings show that the extent to which a social alarm system is integrated into care practices is based on assistant nurses' situational and personal interpretations of both technology scripts and quality of care. In technology-mediated care practices, consisting of receiving alarms from residents, checking alarms, responding to alarms, and documenting finished alarms, the assistant nurses defined technology scripts according to their expected requirements and outcomes, and meanwhile considered the quality of care by evaluating the priority of practical, moral, or relational care in the situations at hand. Through further negotiations with the defined scripts and the considered quality of care, the assistant nurses decided on the final way of using (or not using) the system in practice.

This paper adds to the literature about technology implementation and public healthcare services in the following three aspects. First, managers who are planning to implement technology in nursing homes can enhance their understanding of how assistant nurses are challenged in adapting the technology into their practices. Second, start-ups can use the feedback from assistant nurses as a reference to consider how their technological products can cater to user needs. Last, policymakers can learn more about the operationalization of technology under a cultural context.

5.5 Summing up

The physical connection of systems in organizations does not equal the successful use of technology in practice. This dissertation provides a better understanding of how to deploy and use digital social alarm systems in nursing homes. As noted, the four papers build on each other and show a progression in line with the implementation processes by which the system transitions from a separate artefact to a part of care practices.

Paper I answers RQ1. What can be learned from previous research about the integration of social alarm systems into care practices? The increasing attention on technology integration into care practices motivates the study. I perform a literature review to systematically analyse and discuss current findings. The findings from Paper I provide a theoretical foundation to the three empirical papers.

Paper II answers RQ2. How are the expectations of the technology implementation plans realized? Based on one gap identified in Paper I about the contribution of implementation work to the technology integration, Paper II explores the realization of implementation plans and strategies by looking into the discrepancies between actual implementation outcomes and implementation expectations. It complements the current findings of technology implementation research by
showing how implementation strategies and interventions go into rendering (or not rendering) the social alarm system functional.

Paper III answers 'RQ3. How is the social alarm system contextualized in nursing homes with respect to differences between middle managers and assistant nurses?' This paper digs into the execution of technology integration, and reveals how different assistant nurses and middle managers are when integrating the social alarm system in nursing homes during the four domestication phases. It also proposes a concept, 'collective domestication', to highlight the importance of collective practices in technology implementation. The findings contribute to a gap identified in Paper I concerning the impact of working environments on the execution and operationalization of technology integration.

Paper IV answers 'RQ4. How do assistant nurses relate technology scripts to care concepts (i.e., relational care, moral care, and practical care) in their technology use?' In this paper, I show how assistant nurses incorporate the scripts of new social alarm systems in care practices, with consideration of the key care culture (relative care, practical care, and moral care) in nursing homes. The paper studies assistant nurses' actual use of social alarm systems in their practices. The findings help to fill in the gap found in Paper I regarding the social shaping of the social alarm system in individual practices.

The links among the independent contributions of the four papers inform a more general reflection. I discuss the overarching theoretical contributions and practical implications of the dissertation in Section 6.
6 DISCUSSION

6.1 Theoretical contributions
This dissertation has several important theoretical implications. First, it contributes to the perspective of social shaping of technology by highlighting the social-technical aspects of implementation and extending the contexts of domestication theory from household settings to working environments. Second, it joins the current discussions on viewing implementation processes as open and iterative, and contributes to change management research regarding the digitalization of care services in nursing homes. Third, it deepens the socio-technical understanding of relevant theoretical topics within nursing care contexts.

Regarding the perspective of social shaping of technology, this dissertation allows us to deepen our understanding of the social-technical aspects of technology implementation. Scholarly interest in digital transformations in healthcare is on the rise (Frennert, 2021). However, the number of empirical studies that utilize the socio-technical view is still limited. To this point, a recent work on digital transformation in municipal eldercare lamented that there is a Collingridge dilemma in the current care settings: it is difficult to anticipate the outcomes of a technology or its related services until its extensive use in the targeted environments. Yet existing studies fall short of providing a holistic account of the dilemma (Baudin et al., 2020). I argue that this might be attributed to two main reasons: first, the absence of an overview that helps consolidate the findings used to describe practices of technology integration in organizations by different authors; and second, the difficulty of obtaining in-depth data that shows the actual interactions between actors and technology under divergent contexts in daily work. To address this dilemma, in this dissertation, Paper I analyses a series of practices discussed in the existing technology implementation literature. Papers II, III, and IV shed light on the interplays between the social alarm system and actors involved in tackling the challenges of implementation work in nursing homes. Together, these papers show the importance of sufficient intertwining of technology and social environments, confirming that socially and culturally adapting technology in specific environments is necessary to enable technology integration.

A further contribution to the perspective of social shaping of technology is the study of domestication processes in working settings. Unlike the technology domestication in household settings where older adults and their relatives have great agency in deciding the installation and adoption of certain technology, the domestication in working settings is subject to various political and cultural regulations and different actors. For instance, Paper III shows how technology integration is differently understood and operationalized by team members, consisting of middle managers and assistant nurses, during the four domestication phases. This supplements the traditional scholarship on technology domestication, which has a tendency to focus on older adults or on the household settings (Callén et al., 2009; Mort et al., 2019; Risling et al., 2018, 2017). This
paper highlights the importance of collective practices in domesticating technology in working settings by proposing the concept ‘collective domestication’. It shows that the domestication in working settings requires more effort in building a common interest to implement technology, as people from different groups have distinct goals, focus on different facets, and develop diverse coping strategies during different domestication phases.

Despite there being a great number of studies that focus on technology implementation and care service digitalization, the topics still appear to focus on explaining influential factors rather than on the mechanisms in implementation/digitalization processes. Starting with Paper I, the dissertation shows that the complexity and dynamics of integrating social alarm systems in care practices are underestimated. The entire implementation process should be viewed as an open, interactive, and iterative process in which the people engaged face a variety of challenges regarding different supportive strategies, social relations, cultures, and competence requirements. The actual use of technology is the result of interplays between the system and the social environments in which it is implemented. Therefore, the review emphasizes the need to reflect on various dynamics underlying the entire implementation process. Building on this insight, this dissertation joins the current discussions on viewing the implementation process as open and iterative. The importance of the social environment in the implementation process has been highlighted. For instance, Paper III stresses that the negotiations and sense-making between middle managers and assistant nurses is a fundamental dimension to consider when integrating the system in nursing homes. Paper IV supports the thought that technology is value-laden by showing how the social alarm system is culturally and socially appropriated by assistant nurses in daily practices. Paper II adds to the existing work on change management in nursing homes (Dugstad et al., 2019; Kraus et al., 2021) by discussing the expectations and changes in implementation projects. It combines the domestication theory with a widely used implementation tool-logic model to ensure a deeper understanding of the emerging discrepancies. The paper details the underlying reasons for these identified discrepancies and provides management suggestions for policymakers, nursing home leaders and middle managers of technology implementation initiatives.

The theoretical contributions of this dissertation extend to the study of nursing care services. The field of STS has a fairly rich tradition of discussing the relationship between technology and users. However, this discussion usually focuses on homecare services, which, to some extent, overlooks the fact that the cultures, structures, and working norms in nursing care services are different. Paper III digs into the implementation in nursing homes where it is usually middle managers and assistant nurses involved in technology implementation projects. It details how people from the two groups, with a clear fault line between each other, conduct and negotiate their practices to foster technology implementation. Paper IV shows how the practices of using social alarm systems are related to the different care concepts in nursing homes. It helps policymakers and nursing home leaders pay more attention to the specificities of care contexts, and rethink the relationship between technology and care contexts.

In summary, the use of theories from the perspective of social shaping of technology is effective in gaining deeper and more comprehensive insight into how such a complex phenomenon can be addressed. This dissertation offers several new insights that together extend our understanding of technology implementation and the changes it entails. Hopefully, this research can provide an impetus for other studies in the realm of technology implementation building on the contributions presented here.
6.2 Practical contributions

The digitalization of care services and related management of technology implementations have attracted much attention in recent years, given their strong practical implications for care organizations as well as eldercare.

Though modern discourse tends to emphasize how certain technology properties affect particular parameters in relation to care activities and work environment, my dissertation focuses on care practices with a view that technology implementation is a continuous process that takes diverse forms depending on the interactions between technology and social contexts. My data mainly consists of direct observations and interviews with actors involved in implementation projects. The data were gathered over one year from four nursing homes. Thus, they constitute a rich source for examples of use-case scenarios.

The four papers provide recommendations on dimensions to consider when integrating digital social alarm systems into care work in nursing homes. The findings offer benchmarking opportunities to identify recommendations for the management of technology implementation in nursing homes. They shed light on various socio-technical transformations underlying the entire implementation process. Therefore, stakeholders, such as technology companies, policymakers, nursing home leaders and middle managers, can benefit from in-depth accounts. The practical recommendations of this dissertation can be summarized by the following types of fit that management needs to consider:

- **Technology-expectation fit**: The implementation of social alarm systems should start with a deep reflection on the expectations of the system from the nursing homes. This reflection allows decision-makers to procure a system that fits their environments. It further affects the efficiency of implementers and users in positioning the system and recognizing the value of the system in their local environments. Practices of defining the selected system based on expectations have been found in my research. Within these practices, actors involved understand the promises attached to the technology, buy into these promises, and interpret and judge such promises in practice. Implementers need to propose the following questions when introducing the system: What do we want to achieve with the use of the system? How can the system, in practical and symbolic ways, achieve that? What is required from us to allow the system to achieve our expectations in these ways? Iteratively adjusting the defined expectation is crucial given the fact that the introduction of a technology brings various changes and its actual operation in practice depends greatly on local environments. In light of this, implementers need to obtain familiarity with the context, and be clear of the actual use of the system after its installation. Meanwhile, workers from technology companies need to be aware of the challenges faced by middle managers, and propose potential solutions for ensuring the original technology promises are met from a technical perspective.

- **Technology-stakeholder fit**: When being introduced into nursing homes, a social alarm system requires different governance to incorporate specific features and elements from local contexts into local care services. The process of creating the technology-mediated service involves different stakeholders such as middle managers, assistant nurses, and residents in nursing homes. Our cases did not involve residents due to limited time and resources, but the collected data indeed show how middle managers and assistant nurses have distinct goals, focus on different facets, and develop diverse coping strategies when implementing and using the social alarm system. Middle managers tend to set this as a goal and follow a linear procedure to create the services. However, assistant nurses do not focus on the system per se and disagree with the pure linearity of technology implementation. To
them, what matters is how to provide high-quality care under various conditions. Hence, they see using the system in an assumed way as less consequential. To align and balance the differences of the multiple stakeholders involved, people need to fully consider the scope of stakeholders, recognize their differences, and aggregate their work in a shared ground. In doing so, different stakeholders can share and discuss the information such as the current project state, emerged problems, and potential problem-solving actions.

- **Technology-culture fit**: The dissertation shows how technology scripts and the concepts of care in nursing homes relate to the actual use of the social alarm system in practice. Assistant nurses define technology scripts according to their expected requirements and outcomes, and meanwhile consider the quality of care by evaluating the priority of practical, moral, or relational care in the situations at hand. Through further negotiations with the defined scripts and the considered quality of care, assistant nurses decide their actual practices of care provision. In this view, the practices of using or not using the system reflect assistant nurses’ values and thoughts. Implementers need to consider the following questions during the implementation process: How does the new technology and its use affect the roles of assistant nurses? An in-depth understanding of assistant nurses is a fundamental step in determining whether the use of technology is in line with local culture. Concerns can focus on assistant nurses’ thoughts of their identity, and their appraisal of the effects of the social alarm system and the changes it entails.

- **Technology-care activities fit**: The shaping of technology use runs parallel to the shaping of care activities in nursing homes. The new system affects people’s ways of acting, thinking and organizing, while people, in turn, change or adjust their ways of technology use based on the specific characteristics of the social contexts. The dissertation underlines that, during the mutual shaping process, there are changes in the social contexts in terms of personal skillsets, communication, division of labour, and incentives and accountability. Yet it is difficult to foresee all the changes until the use of technology in care activities becomes routine and stable. Consequently, implementers should pay attention to the flexibilities of their arrangement and the specificities of continuous adjustments. Specifically, it is important to observe how users conduct care activities over time, and to remain open and flexible when assessing users’ technology-mediated practices in care activities. One crucial point for implementers is to develop approaches to quickly recognize the changes that occurred throughout the process, and to effectively support individuals and teams in problem-solving when they face unexpected changes.

In a world where technology and social environments are dynamically intertwined, it is difficult to identify the best fit to meet organizational or individual needs and objectives by a fixed implementation plan. I hope that this dissertation provides valuable guidance on discerning and leveraging the opportunities that a mindful approach to the management of technology implementation can bring.
7 LIMITATIONS AND FUTURE WORK

This research has some limitations, which suggest opportunities for future research. While some of the limitations apply to all four empirical papers, others are specific to a single paper.

The selection of social shaping of technology as a main theoretical perspective on technology implementation in nursing homes leaves ample room for future studies to combine other theoretical perspectives. While the lens of domestication theory helps to explain the details in the mutual shaping process between technology and its use contexts, the findings are hard to translate into prescriptive lessons for policymakers and implementers because they are purely descriptive. In Paper II, I combine the theory with the logic model to explore the discrepancies between expected and actual implementation outcomes, as well as underlying reasons for these. This is a tentative method that presents the complex interplay of technology and social contexts while keeping the findings easy to understand for policymakers and implementers. The combination of domestication theory and other management tools has so far been unexplored. Future research can thus focus on this direction.

Residents in nursing homes are an important dimension that was not explored in the dissertation. The appended papers only limitedly discuss technology implementation by recruiting, for instance, technology developers, nursing home leaders, middle managers, and assistant nurses. Future studies could address this limitation by extending the data collection to cover nursing home residents. Connected to this, the fault line between middle managers, assistant nurses, and residents throughout the domestication process is a topic that deserves attention and energy to explore. Moreover, the question of what roles residents play during the collective domestication processes is worthwhile to address.

Another limitation of the dissertation is the selection of nursing homes. In this dissertation, nursing homes were selected based on their interest in the research and their status of implementing social alarm systems. Future studies could examine the relationship between implementation processes and nursing home characteristics such as size and organizational structure. The latter entails longer engagement with and within teams in order to more closely observe the interactions among actors on organizational, collective, and individual levels.

In addition, the dissertation is limited because only English-speaking persons are included in my investigations. People may find it difficult to express personal ideas and thoughts when using another language. Moreover, non-native speakers who are fluent in English might have higher levels of education. The potential impact is that collected data may not be sufficient to show the full map of the central topic. In this dissertation, I try to avoid this potential negative impact by observing as many contexts as possible, and by following and interviewing different healthcare professionals.
Further research could try to include Swedish-speaking persons to gain more detailed descriptions of the digitalization of social alarm services in nursing homes in Sweden.

This study is further limited by the fact that the role of power that affects the operationalization of technology implementation is downplayed. All four empirical papers mention that management matters, whereas questions about leadership remain unanswered. How do different types of leadership affect implementation progress? Which types of leadership can foster technology implementation under a specific condition? Answering these questions requires extensive study about organizational structure and leaders’ decision-making processes. Other researchers could extend the scope of this dissertation by focusing on practices and behaviours that leaders adopt to foster technology implementation.

In this dissertation, socio-technical transformations have been discussed in terms of the realization of project plans, the execution of technology contextualization within team members, and the actual use of the system in personal daily practices. Future research can shed light on the mechanism of digitalizing social alarm services in nursing homes by identifying all changes during the digitalization process and summarizing their interrelationships.

Finally, comparative studies between nursing homes and hospitals can be conducted since most residents in the nursing homes will transfer to hospital environments for better treatment. Yet the norms and cultures in nursing homes and hospitals differ. Paper IV shows how organizational culture can lead to different ways of using technology in practice. Its findings could thus lay the groundwork for future work that would expand the settings for implementing the social alarm system from nursing homes to hospitals.
8 Conclusion

The dissertation explores various socio-technical transformations in care practices during the digitalization of social alarm services in nursing homes. The overall aim is to reveal how the implementation of digital social alarm systems is socially shaped in nursing homes, with particular focus on: understanding and reviewing the integration of social alarm systems in care practices in existing literature; the realization of implementation plans and strategies; the execution of technology implementation within teams (i.e., middle managers and assistant nurses); and individuals’ actual use of the system. The interests are operationalized by four research questions, which are addressed in the appended four papers.

Despite the long history and wide acknowledgment of social alarm services in nursing homes, the implementation of a new social alarm system is far from predictable. A variety of changes occur during the implementation process, and thus a predetermined implementation plan is insufficient to fully consider and unravel the complexity and dynamics within the implementation process. The findings emphasize the importance of understanding the socialization process of technology implementation due to the existence of various socio-technical transformations in different care practices. In terms of executing the technology integration, the dissertation shows how middle managers and assistant nurses have distinct goals, focus on different facets, and develop diverse approaches for integrating the system into daily work. More studies are needed regarding how to ensure technology integration on a collective level. Moreover, looking into assistant nurses’ daily practices of employing the new system, this dissertation indicates how people decide their ways of using the new social alarm system under given contexts, and how they actively define and assign meanings to the system according to the situation at hand.

The dissertation contributes to theoretical clarifications as well as practical possibilities and limitations to guide the implementation of social alarm systems in nursing homes. From a theoretical perspective, it contributes to the perspective of social shaping of technology by highlighting the social-technical aspects of implementation and extending the contexts of domestication theory from household settings to working environments. It also joins the current discussions on viewing the implementation process as open and iterative, and contributes to change management research by focusing on the care services in nursing homes. From an empirical perspective, this dissertation proposes that the digitalization of social alarm services can be enhanced if there is a clear positioning of the new system, a common ground for sufficient communication between involved actors, an in-depth interpretation of local environments, and flexible and continuous implementation strategies. Future studies can focus on revealing the mechanisms within different socio-technical transformations by including different kinds of actors, settings, actions, and activities.
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