The complex life of a Smart City initiative

An empirical study of the planning, development, implementation, and use of a Smart City initiative in a Norwegian municipality

Emil Säll & Irene Solberg

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Abstract

This master's thesis is an empirical investigation of a Smart City initiative within healthcare in a Norwegian municipality. What is presented is a rich description of how local actors have engaged themselves in the planning, development, implementation and use of the Smart City initiative. The research approach is inspired by praxiography, a qualitative methodology, where we have followed the initiative across different contexts and practices within the municipality.

Since urban life is becoming increasingly entangled in advanced technology, it is essential to explore modes of inquiry that challenge perspectives that treat the social and material as to separate worlds. This thesis has therefore used theories and concepts from research on sociomateriality as a sensitising device (e.g., Law, 2004; Mol, 2002). This perspective is used to illustrate the sociomaterial complexity of the Smart City initiative, by demonstrating how it changed, slipped and multiplied when it was interpreted, negotiated and being done across different local contexts.

The thesis presents a story about how local actors within the municipality have applied the idea of Smart City to their urban strategies by embracing domain-agnostic approaches to public management. The actors involved in development enacted smartness as technologies' capacity for being generic, which led them to utilise so-called generic technology based on its potential to function across, and create synergies between, the different domains within the city. By using a sociomaterial lens, this thesis has raised some questions about domain-agnostic systems. We have argued for how enacting technology as generic can contribute to rigidity in the development and evolution of the Smart City initiative. This was seen in terms of how the design space was limited to explore during development, how the resulting technology was difficult for the users to 'fit' in their everyday work situation, and how it was difficult for the developers to implement changes to accommodate emergent local needs.

Based on our insights, the thesis presents some suggestions for Smart City practitioners wanting to create Smart City technology.

Keywords: Smart City, sociomateriality, multiplicity, enactments, praxiography, generic platform.

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List of abbreviations

VKA	Virtual Short-term Clinic
R&D	Research and Development
SaaS	Software as a service
ICT	Information and communications technology
IS	Information Systems
NCE	Norwegian Centres of Expertise
ANT	Actor-network theory
ER	Emergency room
NSD	Norwegian Centre for Research Data
IoT	Internet of Things

1 Introduction

We are living in an increasingly urbanised world, and more and more people are relocating themselves to cities. Today, more than 50 per cent of the human population live in urban areas, and this is expected to rise to almost 70 per cent in the near future (United Nations, 2018). This trend illustrates the growing demand and challenges put on our cities, and many of the problems associated with urbanisation remain unsolved. Some of the issues facing many cities today are the prospect of an ageing population, social inclusiveness, environmental sustainability and health care. The need to find good solutions for planning and managing for urban development and to improve the quality of life in urban spaces is, therefore, a shared concern for many cities. In the search for solutions to meet the challenges of modern urban life, many cities worldwide have embraced the idea of Smart Cities (Caragliu, Del Bo, Kourtit, Nijkamp, 2015).

The Smart City agenda has become a global phenomenon and cities both in the global North and South are placing an increasing share of their investments into initiatives aimed to increase urban smartness. The European Commission aims to invest one billion euros in 300 Smart Cities by 2020 (EIP-SCC, 2018), and countries such as India, Singapore and China are promoting Smart Cities trough policy agendas and pilot projects (Karvonen, 2018).

In existing Smart City projects around the world, a focus has often been on the utilisation of technology to make the cities smart. Emerging technologies such as Artificial Intelligence and Internet of Things (IoT) provides us with the prospect of living in increasingly smarter environments and enables the city to make better decisions and enhance its services to citizens (Hashem et al., 2016). Smart City initiatives have, however, regularly received criticism for overselling the promise of technological solutions and ignoring social context (Caragliu et al., 2015). Some of the empirical studies done on Smart City initiatives demonstrate how some of them fail if they overlook social context, and goes against viewing technology as an easy fix to urban problems (see

Catwell & Sheikh, 2009; Harrison, 2017). Our approach is in coherence with those who view both the social and technological as important in building Smart Cities, and that Smart City initiatives are very much embedded in politics and culture as much as technological affordances (see, e.g., Kitchin, 2015; March & Ribera-Fumaz, 2016; Ravindran, 2015). Hence, as urban life is becoming increasingly entangled in advanced technology, we believe that it is essential to explore modes of inquiries that challenge perspectives that treat the social and material as to separate worlds.

As many cities around the world are aspiring to become "smart", we believe it's important to research this phenomenon. When you look in to the literature on Smart Cities, there is no shortage of authors contributing to discussions on what to include or exclude from definitions of Smart Cities, on indicators to measure smartness, or whether the social or technological is the most important drivers to build them (Caragliu et al., 2015). However, March and Ribera-Fumaz (2016) argue that "the Smart City is a rather empty and ambiguous concept that is being deployed more on an imaginary and discursive level, rather than materially" (p. 817), and calls for more research on actually existing Smart City projects. This scarcity in the Smart City literature is also called out by Rob Kitchin (2015) in his article *Making sense of smart cities: addressing present shortcomings*. He argues that the literature lacks “detailed case studies of specific cities, programmes or stakeholders based on extensive fieldwork” (Kitchin, 2015, p. 134).

To accommodate the lack of empirical studies on how actual cities apply the concept of Smart Cities to urban strategies and development, this thesis is an empirical investigation of how local actors in a Norwegian municipality have engaged themselves in the planning, development, implementation and use of a Smart City initiative. The initiative under study started in 2016, and together with a local software developing company, called eSmart Systems, the municipality developed Virtual Short-term clinics (hereby referred to as VKA). The smart city solution was a new way for the municipality to organise and deliver health care services through the use of ‘virtual means’ by utilising technology such as a cloud-based platform and sensor technology. Our research strategy is inspired by praxiography (Bueger, 2014), where we have followed our object under study (VKA) as it has been negotiated and interpreted across different contexts and practices within the municipality.

A goal of this thesis has been to inquire into and get a better understanding of the complex co-constitutive relationship between humans and technology in a Smart City context. To do this, we have used theories and concepts from the literature concerned with sociomateriality (see Law, 2009; Mol, 2002; Orlikowski & Scott, 2008; Parmiggiani & Mikalsen, 2013). Our theoretical approach was chosen to wash away the hard distinction between the material and the social (humans and technology) that characterise much of current Smart City literature, and showcase the sociomaterial complexity of a Smart City initiative by demonstrating how it can change, slip and multiply when it is interpreted, negotiated and being done across different local contexts.

1.1 What is this Smart City initiative?

If you imagine attending one of the many conferences on Smart Cities held around the world, you would much likely walk into a space were inspiring ideas about *smart* urban futures would jump towards you from wherever you turn your eyes. Maybe you would walk up to one of the exhibitions and pick up a pamphlet about the Virtual Short-term clinics in Halden municipality at your visit there, the description you would read could look something like the following:

> VKA is a service for patients in need of short-term care after being discharged from the hospital, but still in need of health care. The service allows for the patients to recover in their own home, instead of being admitted to a short-time rehabilitation clinic in the municipality. The service is meant to provide the patients with a feeling of safety, as well as the opportunity to stay in their own home. This is achieved by equipping the patient with an iPad and a safety alarm, which enables them to get direct access to certified nurses via video-call. The nurse can then use his clinical knowledge to assess the needs of the patient, and if necessary, send an assignment to a home health nurse that can visit the patient. VKA is a technology that is built on a cloud-based platform using digital intelligence to optimise resources and help patients when they actually need it.

The above description gives a short outline of the Smart City initiative in Halden municipality. However, what we will argue throughout this thesis is that reality is much

more complex than allowing any ten lines of text to capture its fuzzy, contingent, multiple and slippery nature. Hence, we would see it as necessary to ask questions like; what is it about VKA that is not present in this particular textual representation? Who has made the pamphlet, and what hinterlands of practices, culture, education and world views are they connecting to, and what was consequently hidden, repressed or seen as irrelevant about VKA when making it? Is VKA a Smart City initiative, a health care service, a domain-agnostic technology[1], a tool for doing health care work, the first step to a much grander smart city vision, or can it be all of them simultaneously? These are some of the questions that have consumed our minds when writing up this thesis. The following anecdote is an illustration of one of the occasions where we started questioning the singularity of VKA.

On March 13, 2018, representatives from Halden municipality were gathered at a national award ceremony in the capital, Oslo. The virtual short time clinics in Halden had just won an award for best *Smart city solution of the year, 2017.* The jury handing out the award stated that the solution exhibits how technology can play an essential role in solving some of our future challenges and should serve as an inspiration to other municipalities and cities (Buckholm, 2018). However, at our first field trip to the emergency room (ER), talking with the nurses managing the VKA-system, we got the impression that the award was deliberately hidden away. At several occasions, we heard some of the nurses jokingly referring to VKA as *works maybe sometimes.* We found these observations puzzling and realised that we were about to get to know a different VKA at the ER than what was presented at the award ceremony.

This was one of many conundrums we experienced in trying to piece together the many fractions of the technology that is at the centre of the story that will be presented in this thesis. In the next section, we will present the research context surrounding our thesis.

1.2 Research context

Smart City is a phenomenon that concerns a multitude of domains within the city, from health care to waste-management and ICT-infrastructure. Hence, we would argue that

[1] We have use the term domain-agnostic technology and generic technology interchangeably to refer to technology that is perceived to be applicable to a wide array of domains or problems.

researchers should mirror this cross-sectional characteristic in their choice of research approaches to studying Smart Cities. This thesis can thus be seen as situated within three different research fields, namely literature on Smart Cities, research on welfare technology, and IS-literature on sociomaterial systems. There is a great deal of literature on platforms in the IS literature concerned with topics such as platform-architecture (see, e. g., Bygstad, Hanseth, & Truong Le, 2015; Tiwana, 2014). However, even though a platform is at the centre of the Smart City initiative investigated in this thesis, we will not engage with this part of the IS-literature. This thesis does not concern itself with architecture, but instead focuses on how the platform, as a sociomaterial system, is being enacted within a smart city context.

In the first section, we give a short account of the discussions surrounding Smart City definitions as well as two studies investigating particular cases of cities applying the Smart City agenda. The studies are concerned with how local actors frame Smart City agendas, and the lack of understanding of the local context in Smart City development, respectively. Then we briefly look at how some cities are exploring innovations in eHealth and welfare-technology. In Section 1.2.3 we report on three studies within research on sociomaterial systems in a health care setting. The first two studies are concerned with the phenomena *design-in-use*, while the third study is related to the interplay between the *local* and the *global* in an implementation process.

1.2.1 What is a Smart City?

The concept of Smart Cities can be heard about in many different areas, from innovation, to city development, to academia and in society in general. Smart City is undoubtedly a buzzword, and it seems like every city wants to be "smart". But what is a Smart City?

Efforts towards realising the Smart City agenda has often been applied by placing Information and Communications Technologies (ICTs) at the centre of urban strategies (Dameri & Rosenthal-Sabroux, 2014). Many governments and policy agencies hope to employ ICTs to increase the quality of public services, to achieve sustainable economic growth and a better quality of life for their citizens (Albino, Berardi, & Dangelico, 2015). Technologies that are receiving a lot of attention for its potential to make cities smarter is, for example, the application of big data technologies and IoT technologies (Hashem et al.,

2016). However, meanings assigned to the Smart City concept is not limited to the harnessing of ICTs. Many scholars would, in contrast to ICT-led initiatives, give precedence to investments in human and social capital as the main drivers for urban smartness (Dameri & Rosenthal-Sabroux, 2014). In fact, there is no universal and agreed upon definition of what a Smart City really is.

Looking into the literature on Smart Cities, there is a myriad of different definitions. According to Caragliu et al. (2015), some of the most notable and cited definitions emphasise investments in human capital and modern ICT-infrastructures to fuel sustainable economic growth, high quality of life, wise management of natural resources and participatory governance. However, they also point out that there is no one size fits all definitions. The concept of Smart Cities is widely adopted around the world by cities that differ significantly from each other both in cultural, economic and social circumstances. Many countries wish to apply a shared idea of Smart Cities and still pursue their own specific goals (Caragliu et al., 2015).

Haarstad & Wathne (2019) argues that we should not view the Smart City agenda as a single agenda. They further state that smartness in the development of Smart Cities is not any specific set of interventions or technologies. Instead, it should be seen as interventions within a broad Smart City framing that is reinterpreted and translated by local practitioners in cities. This argument is illustrated through their case study on how standards and definitions for achieving Smart Cities, promoted by the EU Horizon 2020 SCC program, is interpreted and converted through local actors' involvement in implementation.

> In light of these insights, the Horizon 2020 smart city concept should not be expected to be *adopted* by Lighthouse cities; it will rather be reinterpreted and incorporated into local "bricolages" of pre-existing policies, discourses, interests and infrastructures. And local actors are key in this process. They are faced not only with pressures to be smart, but they also have to balance a host of overlapping and competing concerns, and they actively negotiate between these to shape the priorities of their cities (Haarstad & Wathne, 2019, p. 921)

What their findings suggest, goes against the assumption that cities are passive receivers of Smart City prescriptions and emphasise how urban actors actively take part in framing the agenda during implementation and practice. Haarstad & Wathne (2019) argues that "smart city agenda should be understood as a *means* to achieve urban change, rather than as a *goal* in itself" (p. 921), which implies that the concept of Smart Cities can be different things for different cities.

Even if practitioners are translating the Smart City agenda in their practices to fit the priorities and needs of the city in which they work, it does not necessarily mean that they do this based on a good understanding of local context. Harrison's (2017) study of a Smart City case in Barcelona serves as an example of how some ICT-driven Smart City initiatives fail because of the lack of understanding of local context. Her work is a contribution to scholarship that takes on a more critical perspective on Smart Cities. She reminds us why we should not view technology as apolitical and objective artefacts because technological artefacts are constructed within specific socio-historical contexts and are thus constituted in relation to politics, budgets and local culture as much as the physical limitations and affordances of technology. She further points out how assumptions and bias related to *assumed users* unintentionally can be a part of the design and implementation of Smart City initiatives.

It can also be important to bear in mind that to be labelled a Smart City can by itself mean a competitive advantage in an environment where cities are gaining increased political and economic power. Having status as a Smart City can be a way of attracting business firms, foreign direct investments, knowledge migrants, visitors etc. (Caragliu et al., 2015). Thus, creating an environment for only paying lip service without actually creating any progress and ultimately making it difficult to separate the difference between image and reality.

1.2.2 eHealth and welfare technology

One important challenge faced by many cities is related to the delivery of health care services, and the potential of information technology to tackle this is increasingly being explored by many countries (Catwell & Sheikh, 2009). For example, mitigating the impact of the "grey tsunami" through social innovations in elderly care is an increasing

concern. Some of these efforts are exploring ways to make the elderly more self-sufficient by harnessing ICTs for increased safety, socialising, disease monitoring, remote treatment etc. (Hofmann, 2013). Strategic healthcare innovations are also increasingly focusing on the coordination of practices and the flow of information across organisational boundaries (Grisot & Vassilakopoulou, 2013). It is anticipated that ICT can reduce cost and improve the safety, efficiency and quality of services in health care settings (Catwell & Sheikh, 2009). Examples of such technologies are online doctor consultations, remote management of chronic conditions, remote health monitoring, safety alarms, emergency response systems, and the like.

However, investments in eHealth are often underpinned by the underlying assumptions that an increased infusion of information technology will translate to a higher quality of care (Catwell & Sheikh, 2009). There is still a challenge to design technology that is actually 'fit for purpose', and Catwell and Sheikh (2009) argue that early evaluations show that many eHealth interventions fail to fulfil their promise. Underestimating the need to recognise the human aspects of design and use in technological innovations is an important reason for this, and many health care professionals find themselves reluctant to adopt new technologies (Catwell & Sheikh, 2009). Bad design can lead to benefits not being realised, vast sums of money being wasted, and potentially putting the safety of patients at risk (Catwell & Sheikh, 2009). Hence, we see it as important to explore ways to evaluate the true value of eHealth interventions.

There are of course also many important ethical challenges related to welfare technology that needs to be explored, such as issues of surveillance and privacy, access and distribution, or the way it may change our social and physical context as well as our bodies (Hofmann, 2013). Although we recognise the series of important questions these issues raise, they will not be answered in this thesis.

1.2.3 Technology as sociomaterial systems

Based on our exposure to the Scandinavian IS (information systems) research[2] during our years in academia, we have come to believe that the *social* and *material* is existing in a co-constitutive relationship. Hence, it is important not to assume that one has primacy over the other. Technology is neither a social product or an external material force; it is being constituted by, and is constituting the social. Since technology has become an important aspect in the development of Smart Cities, we believe it is essential to address and acknowledge the co-constitutive relationship between humans and technology, also in a Smart City context. In the following, we present three examples of studies of sociomaterial systems in a health care setting.

In her article *The Camera as an Actor: Design-in-Use of Telemedicine Infrastructure in Surgery,* Aanestad (2003) argues that an important part of successful design is to allow for the technology to be *designed-in-use*. Her case study is concerning telemedicine, and she investigates the implementation of cameras in a surgical setting. Following the implementation, many adjustments were required in both the technological configuration and the work tasks of the surgeons and others. She describes how the open and generic technology is being implemented as an actor in a network where it both changes and is being changed by the network. Hence, no matter how much a designer tries to envisage the use of a technological artefact or system in advance, many needs will not become evident before the system is actually in use. This implies that the technology might become different in use than what was originally planned for by the designer. The combination of work practice and the new technology is a heterogeneous network where the configurations are continually changing. Aanestad (2003) uses the concept of *configuration* to describe an instance in time of the actor-network. In other words, the elements in the network and how they are connected at a given time.

Another study concerning design in use is Aanestad, Driveklepp, Sørli, & Hertzum's (2017) study *Participatory Continuing Design: "Living with" videoconferencing in rehabilitation*. They studied the use of video conferencing technology in the rehabilitation

[2] For example research published in *Scandinavian Journal of Information Systems*

of patients at Sunnaas Rehabilitation Hospital in Norway. They define *design in use* as the work users do to incorporate ICT into their work processes through experimentation, learning and redesign required to "finalise" the design. The authors call this process *participatory continuing design* (pcd), and, similar to Aanestad (2003), argues for a focus-shift from design before use to design in use. Some of the consequences of this shift in focus relate to having a longer-term perspective when developing technology. In addition, they argue that design before use and *participatory continuing design* have processes of a quite different character, where *participatory continuing design* is characterised by insights and opportunities arising through improvisation more than planning and specification.

In their case study on a patient-centred portal in Norway, Grisot and Vassilakopoulou (2013) use a socio-technical perspective to investigate the design, development and implementation process of a patient portal, where they focused on the evolutionary infrastructural development. In the case study, they discovered that there was a continuing interplay between standardisation and generativity after the technology was implemented into a use-situation. The authors argue that the local and the global are entangled, and illustrates this by describing how the project team were trying to bridge the two. The technology had to be in line with current national health regulations, such as having secure communication and login futures. To fulfil the regulations, the project team were integrating standardised solutions such as BankID, at the same time as they were providing localised capabilities such as an easier way to change appointments in the system. The project team were overall adjusting the technology to fit the emerging user-needs when the technology was put into use. For example, they would develop new functionality based on evolving needs, or remove functionality that was not in use. This illustrates that there was a continuous negotiation between the generative and standardised features and that these were fundamentally sociomaterial (Grisot & Vassilakopoulou, 2013).

1.3 Research questions

In this section, we present the research questions that have been the focus of this study. As we started out with an explorative study of a Smart City initiative within healthcare, the focus of the study has developed during our research period. However, our research interest has from early on been focused on how the Smart City initiative was planned, developed, implemented and used. This research interest helped us guide our research, and focus our data gathering activities and analyses. After a process of becoming more familiar with the Smart City initiative, reading up on relevant literature, and developed the theoretical framework for this thesis, the research questions this thesis will answer is formulated as follows:

1) *How has a Smart City initiative within health care been enacted in planning, development, implementation, and use in a Norwegian municipality?*

This has been a central question to our thesis, and will mostly be answered in Chapter 4, where we tell the stories of how the Smart City initiative have been enacted by the different practices. To do this, we used theories and concepts from the literature concerned with sociomateriality as a sensitising device (e.g., Law, 2004, 2009; Mol, 2002).

By exploring different enactments of the object, our aim has also been to provide an understanding of Smart City initiatives that such a theoretical perspective makes known. Our second research question is thus:

2) *What can we learn about Smart City initiatives by applying a sociomaterial lens?*

This question will mainly be answered in the Discussion chapter, where we highlight some of the main learnings we acquired during this research. By attempting to answer these questions, our aim is also to provide insights for future development and implementation projects within Smart City development. Hence, we will make some suggestions based on our findings that we hope can be beneficial to practitioners wanting to apply the Smart City agenda. Since we have investigated a welfare technology within a

Smart City context with a sociomaterial perspective, our hope is also that this thesis can contribute to the research fields of Smart Cities, welfare technology and the stream of Scandinavian IS that focuses on sociomateriality. The concluding section will, therefore, include a section on how our research might add to these fields.

1.4 Thesis structure

In order to provide the reader with an impression of what to expect when reading this thesis, this section will give a short description of the subsequent chapters.

In Chapter 2, we present the theoretical framework that has guided our research and analysis. The theoretical framework presented in this chapter derives from literature that concerns itself with sociomateriality.

In Chapter 3, we present our methodology and research approach. Here we present our ontological perspective, our approach to doing this research, and the methods we used for data gathering and analysis. The final three sections describe how we adapted to the case, our methodological challenges, and our ethical considerations, respectively.

In Chapter 4, we present our empirical data, analysed and interpreted in light of our theoretical framework. In this chapter, we attempt to tell the stories of the different realities comprising the Smart City initiative we have studied.

In Chapter 5, we discuss some of the main learnings we acquired when investigating a Smart City initiative and its comprising practices with a sociomaterial lens. In the final two sections of this chapter we present some suggestions for Smart City practitioners, and the limitations of this study respectively.

Chapter 6 is our concluding chapter. Here we give a summary of our analysis and discussion, structured around our research questions. This section also contains the research contribution of this thesis and suggestions for future research.

2 Theoretical Framework

The purpose of this chapter is to account for the theoretical foundation that will be used to address the research question expressed in Section 1.3. This will serve as the frame of our study, or in other words, as a lens through which we view the area of interest (Walsham, 1995). Our search for relevant theories and concepts has mainly concerned the bulk of research and use of theory within the field of Information Systems (IS), and mainly the Scandinavian branch. The chapter will start with a historical account of how conceptualisations of the human-technology relationship have changed over time, which can be seen as "three waves" within the literature. Further, we will explain how this thesis is position within the third wave, namely that of the sociomaterial, by describing its focus on human-material entanglements and how it draws on many ideas from actor-network theory (ANT). In Section 2.4, we will elaborate on some recent contributions within this field that has branched out into *diasporic creativity*[3]. A substantial part of our theoretical framework has been drawn from these diasporic contributions.

2.1 Theoretical background

Explaining the relationship between humans and technology is a fundamental challenge in the field of Information Systems (IS). In the literature, we can identify different streams of research delineated by contrasting conceptualisations of this relationship (Orlikowski & Scott, 2008). Early academic discourses have been characterised by dualistic approaches, where technology has been conceptualised as either a social product or an objective material force (Orlikowski, 1992). These two contrasting positions are also referred to as social or technological determinism. Socio-technical theorists argued, already around the 1950s, against treating the social or material as two separate worlds, and instead promoted a reconceptualisation of technology, its role and nature, that brought the two worlds together (Rice, 1958; Trist & Bamforth, 1951). IS research recognising a mutually dependent relationship between people (or organisation) and

[3]. *Diasporic Creativity* is what Law (2009) calls recent contributions that derives from actor-network theory.

technology has been properly established within literature since then (Parmiggiani & Mikalsen, 2013).

Researchers that share this socio-technical perspective assumes a mutually dependent interaction between the material and social that occur over time, in which emergent and embedded interconnections evolve. The earlier works of Orlikowski can be found here. In a quest for more appropriate theoretical approaches to study the role of technology in organizations Orlikowski (1992) draws on Gidden's (1986) theory of structuration. Giddens theory assume that structuration is a social process that involves the shared interaction of humans and structural features, and that both structure and agents create and reproduce social systems, without giving primacy to either. The theory identifies that human actions are both enabled and restricted by the structures, at the same time that these structures are the result of previous actions (Orlikowski, 1992). Orlikowski's *structural model of technology* builds on the duality of structure that underpins Giddens theory. Her theoretical framework thereby conceptualise technology as something that can be constructed within organisational structures (by embodying some of its rules and resources) and thus also potentially act as a structural property of that organisation (by reinforcing or altering the organisational context) (Orlikowski, 1992). Her work offered a theoretical vocabulary to explain the dynamic and dialectic relationship between technology and organisations, while still maintaining a conceptual distinction between the materiality of technology and human agency (Orlikowski, 1992).

Orlikowski has since then further developed her argument and, accompanied by other scholars, argued that the intimate relationship between humans and technology could be taken even further (see Law, 2004; Leonardi & Barley, 2008; Orlikowski & Scott, 2008). This position criticized the ontological separation between technology and humans for limiting our view to only considering technology as relevant at specific technological events or processes and thereby "obscures ways of seeing how all organizational practices and relations always entail some sort of technical (or material) mediation" (Orlikowski and Scott, 2008, p. 454). Since Orlikowski & Scott (2007, 2008) started formulating the agenda for studying the entanglement of the material and social, there has become an increasingly significant area of research concerned with sociomateriality.

2.2 Sociomateriality

The sociomaterial approach, as described by Orlikowski and Scott (2008), promotes a relational ontology that eliminates the distinction between the social and the material. By performing this ontological shift, we move towards conceptualisations were "human and technology are assumed to exist only through their temporally emergent constitutive entanglement" (Orlikowski & Scott, 2008, p. 457). The social and material is seen as *mutually constitutive* and *inherently inseparable*, making it impossible to view them as individual units with inherent characteristic. We are instead shifting our focus to study how humans and non-humans are constituted through the configuration of composite and shifting sociomaterial assemblages (Parmiggiani & Mikalsen, 2013).

This transformative co-constitutive relationship reveals how people and things don't just appear out of nothing. Introna (2007) argues for how tools and humans not only share a common history but in fact are each other's history by referring to Latour "A body corporate is what we and our artefacts have become. We are an object institution" (Latour as cited in Introna, 2007, p. 13). Hence, we as humans constitute our tools as much as they constitute us. To illustrate this, let us consider an example.

When a nurse straps a sphygmomanometer[4] around a patient's arm, he acquires certain abilities; to rig the equipment in the right place, read the measurement and connect it to relevant knowledge. The sphygmomanometer only becomes an actual possibility for measuring blood pressure when picked up by the nurse. If the nurse detects abnormalities in the measurement, he can access an enormous volume of information about symptoms stored outside his brain in a database. The database only becomes a potential source of information in relation to the nurse when it is available through a local computer that is connected to a network. This example illustrates how the nurse and the surrounding technological artefacts become constitutive conditions, being what they are only in relation to each other.

[4] A device used to measure blood, also known as a blood pressure meter

This example illustrates the relational ontology of sociomateriality which our research approach is based upon. Moving forward we need to examine what analytical tools this literature provides for practical use to make sense of our empirical findings and guide us through our discussion. According to Orlikowski and Scott (2008), it is possible to "disentangle" the sociometerial assemblages analytically, to be able to study them. In the following section, we will look further into how some authors have approached this by applying theories and concepts related to sociomateriality.

2.3 Theoretical heritage

Sociomateriality was not an entirely new idea when it emerged. In a systematic review of the literature on sociomateriality, Parmiggiani & Mikalsen (2013) describe how the notion of *sociomaterial constitutive entanglements* draws on many earlier and related concepts and theories. For example Bijker's (1999) *sociotechnical ensemble*, Cetina's (1997) concept of *object-centred sociality*, and Law's (2004) concept of *relational materiality*. Parmiggiani and Mikalsen (2013) furthermore located a strong actor-network theory (ANT) root in literature in the way empirical studies apply concepts from ANT to describe and analyse sociomaterial entanglements. They advocate ANTs potential as a powerful vocabulary for analysing, however, they recommend that other intellectuals, wishing to employ its potential, should explore ANTs more current articulations and "branches". Law (2009) describe the more recent contributions which have originated from ANT as *creative diasporas*. These creative contributions are, according to Law (2009) a result of how "the material-semiotic traditions have interfered with one another to articulate new intellectual tools, sensibilities, questions and versions of politics" (Law, 2009, p.12). Taking on Parmiggiani & Mikalsen advice, we will in the following section present a short description of the emergence of ANT, followed by some of its more modern applications.

2.3.1 Actor Network Theory

Since Callon (1984) and Latour (2003) first started articulating its vocabulary and agenda, ANT has been further developed and extended by the original authors, as well as others. By applying an ANT-lens, sociomaterial assemblages can be studied as networks of human and non-human actors. Within these networks actors become each other's

constitutive elements, coming into being only through its many relations to other actors (Law, 2009). Following the sociomaterial ontology, ANT does not give privilege to either the technical or social and instead treat them as equal, founded on the idea that what appears as technical is always social and vice versa.

The relational ontology of ANT does not see a distinction between kind, and its toolkit contributes to level the categories usually understood as foundational (human/non-human, micro/macro, social/technical, nature/culture). Law (2009) states that "An actor is always a network of elements that it does not fully recognise or know: simplification or "black boxing" is a necessary part of agency. This implies that the notion of "level" is also a relational effect" (p.147). He argues that there is no general natural, social or conceptual structure where things happen, but instead that webs grow in their own agenda. Structures in the society can thus not be seen as explanatory foundations, but rather as effects of the network. In this regard, the social and technical is also a dualism that vanishes. Hence it is not possible to explore the social without also studying the relational materiality (Law, 2009).

A central idea in ANT is to inquire into, and theorise about how these networks arise, trace the associations that exists, how they move, how actors become enrolled in the network, how networks can be a part of a bigger network, and how networks does or does not achieve temporarily stability (Cresswell, Worth, & Sheikh, 2010). These webs are seen as performative, as they are generating reality. There is no social or technical construction, or one “builder” making the world. To illustrate this, if someone invents something, take Elon Musk and the Tesla for example, within this relational ontology, he is not seen as the cause of the invention, his invention is rather an effect of the assemblage. Many things have thus played its part in relation to each other, to the effect of a new electric car. In Laws (2009) words, all parts “assemble and together enact a set of practices that make a more or less precarious reality” (p.151).

In ANT, agency can be conceptualised as "capacity to act" or "capacity for influence", constituted by the actor’s position within the network (Aanestad, 2003). Agency is therefore not a trait of any single actor *per se* but rather an *emergent* characteristic of the association of actors, or in other words, agency is simultaneously human and material

from the start (Latour, 1990). An actor can hence only act in association with other actors since it is its position in the network that gives the actor the capacity to act (Latour, 1990). It is also believed that if any actor, regardless of its position, is included in or taken away from a network, then the functioning of the existing network will be affected (Cresswell et al., 2010).

Conceptualising agency as fundamentally sociomaterial has implications for studying the role of technology in organisations. In the section on related research on sociomaterial systems (Section 1.2.3), we referred to an article by Aanestad (2003), *The Camera as an Actor: Design-in-Use of Telemedicine Infrastructure in Surgery.* Her study is an example of how some scholars have applied ANT to study the implementation and use of technology in organisations. Trough the ANT-lens, implementing technology implies making changes to an existing network of heterogeneous actors in an organisation. Because each element is constituted through its relation in the network, an alteration to the network means that agencies, roles and relations between actors change when technology is enrolled. This is also the case for the technology itself, as the network serves to shape the capabilities and capacities of the technology. Hence, technological artefacts can become something "different" than what was originally intended by the designer. Because technology is continuously being shaped by its shifting position in a network, the design of network configurations should be seen as a part of the design process, according to Aanestad (2003). This way conceptualising agency is, however, one of the main critiques of ANT. We will go further into this below.

2.3.1.1 Dealing with the symmetry-critique of ANT

One of the main critiques of ANT is the equating of material and human agency, and the assumed symmetry has led some scholars to point out the absurdness in ascribing intentionality and agency to inanimate objects (Walsham, 1997). This issue has aspired some scholars, inquiring into the sociomaterial, to work out more appropriate ways to reconcile human and material agency. One alternative is provided in Leonardi's (2011) article on *sociomaterial imbrications*. Here he offers a framework for explaining the organisational change that gives primacy to human agency but still is able to incorporate notions of material agency. Even if we acknowledge that these discussions are valuable to the study of sociomateriality, we will not try to provide answers to this in our thesis. Our

understanding will stay true to the notions of agency as distributed and emergent, which will be further illustrated below.

Whether non-humans can have agency or not, was the central question in Law & Mol (2008) *The Actor-Enacted: Cumbrian Sheep in 2001*. Here they tell the story of a particular moment in the life and death of the sheep living in Cumbria, UK, in March 2001, where foot and mouth disease at the time was spreading in the area. One example they put forward to answer their initial question, was how mathematical models were used to make predictions about risks related to the spread of the disease based on data on cattle. Since cattle and sheep respond differently to the disease, the correctness of the predictions was questioned. Law and Mol (2008) describe how the sheep had the influence to change the mathematical model to be more appropriate to how their bodies responded to the diseased. However, they could only have this effect on the model in association with other actors. In other words, the sheep got their capacity for action in relation to other actors in the network. By giving this example, they entangle intentionality from agency and disprove the idea that an actor needs to be reflexive and assert control, characteristics we usually prescribe human agents, to have a capacity for action (agency) in the network.

2.4 Diasporic creativity and multiplicity

What has been discussed in this chapter up until now has made the basis for our understanding of the human-technology relationship. As explained in the previous sections, a central discussion in research within sociomateriality is about how realities are made. A common thread is to understand reality as performed, not pre-given and objective, through assembled relations of human and non-human elements.

This section will therefore start off with a classical ANT-research paper on the construction of reality through human practices and material devices, and further explain how some of these ideas have been taken further by the so-called *diasporic creativity* (as described in Law, 2009).

Drawing on the insight from Latour's ethnographical studies of laboratory life, Latour and Woolgar (1986) present an argument for how scientific facts becomes constructed in

scientific practice. They witnessed how the scientists, being studied, were concerned with generating representations of what they observed in the laboratories, by for instance creating diagrams and figures. Latour and Woolgar (1986) portrayed this as an example of how scientists are engaged in making inscriptions as representations of scientific facts.

They further explained how the material substances studied in the laboratory got transformed into inscriptions with the use of what they term *inscription devices*, such as test tubes and machines for analysis. The phenomenon presented and discussed amongst scientists is therefore not seen as something that is uncovered but instead as something being constituted within the material setting of the laboratory. These scientific facts could not exist without its material representations and inscription devices. Hence the argument follows that the construction of reality is materially situated – facts about reality are constituted in relation to material artefacts as well as human practices (Latour & Woolgar, 1986).

2.4.1 Method assemblage

Law (2004) has taken the work by Latour & Woolgar (1986) further and suggests what he calls method assemblage. He draws on Woolgar and Latour when he argues that social science methods do not only describe social realities but creates the realities they study. Methods do not only influence our perspective on reality (epistemology) but works to create reality by creating new associations (ontology). Law argues that methods should "include not only what is present in the form of texts and their production, but also their hinterlands and hidden supports" (Law, 2004, p.144). He argues that methods are not only what we learn about in books and lectures, or what we practice in field trips, ethnography or interviews. Methods "ramifies out into and resonates with materially and discursively heterogeneous relations which are, for the most part, invisible to the methodologist" (Law, 2004, p.144). He then argues that the notion of *method assemblage* better captures these ramifications.

Law (2004) argues that method assemblage may be seen as the crafting or bundling of a hinterland of ramifying relations that distinguish between (1) what is in-here or present (a representation or an object); (2) what is absent but also manifest (manifestly relevant to presence - implicit); (3) what is absent but Other (necessary for presence but hidden,

repressed or uninteresting). The way we have interpreted Laws method assemblage is as follows. What is *made present* is the representations of a reality, enacted in practice. This may be descriptions, a text, an object, a process etc. What is *manifest absent* are all the things that are relevant for present, but not made explicit in present. What is *Othered* are the things that are insignificant to present, not known, or does not fit with what is made present, such as a contradicting statement about reality.

To illustrate the notion of method assemblage, let's look at an example. When doing research, some rules have been common for the academic community. What Law (2004) calls Euro-American social science have traditionally had some inherent assumptions about reality, and how to know something about reality. An example could be the detached researcher, which for a long time was the golden rule for *observing* what was conceived of as a *given reality*. If the researcher could prove his objectivity, the research would be considered valid. When the researcher is making a representation, such as a text, about the reality he is observing, he is making something present. What is manifest but absent in his enactment are all the things that are implicit to what is made present, for example the belief that there is one objective truth one can observe. However, what he is othering are all things that do not fit whit what he made present, or enacted, for example the belief that reality is not singular but multiple. He could also be othering things renders insignificant or unimportant for present.

In addition, Law (2004) argues that one cannot create any reality one wants. If a potential reality becomes a reality or not, depends on it being acknowledged as a reality in the given community. Potential realities can be presented as statements about a phenomenon, where some will be disregarded, and others will be accepted, with conditions, by the relevant community. Over time, inscriptions and statements about a reality involve an increasing sociomaterial assemblage of material artefacts and human practices. When these inscriptions and statements about reality become stabilised, they become the hinterland of potential new statements, where new statements are based on all that has previously happened. This argument might seem radical, as we always cover up our traces, deleting the individual and embodied work that was the backdrop of the final statement, resulting in a reality that seems objective and not produced(Law, 2004).

Let's go back to the notion of the *detached researcher* again. Based on the ramifying sociomaterial relations, the *detached researcher* had become a taken for granted part of reality in the given academic community – it had become stabilised and black boxed method for saying something about reality. This in turn means that the reality that the given research *creates,* exists because of the work that had been done (the hinterland of the method) prior to its statement about the reality. Thus, the methodology had produced the "new reality", but what reality that was made was limited by the hinterlands within the methods. In recent times, however, especially within social science, the belief that the researcher instead is an integral part of what she observes, and could never be completely objective, has become a statement that to a higher degree is accepted in academic communities. In addition, the notion that reality might not be singular has also attracted some attention, as this thesis is an example of.

Even though the examples given above are examples of scientific method assemblages, method assemblage is not only what researchers do. Method assemblages are something everyone does. They are used by everyone, all the time, whenever they are composing a reality. However, as researchers and academics are making statements about reality in papers, reports and thesis, non-academics create realities of technology, a landscape, bodily actions or feelings etc. Their realities are being crafted into materials other than (or in addition to) the linguistic (Law, 2004). To illustrate this, the following is an example of how reality is crafted into a technology.

When travelling back in time through the hinterlands of a technology we would "deploy an increasing assemblage of ancient times and dispersed spaces" (Latour as cited in Introna, 2007, p. 14), and thereby revealing many connections that are invisible today. Let's go back to the sphygmomanometer, exemplified in Section 2.2. The sphygmomanometer has a hinterland of practices, scientific facts and so forth constituting it as a tool that makes sense to the nurse using it. When the nurse perceives the affordance of the sphygmomanometer, he draws on a hinterland were sphygmomanometers and the act of measuring blood already makes sense. In a world without nurses, hospitals or practices of measuring blood pressure, a sphygmomanometer would most likely appear as something different.

2.4.2 Multiple realities

Following the argument of Latour and Woolgar (1986) on how realities are being constituted in relation to human practices and material devices, and in line with Law's (2004) notion of method assemblage, Mol (2002) describes and explores the possibility of multiple realities. This way of looking at reality is different from traditional ANT, as it argues that a successful translation will generate a single network and a single and consistent reality. Mol (2002) on the other side argues that practice, for the most part, produces chronic multiplicity. In Mol's (2002) empirical investigation of the diagnosing and treatments of atherosclerosis at a hospital, she studied the existence of different versions of atherosclerosis at different wards in the hospital.

In her study, Mol (2002) found many different versions of the disease across the different wards in the hospital. To illustrate this; in the department of pathology atherosclerosis *is* an encroachment of the vessel lumen and a thickening of the vessel wall, that becomes visible through the practices that are being done by activating different techniques and devices. The thickening of the vessel wall can first become visible when the pathologist is looking into the microscope at a blood vessel cut out of the body, using tweezers and knives to dissect it and dye to turn cellular structures pink and purple. However, in the consulting room the atherosclerosis *is* something else. It is the pain the patient express while being consulted by the doctor, the poorly nourished skin and bad pulsation in the dorsal foot artery that the doctor can detect by looking and placing his hands at the leg of the patient.

By foregrounding practices, Mol (2002) moves away from epistemological concerns about revealing the singular and true nature of things, towards assuming that "ontologies are brought into being, sustained, or allowed to wither away in common, day-to-day, sociomaterial practices" (p. 6). Instead of talking about the construction and representation of reality, she talks about the *enactment* of reality in the way objects come into being through practices. Therefore, it is not about different human perspectives towards a single object, but about how objects tend to be manipulated differently from one practice to another and thus multiply. To talk about what something *is*, therefore,

becomes a question about how it is being *done,* in the way it is situated within a local nexus of practices and activities of humans and non-humans.

Orlikowski & Scott (2008) argue that studies that apply a practice-lens, view organisation as a "recurrently enacted and patterned set of relations, reproduced over time and space" (p. 462). Relationships and boundaries are enacted in recurrent activities. In contrast to Latour and Woolgar (1986), who describe processes were objects achieve stabilisation and closure, Mol (2002) instead refer to what she calls *practical closure*. She argues that if reality is *made* in practice it needs to be enacted again and again, and for this reason, it cannot achieve closure or endure permanently (Mol, 2002).

Mol's (2002) argument is that every different practice generates its material reality. Because of this, atherosclerosis has not one, but many actor networks of realities. Mol further describes how these realities might relate, if they even do so (Mol as cited in Law, 2009). Even if atherosclerosis exists as multiple objects throughout the hospital, Mol (2002) argues that "it also hangs together" (p. 55). In her work, she seeks to answer questions about how these objects relate and how the "various realities of atherosclerosis are balanced, added, up, subtracted […] and fused into a composite whole" (p. 70).

2.4.2.1 How different realities relate

When there are many different realities, how might these relate to one another? In *The Body Multiple*, Mol (2002) talks about how the different wards at the hospital are not entirely separate. When the enactment of the object coincide across different practices, we can think about it as a common object, but if they contradict each other, they are no longer a sign of a singular object (Mol, 2002). An example of an object that coincides across practices is when both the clinical practice and laboratory practice enacts that atherosclerosis is present in a patient's body. On the other hand, if there is disagreement between the two practices of diagnosis, if clinical tests find that atherosclerosis is present while the laboratory tests deny it, it does not sign a singular object.

To achieve coherence in the treatment, it can sometimes be necessary to smooth out the gaps between the different versions of the disease. Mol (2002) argues that different versions can be negotiated or *coordinated* to form a single disease. One example of this

that she gives is how different versions of the disease can be aligned by simply adding them together into a patchwork or composite object. To explain this, Mol (2002) points to how the "social disease", as experienced from day-to-day by the patient, and the physical disease can be treated as two separate things at the same time as being one. There is no problem of adding these two realities together.

2.4.2.2 The co-existence of conflicting realities

In her studies, Mol (2002) witnessed that it wasn't necessarily so that these different objects were coordinated together to form a singular object. She encountered several incoherent versions of the disease within the hospital. They were not necessarily in conflict, and even if they clashed, she argues that these conflicts are pacified. Mol (2002) thereby makes an argument that contrast a long-standing assumption within social sciences, namely that conflict has to come to rest at an endpoint. In other words, she argues against assuming that there has to be established a form of closure where differences are settled, and that everyone comes together around a unified perception of reality at the end. She witnessed that the disease did not always come together to form a singular object, and that this did not need to hinder the work of diagnosing and treatment as long as the different versions did "not seek to occupy the same spot" (p. 88), and are separated in a form of *distribution.*

How different versions of an object can co-exist, and the lack of singularity can be unproblematic or even beneficial, is presented in Mol and de Laet's (2000) study *The Zimbabwe bush pump*. The pump is being enacted in different ways by different practices. It is a mechanical object, a hydraulic system, a health promoter and a technology that helps to build infrastructure, amongst others. The success of the pump, they argue, is because of its fluidity. It is fluid in its boundaries, its working order and its maker. When the pump travels to other places, it's not too rigorously bounded, it doesn't try to impose itself but tries to serve, it is adaptable, flexible and responsive. It changes shape in the process, being what Law (2009) calls *mutable mobile*.

2.4.3 Realities, goods and Ontological Politics

When there is no singular reality, there is neither one singular truth to be the final judge. What happens then when different realities overlap? Two realities might be in opposition

with each other, combining and enacting the social, natural or political. The social and political might be broken down further; there might be legal issues, economic concerns, epistemological conflict (what is considered correct knowledge) and normative or moral issues, amongst others. The two practices might enact realities that are contradictory, however, they are both enacting what they deem *the good* or *the bad* (Law, 2004).

Take for example anti-abortionists in Norway. In their enactment, the foetus is from its inception seen as an independent life, separated from the mother's body, that needs to be protected. They enact a moral reality that they believe is good. On the other side, you find the pro-abortionists. They enact the foetus as a part of the mother's body that she should be able to decide what to do with up to a certain point. They also enact a moral reality they believe is the good. This is an extremely simplified example. There are of course other things playing its parts in these enactments, such as religious, medical or economic realities. One could argue that the debates currently surrounding the regulation of the abortion laws in Norway can be seen as political discussion between communities enacting what they believe is the good. This brings us to ontological politics.

> ...if realities are enacted, then reality is not in principle fixed or singular, and truth is no longer the only ground for accepting or rejecting a representation. The implication is that there are various possible reasons, including the political, for enacting one kind of reality rather than another, and that these grounds can in some measure be debated. This is ontological politics (Law, 2004, p.162).

In other words, ontological politics is the negotiations taking place between different realities, and their enactment of *good* or *bad*. What realities will thus "win" or be given most weight?

2.5 Summary of theoretical framework

This chapter has up until now portrayed the theoretical framework that we have used as a sensitising device in our research. For the readers ease of reading, this section will provide a summary of the most applied understandings and concepts used in this thesis.

Our understanding of the relationship between humans and technology.
Both the social and the material exist in a co-constitutive relationship. Humans and non-humans are constituted through the configuration of composite and shifting sociomaterial assemblages. To understand the phenomena of interest, we have to trace its many relations to its constitutive elements.

Our understanding of Reality
Reality is not pre-given and objective, it is being performed through the assembled relations of material artefacts and human practices.

Method assemblage
Whenever we are composing a reality, we are doing that based on our method assemblage. Method assemblage is the collection of methods people use, not just to describe reality, but also to create them. Method assemblage is not only what researchers do when they want to say something about reality, but something everyone does whenever they are composing a reality.

Method assemblage is the crafting or bundling of a hinterland of ramifying relations that distinguish between; What is *made present* is the representations of a reality, enacted into being within practice. This may be descriptions, a text, an object, a process etc. What is *manifest absent* is all the things that are relevant for present, but not made explicit in present. What is *absent but Othered* are the things that are insignificant to present, not known, or does not fit with what is made present, such as a contradicting statement about reality. However, one cannot create any reality one wants, because a potential "new" reality has a hinterland that limits the possible realities.

Hinterlands

When realities are being performed within sociomaterial assemblages, whatever is made present is based on what has happened before. The hinterland is the indefinitely extending social and material relations that include both statements about a reality, and the reality themselves. In other words, hinterlands can be seen as an already composed reality that is the basis of, and influences, future realities.

Enactment

Reality and representations of reality (present and absent) is being brought into being in a process of production and reproduction. These have no reality or status outside of these processes. An object is not a state of nature, and it will take different form in different places. Hence an object is not real until it is enacted into being. Since realities are constantly being performed, they can always be unmade and can thus only achieve temporary closure.

Multiple realities

Reality is being performed within sociomaterial assemblages, and a reality of an object can be quite different from one community of practice to another. Different communities have different practices that effect what reality is being enacted. This, in turn, implies that there is a possibility that there are multiple realities.

3 Methodology and research approach

The purpose of this chapter is to describe the philosophical basis for our research, as well as our choice of methodology and our methods for gathering empirical data and analysing. In our master's thesis, we have used qualitative methods for collecting data. The following section will present the philosophical basis of this thesis. Section 3.2 describes our research approach, praxiography, while Section 3.3 presents the methods we have used for data gathering and analysis. In Section 3.4 we describe how we adapted to our case. The final two sections in this chapter will take on our methodological challenges, and the ethical considerations we had to take during our research.

3.1 Philosophical basis

Myers (1997) argues that every research has some underlying philosophical assumptions, and the most important assumptions are those that deal with the underlying epistemology that guides the research. In this regard, Myers suggests that there are three underlying paradigms for qualitative research. These are positivist, interpretive and critical. Within the interpretive paradigm, researchers " [...] start out with the assumption that access to reality (given or socially constructed) is only through social constructions such as language, consciousness and shared meanings" (Myers, 1997). This is in contrast to the positivist paradigm, where the philosophical assumption is that reality can be objectively described and is independent of the observer.

In line with our theoretical framework, our ontological assumption is that reality is being enacted in practice, and thus "access" to these realities is through the engagement with the practices (See Mol, 2002 and Law, 2004). This implies that our stories (or enactments) of the different realities are our interpretations of other people's enactments in practice. In this regard, we will argue that our research is situated within the interpretive paradigm.

3.1.1 Reflexivity and performativity

In line with the theoretical framework we presented in Chapter 2, our conception of reality is that reality is continually being enacted in practice, resulting in many different, and sometimes interacting realities. As reality is not singular, our goal should not be to create one "correct" representation of a pre-given reality that exists independent of ourselves. Instead, we want to study practices, to understand how different realities are being enacted, in practice. According to Law (2004), when we concern ourselves with practices, we also have to concern ourselves with reflexivity. We have to be able to recognise that our methods also construct realities. Our own complicity in reality-making is unavoidable.

In this regard, we acknowledge that our background and previous experience (our hinterlands) have affected how we enact our reality of the practices under study. We, as masters students and researchers, are entangled in the sociomaterial assemblages of academia, as well as in the practices we wish to investigate. Our hinterlands have affected how we have conducted our research, what we have chosen to focus on, how we have analysed and interpreted our findings, and how we have chosen to write up this thesis. This is not necessarily a bad thing. Law (2004) argues in his book *After method* that we should move away from the conception that a deletion of subjectivity is crucial to scientific truth. Haraway (1988) argues that a researcher's detachment is never possible. When we produce knowledge, we are located somewhere both in bodies and in practice. We are entangled in a dense material-semiotic network. We are caught up in webs of relations consisting of both meaning and materials, there is no escaping our bodies or practices, and thus detachment is not possible (Haraway, 1988, see also Law, 2004). While Crang & Cook (2007) argues that it's essential that researchers, rather than aspire to an impossibly distanced objectivity, comes to term with their partial and situated subjectivity. "Once this is done, subjectivity is much less a problem and much more a resource for deeper understanding" (Crang & Cook, 2007, p.13).

Law (2009) also says that the new material semiotics insists that the stories of social theory are not innocent - they are too performative. He argues that since our own stories weave further webs, it is never the case that they merely describe something. So what stories do we want to tell? This will be elaborated on in Section 3.6.6 under the Ethical Considerations-section.

3.2 A praxiography of a Smart City initiative

Law (2009) argues that an object should not be regarded as a state of nature, as it will take a different form in different places, hence an object is not real until it is enacted into being. If we wish to understand something, we thus have to trace the webs of heterogeneous material and the social practices that produce it (Law, 2009). Since realities are being produced in practice, we need ethnographic methods, or more specifically praxiography, to know something about these realities. The social and the real is mixed up in practice, and praxiography can help us explore how these realities are constituted in practice, rather than fixed. By doing a praxiography, we can:

> Investigate the uncertain and complex lives of objects in a world where there is no closure. Where, willy-nilly, there is no singularity. It allows us to explore the continued enactment of objects. And as a part of this, it allows us to investigate the multiplicity of those objects, the ways in which they interact with one another (Law, 2004, p.59)

Praxiography is similar to ethnography, however with a different focus. Instead of having an interest in culture, praxiography is interested in practice. The praxiography research strategy that have influenced our research strategy is "an ethnography of an object" (Bueger, 2014, p.15), which implies to follow an object, such as a technology, across space, but also in time - tracing how it is being used in different places, and how the practices revolving the object might change (Bueger, 2014).

While participant observation is an essential method for praxiography, thing such as access, logistics, time use etc. might limit the possibility for doing participant observation. In addition, if one is to research historical practices, participant observation is insufficient. Doing praxiography might therefore also rely heavily on interviews and document analyses (Bueger, 2014). During our research, we tried to follow the Smart City initiative through different practices, to investigate how the different practices enact the object of interest. We have also tried to trace the object backwards in time, to reconstruct activities that happened in relation to our object of interest prior to our involvement, to see how the practices enactments revolving the object arose or changed. We have done some observations of the system in use, to investigate how the system was

enacted at the time of our research. However, because of our interest in the different practices enactment of VKA prior to our involvement in the case, in addition to constraints in both time and access, we have to a high degree relied on interviews and document analyses, to get a better understanding of both historical- and current practice.

3.2.1 Target practices

When trying to "follow the technology", we have chosen to focus on some of the practices involved in VKA. The research sites we have focused on has been the project group within the municipality, eSmart systems, and the ER, all connected through their relevance to the phenomenon of interest in our study. Other research sites could also have been relevant to investigate, such as the patients in their home, or the home health nurses. These sites were initially interesting for us to investigate, however, because of difficulties getting access to this vulnerable patient group, limitations in time and scope of the thesis, and our interest in investigating the given practices, the project developed in a different direction. We have thus delimited our investigation to only include the sites put forward in this thesis.

3.3 Data gathering activities

The field research presented in this thesis took place over approximately eight months (May 2018 to January 2019) and started a little over a year after the implementation of the virtual short-term clinic at the ER. This was a period were some negotiation and alterations around its design and use still was ongoing, and many important decisions around its further development were up for discussion.

To be able to say something about the practices we investigated, and the object we followed, we had to get to know the different enactments. Praxiography is not a singular strategy, as it has to be tailored to the problems and practices under study. It requires that we mix or adopt different strategies, or invent new ones, to fit what we are studying (Bueger, 2014). Our methods for inquiry are therefore based on established methods within social science and especially ethnography/praxiography. There are three main ways of carrying out data collection when doing praxiography. These are participant observation, interviews and document analysis (Bueger, 2014).

Crang and Cook (2007) suggest that "[…] the dynamics and benefits of each method be kept in mind as the possibilities for research unfold, so that appropriate methods cannot only be formally proposed but also flexibly adopted when the need or opportunity arises" (p. 35). With this in mind, we have kept an open mind in regard to improvising and adaptation of the methods and strived to adjust our methods to find out more about what we have deemed interesting and relevant for our research. We have improvised, trusted our hunches, and tweaked our modes of inquiry, to accommodate our inquiries to what we found interesting and relevant for our research. To illustrate this, we present an example of when we were interviewing a nurse at the ER, using an opportunistic approach. We started out by using interviewing as a method, but allowed the method to develop into something else as the opportunity presented itself. Close to the end of the interview, the nurse asked if we had seen the system at the ER. At that point, we had only seen a test-version and said we would like to see how it looked like there. As a result, the interview evolved into a demonstration of the system, followed by a group discussion as the other nurses present at the ER joined in a conversation about their everyday work situation.

In total we conducted 10 semi-structured interviews with different stakeholders, four observations of use, one focus group as well as numerous document investigations. Before we initiated the field research, we also attended three meetings with representatives from eSmart Systems and the municipality. These meetings gave us an initial insight in to eSmart Systems business and how they collaborated with the municipality. The data gathering activities are summarized in Table 1 (for a detailed table, see Appendix B), and will be further described in the following three sections.

Table 1. *Summary of data gathering activities*

Field trip 1 (11.09.18)	Field trip 2 (16.10.18)	Field trip 3 (02.11.18)
Interview 1 (Project leader) Halden City Hall	**Interview 3** (Product owner) eSmart Systems	**Interview 6** (Domain expert) eSmart Systems
Interview 2 (General mamnager) Emergency room	**Interview 4** (Patient coordinator)	**Interview 7** (Nurse) Emergency room
Observation 1 Emergency room	**Observation 2** **Interview 5** Home care	**Observation 3** Emergency room

Field trip 4 (27.11.18)	Field trip 5 (29.01.19)
Interview 8 (Department manager, Home care) Halden City Hall	**Interview 10** (Chief architect) eSmart Systems
Interview 9 (Nurse) Emergency room	**Focus group** (Representatives from eSmart Systems and the municiaplity)
Observation 4 Emergency room	

3.3.1 Interview

The purpose of interviews in praxiography is to get to know the background knowledge and can be an important mean to "unravel the implicit structures of meaning" (Bueger, 2014, p.18). The interviewee should be someone that has participated in the practice under study and is thus an expert of this practice. One can ask questions about the details of the practice one is interested in, how certain activities are performed, and with which knowledge, motivation or feeling the practice is performed (Bueger, 2014).

In order to obtain information from a conversation, interviews can range from highly structured to relatively unstructured. In between the two poles, we find semi-structured interviews, where the researcher and the participant discuss under some predefined constraints, such as important themes and questions (Crang & Cook, 2007). We have primarily conducted open to semi-structured interviews, with some predetermined open-ended questions and topics. This structure has given us an opportunity to add follow-up questions, and to explore interesting topics. At the same time, it has allowed us to guide the conversation if it would derail too much from our predefined themes.

During this research project, we conducted ten open to semi-structured interviews with key stakeholders in the development of VKA. These were people that had a say in the design and implementation, as well as the primary users of the system. These have all been part of different practices surrounding the technology we have followed. Primary use in our case applies to nurses at the emergency room, home health nurses and patient coordinators. The key stakeholders we interviewed were the product owner and developer of VKA at eSmart Systems, project manager at the municipality, de facto leader of VKA (at the home health nurse unit) and a Medical Doctor and consultant at eSmart Systems.

Some of the interviews were conducted as "traditional" semi-structured interviews, mainly when interacting with the people from the municipality and eSmart Systems. This may be because we, early in the data gathering phase, had not yet developed our awareness of letting go of rigidity in data gathering activities. This rigidity may also have been due to our wish to present ourselves as professional researchers. However, some of the interviews, primarily with the nurses at the ER, started as interviews, but gradually developed into more dynamic field research, with demonstrations of the system and

observation of their practice. While present at the ER, we also took part in informal conversations with other nurses, and observation of discussions between the different nurses.

3.3.2 Observation

Observation is a good way of witnessing the interaction between humans and technology. Observation can be conducted either in controlled environments or in natural settings, depending on what is possible to carry out, and what you want to bring from the data gathering activity. In praxiography, participant observation can provide access to the actions that keep a practice alive. Observing practices allows us to see what does not entails linguistics, and participating will enable us to learn about the implicit knowledge that underpins the practice (Bueger, 2014).

During our research, we conducted four observations at the ER. We wanted to witness how the system was used in the practices at the ER, and not only through the stories of the nurses. Observing the activities and context of the ER nurses was a good way for us to get a richer impression of their work situation, how they enacted the system in their practice and to investigate the implicit knowledge related to their practice. Observations were also a way to supplement the impressions we got from the interviews. We were, amongst other things, interested in observing how VKA was constituted in relation to other sociomaterial element at the ER, as well as how it played a part in constituting the nurses' roles, work tasks, responsibilities and relations to other health care workers and patients. For example, to observe how the ER nurses used the system to coordinate tasks with the home health nurses, or to communicate with patients.

3.3.3 Document investigation

Documents often hold valuable hints on practice and implicit knowledge. Manuals, for example, could provide a description on how to carry out activities, however, it is not the same as the practice itself. A manual tells us little about how the technology is actually being used. Even so, it might give clues about the practice and the knowledge that informs them. To interpret such documents implies that we take a reflexive stance towards "the idealized character of the instructions provided and their silence and limitations" (Bueger, 2014, p.19). In addition to manuals, many practitioners produce

documents where they describe their practice. These types of documents might be activity reports, plans, autobiographies, newspaper/web-pages etc. (Bueger, 2014).

During our research, we have browsed documents provided by the municipality, in addition to newspaper articles and the company- and municipality's web pages. Documents such as funding applications, documentation from project meetings and a research report from Østfold University College, has given us the means to trace the development of VKA back to relevant events and activities prior to our involvement in the case. We have also looked through both eSmart Systems' and Halden municipality's official web pages to find relevant information about the VKA-project, to investigate how they might make VKA present in their enactments. In addition to this, we have searched for relevant keywords and found numerous newspaper articles about the project, also to understand better how the municipality and eSmart Systems make the project present in their enactments.

Early in our involvement, we were also provided with a testing version of the VKA-system. To be able to do this we installed the VKA-client, used by the nurses to consult patients and coordinate tasks with other health care workers, on a computer at our research facility. This enabled us to investigate the system and the user interface to better understand what we were investigating, and what the nurses were dealing with.

3.3.4 Analysis of field material

The data that has been collected during this research has been qualitative data, such as audio recordings, documents and field notes. The audio recordings have been transcribed, and the field notes have been discussed shortly after each field trip. The transcripts from the interviews functioned as a way of visualising and remembering what had been said in the different interviews, and as a basis for analysing and discussing the different enactments. The field notes have primarily been observations and reflections we have made during and after the various field trips and also served as a mean for discussion between us as researchers.

We believe that our analysis started before we even conducted our first official field trip, because we as researchers, as mentioned in Section 3.1, can never be completely

objective and detached from the "reality" we want to study, and thus had assumptions about the case beforehand. Both when defining questions for our interview-guides, and choosing appropriate informants and sites to do the observation, we were guided by our research interests and assumptions about the case. This also influenced what caught our eye during observation or what paths we chose to follow during our conversations with informants. Hence, part of our analysis also happened during our field trips, as we were writing down interesting observations and asked follow-up questions that we deemed relevant. Consequently, some observations will not be noted and some topics in the interview will remain unexplored and therefore not be available for further analyses. After each field trip, we also discussed and analysed our findings, acquired new knowledge of the object under study, which again influenced both the direction of the research and future data gathering activities.

Our approach to analysing our field material has thus been similar to what Walsham (2006) calls "a looser approach" (p.325), where he would take notes of impressions he had after a data collecting activity, followed by the creation of more organized themes and issues after a series of activities or a field trip. After this, he reflected on what he has learned so far in is research:

> I believe that the researchers best tool for analysis is his or her own mind, supplemented by the minds of others when work and ideas are exposed to them *(Walsham, 2006, p.325).*

Initially, our research was characterised of being quite open and explorative, where we were trying to learn from the data itself, guided by our research interests. When trying to "learn from the data" we looked for patterns of meaning and issues of interests in our empirical material. Themes were identified by reading through transcripts and field notes, as well as through discussions between the two researchers. They were chosen, not based on its quantitative weight, but more on the grounds of its relevance to our research question. Examples on such themes were ‘top system’, ‘generic concepts’, ‘interface issues’, ‘safety’, etc.

In parallel with moving back and forth between data gathering and analysing, learning more about our object of interest, we read relevant literature to help us understand and interpret our data. Theories can serve as a valuable way of both guiding your data collection, and later on making sense of your data material (Myers, 1997). As we gradually developed the theoretical framework explained in Chapter 2, further analyses naturally became more influenced by our theoretical framework. Theoretical concepts such as *enactment*, *method assemblage*, *hinterlands* and *multiplicity* have been important as a sensitising device to organise and make sense of our empirical data and to analytically follow our object across different communities of practice.

After we had identified themes and issues, associations between them were also explored through graphical representations such as mind maps, or by organising post-its. This enabled us to explore the different associations between themes that were theory-driven and data-driven. As an example, we explored connections between data-driven theme like ‘generic concepts’ and ‘top system’ in relations to theory-driven themes like ‘enactments’ and ‘present'. This was helpful because it enabled us to make connections, for example, to see how our object of study was ‘made present’ as ‘generic concepts’ in the ‘enactment’ of a community of practice. By analysing our empirical material, we were breaking down our insights into smaller parts which we then formed into a coherent story which will be portrayed in Chapter 4.

3.4 Adapting to the case

3.4.1 Gaining access to a case

During our search for an appropriate case within the field of Smart City solutions, our master’s thesis supervisor introduced us to eSmart Systems in Halden. Initially, we had a meeting in Halden where eSmart Systems presented some of their Smart City solutions. After this, we corresponded for a while via email, and by May 2018 we had agreed on having their new health solution VKA as a case for our study. After this, we had a few Skype-meetings to plan the collaboration and assess what we could do for them, and what they could do for us.

Initially, the project leader in eSmart Systems articulated a strong wish that we, as interaction design students, would be able to design a better user interface for the response centre, as this had not been a priority until then. This changed however during the research process, as we communicated our interests in investigating the development, implementation and use of VKA, which they also found valuable to them.

In August 2018, eSmart Systems appointed one of their employees to be our contact person. Peter has a long medical experience, being a Specialist in general medicine (Medical Doctor) and has worked at the ER for many years. He was hired by eSmart Systems to be a medical consultant in the development of their health-portfolio. He has been of great help to us during our research, and has, amongst others, introduced us to key actors in the municipality. All of our informants have been open and welcoming to our research into VKA.

3.4.2 Recruitment of participants

Finding participants to contribute to this study has not been a big problem for us. In the beginning, we were provided with excellent help from our informant, Peter, that put us in contact with other relevant people. Peter has worked as our "gatekeeper" (Crang & Cook, 2007), as he has been very sympathetic to our project and seemed always eager to talk with us. We have had regular email correspondence, he has provided us with information on who we should contact, and sometimes he even arranged meetings with informants that has been central to our research. After meeting with different people, we got to know them and could contact them by ourselves.

A challenge in this regard is that when we were interviewing nurses at the emergency room and the home health nurse, those participants were in a way “provided” to us by their superiors. We could not in advance know if they were participating out of their own free will, or if they were told that it was a part of their job. On the other side, after we told them about our research and what we wanted to do, they gradually opened up and seemed eager to talk about their experiences with the system. We did not get a feeling of participants being forced to participate in the project.

3.5 Methodological challenges

3.5.1 Scientific rigour in the interpretive paradigm

Positivist and interpretive paradigms are often juxtaposed by contrasting their epistemological and ontological positions. The natural sciences are traditionally assumed to have a greater truth claim than for example ethnographical studies, as it is viewed to be more rigorous and a more a verifiable source of knowledge (Checkland & Holwell, 1998). Hence, choosing to do research within the interpretive paradigm can make your study a subject of critical scrutiny from more positivist scholars questioning its degree of validity and truth-claim (several scholars within the interpretive paradigm has tried to take on this critique, see Baskerville & Wood-Harper, 1996; Crang & Cook, 2007; Flyvbjerg, 2006; Golden-Biddle & Locke, 1993).

Since our choice of theoretical perspective focus on how ontologies are being brought in to being within practices, we assume that social phenomena are complex, situated, changing, multiple and continuously produced and reproduced within sociomaterial entanglements. Hence, investigations into these phenomena cannot be based on ontological positions that prescribe the use of precise measuring devices to produce knowledge about underlying and objective truths. Our empirical approach, praxiography, has helped us investigate the complexity of our phenomenon of interest and allowed us to develop an in-depth understanding. However, how can we argue that this research is of any scientific value when it is based on our interpretations? As mentioned in Section 3.1.1, a researcher can never be entirely objective. Crang and Cook (2007) argue that once the researcher comes to term with his subjectivity, it could be a resource for deeper understanding. The real world is messy, and the ability to engage with this messiness, rather than withdraw from it, is a valuable contribution (Crang & Cook, 2007).

Crang and Cook (2007) argue that researchers that find themselves within the interpretive paradigm could also claim scientific rigour in their research. However, the truth-claim of interpretive research should be judged on its own terms. To help achieve what they call *rigorous subjectivity*, they suggest that researchers should try to carry out research that is theoretically sampled, theoretically saturated and theoretically adequate. In our research, we have attempted to achieve rigorous subjectivity by following Crang and Cooks (2007)

three concepts. We have "sampled" informants and sites, based on the quality and positionality of the information they could offer, rather than their "representativeness". When it comes to theoretical saturation, we have tried to continue our field work until we felt like we had heard the range of stories within a community in relation to the object under study. We would also argue that our research has theoretical adequacy, considering we have read relevant literature of related research, to be able to contrast and compare it to our interpretations, in addition, to situate our research within a theoretical framework (Crang & Cook, 2007).

3.5.2 Challenges with the dominance of a positivist paradigm

One example of a situation when the dominance of a positivist paradigm within academia posed a challenge for us, was when we applied for approval from NSD. We were required to list every detail about our planned research, such as every plan for observation, every interview question etc. before we had even begun our research. However, when we decided to follow the object, we were doing an explorative study. We did not know exactly who we were going to interview or observe, or exactly what we were going to ask them. This application process was ill-suited for our approach. However, we managed to do it (see Section 3.6.2 for more info about the application).

The use of this theoretical framework has also brought with it some problems related to the wording in our thesis. We have had some concerns regarding wording that seem reductionist, that implies a singular world or wording that implies that we are objective researchers that observes the truth about a given reality. Examples on such words have been *discover, reveal, uncover* etc. We have tried our best to avoid positivist wording, and to formulate sentences in ways that are consistent with our theoretical framework.

3.6 Ethical considerations

3.6.1 Doing research within healthcare

Sensitive personal information has not been of interest in this study. However, as we have been investigating a system that is located at the emergency room, there has been a risk for us to overhear patients or nurses talking about their own or other people’s personal

information. We made an agreement between us that in the unlikely event of us recognising someone we knew, we would leave the room.

3.6.2 NSD application

We have also applied for and received an approval to perform the study from the Norwegian Centre for Research Data (Norsk Senter for Forskningsdata, NSD). The approval letter is located in Appendix C. Before we got the final approval from NSD, we were required to apply for an exemption from the duty of confidentiality from Regional Committees for Medical and Health Research Ethics (REC). Our advisor had to apply for the exemption on our behalf, and we got approval in January 2019. This exemption can be found in Appendix D.

Storage of data

Some of the data included identifiable information about the participants, such as their voice on the records and their work title in the VKA-project. All identifiable data were stored on secure servers at UiO as stipulated by NSDs guidelines.

3.6.3 Informed consent

Most interviews were recorded using a voice recorder. Before every data gathering activity, we described the purpose of the research and gave information about the participant's rights. All participants and informants have read and signed an informed consent form that informed about the goal of the study, how data was being stored, our contact information, and the option to choose what data to be recorded, amongst others. The consent forms have been approved by NSD and is designed after their guidelines. The consent forms have been approved by NSD and is designed after their guidelines. The different participants have different roles related to the VKA-system. Hence, the "Why we ask you to participate"-section was tailored to each participant. The consent form template can be viewed in Appendix E.

3.6.4 Agreements with collaborators

Before we initiated our research, we had to come to some agreements with our collaborators, eSmart Systems and Halden municipality. We discussed practicalities with

both the municipality and eSmart Systems, such as how we could contribute to the project, in return for their time and collaboration. This was formalized in two different contracts, one for each collaborator. These can be seen in Appendix F and Appendix G. In addition, we signed a mutual non-disclosure agreement with eSmart Systems (see Appendix H).

3.6.5 Our role in the project and ethics with a lower-case e

As described above, many ethical considerations were done during the planning process. Forms for informed consent, agreements between stakeholder, procedures for storing data were created for research proposals and ethical reviews to be submitted. However, all important ethical considerations cannot be done before you enter the real-life situations of your informants. Crang and Cook (2007) make this argument by distinguishing between ethics with a capital E and ethics with a lower-case e. The former has to do with broad and fixed ethical principles that are typically an essential part of planning the research and applying for research permits. The latter is described as "the messier, ongoing, impure, continually updated set of ethics that develop over time and through experience" (Crang & Cook, 2007, p. 32). We encountered several situations which required us to make ethical considerations, with a lower-case e, during our time in the field. This will be explained further below.

Offering helpful advice and knowledge on interaction design

As university students within informatics and interaction design, we too have hinterlands that affect what kind of reality we are enacting, both in our interpretations of our research material (as explained in Section 3.1.1), and in our contact with the involved participants. During our interviews and conversations, we noticed how many of the informants' understandings of concepts such as user involvement and usability were not always in line with our own understanding. We therefore became aware of the potential for interview sessions to become a space for negotiations between these different realities.

This led us to several ethical discussions around our role in the project. We asked our self; If we believe that we hold some of the answers or solution to some of the issues they experience, should we try to communicate this to the project or not? Of course, if our role in the project were to serve as interaction designers, an essential part of our job would be

to convey a designer's perspective on usability and user involvement, and in this way try to coordinate these understandings and efforts with other stakeholders. However, we refrained from correcting these differences because studying different method assemblages was one of our main subjects of interest and hence did not want to impose our own methods, ideas and understandings. At the same time, we felt like we could not ignore that our insights could be helpful to them. This was similar to what Walsham and Sahay (1999) experienced when they studied the implementation of Geographical Information Systems (GIS) in India. They felt a moral imperative to get involved in the project they were studying, and that "A refusal to offer ideas and constructive suggestions would reflect a lack of concern for the people in Indian districts" (p.45). Our approach to solving this moral problem was that we at the end of our field research presented a summary of our findings and suggestions to the relevant stakeholders in the project.

Clarifying our own agenda to informants

More than once were we asked if this research was a proposal to eSmart Systems for giving us jobs when we were done with the project. When we told people about ourselves and the research, some of the interviewees seemed to assume that our involvement with eSmart System was a strategy for us to be hired by them in the future. It was important for us to be seen as neutral and not as an agent for eSmart Systems interests, as we wanted informants to be open an honest about their experience with the company and the technology. We therefore tried to debunk this assumption and told the informants that we were striving to be as impartial as we could, that we already had signed contracts with other companies, or that we wanted to live in Oslo etc. After this, the informants seemed reassured that we were not consultants for eSmart System, but rather our "own clients". After these incidents, we introduced a reassurance of our viewpoint as part of our presentation of ourselves and the project in following data gathering activities.

Reporting on negative aspects or conflicting opinions

At the beginning of our research, we also acknowledged that we might end up reporting negative aspects related to the Smart City initiative in our thesis. It was therefore vital for us to discuss this with the people who gave us access to do the research, to be able to manage each other's expectations from early on. We also encountered other related ethical dilemmas, for example when the users of the technology would express critique or

negative attitude around the system, it has been essential for us not to disclose these sources to higher level stakeholders. Another example has been when we were told things "off the record" or when we came across information that had not yet been made public. In these cases, we have restrained from using the data in our thesis, even though it might have been relevant to our research.

3.6.6 What stories do we want to tell?

In line with our ontological perspective, there is no one reality out there for us to describe. Instead, we have in this thesis attempted to describe our interpretations of the many realities comprising VKA. As mentioned in Section 3.2.1, there are other practices entangled in VKA, having stories that we will not tell. The reason for our choice of stories to tell relies on access, constraints and priorities. One of those priorities was to include the stories of the nurses at the ER. We perceived that this was the community of practice with the most problems related to the technology. We thus have tried to be sensible also to make their stories heard. We could, in theory, have investigated the enactments of just the municipality and eSmart Systems, but we would argue that this would have become a different story.

In addition, there undoubtedly might be other enactments of the Smart City initiative, or connections to different hinterlands, that we have not told about in our thesis. However, because of the complexity and messiness of the world, we cannot fit everything into this thesis. In addition, as Law (2004) argues, the attempt by social science to provide simple and clear descriptions of a messy and complex world would increase the mess. Hence, we have tried to tell the stories as rich descriptions of the enactments we encountered, in an attempt to provide a sensibility to the complexity of the world.

Law (2009) also argues that since realities are being enacted in practice, reality is not destiny, hence what is real can be remade. We therefore hope that our contributions in this thesis can contribute to improving the development of VKA and other Smart City development projects. In the following chapter, we present the multiple stories of the Smart City initiative.

4 The multiple stories of a Smart City initiative

As we have demonstrated in our theoretical framework, neither the atherosclerosis, the sheep or the bush pump have to be conceived of as definite objects. Rather, the different objects are enacted as multiple objects by different practices. These different realities are made possible based on the different communities' method assemblage – their hinterlands define the reality-possibilities. To put it in other words, reality is multiple, and these realities are diffuse, they have different boundaries, and they are not always coherent.

Our first time partaking in the enactment of the virtual short-term clinics (referred to as VKA) was at our first meetings with the product owner, Eric, who introduced us to the system by giving us a thorough demonstration of the VKA-client's user interface. Trough the presentation we were introduced to how users could receive calls from patients, how patients could be identified on a map and so forth. Subsequently, we installed a test-version of the VKA-client on a local computer at the University in Oslo. The test-version enabled us to explore and inspect the features in the user interface further by navigating the interface.

For us, being interaction design students, connecting to our hinterland of design practices, VKA became a technology with some basic affordances for storing information, accepting incoming calls and creating assignments. Furthermore, we identified several issues concerning its user-friendliness. The user interface had a dark colour scheme, small text fonts, weak colour contrasts in some places, and a lack of consistency and signifiers[5] in the use of symbols and microcopy[6]. However, our enactment at the time did not connect to any specific patient group in a virtual short-term clinic, any home health nurse

[5] Signifiers is a usability-concept used in UX-design practices. Signifiers can be described as clues to signify how users can interact and use a product or service (Norman, 2008)

[6] Microcopy can be defined as "the words or phrases in the user interface that are directly related to the actions a user takes: the motivation before the action, instructions that accompany the action, and the feedback after the user has taken the action" (Porter, 2009)

that could approve the assignment, or any persisting pressure from activities at the emergency room (ER).

Throughout our research period, VKA as an object of study in our research practices has changed a lot since our first enactment of it. As an example, our understanding of VKA changed a lot from when we first inspected the test-version to when we observed its use at the ER. There has been a continuous negotiation amongst ourselves where we at times experienced a feeling of distresses in our discussions, analyses and writing up our findings, to try to describe what VKA really *is*; to distinguish between VKA as a service (as a short time clinic), as its technological components, as a research and development project, or as the generic platform it is built on, amongst others. We had some struggles identifying what was the actual unit of analysis; what was our Cumbrian sheep, our bush pump, or our atherosclerosis? Contradictory to our choice of theory, we were more than once urged by a feeling of having to come to the core of the *real* VKA, that every fraction of the phenomenon had to be put together to a unified whole at the end. After multiple and extended discussions and reflexions surrounding this issue, we discovered that the object that we were following was multiple, as it changed in both its shape and its name. We had to come to terms with and accept the fractionality of our object of study. To quote Law's (Law, 2004) description of alcoholic liver disease "This was an object that, as it moved and slipped, also changed its shape. It was a shape-changing that, even more misleadingly, also changed its name" (p.79). In our case, it turned out that the object we were studying was sometimes a Research and Development-project, sometimes a Smart City initiative, sometimes a generic platform, sometimes a future vision, sometimes a tool for work, and sometimes other things. Because of this, our unit of analysis, the object we followed through time and its comprising practices, has been given many different names throughout this thesis (such as *the Smart City initiative, VKA, the system, the R&D-project, the future vision* etc.).

In this chapter we attempt to give answers to our first research question:

1) *How has a Smart City initiative within health care been enacted in planning, development, implementation, and use in a Norwegian municipality?*

The chapter presents our empirical findings and analysis interchangeably. We aim to keep parts where we present our findings as rich descriptions open to enable the reader to discover her own truths within the case. At some places within the chapter, we have used our theoretical framework to analyse and make sense of the rich problem area in a way that addresses its complexity and contradictions.

The structure of this chapter is aligned to the chronological unfolding of the smart initiative, from its initiation as an R&D-project, to the development process, and to the implementation and use at the ER. An overview of the VKA-project's timeline can be seen in Appendix A. In addition, we aim to provide the reader with an insight into three important and different contexts, their practices and hinterlands, where the Smart City initiative have been negotiated and interpreted. Hence the chapter is also structured around how the Smart City initiative is being *enacted* in three different contexts; the public sector of Halden municipality (Section 4.1), the developers of the software, eSmart Systems (Section 4.2), and the use context at the ER (Section 4.4).

4.1 The Smart City initiative enacted by Halden municipality

In September 2018, we made our first field trip to Halden with the purpose to learn more about the municipality's engagement and role in VKA. The project leader, working in the municipality, has played a central role from the initiation of the Smart City project until its operation today. For anonymity, we have given her the name Sophie. On a daily basis, Sophie has an administrative position in the municipal health and care department. Also, she has an advisory role in relation to the municipal chief executive as well as occasionally taking on the part as a project leader in different municipal projects. As the project leader for the VKA-project, her primary responsibility has been to ensure its progress and coordination amongst relevant stakeholders. Hence, she has served as an important informant from the municipality in our research.

During our research, we have made several visits to the municipal building to meet with Sophie and other actors from the municipality. The inside of the building looks like any other Norwegian small-town municipal building, with a staffed reception, a waiting area,

and a locked door leading to the rest of the building. Whenever we had meetings here, we had to register our arrival at the reception desk and wait to be picked up by the person we were meeting. Walking to our meeting room took us through quiet and narrow hallways with rows of locked single person offices with a name and work title on each door. The physical arrangements we observed gave us a glimpse into the hinterlands of bureaucratic practises often associated with public agencies, enacted through the hierarchical organisation of decision making and highly delineated areas of responsibility.

In the following sections, we will try to "turn back time" and trace some of the many connections spanning across time and space in VKA's hinterlands. What became real to us about VKA was that it also was in part a story about a municipality in economic distress, the nurturing of a local community of innovation and knowledge, and the ambitions to build a Smart City.

4.1.1 To build a Smart City out of economic difficulties

At the time when the Smart City initiative at the centre of our study was initiated, Halden municipality was under financial supervision. The ROBEK-list is a list of Norwegian municipalities that have had an economic imbalance, and thus needs the national government's approval on every loan and investment. The municipality was put under financial supervision in 2012 after having accumulated the most significant budget deficit in Norway (Halden Municipality, 2017). This led Halden municipality to take drastic measures to save money in an attempt to get off the Robek-list as soon as possible. In a newspaper-article from 2016 (Fange & Lilleåsen, 2016), the Mayor stated that the municipality was working to turn the situation into something positive. He argued that distress may fuel innovation and that within two years they wish to be the most innovative municipality in Norway. VKA was here brought up to exemplify Halden municipality's innovative capabilities and its potential to achieve this goal (Fange & Lilleåsen, 2016).

At their website, *Haldenkommune.no,* this vision is further articulated as an aspiration to become a Smart City, focusing on creating a sustainable future with innovative technological solutions (Halden municipality, 2018a). The municipality has several ongoing and planned projects as a testament to their Smart City endeavour. Amongst

smart benches, smart street lighting and smart water, VKA is one of the Smart City projects promoted as steps they have taken towards this future. These Smart City initiatives are founded on public-private collaborations, and an essential part for the municipality to realise their Smart City vision is to craft relationships with actors that have the necessary competence and expertise.

Sophie told us about the municipality's long-standing ambition to contribute to a growing community of innovation and knowledge within the municipality:

> *It has always been a goal to establish a collaboration with the business community, both local and perhaps other, to get the right link. It has been a political ambition but also the ambitions of the municipal chief executive.*

One important area here has been to create a professional environment for technology and innovation. The municipality played an essential role in establishing a thriving community of actors involved in science, innovation and technology, all located within an area called *Halden Innovation Park,* also in close proximity to Østfold University College. The municipality provided funds through subsidies in the initial phase, and what has now grown out of this initiative is a cluster of almost 30 research communities in the Halden-region called NCE Smart Energy Markets, working within the fields of information technology (IT) and energy.

What initially put the Smart City initiative in motion, was the municipality's desire to get something back from their initial funding. Hence, they initiated a collaboration with NCE in 2015, with the purpose of creating innovation to solve some of the challenges faced by the municipality. The health care sector was seen as an area were innovative solutions could have an impact. Sophie shared her reflections around this by explaining some of the issues they are faced with within health care:

> *The population is getting older, and we need health innovation. We need to think differently to get more out of our available resources. Therefore, we tried to think about what the biggest challenges are right now. In 2012 the health reform came to, which meant that patients very quickly get out of the hospital. Previously, it*

was the case that patients were discharged when they were done with treatments, now the responsibility for the final care is transferred to the municipality. This means in many cases that we need to continue the treatment in the home.

In 2012, the government in Norway issued a health reform called *Samhandlingsreformen*. The health reform meant a greater responsibility for Halden Municipality towards those in need of further care after being discharged from the hospital. In addition, one of the main challenges for public health care in Norway is chronical diseases which represent 87 per cent of the disease burden in the country (Haaland et al., 2007). Hence, long-term diseases amount to significant expenses for the health care sector as well as society in general. Due to the reorganisation in health care, chronical illness, and the post-war-generation getting older, the municipalities have now a greater responsibility for people of all ages in need of health care. As a result of this, the number of people that the municipalities have to provide healthcare will only increase in the future (Otnes, 2015).

Sophie further explained how it could lead to considerable costs for the municipality if they did not uphold their new responsibility: *"[...] If we do not accept patients when they are discharged from the hospital, there is a day fee on around 4900 NOK".* This created further strain on their available health-care resources. The shortage of available beds to treat patients, the prospect of a growing and ageing population, as well as being under economic supervision stressed the need for health care innovation even further.

At this time there was also a growing trend amongst policy-makers in Norway to view information technology as a key driver for innovation in the health care sector, and national guidelines were pushing for investment and innovation within this area. A white paper on innovation in care, issued in 2012, played an important part in terms of placing attention to the promise of harnessing welfare technology in meeting health-care challenges on the national agenda. One of the focus areas for making use of welfare technology in Norway was distance monitoring for the treatment and care of chronically ill and the elderly (Ministry of Health and Care Services, 2013). The broad political support towards the white paper in parliament made its suggestions influential in the development of a new plan for the healthcare field in Norway, published by the Norwegian Ministry of Health and Care Services in 2015. Some of the central themes in

the plan were patient and user-centred services, education, welfare technology and innovation processes. Among other things, the report advocated for planning processes within municipalities to become more innovative by exploring alternatives and identify new solutions, and that policymakers increasingly should involve other actors such as users, businesses, organisations in the innovation of services (Ministry of Health and Care Services, 2015).

This backdrop (described above) created the incentive for making the use of technology for innovation in public health-care the primary aim of the collaboration between Halden municipality and NCE. This can be seen in relation to Haarstad & Wathne's (2019) argument on how the Smart City Agenda is interpreted and translated to fit the needs and priorities of the city. In our case, it seems like actors within the municipalities framed and made sense of VKA as a Smart City initiative by referring to hinterlands of being a ROBEK-municipality, political ambitions to grow and establish a closer relationship to local innovation and technology communities, and challenges for health care delivery. As we saw in the start of this section, the Mayor referred to the VKA-project in a way that is equivalent to metaphors such as *necessity is the mother of innovation,* to illustrate how Smart City initiatives can become steps out of their delicate economic situation. This is similar to what Haarstad & Wathne, (2019) found in their case study (see Section 1.2.1) on how Smart City is more about the means to achieve urban strategies than a goal in itself.

In 2015 Halden Municipality entered into a consortium with NCE. Formally they established a research and development project (hereby called R&D) - creating an equal partnership. This will be further elaborated on below.

4.1.2 VKA as an R&D-project

From this point on, our object of study was enacted by the municipality as an R&D-project. What was made present about the Smart City initiative was a specific start-date and end-date, a financial plan corresponding to project-goals, as well as a specific organisation of members partaking in the project with associated roles and responsibilities. The R&D-project was organised into three groups, namely a project group, a steering committee, and an advisory committee. The project group was made up

of members from the municipal health and care department, and a representative from the IT-department, and they had weekly meetings to ensure progress in the project. A shifting array of other relevant stakeholders also attended these meetings. Their decisions were made about the overarching goals and scope defined by the steering committee that was made up of more high-level stakeholders in the municipality. The advisory committee was made up of people who hold valuable expertise for the project such as from NCE, which enabled the project group to draw on necessary expertise.

4.1.2.1 The goal of the project

The overall goal set for the R&D-project was to develop virtual short-term clinics (VKA) representing a new way of organising the care service of home-based patients in need of close monitoring after being discharged from public hospital care. The new solution would make better use of available recourses and create an alternative to the shortage of available beds in care homes, as well as enable the patient to stay in their own home as long as possible.

The idea was inspired by a model for home-based care in a neighbouring municipality, where a specialised nurse took extra care of people discharged from the hospital to their homes. The municipality figured they could do something similar, but also include technology. By utilising the possibilities of technology, they could enable health care professionals to consult and monitor patients remotely. Hence, to establish a response centre to serve this function also became an essential part of the project.

4.1.2.2 Defining the local collaborative arrangement

Going forward with the planning of VKA, the project group in the municipality decided that the emergency room (hereby called ER) should be the location of the response centre. The response centre's function was to enable patients to communicate and get assistance form health professionals from their own home. The municipality justified locating the response centre at the ER with several reasons. Firstly, the security alarms, usually used by the elderly, were already managed from the emergency room. Secondly, the nurses at the emergency room had the experience and medical competency to assess the patient's health situation. Thirdly, it was not economically viable to create a designated response centre.

The patient coordinators, working in the municipality to coordinate and assign patients to different treatments, were given the responsibility to locate and assign patients to the virtual short-term clinics. A set of inclusion criterions were defined to guide the patient coordinator in her decisions on which patients to enrol into VKA. The home health nurses were also decided to have a central role in VKA. They would install the technology in the patients homes and come to their aid if they needed help, as they currently were doing with the regular safety alarms. The new collaborative arrangement is illustrated in Figure 1.

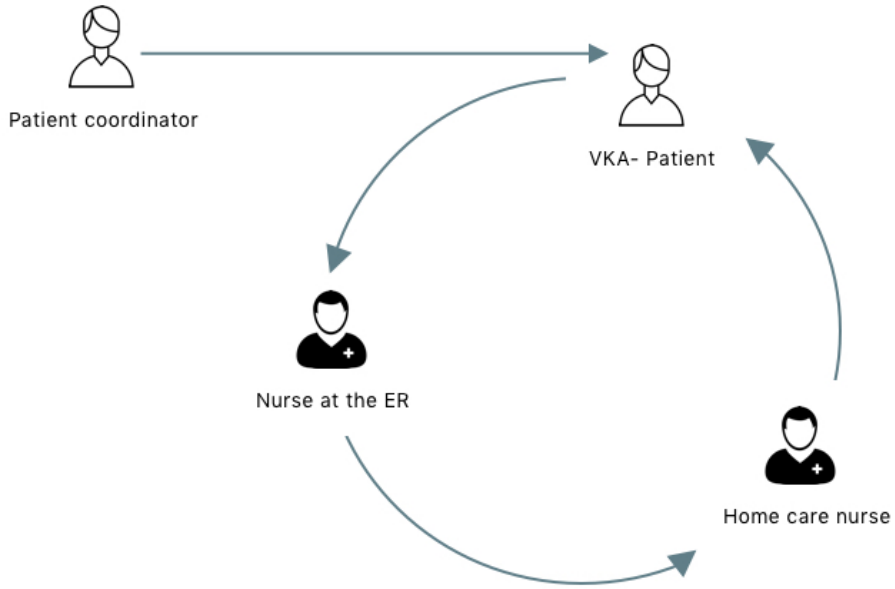


Figure 1. *Illustration of the collaborative arrangement in VKA*

4.1.2.3 Choosing the technological supplier

The virtual short-time clinic was to this point enacted in the discussions, plans for care coordination, work descriptions, meeting minutes etc. made by public administrators mainly working within the health and care department. In these practices, VKA was a description of a new model of home-based care, a set of inclusion criteria for VKA-patients, new work descriptions for nurses at a response centre and the home health nurses.

The next step for the project group was to infuse this idea with technology to transform the collaborative arrangement into a *virtual* clinic. In this regard, Sophie told us about the limited IT-capacity of the municipality:

> *Since we have outsourced most of our IT services, we have a small IT department. I would say that this has been a challenge, that the IT department has a limited capacity to do actual development work. This is a significant part of it the municipality today, not just to manage our existing IT-services, but also to develop new services.*

Based on their aligned interests in Smart City innovations, the municipality entered into a consortium with a local tech company called eSmart Systems, a member of NCE and one of the companies located at Halden Innovation Park. eSmart Systems was given the responsibility to develop the necessary technology for the virtual short-term clinic.

4.2 The Smart City initiative enacted by eSmart Systems

During our research period, we made several visits to eSmart Systems' offices, which is located at Halden innovation park together with a simulation centre, a business incubator, research environment, NCE energy markets and others. Our first visit to the office of eSmart Systems took place in the spring of 2018. By gazing over the open landscape of workstations, one can see people looking into their computers, sometimes shifting between more than one computer screen at the same workstation. You get a glimpse of code being written in some programming language, and outside the window, you can see a miniature model of a high voltage wire set up to test drone-inspections. We had entered a world that is very different from the municipality. A hinterland connecting many things that seem foreign to most people, such as cloud computing, microservices, data storage technologies, expertise on artificial intelligence, drone technology, agile development processes, test environments etc.

Three key people have given us access to study the company's practices and role in the development of VKA. Sam, the project owner of VKA, Adam the chief system architect and Peter, the Medical Doctor, hired as a domain expert to explore further development of VKA. They have all been given aliases for the sake of anonymity. How VKA was enacted in their practices is a central part of the story that will be presented in the following sections.

4.2.1 VKA as a list of requirements

During the time when the Smart City initiative had status as an R&D-project, there were conducted regular project meetings at the municipality building. These meetings were instrumental for eSmart Systems and the municipality to coordinate their joint efforts, as well as to assess and ensure progress. The creation and choosing between design decisions related to VKA, as well as prioritising between them, was done at these meetings. Eric, as a representative of eSmart Systems, attended several of them and has had an important role as a mediator between customer needs and technical feasibility. As a product owner, he listens to the customer, takes note of their needs and wishes, presents ideas and facilitates an agreement between relevant stakeholders on further development. The different participants can at the project meetings negotiate their interests and realities by drawing on their hinterlands to agree on requirements for VKA

At their very first project meeting, one could assume a situation much like starting at a clean slate, only limited by the boundaries of the participants' imagination. However, if we ask why certain design decisions for VKA were made, the answer will unfold many connections in vast hinterlands and reveal how the technology did not just appear out of nothing. In fact, requirements arrive from somewhere, extending far away from the confinements of the meeting room walls or the time-frame set for the meeting.

In the case of VKA, requirements have to make sense to participants such as Sophie, drawing on her background within health care practices and as a representative of the municipality. The choice to include logging-functionality in VKA serves as an example. This requirement was established to adhere to health care regulations which oblige the nurses to document their consultations of patients. VKA as a means to deliver a municipal health care service was her made *present*. It also has to make sense for Eric, drawing on

his technological background and as a representative of eSmart Systems, and many examples to illustrate this will be presented throughout this chapter. Established requirements for VKA can thus be seen as analogous to statements about reality in the way they both achieves a right for existence within communities by referring to and negotiating different hinterlands of accumulated sociomaterial relations.

When an agreement on what to include in VKA was reached, this was formulated as requirements and added to a *product backlog* – an order list over what they at the time assumed was needed to complete the product. From here on the development practices followed the principles of agile development processes with iterations of *sprints*. Each iteration started by creating a list of tasks to be developed during a fixed time-frame of three weeks (sprint), and each of the tasks were given an estimated unit of time and a priority. After each iteration, a new one starts informed by the preceding, where some requirements uphold, and others are removed, through methods of testing and validation. Hence during the development process, there was a continuous and changing negotiation between stakeholders included in the process around what VKA was. Activities like establishing requirements, prototyping, incremental development, testing and validation, and making changes to the design all became an important part in crafting VKAs hinterlands. The development process can therefore also be seen as a process of folding a growing assemblage of sociomaterial elements, through which the object being designed gradually achieves a degree of closure and presence in reality.

VKA was at other times made present as a specific combination of technological artefacts when the project team put together a VKA-kit. The kit contained what the project team deemed necessary for the home health nurse to install the virtual clinic in the home of a patient. The technology that was chosen was a portable safety alarm and an iPad with 3G (see Figure 2). The mobile safety alarm they chose has a simple button attached to a neck ribbon that can be worn by a patient and could be used in emergencies. A basic interface for the iPad was designed and developed, consisting of a big green button. By pushing the button, the patient was put in direct contact with the response centre and could communicate with the nurses through audio and video.

Figure 2. *The VKA-kit, consisting of an iPad and safety alarm*

To enable the communication between VKA-patients and the nurses at the response centre, they developed a *VKA-client* that was to run on a stationary computer at the ER. The project group established requirements for functionality and made sketches of the user interface which they evaluated at the project meetings. VKA was trough these practices made present as a response centre, for instance by developing functionality that afforded the nurses at the response centre to coordinate their actions with the home health nurses. However, what was enacted as irrelevant or repressed (othered) in these meetings was the already existing practices at the ER. In other words, they were enacting the response centre as something that was detached from the ER nurses' practice. This will be further elaborated on in the discussion chapter.

The idea, as touched upon above, was that VKA would enable the nurses to make judgments based on a visual assessment as well as the patients' verbal account. If a nurse concludes that the patient requires immediate and urgent care, he can make an emergency call to the ambulance by telephone. If not, he could either find that his own consulting of the patient is sufficient, or that a home health nurse needs to visit the patient. In the case of the latter, he can use the system to create a task describing the situation in the VKA-

client, related to the respective patient. The assignment is then sent to a home health nurse at the specific zone where the patient belongs. The home health nurse on guard receives the task on an app on her mobile phone and thus has to visit the patient in need of care. When the home nurse has received the assignment, she also has to sign it so that the nurse in the emergency room knows that the task has been received. Figure 3 depicts the user interface of the VKA-client (a test-version with dummy data) illustrating patients as icons on a map in the middle, a list of patients at the left, and assignments sent to the home health nurse at the right. An overview of the VKA service can be seen in Figure 4.

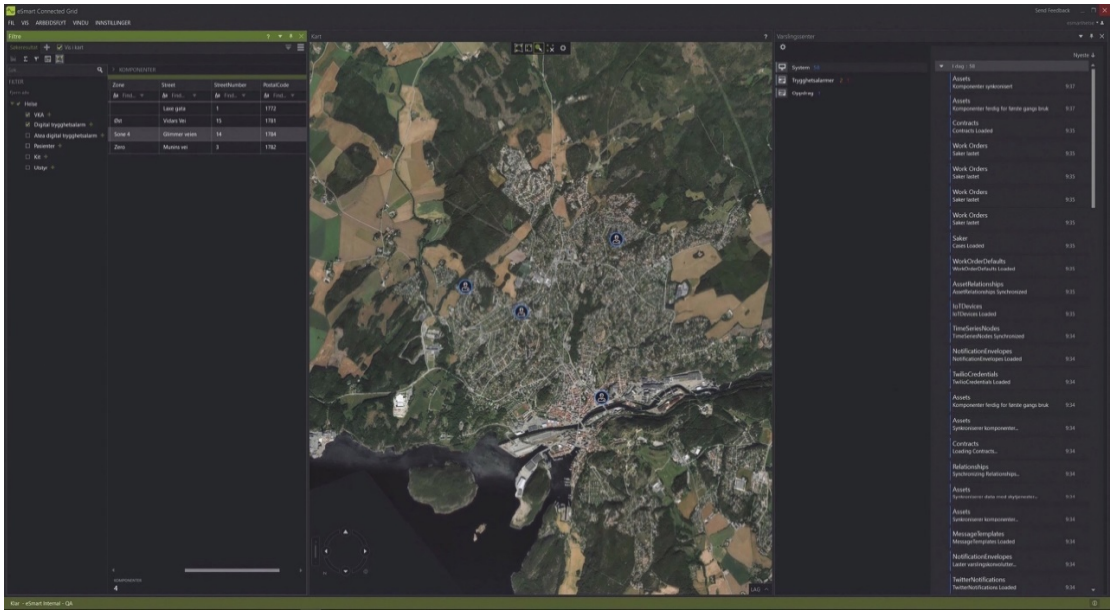


Figure 3. *Screenshot from the user interface of the VKA-client.*

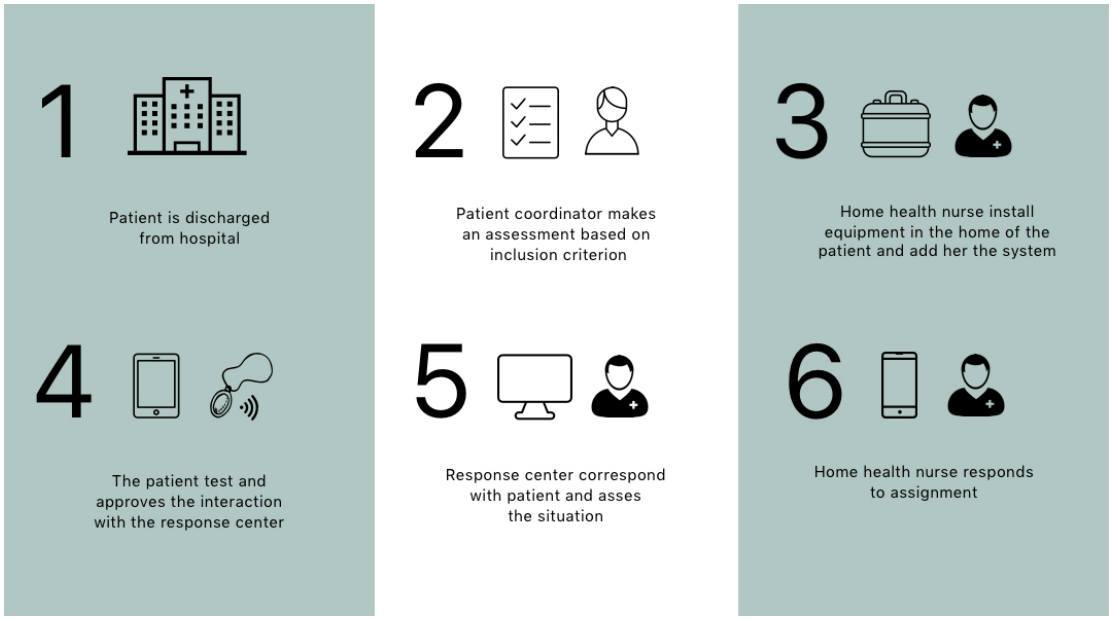


Figure 4. *An overview of the VKA service*

Placed at the centre of this nexus of practices and technologies was eSmart Systems intelligent system platform. Figure 5 illustrate how the VKA-alarm, iPad, iPhone app and VKA-client were all connected through the open platform. At this stage in the project, VKA as a network of people, practices and technology was still only enacted in plans, discussions, graphical representations and development practice.

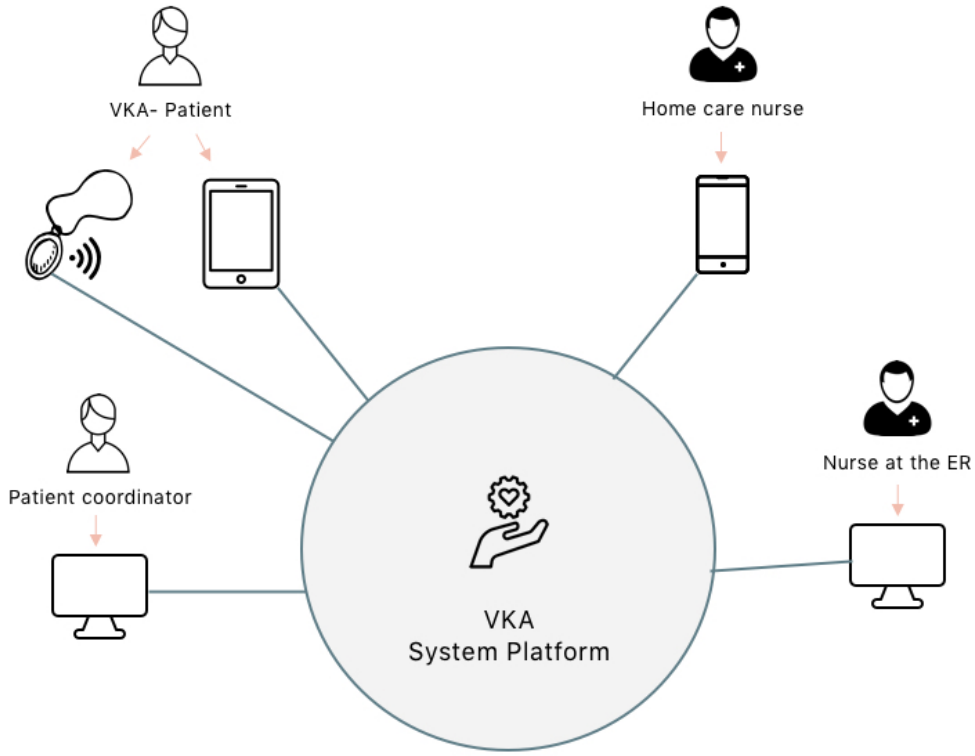


***Figure 5**. Illustration of the VKA-system*

4.2.2 The platform as an actor

As shown in the previous sections, the project meetings have served as an important site were people from both the municipality and eSmart Systems could negotiate their interest and realities. The project meetings gathered the actors; however, one of the most influential actors in the development process was not even physically present in these meetings. This became apparent to us when we asked Eric how their future vision for VKA was taken into account when developing the VKA-platform:

Well, what you think of as the first little part was not actually the first little part because we built it on a platform we already developed. So it takes in to account a lot of those thoughts about further development. For example, the platform is designed so that it does not matter what kind of sensors you want to connect it to […] it can be integrated with water meters, electricity meters […] you can get in data from many different areas.

As this illustrates, an important actor in the development process was actually the platform in itself. Even if the municipality took part in the discussions on what functionality to include, many of the possible choices were already created elsewhere. The core functionality in VKA, like how to visualise patients with alarms and incoming calls, taking calls from patients, create and send assignments to home health nurses, was developed long before the idea of virtual short term clinics had even entered the minds of any of the actors in Halden promoting it today.

The VKA-platform was, in fact, a utilisation of a generic system platform that was already developed. What was new for VKA was a new configuration of general components and functionality that they already used for other product. Hence, VKA, its functionality, user interface etc. was very much determined by whatever the existing platform "allowed". In association with Eric and other actors within eSmart Systems, the generic platform gained agency to have this influence on the development of VKA. This means that VKA already had a degree of closure when the first project meeting was held because the space to explore other opportunities and alternatives was already limited in favour of the technology that was available.

What we now know is that the development process of VKA is situated within a specific technological heritage – technology that already exists – but equally important is the practices and their hinterlands that shape further development. Hence, it is important to know more about the practices around the generic system platform because it is also an essential part of how eSmart Systems enact VKA. In the following, we will elaborate on this.

4.2.3 eSmart Systems intelligent analytics platform

eSmart Systems business model is based on their intelligent analytics platform that captures, analyses, visualises, and converts real-time operational data into insight to enable operational performance. The platform was initially developed by eSmart Systems to manage data produced by the new digitalised energy meters that at the time was being rolled out in Norway. They saw an opportunity for innovation by harnessing sensor-inputs to obtain an overview of the grid network. In addition to being infused with artificial intelligence, the platform is also characterised as open and generic which enables them to run all of their products on the same platform.

eSmart Systems different products are organised under three business teams. The first one is *Utility,* working with grid companies and electric power companies for optimal operation, maintenance and planning of grids. The second one is *Energy markets* devoting its attention towards energy suppliers as well as their customers. Recently, Energy markets was merged with what was formerly a third business team called City, dealing with products within connected health and Smart City-solutions.

4.2.3.1 Three concepts to rule them all

Adam has played a vital role in developing the intelligent platform that is shared between eSmart Systems different products. As a chief architect, his role is to work in between domain knowledge and technological expertise. This could entail having to come up with concepts to solve issues in a domain through technological means. When engaged in this type of work Adam explains that he is very concerned with creating reusable and general concepts.

The data platform is founded on three general concepts that were developed in the early days of eSmart Systems and has been constant since then. The first concept concerns the way data input from various sensors are transformed into a uniform data model in the system. What you then get is a time series were values are distributed in a time order. A value can, for instance, be a measured effect in the power grid, or if someone has activated a safety alarm. The fact that both can be formed as times series makes it possible to view them as generic. The second concept is that each time series has an

owner. This can be a person, a cable or something else. The third concept is that these owners are connected in some way, usually in the form of a network.

These three concepts constitute the foundation of the platform. On top of this logic, the platform consists of an ecosystem of generic concepts and the idea is that they can be reused and configured up in different ways to fit the need in any specific domain. Adam explained that an important aspect of their business strategy is to create synergies between various products, and their aim is to sell products as modules within the same interface:

> *We try to have common components for the map-solution, common components for detailed information, common components for visualising curves and all those types of things.*

The generic concepts can also be described as different rule engines. Let's consider an example. If a threshold value breaches, let us say a patient activates her safety alarm, the platform can act on this according to some predefined rules. The actions that need to be executed is configurable and can be both manual or semi-automatic. For instance, to make a person perform a manual task like answering a call from the patient and documenting the consultation. Alternatively, it could be semi-automatic by allowing the user to approve the execution of automated tasks, such as sending a predefined SMS to one or more costumers of a power company.

To explain the generic characteristics of concepts which enables their utilisation of the platform for VKA, Adam draws several comparable references between the world of energy and the world of health care. Both a patient with a sensor that measures blood pressure or a high-voltage wire with a sensor that measures voltage can be reduced to the same general concept (this is a hypothetical example as functionality for measuring blood pressure is, at this point, not implemented VKA). For example, if the sensor measure values over or under a defined threshold the platform can initiate an action. This could be the case if a tree has fallen over the high-voltage wire or if a patient's blood pressure drops under a normal level. The system can then trigger an alarm at a response centre prompting the operator (a grid operator or an ER nurse) to evaluate the situation and

create a task, which then can be forwarded to someone out in the "field". If you develop this idea further, sensors can in both cases be organised in a network. In the energy sectors, there could typically be a rule that says that if at least ten sensors in a network break the threshold, a specific action is triggered. To compare this to a similar scenario, Peter the doctor sketched out a possible future scenario for us. Different sensors can be connected in a network to add together different measurements related to the same patient. If oxygen saturation decreases, top-flow on breathing drops and the pulse increase this could be combined in an algorithm and trigger an alarm. Creating algorithms to calculate risk levels could also serve as decision support for both nurses and grid operators, and enable them to work more efficiently.

4.2.4 From energy solution to health care solution

Developing products for health care services was a completely new focus area for the company and VKA represented their first step to take this kind of investments seriously. The main challenge, as expressed by Eric, was to build the health-solution from reused components from the digital platform that was meant to serve as an intelligent decision support tool for grid operators.

One of the first things that were discussed regarding how they (eSmart Systems) could take the already existing energy platform and transfer these ideas to a health platform and VKA, was the use of data. Having insight into the data you collect is the first priority according to Adam. Since the data also have a geographical position, it is important to be able to both represent data on aggregate-level – accumulations of data represented in curves or the like - as well as geographic representations. For the grid operators, these types of data representations are used to view and manage power grids and to track drones that are inspecting the grid on a map. Adam explained their initial idea for how this could be transferred to VKA: *"we found out that it would be perfect to be able to view the safety alarm on a map, to locate an activated alarm in a VKA context".*

Both the user interface made for operating grids and consulting VKA-patients share a lot of functionality. They can both view a map locating the different energy meters for grid operators or patients for the VKA-nurses, they both have to evaluate the situation and make judgments about appropriate actions to be carried out, and can create a task related

to the patient or energy meter and send it to someone working out in the “field”. Both also need to pay attention to whether the task has been received. They had originally made functionally for receiving calls and view information about the caller as a proof of concept for the energy sector. They chose not to go further with this for the grid operators, but it made it possible to reuse this already developed component in VKA.

The user interface for the VKA-platform at the emergency room has also mostly the same look as the one used by the energy sector. The user interface has a dark colour scheme of black and green that initially was chosen to attune to the masculine environment at the electric power companies. What has changed in the user interface has mostly been the naming of information objects, such as changing “energy meter” to “patient” etc. Some of the naming and symbols are still left from the original user interface and seem completely irrelevant, like a patient's *meter number* or symbols for interacting with the map in the interface (see Figure 6).

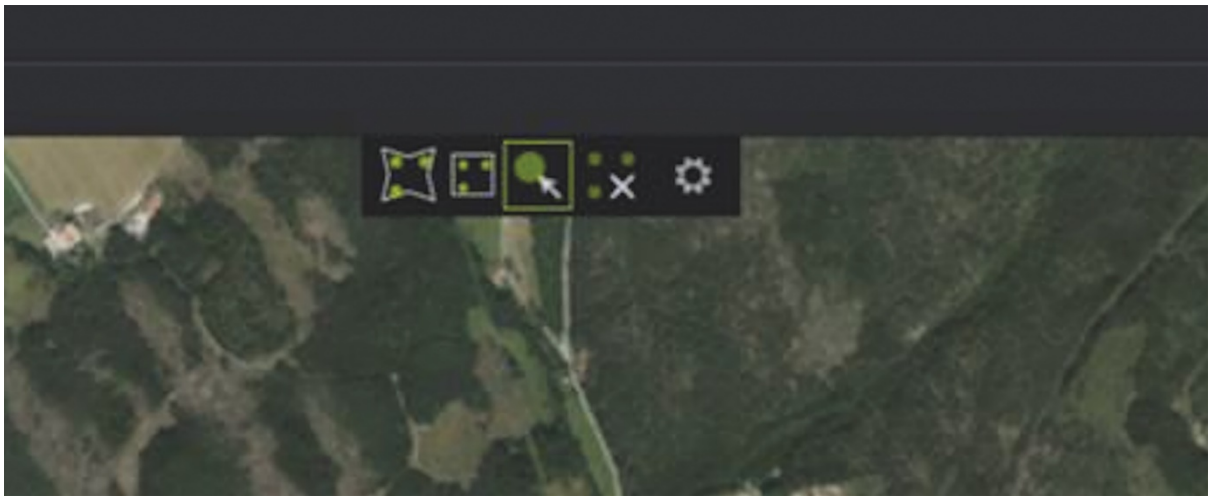


Figure 6. *Screenshot from the user interface of the VKA-client, showing symbols related to interaction with the map.*

4.2.5 VKA as a configuration of generic concepts

In contrast to the users at the emergency room, Adam can, like a surgeon at the operating desk, “open” the VKA-system to look at its internal parts. Through his practices such as creating graphical representations of different perspectives of the system VKA *is* the internal logic of the different components, their dependencies to other parts of the system, how they interact with each other and so forth. Hence, what is made present about VKA

at this point *is* the specific configuration of generic components in a generic platform. How patients could be treated as something generic in their platform was explained to us by Eric:

> *... it's not a patient for us in the technical world, for us it's just an asset as we call it, that's just a gadget, it's a bit bad to talk about a patient like that, but a patient in our system is the same as a water meter, a power meter, or an alarm.*

eSmart Systems' practices enact nurses, patients, work-tasks, and coordination work in ways that reduce them to their generic characteristics, for instance by making present the commonalities between patients and energy meters as well as making absent their specific characteristics. This will be elaborated on further in the next section.

4.2.5.1 Practices that make the generic present

During the R&D-phase and after implementing VKA into its use context, Sophie from the municipality or the nurses using the technology would sometimes request changes or additions. However, this also has to make sense to eSmart Systems enactment of VKA as an open and generic platform. If the request is to end up as a requirement in the backlog for further development, it needs to refer to eSmart Systems hinterland of practices to be accepted as a part of their enactment of VKA. In other words, in the practices of eSmart Systems, the generic is made *present*, and the specific is *othered*. This has many implications for what VKA can be, or becomes in these practices. To illustrate this point, let's consider some examples of how eSmart Systems handle requests for changes or new functionality in VKA.

Above we listed three concepts which make up the fundamental logic in the platform as well as the ecosystem of concepts running on top of this (see Section 4.2.3). Adam illustrated for us how, in his practices as a chief architect, introducing changes to VKA is really about introducing changes or additions to the generic platform:

> *If we introduce a change, one of my tasks would be to see whether it defy any of the concepts. It is important to act as kind of a police officer to ensure that we do*

not tamper with any of the concepts, then it would be free for all, and nothing to make sure that it all hangs together.

When eSmart Systems handles change requests, it is first of all important to consider whether or not a change breaks any of the existing concepts. Adam further referred to a closely related consideration around whether the proposed change affects other parts of the system. Let us illustrate this with an example. If the component that is used to present information about a patient also is used to present information about an energy meter, they need to assess how changes to this component for one system affect the other system. Hence, even if the proposed change makes sense for managing information about patients, it also has to make sense for energy meters. This implies that any proposed change needs to correspond with eSmart Systems business model. Adam explained this to us:

If someone requests a change, it is not necessarily the case that we would just implement it. It could be strategically wrong for the company, or not profitable, or it could be only one person requesting something that would completely go against our whole concept.

To assess the profitability of proposed changes or additions they need to perform a cost-benefit analysis. eSmart Systems have recently established a product board that deal with such practices. A typical consideration would be its "value" as a generic concept – for example how much extra functionality they would get out of developing something. Adam gave us an example of how such considerations were made:

It could be the case that the energy market and utility could benefit from the same change, then we can offer a more comfortable price to the municipality. This is how we wish to manage the whole development process, if everyone is using the same software, then everyone can finance their share, and the total cost of it does not need to fall on just one of them.

These practices make the many connections VKA has to other products in eSmarts Systems' portfolio *present*, both in terms of technical and financial feasibility. In these

negotiations, the municipality partakes in the enactments that make VKA present as generic and open as well as a clearly defined health care service. Hence, VKA can in practice be treated as two different things (or versions) as shifting between them make visible either the specifics of use and use context, or the generic. However, the two versions still seem to come into form a singular object. The rationale made present in the coordination of these two versions will be dealt with in the next section.

4.3 VKA as the seed to a top-system in the municipality

In our conversation with people, both from the municipality and eSmart Systems, there seems to be no problem adding together the version of VKA as something generic and as something specific. It is not difficult to understand how this made sense when referring to eSmart Systems' business model, practices and world view. However, it is important to understand how this also makes sense for Sophie and the others working within the municipality. Trying to get a grip of this is also where our object of study started to become more slippery.

At one of our first conversation with Sophie, it became evident to us that the municipality also enacted VKA as the seed of a broader Smart City agenda. This was in part based on a recognition of the significant challenges within the health care sector in the lack of communication between systems and access to health data. Sophie exemplified this by describing one of the issues this posed for the municipality:

> *The companies tell us that they have open APIs, but that we need to buy access to the system be able to retrieve the data, it is like we have to buy the key to our own house.*

The municipality aspired to create a solution that didn't retain these kinds of barriers. Sophie explained to us how this could be solved by developing an open platform that was domain-agnostic:

> *The big thing in Norway are these health care platforms, but we envisioned, even if health care was our starting point, to work with artificial intelligence, collect*

data from different sectors, and that the platform that eSmart Systems have developed could become a top-system for aggregating data in the municipality.

Sophie described this as a top-system in the municipality that would function as a shared platform between the public sectors. This could, for example, enable them to aggregate data from different domains, combine them in new ways, and thus provide new and useful information. VKA is by the municipality enacted in a certain way, being in part the seed of some future all-encompassing system within the municipality. This Smart City vision was in line with the interests of eSmart Systems, being a local company with a business strategy of breaking down silo structures between domains. The municipality and eSmart Systems shared faith in generic platforms made way for the utilisation of already existing system-platform, used for the energy market, to also serve as the system platform in VKA. At one of our visits to eSmart Systems' offices, Eric expressed their vision:

Before you typically had electricity, it was one solution over there, and then you had health, for example, healthcare solutions for the doctor, it was over here. The two programs could not talk together, and then you had a third solution, that could be for hydropower and water supply in Halden municipality, it was a separate program[…] Our platform is designed to be open. It should not be silo-based, so it means that even if it is a patient system, you can retrieve power data about the customer, if it is interesting of course. That's is what our whole platform is based on, it's open and breaking down the silos.

This idea was also echoed by Sophie when she mentioned the potential for innovation by enabling the flow of data between different sectors in a future Smart City in Halden. An interesting future scenario that repeatedly got sketched out in our conversations with both the municipality and eSmart Systems was about the cross-fertilisation between the worlds of public water systems and health care. Data from water meters installed in the home of citizens could serve the interests for both sectors, and the people working with public water systems could in principle even use the same program as the nurses at the emergency room. Eric gave us an example of how this future scenario could play out:

For example, a patient may turn on the water, and it will never be turned off. From the technical side, they really want to look at the numbers, how much water does Halden municipality use, or maybe look at leaks in the network or such things. While at the emergency room they may be interested in, let's say, if someone turns the shower on and the shower goes on for three hours, an alarm will be triggered, or if it exceeds some threshold value. Because then they may have an alarm, because there
may have been something about that patient. Maybe they have fainted in the shower or fallen.

This excerpt starts to draft the idea around what the municipality and eSmart Systems expect VKA to become in the future. Enacting VKA as being the first step to develop a top-system in the municipality seem to coordinate well with enacting VKA as a generic and open technology. This allows technology to be transferred to other sectors faster and at a lower cost relative to developing specific technology for each domain. This also makes sense for the municipality when referring to issues of a silo-oriented organisation, or by referring to hinterlands of an unsustainable economic situation (as described in Section 4.1.1).

In addition to making VKA present as a future top-system in the municipality, VKA was also enacted by eSmart Systems as a future *advanced health care system*. Peter, the Medical Doctor, was appointed as a domain expert in the project to draw on his medical expertise to develop concepts for doing advanced measurements in VKA. An important part of his practices has been to develop and evaluate prototypes for further developments, which will be further elaborated on in Section 4.5.3.

4.3.1 Are we dealing with a shapeshifter?

After several iterations of development and project meetings, the object of our study had gradually gone from a Smart City initiative as a remedy for socioeconomic challenges to become a virtual short-time clinic. At this point, VKA was enacted by creating new work descriptions, collaborative arrangements, a set of inclusion criteria for VKA-patients, as well as developing and configuring technological tools by highlighting the users' generic characteristics. The Smart City initiative as an object here also started to slip and slide

during our interviews. Both Sophie and Eric would switch between talking about the smart initiative as *a short-term clinic*, *a municipal top-system*, *a generic platform* or *an advanced health care system.* It started to dawn on us that we were studying an object that was multiple. As we were carrying out our empirical investigation, VKA was starting to shift in its shape and name, and still, we had yet to understand what our object of study would "become" in the practices of the users.

Before VKA was implemented, few actual users had been included in the development process. VKA was first put into its use context at the response centre, the home health nurse unit, and the lives of the first patients when the project entered its pilot stage in December 2016. In the following section, we will describe what happened when VKA became a part of the practice of the nurses at the ER.

4.4 VKA at the Emergency Room

The response centre for the virtual short-time clinics is today located at the emergency room (ER) in Halden, and during our field trips, we visited the ER three times to talk to the nurses and observe them in their everyday practices. The hallways of the ER are wide and long with a low ceiling, and as we were guided through the facility, we looked into the many doors down the hallway. There was a waiting room for people visiting the ER, two examination rooms, a break room, and at the end of our tour of the facility we arrived at the nurses' station. At the nurses' station there is a reception window facing out to the waiting area, were nurses can assist people visiting the ER. Behind the nurse looking out of the reception window, is a small section cramped with several computers and computer screens (see Figure 7). The nurses occasionally have to walk over here to attend to journal systems, safety alarms, VKA-alarms, or if someone calls into the ER by telephone. The nurse showing us around told us that they call this area "the cockpit" of the emergency room. On the walls in "the cockpit" there are several lists and papers on things like symptoms, checklists and reminder notes. Shelves and tables are packed with binders of different kinds, files, reference books, etc. Regularly the doctor would pop his head into the nurse station to ask the nurses to take vital signs, administer medicine or assist with treatments. The nurse would then lead the patient through the hallway and into one of the examination rooms. What we noticed was a world that is quite different from both eSmart Systems and the municipality. The nurses are connected to hinterlands of medical

education, nurse ethics and patient care. In contrast to eSmart Systems and the municipality's realities, things like AI, micro-services, cloud computing or Smart City strategies is not a part of their everyday practices, what they care about is to provide the best care to their patients.

The general manager at the ER, Hannah, and two of the nurses, Ida and Mary, has played an important part in giving us access to study VKA as a part of their everyday work practices. In this the following sections, we want to tell the story of a system that wanted to be something but became something else.

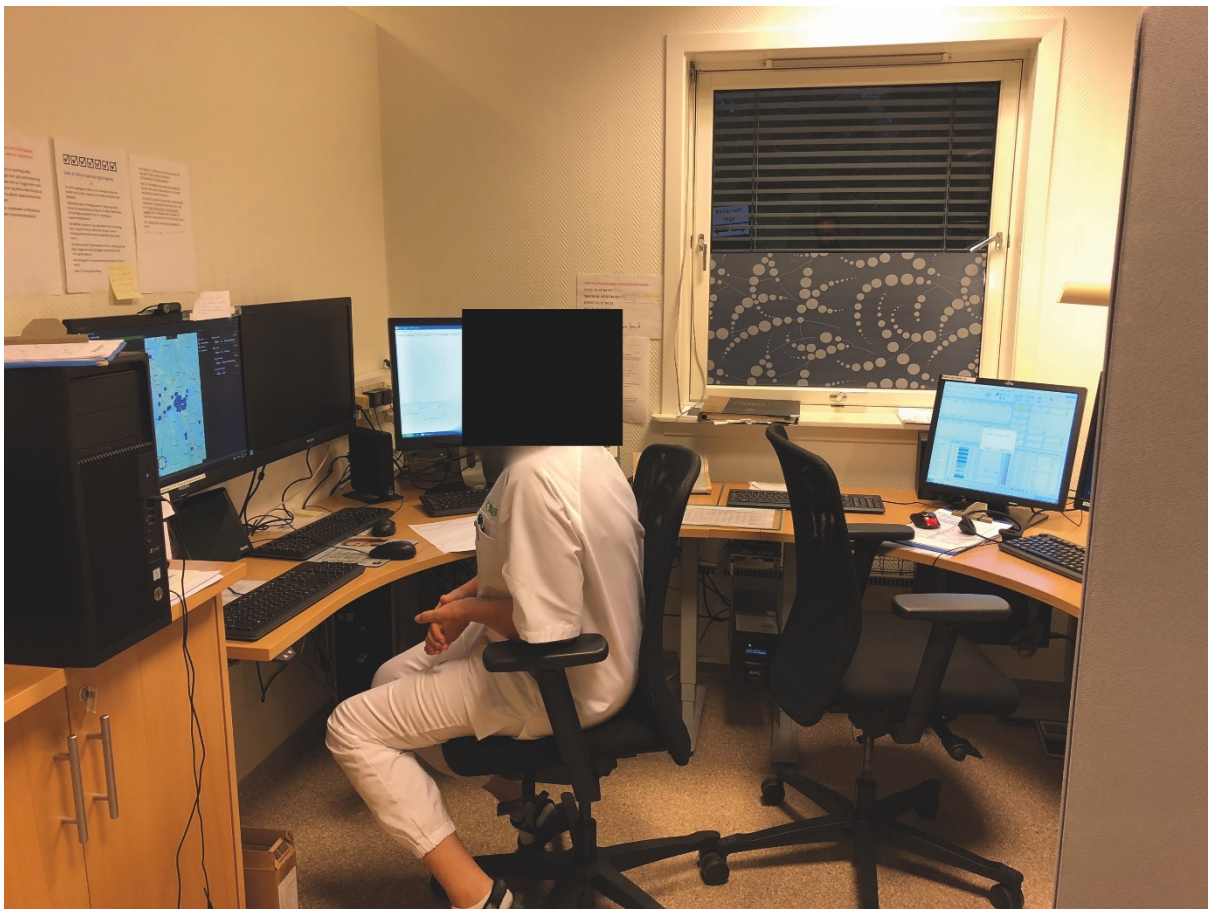


Figure 7. *Section with computers at the nurses' station.*

4.4.1 The implementation

Before the new technology and work arrangements for the VKA-response centre were implemented at the ER, the nurses' station was getting a bit of a makeover. Nurse Ida told us about how the nurses awaited this, and it was something they were happy about. Ida

said*: "When they were installing these screens and stuff, this area behind this wall was upgraded, they refurbished a bit, and we were happy about that" (Ida).* Many of the nurses were eager to start using the system and felt lucky to be a part of the innovation in the municipality. Hannah told us that: *"So, we got this [VKA-platform], its innovation, its development, and we are lucky to be part of this development"*. She further explained that the nurses were also given extensive training in the new system before the system was implemented:

> *It [the Implementation] started with training of every employer. Both here and at the IT-department in the municipality. And it was eSmart [Systems] that conducted the training. They were asked if they needed more training, and someone did, so we got more training.*

The implementation of VKA required many changes to the existing sociomaterial assemblage or network at the ER. In the pilot stage, changes were introduced both in terms of new roles, responsibilities and work tasks for the nurses. It also involved changes to the relations between the ER-nurses, patients, and home health nurses, and new technology was introduced as a part of these new arrangements.

When we first visited the ER, Hannah showed us the VKA-client at the ER. It was placed in the same corner as the other systems and computers the nurses had. We saw that the VKA-client at the ER was running on a stationary machine, connected to a headset that the nurses could use when talking with the patients. Hannah wanted to show us how the system worked, by using their own VKA-kit, which they had for testing purposes. She called the ER with the iPad, and we were able to see how the video call function looked like. We noticed that it enabled the nurses to see and hear the patient calling in, which made it possible for the nurses to use, in their own words, 'their clinical eye', including the verbal account to assess the situation. Hannah told us that after a nurse has made an assessment of the patient's situation, the system makes it possible for him to create an assignment and send it to the home health nurse, that was connected through an app on a smartphone.

At first sight, there were many similarities between the VKA-system as it has been enacted during the development process and how it appeared at the ER. However, when we started to trace the many relations in the constitutive entanglement of the VKA-technology, we identified loads of other elements that also came to play an important part for the technology to exist as a tool in the nurses' work. As will be further elaborated on in the following section, the implementation of VKA at the ER was followed by a long process of many alterations in the network which were not planned for, but essential for the nurses to be able to enact VKA in their practices.

4.4.2 Alterations in the network

When talking with the nurses at the ER, we discovered that they experienced the implementation phase as long and filled with technical problems. Even though the technology had been put in place, some time went by before they could start using the system. One nurse described this phase as chaotic, while another nurse said:

> *They [eSmart Systems/municipality] struggled a lot with getting it up and running, and we were on the sidelines and could not get started, you know. It was not easy that stuff, you know. It was a lot of things in the beginning, and we became a little negative to the whole thing. We did. We almost felt like they wouldn't make it, it won't work. It was like that for a long time (Mary).*

Consequently, it took some time after training to when the nurses could start using it. They had waited a long time before any patients were enrolled, and those patients were mainly test-patients. Nurse Ida told us that *"the time from the system training until the system was operative was long. What we learned at that time was almost forgotten when we got started".* While nurse Mary said about the system in the beginning *"works, scmorks*[7]*, we had very few patients, patients that were self-reliant, so we did not get to practice sending assignments at once".* As this illustrates, the very beginning of the VKA-system at the ER got off to a rough start. It took some time with several changes at the ER before VKA could be realised as a short-term clinic in the nurses' practices. There are many examples of this, which will be described in the following subsections.

[7] In Norwegian «virker og virker [...]»

4.4.2.1 The speaker

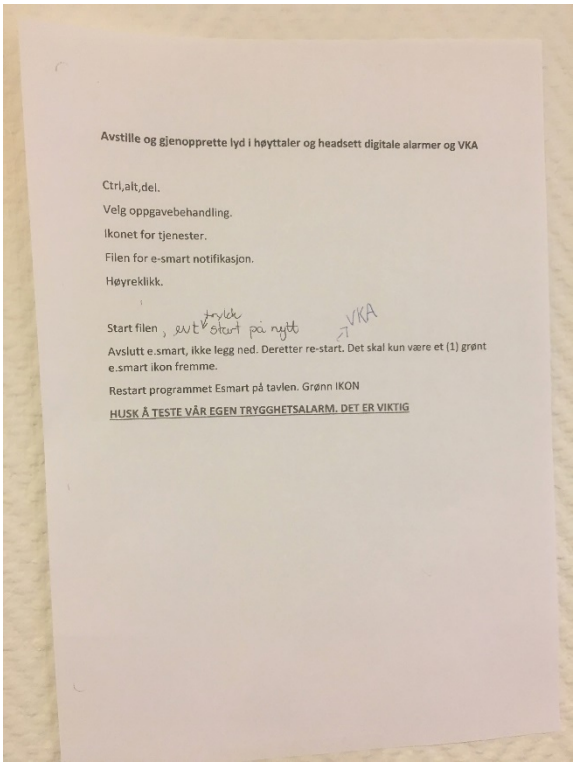
One example relates to the nurses' many other obligations at the ER, not related to VKA. The nurse rarely has the time to sit in front of the VKA-client to monitor it, as they have plenty of other tasks elsewhere in the building. A problem they discovered was that the nurses did not become aware of alarms ringing, as they were not hearing them from the computer at the nurses' station. The solution to this was to install a speaker in the hallway so that the nurses could perceive incoming alarms when, for example, treating a patient in one of the examination rooms. In addition, they also had to keep from closing the door to the consulting room completely when treating a patient, so that they would be able to hear the alarm.

4.4.2.2 The manuals and check-lists

The many difficulties the nurses experienced in being able to navigate and use the system was also being accommodated by creating manuals and checklists placed around the VKA-client. Above the screen, the nurses had placed a checklist for restarting the sound in the system (Figure 8), and a checklist for controlling that the system was operative (Figure 9). A checklist for restarting the system (Figure 10) was placed underneath the computer screen. At the side of the computer case, someone had stuck a post-it with a description of the exact steps to create a new assignment (Figure 11). A black binder with user manuals and procedures, for things such as restarting the sound, was placed at one of the shelves nearby.

4.4.2.3 The changing work

Followed by the implementation of the system at the ER, the nurses were given new and changed ways of doing their work. For example, they were required to interact with both patients and the home health nurse in new ways, use another electronic patient journal (Gerica) in relation to the system, and monitor the system to see if the home health nurse had checked out the assignment, amongst others. In addition, the leader, Hannah had been granted 50 per cent of her full-time employment to spend on making the system work at the ER. This had not been planned in advance but was discovered to be a necessary mean after the implementation. This work has implied encouraging the nurses to get to know the system, hanging manuals on the walls above the client, making forms where the nurses can fill in errors related to the system, and report problems to the developers, amongst others.



Avstille og gjenopprette lyd i høyttaler og headsett digitale alarmer og VKA

Ctrl,alt,del.

Velg oppgavebehandling.

Ikonet for tjenester.

Filen for e-smart notifikasjon.

Høyreklikk.

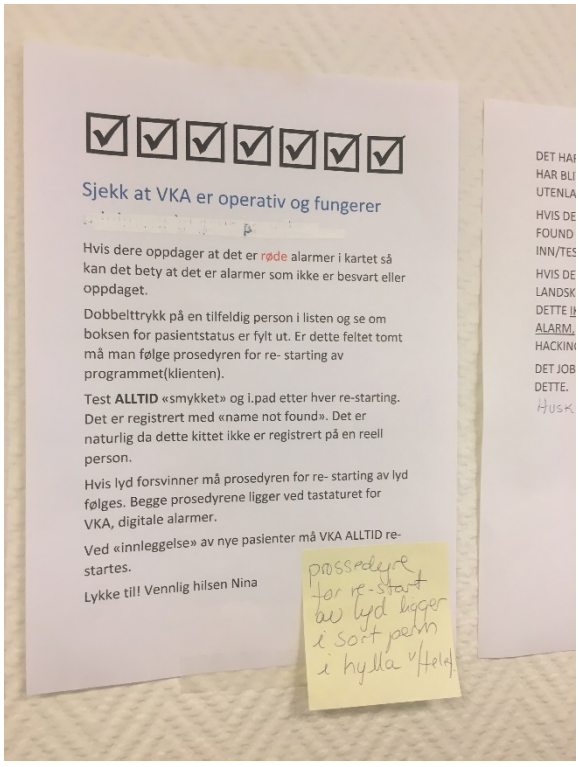
Start filen , avslutt trykk start på nytt VKA

Avslutt e.smart, ikke legg ned. Deretter re-start. Det skal kun være et (1) grønt e.smart ikon fremme.

Restart programmet Esmart på tavlen. Grønn IKON

HUSK Å TESTE VÅR EGEN TRYGGHETSALARM. DET ER VIKTIG

***Figure 8**. Checklist for restarting the sound*



Sjekk at VKA er operativ og fungerer

Hvis dere oppdager at det er røde alarmer i kartet så kan det bety at det er alarmer som ikke er besvart eller oppdaget.

Dobbelttrykk på en tilfeldig person i listen og se om boksen for pasientstatus er fylt ut. Er dette feltet tomt må man følge prosedyren for re- starting av programmet(klienten).

Test **ALLTID** «smykket» og i.pad etter hver re-starting. Det er registrert med «name not found». Det er naturlig da dette kittet ikke er registrert på en reell person.

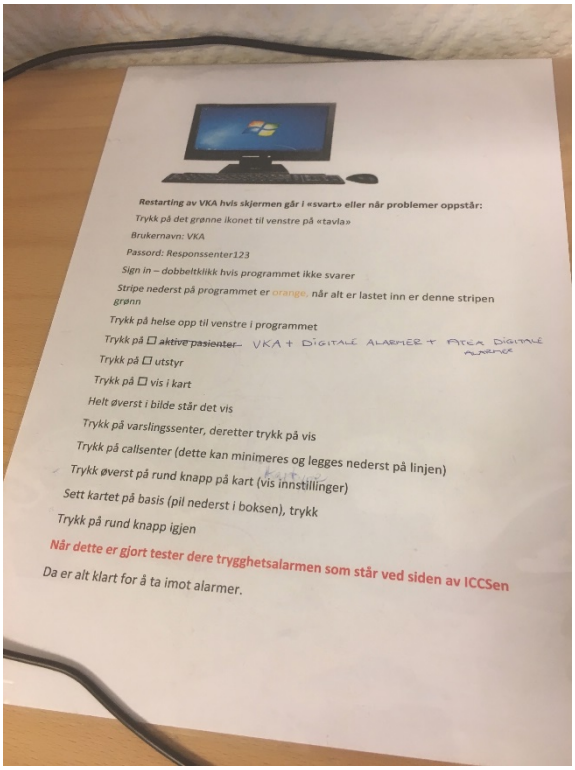
Hvis lyd forsvinner må prosedyren for re- starting av lyd følges. Begge prosedyrene ligger ved tastaturet for VKA, digitale alarmer.

Ved «innleggelse» av nye pasienter må VKA ALLTID re-startes.

Lykke til! Vennlig hilsen Nina

prosedyre for re-start av lyd ligger i sort perm i hylla v/telef

***Figure 9**. Checklist for controlling that the system is operative*



Restarting av VKA hvis skjermen går i «svart» eller når problemer oppstår:

Trykk på det grønne ikonet til venstre på «tavla»

Brukernavn: VKA

Passord: Responssenter123

Sign in – dobbeltklikk hvis programmet ikke svarer

Stripe nederst på programmet er oranje, når alt er lastet inn er denne stripen grønn

Trykk på helse opp til venstre i programmet

Trykk på ☐ ~~aktive pasienter~~ VKA + DIGITALE ALARMER + FJERA DIGITALE ALARMER

Trykk på ☐ utstyr

Trykk på ☐ vis i kart

Helt øverst i bilde står det vis

Trykk på varslingssenter, deretter trykk på vis

Trykk på callsenter (dette kan minimeres og legges nederst på linjen)

Trykk øverst på rund knapp på kart (vis innstillinger)

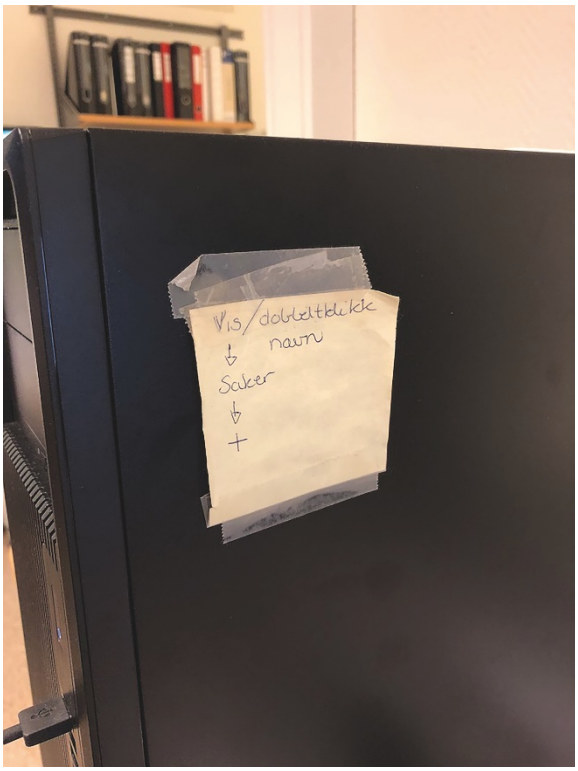
Sett kartet på basis (pil nederst i boksen), trykk

Trykk på rund knapp igjen

Når dette er gjort tester dere trygghetsalarmen som står ved siden av ICCSen

Da er alt klart for å ta imot alarmer.

***Figure 11**. Checklist for restarting the system*



Vis/dobbeltklikk

↓

navn

Sucer

↓

+

***Figure 10**. Steps for creating an assignment*

4.4.2.4 The phones

Phones also turned out to serve a crucial function in the response centre in several ways. Firstly, to enable the nurses to plan and coordinate with other users, such as patient coordinator and home health nurse. At one of our visits, we observed that one of the home health nurses called the ER to 'install' a new short-term clinic by adding a patient and corresponding VKA-kit to the system. However, it turned out that the kit she used was broken and thus had to call again to connect the patient to a different VKA-kit. Secondly, they used a designated mobile phone as a backup solution that received the alarms if the system was not working correctly. Thirdly, if there happened to be an emergency with any of the patients calling in, the ER nurses were required to use a phone to call for an ambulance. Fourthly, the phone was important if the system broke down, or if the nurse did not know who had called. In these cases, they had to call the home health nurse and initiate a procedure to find out if any patients were in trouble.

4.4.2.5 Every constitutive condition played its part

From a sociomaterial perspective, we can understand the process of implementing VKA as introducing changes to an already existing configuration of actors in the local network at the ER. Consequently, VKA is being generated as a reality through the enrolment and shifting position of sociomaterial actors within the network. There are many constitutive conditions – such as the nurse practices, the hinterland of medical practices and education, 4G network, stationary computers, the mobile phone, the speaker in the hallway, checklists on the wall and Gerica, that all had to "play its part" for VKA to exist as a response centre for consulting and treating VKA-patients. If you would remove one of them, it would most likely change the role and position of the actors in the network, and possibly compromise the existence of VKA within the network. An example of this was experienced during the pilot stage. Sophie explained how they struggled to facilitate communication between patients and the nurses at the ER due to the choice of wireless technology:

> *It was the first significant grief, or obstacle, in the project. Our municipality borders to Sweden, so it was a lot of trouble by turning to a Swedish network. There was a lot of issues we could not have known until we had tried this out, so it*

was a bit disappointing. It was a very poor signal in some places. It all ended with us having to replace all of the iPads to get 4G.

This, as well as all the other issues explained above, first presented itself when VKA was transferred from the test environments at eSmart Systems and in documents crafted by the project group, to the real use context of people's homes and at the ER. The response centre of VKA has become what it is in the practice at ER, but what has it become? In the following sections, we will tell a story of how the ER-nurses were enacting the VKA-system.

4.4.3 What had VKA become in the practice at the ER?

What we learned before following VKA to the nurses' practice, was that the VKA-platform is supposed to be a tool that enables the nurses to consult and assist patients in their home through video calls, in addition to communicate with a home health nurse. What we discovered during our field trips to the ER was that in the nurses' reality, the technology was rarely being used for the purpose of a short time clinic. What is then made present in their practices and use of VKA? This will be a central question for the rest of this section.

4.4.3.1 VKA as a short time clinic is enacted as a system being tested

The nurses told us that whenever VKA as a short time clinic was being used, it was primarily during the day when the ER is closed for the public, and the video calls they received consisted for the most of test-calls. The testing of the system was mainly done during the daytime when the ER was closed. This was because they did not have the time when the ER was open. What is made present in the practice of the nurses at the ER is that VKA as a short time clinic is an object for extensive testing. Ida told us about her experience with testing:

> *They test all the time. They are not allowed to test when we are open. The nurses at work when the ER opens at 16.00 have enough to do. There is a lot to do. They are not supposed to test then.*

When we asked how often they received these video calls, nurse Mary said: *"It's been a lot of testing. The people enrolled VKA has not been that ill, [they are enrolled] only so*

that we could practice it a bit". When we followed up with a question about the system being used for its purpose, she stated that *"do you mean if we can see if they are having a bad day? No!"*. Another nurse, Ida, said that:

> *Personally, I have never responded to a video call. Those video calls that are on there [VKA-system] are only those who test. They [patients] gets home assignments, to test if the system is working. So there is a lot of testing, but nothing […] I have never answered a real video call.*

Even though we got an impression that the nurses enacted VKA (as a short time clinic) as a system with limited actual use, there were still problems and discontent afflicting the system that VKA as a short time clinic is a part of. But how could the nurses experience difficulties in use, when the short-time clinic was rarely "operative"? The answer to this might be that a while after implementation, the municipality's newly purchased digital alarms were added to the VKA-platform. These alarms had the same procedure for creating and sending assignments etc. (but for another patient group). Hence, the only difference in the interface of the system at this point was the name of the alarms (VKA and Digital alarms, respectively), and the fact that VKA as a short time clinic supported video-calls.

When we during interviews and conversations asked the nurses questions about VKA (as a short time clinic), they were, for the most part, enacting the system as a system for handling safety alarms. Ever since the new digital alarms were included in VKA, most of the problems that had occurred for the nurses since implementation had thus been in relation to these alarms. The platform that was supposed to realise VKA as a short time clinic had instead become a platform that replaced the old safety alarm system.

In the following sections, we will thus tell a story of a tool that during the day was being tested as a short time clinic, but at other times was a tool for handling safety alarms. For reasons such as technical issues, a problematic user interface, and work demands, the VKA-system was in the nurses' practice enacted as an unsafe system.

4.4.3.2 VKA is made present as unsafe

During our field research, we have heard many stories about things that had gone wrong when the nurses were using the system, and more than once we heard the term "Unsafety alarm" in conversations about the system. When we asked nurse Mary about what was important for her when using computer systems in her work, she said that *"I need to feel that the system is safe to use, since it is people we are working with".* She added that this was not a problem with the old safety alarm system, however with the VKA-system she did not feel that the system was safe due to problems that had occurred.

An example of a technical problem that had happened more than a few times was that the alarm sound indicating a safety alarm-call (or video call) had not been working properly. A solution to this has been for the nurses to regularly test the system with their own VKA-kit (a kit the ER keep for testing purposes). If the sound turns out to be missing for some reason, they follow a routine to restart the client. Restarting of the system is also done as a precaution, at least once a day. Hannah told us that:

> *We made some routines of closing the program [client] and open the program at least once per shift. For this client, it has been necessary in regard to feeling secure that the system works. We have these checkpoints that we go through.*

In addition to the precaution restart, whenever something has stopped working, the routine is to restart the client. Hannah also told us that:

> *Unfortunately, more often we have had to do this [restart], when we, when there are certain things that do not work, our procedure is to restart… And that takes time. It is possible that eSmart [Systems] doesn't think that it's necessary with all this restarting, but we are not getting any further and cannot do anything without the restarting.*

While Mary said:

> *It's that restarting, you have to log out and then you have to restart. And this takes time and it can happen almost out of the blue, anytime. And it's maybe what's*

more insecure, you know, because we have to get everything up and running again. We have a procedure that is quite detailed.

As previously mentioned, technical issues had happened a lot during implementation and for a time after. Even though the amount of actual technical problems might have decreased, the nurses still did not feel the system was as safe as it should be. One nurse told us that she still experiences a lot of disquiet surrounding the system:

I experience a lot of worrying, there is much disquiet in the group because of that VKA-system, because we don't know, it's something new all the time […] Then we have to press here and restart and do this, there is a lot of information consecutively, all the time, because things do not work. Its creating disquiet in the group. Amongst us that manages the system. That's my impression.

Another nurse told us that for some, the implementation of the system felt really bad, and that they were struggling to get the hang of it:

You know when you have 40 per cent of full employment, you don't have that much time to try it out, because there is, as mentioned, not that many that uses it, so that it is almost like, it may have to do with age, they feel like it becomes unsafe to go to work, they feel like they can't handle it.

The many technical issues experienced at the ER since the implementation of VKA seem to have been carved into the landscape of the nurses' hinterland - affecting the nurses' current trust in, and use of, the system. However, problems related to interaction with the interface of the VKA-client could also be affecting their impression of the safety of the system. The following section will tell a short story from one of our visits to the ER that illustrates this interaction.

4.4.3.3 Marys short demonstration of the system

During one of our field trips to the ER, nurse Mary wanted to demonstrate how she usually was sending an assignment in the system. Quite early in the demonstration, the system did not respond as she was expecting. She called on the other nurses present at the

ER, to ask if they knew how to fix the problem. Two other nurses came over to the desk, but it turned out that none of them could help. The nurses struck up a conversation with us and each other about the VKA-client, telling stories about their interaction with the system. Suddenly one of the nurses expressed: *"What is it we are calling it, VKA? Virker Kanskje Av og til"*, which translates into "VKA, works maybe sometimes" (In Norwegian this abbreviation gives meaning). The nurses laughed a bit, but then, on a more serious note, told us that it was important that people get the help they needed.

During our conversation with the other nurses, Mary had solved the previous problem, and located the "create assignment"-window. The window was filled with different boxes where the nurse had to fill in different information. She immediately told us about how important it was to delegate the assignment to the correct home health care zone, as this was not done automatically, and easy to forget when the time was of the essence. She told us that in the past there had been incidents where someone had forgotten to assign an assignment to a zone, and thus the assignment had not been sent to anyone. She then referred to the "assignment sent"-list, where there were a few assignments that had never reached the home health nurse:

> *Here you can see a common error where we have not assigned a zone to the assignment, you see, and then they will just be here [in the list]. When was this, September 30th, September 29th, and they just lie here..*

Mary told us that these errors had been handled, however, the nurses at the ER had not been able to delete the invalid assignments, leaving them to clutter up the interface. If this was even possible for the nurses to do, they did not feel secure enough to try to figure out how to.

When she was ready to send the test-assignment, we noticed that there were no explicit "send"-button in the "create assignment"-window. Rather the "save"-button meant the same as send. Mary further told us: *"These fields that are framed in red, it means that we have to fill them out, then we save, which means the same as sending it to the home health nurse."* When she had sent (saved) the assignment, we noticed that there was no confirmation that the assignment was sent. We asked Mary how they could know that the

assignment had been sent. She told us that when they have pressed the “save”-button, they just have to wait to see if the assignment appears in the list over assignments to be sure that it has been sent, and if so, they have to assure that the home health nurse will check it out:

> *And then we have to monitor it, that it is being checked out. Because if they don’t see the assignment, it won’t get checked out, and then we have to call them.*

This was also something that was discussed amongst the nurses that were present. They were often too busy to have time to sit around and monitor the response centre.

At the end of the demonstration, we were wondering about some of the features presented in the interface. Many of them are ambiguous and seems excessive for its current use. When we asked Mary about what a random element in the interface did, she said that:

> *I don't know... I'm not that... to save? Sum up? I almost don't dare [to press the button] I don't dare. I managed to, before they [eSmart Systems] avoided that everything collapsed, to press that x, and then I pressed that other x instead. Everything went black. And I almost don't dare to press anything else than what I know I should press.*

As this subsection shows, we experienced a lot during this short time at the ER. Mary’s demonstration of the system showed us how the interface was difficult to manoeuvre, how this could cause the nurses to not be able to complete their tasks or do something that would cause a breakdown. During our field trips, we discovered that what happened this day was not an exception to the rule. In the following section, we will describe some of the issues that were related to the nurses’ interaction with the interface, including how they also struggled with the demands of the system in their current work context.

4.4.3.4 Problems with the system interface and the nurses' work context

Interface problems

The interface was a recurring subject when talking with the nurses. The interface afforded little ease of use for them. When we asked about the interface, nurse Mary told us how she would just do what she always did in the prescribed order, and it would be fine. However, when something had gone wrong, it was difficult for the nurses to recover in the system. They had learned some procedures that they followed, and when something deviated from this, it was hard for them to figure out what to do next. The procedures were necessary since the interface was not intuitive enough for them to figure out how to do things on their own. At the same time, if the system was updated, or if they had been doing something wrong, they would get new procedures. Nurse Ida told us that:

> *When you think you have figured something out, then we get new messages that we now have to do this and that, and we end up having these home-made solutions to the computer. Some bright heads are clicking and fixing, and tells us that we can do this and that, that will fix it. We have to do this, or we have to restart here. There is new info all the time.*

Alternative ways of doing things, or additional complexity, was often treated as irrelevant or obstructing by the nurses. In the nurses' interface, there is a map that shows where the safety alarms are, which is taking up large parts of the screen. This was, as described in Section 4.2.4, derived as a function from the energy market to become a central feature to the VKA-functionality. However, nurse Ida told us how she did not understand the inclusion of this central element in the interface:

> *I do not care for that map. I don't quite understand the logic, that we have to know where they are. No, but that's me personally. Because we are able to provide the care for those who need it anyway. So that map seems to me, I don't understand it. Maybe it doesn't need to be there (the interface) because it takes up a part of our screen.*

Hannah told us about how some of the nurses had gotten lost in the interface, where things had been moved around or changed so that they did not recognise what was on the screen. Since the nurses had no chance of recovering from this, the solution was often to restart the system (as mentioned above).

This has been an account of some of the problems the nurses experienced concerning the interface of the VKA-system. The interface was complicated and not intuitive, hence, there was a need for specific procedures, procedures that were frequently changed. In addition, there were multiple elements that did not make sense for the nurses and contributed to a more complicated interface. In their practice, the nurses had little time to try to figure out how to manoeuvre in a difficult interface. Mary told us that:

> *When the ER is open to the public, we do not have a lot of time to spare to ponder about different systems, you know.*

This brings us to the way the nurses work at the ER. At times it could become very hectic, which meant that they had to balance between many different tasks, to determine their urgencies and decide on order of attention. In other words, they would have to, in the blink of an eye, choose what fires to put out first.

The nurses' work context

A problem we often heard about at our field trips to the ER was how the VKA-system did not support their hectic work situation. During one of our observations, a nurse told us that even though she did use the system to send assignments, as required by her work description, she often just wanted to pick up the phone and call. She said that at the moment, this was much quicker than having to type a lot of information into the system, send it to the home health nurse, and monitor that the assignment was checked out. When comparing the old analogous alarm system and the new VKA-platform, Hannah told us that:

> *[about the analogue alarm system] we pick up the phone, call the home health nurse, and we have delivered the assignment. This is the simple analogous alarm*

system. The digital is that we have to create an assignment, and that takes its time, you know, purely technical.

In the old analogue system, which was still in use, the nurses at the ER received the safety alarm calls, and if needed, they called the home health nurse to convey the assignment. Nurse Ida told us that:

It is demanding, it takes time to answer an alarm call, because you should make a report and send it, and it should be checked out, and you have to be sure that the assignment is sent.

A big part of the problem was that when the nurse at the emergency room had delegated an assignment to the home health nurse, they were still responsible for ensuring that the home health nurse had received and confirmed it. Nurse Mary told us that:

We have to monitor that the assignment is checked out, but when there is a lot to do here, we simply forget about it. Oh God, is it checked out? You know.

This became an extra thing for the nurses to keep in mind, as they usually had no time to sit in front of the screen and wait for a confirmation. Sometimes they would experience that they forgot about it for a minute, which could be unsettling.

When a patient calls the response centre with a safety alarm, they often need help fast. In the binder where the ER nurses would record any problems related to VKA, we noticed that in the previous month there were at least two occasions where a home health nurse had not confirmed the assignment they had been given. Issues like this led the nurses to work around the system. Some of the nurses told us that in these situations they had developed a procedure where they use the phone to call the home health nurse to check if they had received the assignment. Ida told us that:

[…] often, I experience that the home health nurse doesn't check out the assignments, why they don't do this is because they don't see it, because they don't get the assignment on their phone, or whatever happens there. Then I have to call them, I call

to check that they received the assignment from me. Just to be completely safe, you know.

Creating assignments after receiving a call from a patient was at times also causing problems. The VKA-client supported the necessary functionality for doing both but was not necessarily tailored to fit the work-flows at the ER. After ending a call from a patient, the nurse had to look up the patient by searching for her name to create an assignment related to that specific patient. Hence, the nurse had to either remember the name of the patient or make sure to write the name down on a piece of paper during the call. If they "lost" the name after ending a call, there was no way to recover it from the system (Or if there was a way, the nurses did not know of it).

4.4.4 Summary of VKA at the ER

As we have tried to illustrate in Section 4.4, the VKA-technology has negotiated its place into existence at the ER. However, what it has become is something different than what was proposed at the drawing board. VKA as a short time clinic was in the nurses' enactment mostly being tested, while the VKA-system was predominantly being enacted a system for digital safety alarms. The nurses had troubles with this system and enacted it as unsafe due to their previous experiences with breakdowns (technical-errors or user-errors). The interface was cumbersome and afforded little ease of use, which may have contributed to their enactment of an unsafe system. In addition, the system was lacking in support of their hectic work context.

The version of VKA that emerged in use at the ER was in several ways different from the version of VKA that the municipality and eSmart Systems had planned, developed and tested. However, it was not given that the new version would replace the previous versions. In the following section, we will describe some of the negotiations that happened between the enactments of the three communities of practice after the VKA-system was implemented.

4.5 Negotiations between enactments after implementation

4.5.1 Negotiations between the ER nurses' and eSmart Systems' enactments

VKA as something jokingly referred to as 'works maybe sometimes' or 'unsafety alarms' was only made present in the ER-nurses' practices, and it was clear that the version of VKA enacted at the ER contrasted with the version that was made present at eSmart Systems since these issues did not appear here. Even if the nurses at the ER did several things to accommodate their practice to the new technology and responsibility (as described in Section 4.4), several of the problems experienced by the nurses were assumed to be beyond their skills, experience or mandate to solve. Consequently, they had to find ways to communicate the issues and needs that appeared in their enactment of VKA to key decisionmakers such as Eric and Sophie.

Eric's communication with the ER has mainly been through the general manager of the ER, Hannah, who would frequently try to communicate errors and needs that emerged in relation to the new technology. The nurses would also write down problems they experienced in a form (Figure 12), and Hanna would occasionally send a report to both eSmart Systems and the municipality. Hannah told us how this could be problematic at times: *"But everything is going through the hierarchies, so I tell my nearest boss, it continues up, and comes back. At times it is cumbersome, but it is how it is decided, so we just have to deal with that."*

When Eric was made aware of issues experienced by the nurses, one important strategy was to try to understand why the problem occurred in the first place. Getting to the root of the problem had often been a subject of discussions according to Sophie:

> *There has been a lot of discussions around "who is at fault now, oh no, now it is wrong again". And that feeling is what I have tried to convey a lot as coordinator for all of this. Because the environment that does the testing and deals with all the equipment's, they say, "but it is like that, we have to test it", but then something is wrong, and they say "no in the test environment it worked perfectly well", but in the block apartment down in the basement it didn't work well at all.*

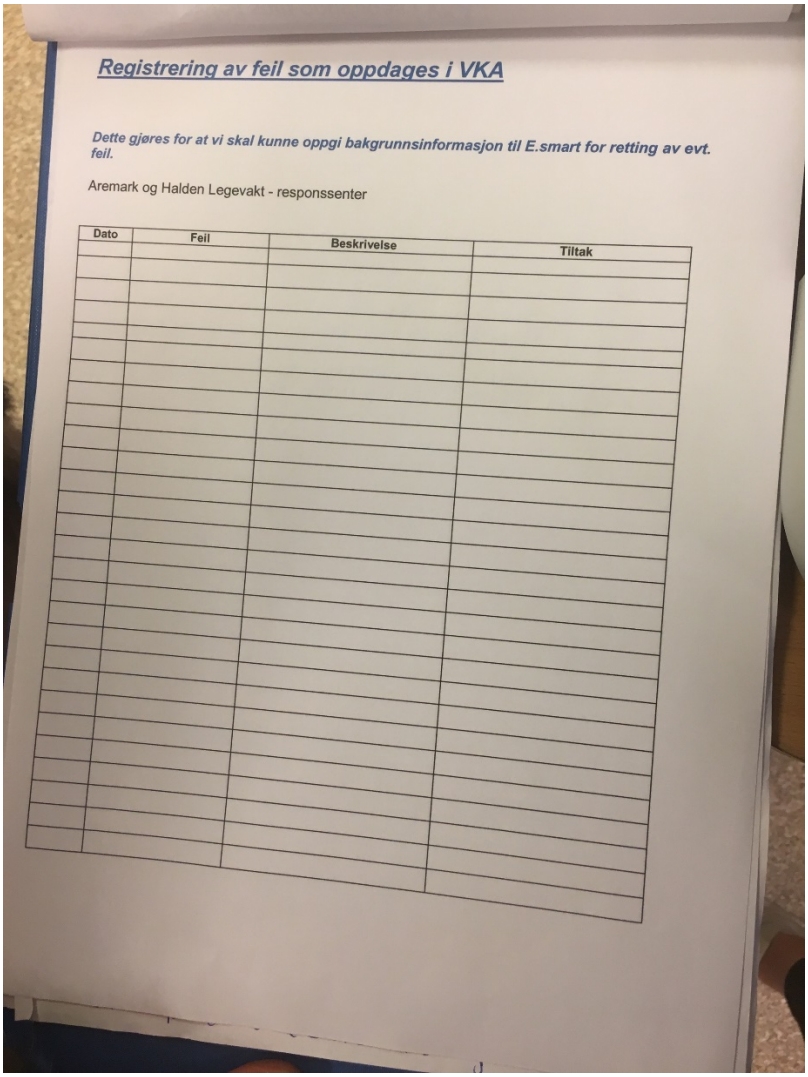


***Figure 12**. Form for registration of errors related to VKA.*

In instances such as this, the developers had tested that the system works in a controlled environment, while the nurses experienced a system that did not work. When Hannah would send lists of problems they encountered in the system to the developers, she felt that they often would just give her a procedure on how to do things. She told us how this most often went down:

> *I have sent them several e-mails with problems chronologically listed, and then they usually reply with possible solutions to each problem, like "are you doing this and that", so this is the method we have used for the most part. And we have taken some of these instructions and placed them over the computer.*

Eric explained that if the nurses have a problem with functionality that works ‘as intended’, it could be sufficient to send them a user-manual. While the developers enacted a system that worked in a controlled test environment, the nurses were enacting a system that did not work in their practice. Even though it might not have been any purely technical issues, the nurses were still enacting the system as unsafe (as discussed in Section 4.4.4.2).

However, in recent time, both eSmart Systems and the municipality had been making the troubles at the ER present in some of their enactments (as will be elaborated on in Section 4.5.3). In addition, eSmart Systems had made some minor adjustments of the interface after implementation to accommodate the nurses’ needs. When the system was implemented, the patients were ordered after the time of enrolment. One change that was done was to make it possible for the nurses at the ER to sort the patients with different alarms in alphabetical order. Another change was to move the button that closed the system, that was too close to the button that exited the "create assignment"-window, to prevent that the nurses would shut the whole program unintentionally.

The reasons for why many of the problems and needs the nurses had were done little about were manifold. When we asked Eric about why some of the changes that would benefit the nurses at the ER was not implemented, he gave several reasons for this.

Firstly, it had to do with prioritising. Both the security of managing the health data of the patients, and the security of the system working as it should, had been a priority. A consequence of this was that the feedback from the users and customisation of the system was given a lower priority.

Secondly, because eSmart Systems enacted VKA as a configuration of generic and mostly reused components. There were some difficulties in coordinating this version of VKA with the reality enacted at the ER. This can be illustrated by Eric explaining some of the challenges they experienced when reusing technology for VKA:

> *The user interface is probably what has been the most difficult because we have based it on our platform. To make the user interface suitable for the world of*

health has not been easy, because in some way there are already some limitations in development and what is technically possible to make if we are to use what we already have.

As we saw in Section 4.2.3, eSmart Systems' business model is based on the re-use of generic concepts. Hence the generic and standardised versions are often given precedence over local versions. This hierarchy is thus institutionalised in the practice at eSmart Systems.

Thirdly, there was an ongoing discussion on who was going to cover the costs, and how, if new functionality were to be implemented. When the R&D-project ended, all further development and financing were regulated by a Software as a Service-agreement (SaaS-agreement). This agreement changed the relationship between the municipality and eSmart Systems from an equal partnership to a supplier-costumer relationship. From this point on, any proposed changes to VKA would only be covered eSmart Systems if it was about improving existing functionality and the municipality would have to cover the costs if this entailed changes or alterations to what they have already agreed on during the R&D-project.

What has been presented in this section can be seen in reference to what Introna (2007) argues, that "many alternative options become excluded or closed off in favour of the technology that is now available – obviously with important implications" (Introna, 2007, p. 13). The nurses' interests and voices were excluded from the design process from the very start, which consequently has led to some of the difficulties they experience in their efforts to interpret and appropriate VKA to fit within their work situation. Introna (2007) further argues that in the process of enclosing, design decisions become a taken for granted part of the technology. Whenever a design option was selected, the technology was further black boxed, and alternative design decisions pushed into absence. In the case of VKA, this can be seen both in terms of the options selected and implemented when developing the platform for the energy market, during the R&D-phase and implementation. VKA, therefore, becomes increasingly entangled in a sociomaterial nexus, and simultaneously increasingly difficult to unentangle and scrutinise (Introna, 2007).

4.5.2 Negotiations between the ER nurses' and the municipality's enactments

As mentioned at the beginning of this thesis, Halden municipality won the award *Smart City solution of the year, 2017,* presented by *Dataforeningen* (an independent professional community within IT in Norway). The jury's verdict was that by combining technology and care, VKA could be the answer to future challenges with an increasingly older population. They said that by the help of combining sensors, communication technologies, and health services, VKA gives a whole new patient experience after hospital treatment. The jury also stated that the solution could serve as an inspiration to other cities and municipalities (Buckholm, 2018). This win was often what was made present as a proof of VKAs success, both on the municipality websites (Porter, 2009), in newspaper articles, and by the mayor in his new year's speech. In the speech, the major emphasised VKA as one of the highlights of the year, describing it as an innovative technology that provides security for patients, a better service delivery, and decreased expenses for the municipality (Edquist, 2019).

On the municipality's website, VKA was also presented with a textual description as well as some pictures and a movie that illustrates how the virtual clinic works. This was an example of how people working within the municipality could engage with enactments of VKA by writing texts and demonstrating its use and success through moviemaking. The movie and the text on the website describe and help to enact VKA in a certain way. In the movie, VKA is presented as a solution that enables patients to feel safe in their home, and as a successful part of the daily operations in the home health care (Halden municipality, 2018b).

In other words, what was made present in websites and newspaper-articles was an award-winning Smart City initiative that is innovative, future-oriented, a safe service for patients, and resource efficient in terms of human resources and hospital spots. What this illustrates is that VKA as both a Smart City initiative, and as a means to save expenses, was a central enactment for the municipality, and there seems to be no problem conflating the two into one object. This singularity was achieved by assuming that utilising

technology in a health care sector was a way to improve the efficiency of service delivery.

However, the municipality's versions of VKA, the version of a system that is worthy of winning a Smart City award, stood in significant contrast to the version that was made present by the nurses at the ER. As portrayed in Section 4.4, the nurses enacted VKA as a short time clinic as something that was being tested when the ER was closed for the public. In their practice, the VKA-system had instead become a response centre for digital safety alarms, a system that was not safe (due to previous technical errors and curren user-errors), and relatively unsuited for their work context.

The municipality's enactment of VKA, when winning the award, or made present in newspapers, was making the reality of the nurses at the ER absent as Other. One way to look at this is that at times, when VKA was winning awards or was portrayed in newspapers, it was being represented as the concept that initially was designed, and thus detached from what had emerged in the practices at the ER.

These conflicting realities had, however, no problem with coexisting, as they rarely came together. They were not trying to occupy the same spot, as they were separated in some sort of distribution. Nonetheless, when they occasionally were crossing paths, the conflict between the two enactments became visible. This became even clearer for us when one of our informants told us about how the news about the award was welcomed at the ER:

> *The final straw was when Halden municipality won an award, they got an award for this wonder, and when this was conveyed to the ER-nurses, I believe it created some kind of clash, as the municipality, VKA and eSmart [Systems] won a price, all of them get a price, and they [the nurses] are left struggling with a system that is not that flexible, it's not as streamlined as it should be, and it creates periods of more trouble than value.*

Public newspapers and speeches aside, when we were talking with representatives from the municipality, it could seem like what appeared in the ER nurses' enactments were beginning to make its way to the municipality, as they were making some of these present

in their enactment. Sophie told us how the process after implementation was filled with both technical issues and issues related to the user interface of the system. As Sophie told us:

> *We have not been quite happy with how they [eSmart Systems] have not been able to make a good interface [for the nurses], this is the next step now.*

She also argued that the presence of Peter in the process could be quite beneficial for the further development of VKA:

> *I believe that he [Peter] can get involved and influence in a completely different way than we can.*

Peters role as an intermediary between the different enactments will be described in the following section.

4.5.3 Mediating between the different realities

As mentioned in the previous sections, both eSmart Systems and the municipality were at times making the problems at the ER present in their enactments, talking about the issues related to the interface and user friendliness on the nurses' part, amongst others. During our field trips, we frequently heard about a plan to develop a web solution that would be more tailored to a health care setting. This suggests that in more recent time in the negotiations between the realities, the reality of the nurses had been given more weight. However, because of the recourses required to develop a web-solution, and the negotiations around who was going to cover these costs, the decision to begin developing such a solution had not been settled at the time of our research.

What had been set in motion at the time was an effort to explore the design of a new web-solution. Peter was hired by eSmart Systems in April 2018, after VKA had been implemented at the ER. He was formally appointed to be a domain expert on medical measurements, consulting the integration of different health measurements in the envisioned developments of VKA. However, Peter had initiated the task to find ways to

better the system for the nurses at the ER. He was doing this by spending a lot of time at the ER while designing prototypes of a web-solution for the response centre.

Peter was currently employed in eSmart Systems, had worked in the municipality for a long time, and had experience from working at the ER in Halden. He was familiar with the three different practices. During our research, we became aware of how Peter was trying to coordinate the realities that he was a part of, and it could be argued that he was an intermediary between them. The sketches Peter made of the envisioned web-version of the system was making present the practice of the nurses at the ER (Figure 13), at the same time as he was enacting the future vision for VKA with advanced measurements (Figure 14). This could indicate that he was in the crossroad between different enactments of VKA and had to find ways to reconcile them.

The sketch (Figure 13) illustrates how measurements of oxygen saturation, top-flow and the pulse can be combined to calculate risk levels. What remains absent but manifest, is that Peter in this prototyping activity also partakes in enacting VKA as a generic platform. The idea presented in the sketch is based on the reuse of one of the three general concepts in the platform (explained in Section 4.2.3). This concept allows the sensor to be related through a network with a specific owner. In this way, different measurements associated with the same patient can be added together.

***Figure 13**. Screenshot nr.1 from prototype made by Peter, illustrating a more user-friendly interface*

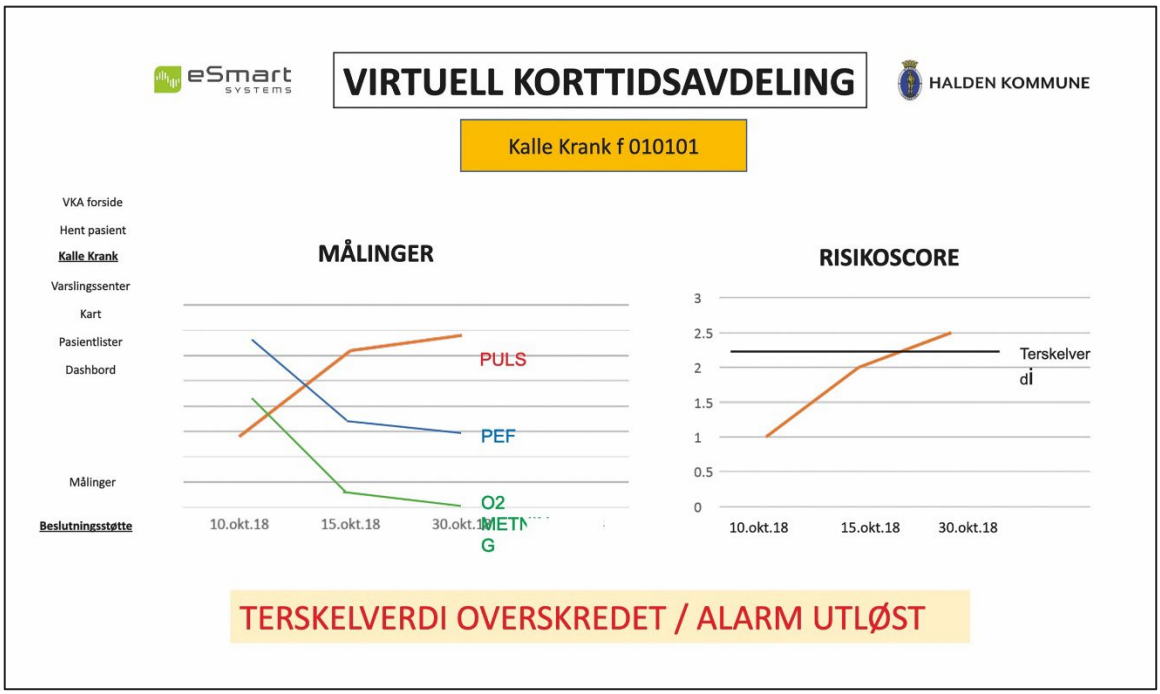


***Figure 14.** Screenshot nr.2 from porotype made by Peter, illustrating advanced measurements.*

Peter was also determined about trying to accommodate his solution to the logistics at the emergency room, such as the nurses' work processes and needs, but also their hinterlands by making sketches that were similar to systems the nurses were familiar with. To cater to the needs at the ER and to facilitate a more effective task execution, he gave more weight to important information about tasks and patients, and less weight to the map in the user interface (see Figure 13). In addition, he sketched out ideas to show how to make it easier and faster for the nurse to create tasks during or after communicating with a patient.

The efforts presented in his sketches reflect how Peter was working to create more singularity between the different enactments of VKA. Firstly, he was combining VKA as a configuration of generic components and as an advanced medical system by illustrating how the concept of sensors in a network can be utilised to combine different medical measurements. Secondly, he was trying to find the middle ground between the nurses' reality and eSmart systems' practices of re-using generic components. *"My desire is to find a good way to reuse what we already have in the system"* (*Peter, Doctor*). Thirdly, it illustrates how he wanted the nurses to get a system that is more adjusted to their needs, so that VKA could become enacted by the nurses at the ER as a system that is more coherent with the way the system is made present in newspapers and at award ceremonies.

4.5.4 After our involvement

After we had completed our field research, things have happened in relation to VKA that has not been included in our analysis. Since the beginning of 2019, the system has over 200 digital alarms connected to it. According to one of our informants, there has been fewer errors and user-complaints about the system at the ER. The users of the system at the ER have become more satisfied with, and confident in, the system. The municipality and eSmart Systems are currently discussing further development of VKA, including the development of a more user-friendly web-solution, health measurements, and decision support with artificial intelligence, amongst others.

5 Discussion

In the previous chapter, we addressed the first research question concerning how a Smart City initiative within health care had been enacted in planning, development, implementation, and use in a Norwegian municipality. We did this by presenting the stories of the different practices comprising the Smart City initiative and used theories and concepts from the literature concerned with sociomateriality as a sensitising device. In this chapter will focus on the second research question that was presented in Section 1.3.

2) *What can we learn about Smart City initiatives by applying a sociomaterial lens?*

In the following sections, we will discuss the main learnings we acquired when investigating a Smart City initiative and its comprising practices with a sociomaterial lens. The discussion starts off by arguing for how we can understand Smart City as a means to a goal for the municipality, followed by a section concerning the complexity of the Smart City initiative. In Section 5.3, we deliberate around how the municipality and eSmart Systems enacted the Smart City initiative and how this relates to technology-deterministic world views. In the section that follows, we discuss the usefulness of a sociomaterial lens to describe how VKA became something different in the ER nurses' practices then what was enacted during planning and development. We will take this further by discussing appropriate approaches to capture the continuous negotiation between enactment that occurred after implementation. In Section 5.5 we attempt to challenge the notion of generic systems, and discuss why enacting technology as generic can contribute to its rigidity. In the final two sections of this chapter, we present some suggestions for practitioners wanting to develop Smart City technology and the limitations of this study.

5.1 Smart City as a means to a goal

The overarching theme in this thesis has been Smart Cities, and our study is, amongst others, an empirical investigation into how a municipality and a software development company has approached the Smart City agenda in developing and implement a Smart City project.

As we have argued for in the introduction of this theses, the Smart City agenda is not a single agenda, nor can it be reduced to any specific set of interventions or technologies. Cities are economically, politically, culturally diverse and many are faced with urban problems of a different nature. Hence the Smart City agenda is interpreted and translated to fit with their own goals and priorities. This understanding of Smart Cities is built on the work of Haarstad and Wathne (2019). In their study, they found how Smart City practitioners are actively taking part in framing the agenda during implementation and practice (see Section 1.2.1). As we have seen in the case of VKA, local actors such as Sophie, Eric and Hannah have played an active part in framing the Smart City agenda for Halden municipality in implementation and practices.

First of all, the municipality was faced with a particular set of challenges. Halden was a so-called ROBEK-municipality, which meant that the municipality had to be under economic supervision until it managed to turn around its unsustainable economic situation. The expected growth in the share of older people in the population, as well as the increased responsibilities and health care expenses for the municipality from the new health reform (Samhandlingsreformen), placed a further strain on their available budgets. Hence, they needed drastic measures to meet their responsibilities more effectively.

Further, they had political ambitions to help grow a thriving community of actors involved in science, innovation and technology in an area called Halden Innovation Park. It was important for them to establish collaborative relationships with this community to be able to draw on the knowledge and technology to innovate their public services. In the case of VKA, collaborating with eSmart Systems gave them access to expertise on advanced technology such as artificial intelligence, Internet of Things and generic platforms.

All of this created the situation from which they pursued the idea of Smart Cities. In other words, the Smart City initiative became a way for Halden municipality to get out of the ROBEK-list by nurturing a local community of knowledge and innovation and finding more efficient ways to meet their responsibilities regarding patient care. Our understanding of the Smart City concept is therefore in coherence with Haarstad & Wathne (2019), arguing that Smart City should be understood as a means to a goal rather than a goal in itself.

However, even if our findings agree with the notion that Smart City can be understood as a means to achieve specific goals for Halden municipality, we will argue that this does not mean that the Smart City initiative has become something unified and singular for all actors engaged in its planning, development, implementation and use. Neither does it mean that high-level stakeholders within the municipality involved in planning and development necessarily has a good understanding of the local contexts or the everyday life of urban citizens in which the initiative will serve its cause. The world is much more complex and messy than allowing Smart City initiatives to be summed up and captured in its totality trough simple and singular goals or visions for urban change. As the Smart City initiative was interpreted and translated at different local sites and practices within the municipality, it was also becoming something more complex. These are some of the issues we will go further into in the following sections.

5.2 The complex life of a Smart City Initiative

At the outset of Chapter 4, we explained the ambiguity we experienced during our research period around what we were trying to study. Our very first encounter with VKA, was Eric's demonstration of the user interface of a test version of the system, followed by our own exploration of its functionality and usability. Early on, we believed that we had a quite good understanding of what VKA was. It was as a digital health care system that was enabling patients to stay at home after a hospital stay, by connecting them to a response centre that was connected to the home health nurse. However, as we carried out our field research, we noticed how our object of interest, the object we initially thought was quite well-defined and distinguishable, were starting to change.

When talking with representatives from the municipality, it became clear that they, in addition to enacting it as a short time clinic with its planned functionality, were also enacting VKA both as *a Smart City vision* and as the *starting point of a Smart City top-system* in the municipality. As our research went on, and we followed the object into more of the practices associated with VKA, the object under study further multiplied. When talking with representatives from eSmart Systems, we noticed that we more often were talking about VKA as *a technology built on a generic platform*. At the same time, what was made present at the ER, when we were talking with the nurses and observing their practice, was that VKA was a *virtual short time clinic that was being tested*, a *system for handling safety alarms*, as well as an *"unsafe system"*.

Our object under study was changing and moving from one site or interview to the next. What we initially wanted to do, to look into the development and use of one digital artefact, could not be done the way we initially set out to, as it turned out we were not investigating *one* object. We were exploring the complex life of an object in a world without permanent closure, where the object was continually being enacted. The Smart City initiative (or VKA) was an object that "moved and slipped between different practices in different sites" (Law, 2004, p.79), and as VKA moved and slipped, it also changed in its shape and name.

As we have tried to illustrate in this thesis up until now, the world is complex and messy. Even though we have not given an account of the complete messiness of the world surrounding VKA, as would be nearly impossible, we have tried to demonstrate how complex reality might be. Different practices can enact a Smart City initiative in quite different and often contrasting ways. We will argue that, in the same way as with Law and Mol's (2008) Cumbrian sheep, or Mol's atherosclerosis (2002), VKA is continuously being created as multiple objects within its many sociomaterial entanglements. The different realities are being created within the different practice's method assemblages. Hence the practices hinterlands affect what in made present and absent.

5.3 VKA from somewhere

One important aspect we have tried to illustrate throughout this thesis is that a Smart City initiative (such as VKA) does not simply appear out of nothing. From the very first project meeting, the space of opportunities for the project members to explore was already limited by all that had already transpired in the history of humans and artefacts. Hence, what we will argue in this section is that Smart City initiatives are fundamentally sociomaterial, as they are assembled within hinterlands and practices of local actors participating in planning and developing them.

In the negotiations that took place among project members, statements about what VKA was (or was supposed to be) was made by referring to hinterlands of health care practices, national guidelines for innovation and welfare technology, political ambitions for the municipality, socioeconomic conditions, laws and regulations, technological affordances, IT practices and so forth. In other words, during planning and development, the Smart City initiative had to make sense for both people working within the municipality and eSmart Systems, based on their communities of practice and hinterlands.

The development process can be seen as a negotiation between different practices' method assemblages, where some things were made present about VKA, and other things were made absent. As we have seen in Chapter 4, VKA was at times enacted as *a*n *R&D-project*, other times as *a health care service* or as *a generic platform*, to name a few. In other words, the development and planning that actors from eSmart Systems and the municipality engaged in can be seen as a process were negotiations between these different enactments took place. In the following, we will look closer into this.

5.3.1 Crafting VKA in a hinterland of bureaucracy

For the municipality, the Smart City initiative had to make sense within the frames of a municipal R&D-project. What was made present about the Smart City initiative in this enactment was the specific project goals, project activities, an organization of project members, responsibilities, partnership-agreements, and a fixed budget and time frame. These practices had important implications, for example when it came to how and where decisions were made, or who got invited to have a say at project meetings. Municipalities

are known for having a high degree of organizational silos. As Sophie was telling us, most municipalities are often divided into sectors, and when making new technology they would often focus on one area at the time, such as health care. Halden municipality, on the contrary, aspired to create a top-system that did not have these limitations.

Even though the municipality aspired to create a system that was unhindered by silo structures, it could be argued that the community of practice were still creating realities reflecting a bureaucratic hinterland. When it came to the planning and design of VKA, it could seem like the process had unfolded in a hierarchical and linear manner rather than agile and iterative. To illustrate, when the municipality were talking about user involvement in the development, they would focus on their inclusion of leaders, instead of the day to day-users. Activities for user involvement was not a part of development practices, and making decisions on use, work arrangements or the like, was left to high-level stakeholders in the municipality or eSmart Systems. The users would rather be given extensive training in the system after implementation. These bureaucratic structures in the municipality can be seen as being continuously enacted and maintained in the everyday practice of public officers, and is thus hard to transform in two shakes of a lamb's tail.

However, Mol (2002) argues that if realities are being enacted and maintained in everyday practices, these realities can also be unmade. Public officials could in theory decide one day to invite nurses to workshops and focus groups and allowing them to have a say in decision-making that will have an effect on their everyday work situation. However, when statements about reality within a community over time have accumulated into a sociomaterial assemblage of material artefacts and human practices, they become a taken-for-granted part of reality, and thus alternative ways of organizing have been othered. In other words, their reasoning about things like user involvement, decision making, hierarchies and silo organization has been stabilized and black boxed in their enactments.

5.3.1.1 Othering the nurses' practical work in bureaucratic practices

Because the Smart City initiative was enacted within bureaucratic and hierarchical developing and planning practices, high-level stakeholders played an important part in

assembling the reality of the virtual short-term clinic (VKA). An important part of their planning practices was, for instance, to define and describe what VKA-nurses and VKA-patients were. This brings us to another central enactment we presented in Chapter 4, namely VKA as *a municipal health care service*. The nurses at the ER were chosen to function as VKA-nurses (operators of the response centre) based on their care competency and experience with managing safety alarms. The higher-level stakeholders involved in the planning made the VKA-nurses present in their practices by crafting new job descriptions and making new collaborative work arrangements. These practices, however, also made all other work circumstances at the ER absent. Firstly, the ER-nurses' work was made present as their tasks and responsibilities as VKA-nurses, such as to monitor the system and coordinate tasks with the home health nurses. Secondly, the nurses' many other tasks and responsibilities as ER-nurses, such as to treat patients or coordinate their tasks with the general practitioner at the ER, was othered. Consequently, this was reducing the complex work-situation of an ER nurse to simple job-descriptions and coordination tasks, and it could seem like VKA was being enacted as something independent of local practice and contingencies.

5.3.2 Crafting VKA in a hinterland of reductionism and generic system development practice

The reductionist and isolated (from local practices and contingencies) representations of the health care domain, as described above, seem to easily co-exist with a third central enactment. Namely, eSmart Systems' enactment of VKA as *a configuration of generic concepts* on a generic platform. As we described in Section 4.2, eSmart System business model is based on developing domain-agnostic technology, and are particularly concerned with reusing their generic platform and its associated generic concepts to create synergies between different products. Hence, VKA was developed by reusing generic concepts already used in eSmart Systems' product for the energy market, developed to support the work of grid operators. Their idea here was for instance that both measuring the blood pressure of a patient and measuring the voltage of a high-voltage wire could, in theory, be reduced to the same general concept. This was consequently making present the commonalities between them as well as othering their specific characteristics. Hence, in these practices, nurses, grid operators, patients, high-voltage wires, work-tasks, coordination work are all enacted in ways that reduced them to

their generic characteristics. eSmart Systems seemed to be enacting reality as something possible to reduce into generic rules and concepts, and consequently, the methods they used to assemble VKA was reproducing a reductionist reality.

In Section 4.3, concerning VKA as a top-system, we saw how the municipality was also partaking in enactments that made VKA present as domain-agnostic. During our interviews, we heard about how the Smart City initiative, in theory, could have been initiated within any of the other sectors in the municipality. This was because what they had developed for VKA was, according to Sophie, equally relevant for the fire department, water management as well as other municipal domains. VKA was here enacted as a *seed to a future top system* for the municipality, as part of the municipality's overarching Smart City vision to create a system breaking down the silo-organisation within the municipality. This would also allow them to create synergies between different sectors such as water management and health care by enabling them to share the same data (a future scenario illustrating this can be found in Section 4.3). This can be seen as the rationale behind why it made sense for the municipality to partake in eSmart Systems' enactment of VKA as a generic and open platform.

5.3.3 Enacting a technology-deterministic world

In this section we have seen how the Smart City initiative (VKA) was assembled in the practices of the municipality and eSmart Systems through sociomaterial negotiation. Both the municipality and eSmart Systems were partaking in enactments of VKA as something isolated from practices and contingencies at the ER. It seemed like they assumed that what was crafted and molded as representations of reality (both in terms of the technology, sketches, job descriptions, etc.) at the drawing table would have a deterministic force in shaping the social to conform to its design.

This is similar to the technological determinism that is typical for conventional system practices and methods for development that is usually based on rigid distinctions between design and use (Maniatopoulos, Mcloughlin, Wilson, & Martin, 2009). Here, technological capabilities and capacities are seen as stable across use contexts and as the sole driver of change. Similar to our case, users are typically not involved in design and hence seldom experience a feeling of ownership to the technological solution. The

municipality and eSmart Systems were seemingly sharing this technological deterministic enactment of reality, which could be one of the things that was enabling them to coordinate their efforts in the Smart City project as well as pursuing their Smart City vision.

This is similar to many other Smart City project according to Dameri & Rosenthal-Sabroux (2014), "A lot of Smart City projects have a technological-deterministic nature. They build upon the belief that (new) media and ICT solutions can improve life in the city and that technology is the main driver to solve the complex societal challenges we face in contemporary cities" (p. 175). What is interesting in this excerpt, is the point that a certain worldview is influencing the approach to building Smart Cities. Below we will present an argument on how the actors' enactments of reality had consequences for how they enacted smartness in their planning and developing practices for VKA.

5.3.4 Enacting Smartness

When enacting a reality in a world where there is no single truth, practices are simultaneously enacting what Law (2004) calls *the good* and *the bad*. This implies that different realities might be contradictory. However, they are both enacting the good. In other words, what is made present as *the good* in one enactment, is not necessarily made present as *the good* in another enactment. Here, we would argue that our case illustrates how different enactments of reality can entail prescribing value to some technologies over others. When enacting reality as singular, reductionist and generic, developing domain-agnostic technology and open platforms becomes *the good.* If the work logistics in health care, power grid management, water management etc. can be reduced to the same generic concepts and rules, identifying them and building on them would be valuable. It would enable the municipality and eSmart Systems to deliver functionality to new domains faster and at a lower cost, relative to technological solutions developed for a very specific purpose and use. In contrast, developing specialised software for each specific municipal domain becomes *the bad* technological choice for building a Smart City within this enactment of reality, because this would be unnecessarily expensive and time-consuming. Overall, we can conceptualise this as eSmart Systems' way of enacting smartness, as the generic capacity of technology.

If we believe the idea of enacting smartness to be true, this also means that there can be alternative ways of being *smart* that are othered. If we do not partake in the enactment of reality as singular and technology-deterministic, we might make other judgments about appropriate 'methods' to plan and develop Smart City initiatives. For example, if we share the underlying ontology of this thesis, which assumes that reality as being brought in to being in practice, this also implies that VKA can become something else then planned for when implemented into the nurses' practice and entangled in the sociomaterial nexus at the ER.
One could hence argue that if the municipality and eSmart Systems had been more aware of the ER-nurses' practice and reality, both before and after implementing the Smart City initiative, the system could have been better tailored to its users. As reality is enacted in practice, practitioners, aspiring to implement Smart City initiatives into existing sociomaterial assemblages, should get to know these practices and their realities, both before, during and after implementation.

This is the underlying ontological stance that has informed our approach to generating knowledge about the world in this thesis, which in turn have other implications for what becomes smart (or the good). We will make such suggestions in Section 5.7, but first, we will illustrate our point about reality as generated within sociomaterial networks by discussing how VKA became a part of the ER nurses' everyday work situation through a continued negotiation after implementation.

5.4 A continuous sociomaterial negotiation after implementation

Like we have seen in Section 4.4, implementing VKA at the ER implied many changes to the nurses' everyday work situations. Like other scholars using theories and concepts related to sociomateriality, (see, e.g., Aanestad, 2003; Aanestad et al., 2017) we have also made a case for conceptualising the implementation process as introducing changes to an existing sociomaterial configuration. This means that we need to take in to account how VKA negotiated its place within an already existing assemblage of sociomaterial elements at the ER.

For the nurses at the ER, VKA changed their roles and responsibilities as well as their relations to other actors such as patients and home health nurses. For example, the ER nurses were given a new responsibility to make clinical evaluations of patients calling in, as well as a new way to coordinate their work with the home health nurse by sending assignments using the VKA-client. However, since the nurses and their work tasks had connections to many other things in the sociomaterial nexus at the ER, making alterations to the existing configuration by enrolling new actors (like the VKA-client and VKA-nurses) had further ramifications.

Followed by the implementation was a period with efforts to 'localise' VKA to fit within the local work conditions at the ER. In this process, new needs and issues surrounding VKA appeared, issues that were not made present during planning and development. Several issues were related to the difficulties in appropriating and adapting VKA to existing work conditions and usability issues regarding the user interface of the VKA-client. One example was the nurses' struggles to be able to hear the alarm triggered in the VKA-system when treating a patient visiting the ER, in another room. This particular issue was solved by installing a speaker in the hallway. Other issues were met by placing procedures and checklist around the VKA-client, amongst others.

However, many usability problems still prevailed, and the user interface was cumbersome and afforded little ease of use for the nurses. In addition, the nurses' previous experience with breakdowns seems to affect their current impression of the safety of the system, even if many of the technical issues had been solved. As a result, VKA was enacted as something referred to as 'works maybe sometimes' and 'unsafety alarms'.

When we observed the ER nurses and talked to them about their use of the VKA-client we realised that VKA as a short-term clinic was rarely used at the ER, one of the nurses had for instance never actually answered a call from a VKA-patient. In most cases VKA was something the nurses had to test before the ER opened, to rule out any potential technical problems. In addition, because the regular safety alarms were connected to the same platform as VKA, the VKA-client, for the most part, served as a new way for the nurses to handle the regular safety alarms.

What had emerged in the ER nurses' practices after the process of sociomaterial negotiations, was a version of VKA that in many ways was different then the version enacted by eSmart Systems and the municipality during planning and development.

These findings are consistent with other studies examining how users partake in design when trying to make sense of and appropriate the technology into their everyday life. The underlying argument made in studies concerned with so-called design-in-use is that design is never 'finalised' before after it has been put into use (Aanestad, 2003). Grisot and Vassilakopoulou (2013) use the concept of *technology enactment* to argue that "parts of the technological capacity planned and made available to prospective users may remain underutilised or become misappropriated as the functionality offered does not always match the objectives of the users" (p. 172). In other words, functionalities planned for in design is not always being embraced by users, or users might use them in unexpected ways. As we have demonstrated in this thesis, a sociomaterial lens and the use of concepts from ANT and material semiotics can serve as theoretical tools to examine and explain a design-in-use situation. However, our research scope extends beyond the use-situation as we also have examined enactments of VKA in the practices of eSmart Systems and the municipality. Further, our theoretical framework has also been concerned with the multiplicity of objects, which will be discussed below.

5.4.1 Negotiations between enactments

During planning, development, implementation and use, the Smart City initiative is interpreted and negotiated among local actors within both the municipality, eSmart Systems and the ER. We have argued for how the Smart City initiative becomes different things when enacted by different people or communities of practice, or in other words, it multiplies. As we have seen in this thesis, VKA was both a *configuration of generic components*, *an unsafe way to manage safety alarms* and *an award-winning Smart City solution*.

This way of looking at the multiplicity of technological innovation is different from many scholars who study the design of technology. The distance between design and use can often be great both in time and space, which can explain why the literature seems to be

characterised by a divide between scholars focusing on the design-before-use or design-in-use (Carroll, 2004; Orlikowski, 1992). Scholars focusing on the design-before-use typically gives less attention to how technology is shaped after implementation (Orlikowski, 1992). Scholars limiting their scope to the design-in-use risks ignoring the sociomaterial processes that transcend the physical construction of the technology (See; Aanestad, 2003; Aanestad et al., 2017). Carroll (2004) calls for more research on the inter-relatedness between these two processes. We believe that this thesis demonstrates how a sociomaterial lens and multiplicity can be useful for this purpose.

In Section 5.3 we illustrated the sociomaterial process that VKA was "born out of" during planning and development, and so far in this section, we have shown how VKA became something different through a process of sociomaterial negotiations after VKA was implemented at the ER. If we had stopped our analysis here, we might assume that the "makers" stop enacting the planned version of a system whenever the system is put into use and coordinates their enactment with the version that has emerged in use. However, as pointed out in Chapter 4, the way VKA was made present in the practice of nurses at the ER was quite different than what was made present by the municipality and eSmart Systems, also after the system was implemented at the ER.

By using the theoretical framework laid out in this thesis, we will argue that the version that was made present by the municipality and eSmart Systems in the planning stage didn't necessarily seize to exist after the technology was implemented, neither did it achieve singularity with the version enacted in use. Further, we will argue that VKA at the ER is entangled in these 'other versions' of VKA which all play a part in the further evolution of VKA. In other words, we argue against researchers *othering* the enactments of the municipality and eSmart Systems by only limiting the scope to the ER.

5.4.1.1 Local entangled in the global

One example of an enactment of VKA that did not end after implementation is eSmart Systems' enactment of VKA as *a generic configuration of components*. As seen in Section 4.2.5, even if new needs and issues related to VKA appeared in the nurses' enactment, many considerations related to VKA as a *generic configuration of components* had to be made before any changes or addition could be done to VKA. When Hannah

tried to communicate the issues they experienced, and needs that were made present in their use of VKA, eSmart Systems had to consider whether these changes also made sense for other products sharing the same platform and generic components. This can be seen as an example of how the local version of VKA was entangled in the global when some of the changes the nurses needed were considered going against the generic (or standardised) elements in the generic platform, or in other words, the version enacted by eSmart Systems.

5.4.1.2 Conflicting realities

In our analysis, we have also seen (in section 4.5.2) how VKA at a particular time existed as two conflicting enactments. At the ER, the nurses enacted VKA as a system that '*works maybe sometimes'* and as *'unsafety alarms'* due to the problems they had experienced when trying to appropriate and adapt VKA to their work conditions. In addition, VKA as a short time clinic was made present as rarely being in use and the system was rather a new system for regular safety alarms. In parallel with the nurses' enactments, the planned version of VKA, the VKA that was an award-winning concept, continued to live on in the enactments of the municipality and eSmart Systems. This was illustrated by how the municipality and eSmart Systems were enacting VKA as an operational, resource efficient, and award-winning system in newspaper articles and at web pages. In this enactment, the reality of the nurses at the ER was being Othered.

5.4.1.3 Entangled in the future

As we saw in section 4.3, VKA was also being made present as a seed to a future top system in the municipality, as well as a future system for advanced distant health measurements. This illustrates how VKA also was entangled in ideas about its future development. An essential part of this was the idea that VKA was an open platform that could be connected to all sorts of sensors from water meters, energy meters and VKA-alarms. This, for instance, made the way for connecting the regular safety alarms to the VKA-platform, and was the reason why the ER nurses now use the VKA-client to manage the regular safety alarms. We have also seen how Peter was trying to coordinate this future vision with emerging needs and issues at the ER in his prototyping practices. When making prototypes, Peter was exploring ways to reuse generic components in the

platform as well as ways to accommodate his solution to the logistics at the emergency room.

5.4.1.4 Entangled in the past, present and future

Based on what we have discussed in this section, we will argue that VKA can be seen as entangled in the past, present and future. The municipality and eSmart Systems are continuing to enact the planned version after implementing VKA at the ER, a version that in turn is entangled in multiple sociomaterial relations and hinterlands. VKA is also made present as a future vision, and thus entangled in ideas about the future. The fact that VKA can exist as conflicting realities – prize winning in one place and as something seldom in use that *'works maybe sometimes'* in another – tell us something interesting about the world stakeholders believe they are building and how the realities they enact might fail to see its way into the life of urban citizens.

We believe that the entanglement of different enactments is important to recognise since the negotiation between them can play a central part in the further evolution of VKA. It is therefore usefull to have a broader scope than just the use-situation when examining Smart City initiatives, especially since smart visions are an accumulated result of many projects as well as all that occurs in between them.

5.5 Enacting a generic technology by othering its heritage

As this thesis has shown, the Smart City initiative was fundamentally sociomaterial. As time went by, VKA was increasingly entangled in a web of sociomaterial relations, all playing a part in determining what VKA was becoming - VKA was entangled in past, present and future. As we also have seen, the nurses at the ER had limited voice in the development process, and the main actors deciding what the initiative was going to be was the municipality and eSmart Systems, through their negotiation of enactments. However, what we discovered a while into our research period, was that the actor that might have the strongest 'capacity for influence' in the development process, was the platform itself. The technological affordance of the platform, in combination with eSmart Systems' practices and business model, focusing on domain-agnostic technology,

consequently caused many alternative design-options for VKA to be closed off from the start. In other words, many "design-decisions" were already determined by the platform prior to the development of VKA. For instance, the interface for the VKA-client as well as a lot of functionality was already developed before the R&D-project.

Since technology is constituting and being constituted in sociomaterial assemblages, and as Introna (2007) argues, that any technology is the outcome of a complex, subtle and situated social process, the generic platform was inherently sociomaterial. If we try to open up the black box of VKA and fold out the many connections across time and space in its hinterland, we can see that it has also been about making health care fit into a platform originally developed for the energy market. How to view patients on a map, how to answer calls from patients etc. are all functions inherited from the system used by grid operators, and many of the issues experienced by the ER nurses stem from this. Still, eSmart System is making the platform present as generic in their practices. They assume that the generic concepts and technology can be transferred and made useful in any domain. This is illustrated in the analysis by Adam telling us about how it would be perfect for the nurses to view the patients on a map, a functionality that is useful for grid operators, while the nurses had not found the map to be useful in their practice.

As we have seen, a lot had to be done by the nurses to be able to appropriate the technology as it was difficult to ‘fit’ within the logistics of the nurses’ everyday work situation as well as difficult to learn and cumbersome in use. The nurses had checklists and manuals on the wall, and other measures were done to try to mend these issues. Many of the issues were related to the fact that the VKA-client was originally made for a different purpose and domain. This resulted in the map taking up most of the screen even if it had no use for the nurses or the mismatch between the need to monitor the VKA-client and the mobility demanded by the nurses’ many other tasks at the ER.

Another way to look at this is that when eSmart Systems is enacting their platform as generic, they are also othering its constitutive history. This realisation raises questions about so-called generic or domain-agnostic technology. Which is by many seen as a potential Smart City enabling technology (see, e.g., Jin, Gubbi, Marusic, & Palaniswami, 2014; Rathore, Ahmad, Paul, & Rho, 2016). What can be argued based on our case, is

that even if a technology is made present as generic, it may still have hinterlands (heritage) reflecting a specific domain and purpose. This hinterland is consequently being Othered, as it does not fit with the enactment of generic technology. The hinterland of the particular technology becomes black boxed part of the technology and thus becomes increasingly difficult to scrutinise and untangle from the sociomaterial assemblage.

In the case of VKA, the developing process hence became more about imagining ways to repurpose existing technology, which created a sort of rigidity in terms of limiting the potential design-alternatives to explore. Further, this forced existing sociomaterial configurations in the health care sector to bend and break to try to accommodate the work logistics of grid operators, that had been black-boxed in VKA, to their own work logistics. What this illustrates is that even if the technology is enacted as generic, it is not necessarily flexible in terms of being adaptable and responsive to local practices and contingencies. The rigidity caused by eSmart Systems' enactment of VKA as generic was also seen in their ability to respond to needs and issues related to VKA that was made present in the ER nurses' practices. We will go further into this below.

5.5.1 Standards vs. local needs

Attempting to create a platform with generic components that can be used in any domain can be seen as a way of standardising. The argument that any changes in the platform to accommodate to the nurses' needs had to make sense for the other products on the platform is coherent with the argument of Grisot and Vassilakopoulou (2013) that standardisation can lead to rigidity. They argue that the global and the local are entangled, where the global is understood as the universal and standardised (the generic version), while the local is understood as the emergent user needs (the ER nurses' version). In their case study on a patient centred portal in Norway, they found that a continued sociomaterial negotiation between standardised and generative elements[8] occurred after implementation. The patient portal had to be in line with laws and regulations, such as having the login standard BankID, however, as new needs emerged in use, they implemented an easier way to access less sensitive data and functionality. This entanglement of the global and the local can also be seen in the case for VKA, as

[8] Emerging needs based on local variations

illustrated by the way eSmart systems did small changes to accommodate the nurses' needs, but only if the changes were making sense for other products sharing the platform.

As we have seen, eSmart Systems were at times not able to cater to the version that evolved out of local negotiations at the ER. One reason seemed to be that the local emergent version at the ER was subordinated to the global outreach of the generic platform. The hierarchies that emerged was institutionalised in eSmart Systems' practices and organisation. This can be illustrated by how they established a product team that was to ensure synergies between products and determine the generic value of any changes or additions. In addition, the Saas-agreement between the municipality and eSmart Systems created further rigidity. The agreement stated that eSmart Systems would only cover costs if related to functionality that was already agreed on during the R&D-phase. However, as we also saw in section 4.5.3, this hierarchy could at times be altered by actors that did not partake in the enactment of the hierarchy, such as eSmart Systems' employee Peter. He had become an important ally for the nurses at the ER and contributed to making their enactment of VKA present through sketches and prototypes of the planned web-solution.

5.6 Suggestions for practitioners developing and implementing Smart City initiatives

Based on our analysis and discussion on some of the things that became apparent to us about Smart City initiatives with a sociomaterial perspective, this section will present some of our suggestions for practitioners wanting to apply ideas on Smart Cities to urban development. We will argue that these suggestions are something Smart City practitioners can keep in mind when planning, developing and implementing a Smart City initiative.

Our first suggestion for Smart City practitioners is not to consider technology as a finished product, ready to apply into any social context. Practitioners wanting to develop Smart City initiatives should, therefore, consider a flexible approach that allows for adjustments to the technology to better fit its use practice, also after the technology has been implemented. This implies applying both a process (project vs Saas) and a technology (platform) that allows for an appropriate design-in-use process. As we have tried to illustrate in this thesis, humans and technology are constituting each other within

sociomaterial assemblages. Technology that is being implemented in an existing sociomaterial assemblage, thus have to negotiate its place in the given assemblage, which might result in changes to both the existing assemblage and the technology that is being implemented.

The second thing we would like to suggest is that Smart City practitioners should strive to become more aware of how their own hinterlands affect what realities they create. In other words, they should "open up the black box" of their own taken for granted assumptions about reality. As we have seen in this thesis, the municipality and eSmart Systems were creating VKA within hinterlands of bureaucracy and generic system development practice, affecting what they made present and absent. However, as Mol (2002) argues, if realities are being enacted in everyday practices, these realities can also be unmade. Perhaps it would be fruitful for Smart City practitioners to see how their own practices and hinterlands determine what realities they create in relation to the development of Smart City initiatives, and thus acknowledge the possibility for there being other, and maybe contrasting, realities. To illustrate this, if eSmart Systems and the municipality had asked themselves why they were enacting the ER-nurses as VKA-nurses, while othering their work and responsibilities as ER-nurses, this could potentially have open up for alternative ways of organising the development process.

The third suggestion we would like to give is that Smart City practitioners should question the "objectivity" of generic technology. As we argued in Section 5.5, the generic platform VKA builds on might not be as "generic" after all, as it has inherited most of its logic from the energy domain. Technology, even if it is made present as "generic", most likely have hinterlands of ramifying relations that have become a black boxed part of the technology. The notion of "generic" thus becomes a taken for granted part of reality for the given practice, and the specifics – the sociomaterial heritage - is being Othered. At the same time, standardisation is for many a *good*, as it saves time and resources, enables universal coordination, and enables the exploitation of pre-existing arrangements (Grisot & Vassilakopoulou, 2013). And we are not about to suggest that practitioners should create everything from scratch every time. Instead, we will argue that the interplay between the global and the local should be more flexible, that practitioners have both a development process and technology that allows for the exploration of new

configurations when utilising generic and standardised elements, both before and after implementation. This brings us back to the first suggestion in this section that technology should not be considered a finished product that will just slide into any sociomaterial assemblage, but rather something that has to negotiate its place in the given assemblage.

5.7 Limitations of the study

At times, when analysing and writing up this thesis, we experienced that there were some things that we could have inquired further into. In hindsight, we see that we could have conducted additional field research. We could have carried out more observations, and especially within the practices at the municipality and eSmart Systems. This would have provided us with additional insight into the complexity of the sociomaterial assemblages surrounding VKA.

In this thesis, we set out to provide insight into the development, implementation and use of a Smart City initiative for both scholars and practitioners. As we have argued, our theoretical perspective has proven useful for understanding the phenomena in a way that is useful for practitioners, and we have thus presented some suggestions for Smart City practitioners to consider when developing Smart City initiatives. However, the theoretical framework we put together has been quite challenging to grasp, even for us that have read a significant amount of the existing literature. Based on this, we will argue that the field of research that we have derived our theoretical framework from holds many concepts and terms that are difficult to use in a practical and everyday situation. Hence, we are uncertain about how applicable the theoretical framework has been to convey our research to others, both practitioners and scholars, that have not the same familiarity with the theoretical framework.

6 Conclusion

Many cities around the world have embraced the concept of Smart Cities as an approach to many current and future urban challenges. There is, however, little empirical evidence in the literature on how cities actually apply the concept of Smart Cities to urban strategies and development. This thesis can be seen as a contribution to this, as it is an empirical investigation of how local actors in a Norwegian municipality have engaged themselves in the planning, development, implementation and use of a Smart City initiative. The overall aim of the initiative was to solve some of the health care challenges faced by the municipality. Together with a local software developing company, called eSmart Systems, they developed virtual short-term clinics. This was a new way for the municipality to organise and deliver health care services through the use of 'virtual means' by utilising technology such as a cloud-based platform and sensor technology.

Throughout this thesis, we have strived to explore and give answers to our two research questions:

1) *How has a Smart City initiative within health care been enacted in planning, development, implementation, and use, in a Norwegian municipality?*
2) *What can we learn about Smart City initiatives by applying a sociomaterial lens?*

In our analysis in Chapter 4, we addressed the first research question by presenting the chronological unfolding of the smart initiative from its initiation as an R&D-project, to the development process, to the implementation and use at the Emergency room. Here, we focused on three important and different contexts, their practices and hinterlands, where the Smart City initiative have been negotiated and interpreted. Namely the public sector of Halden municipality, the software development company eSmart Systems, and the use context at the Emergency room. The stories were told by using theories and concepts from literature concerned with sociomateriality as a sensitising device. What we presented throughout Chapter 4 is the story of an object, VKA, that was changing both in its shape and its name, across time and space. VKA turned out to be different things for the different practices, it was multiple in its nature. Some of these enactments were seemingly coherent, while others were contrasting.

In the Discussion chapter, we answered the second research question, by putting forward and discussing the main learnings we acquired throughout the analysis. In the following, we will summarise these learnings.

Firstly, we have illustrated how the Smart City initiative was assembled within practices of the local actors participating in planning and development. These practices were situated within hinterlands that conditioned what realities that were produced. VKA was created within the municipality's bureaucratic and hierarchical developing and planning practices, as well as eSmart Systems' generic system and development practices. VKA was consequently enacted in a way that was othering the local contingencies and practices at the ER. Hence, we have argued for how eSmart Systems and the municipality shared a technological-deterministic world view, which we also found is typical for many Smart City projects. Further, we have seen how world views have implications for how actors enact smartness. In our case, we have seen how smartness was enacted as the generic capacity of technology, which made the generic platform that was already developed by eSmart Systems an appropriate choice for the development VKA.

Secondly, we argued for how the Smart City technology under study was fundamentally sociomaterial. During planning and development, VKA was being increasingly entangled in a web of sociomaterial relations through time and space. It was being entangled with elements such as iPads, safety alarms, eSmart Systems generic platform, regulation for documenting patient consultations, existing health care recourses in the municipality, new job descriptions for the nurses, new work arrangements, established system requirements for development and so forth. Consequently, VKA was becoming increasingly difficult to untangle as it was becoming a stabilised and black-boxed part of reality, even before the system had seen the light of day at the Emergency room (ER). This implied that when VKA was implemented at the ER, the opportunity to realise VKA in alternative ways was limited.

Thirdly, we saw that VKA became something rather different in the ER-nurses' practice than what the municipality and eSmart Systems had planned, as it had to negotiate its place within an already existing assemblage of sociomaterial elements at the ER. For the

most part, VKA was something the nurses had to test daily to rule out potential errors, as well as being used as a new way for the nurses to handle the regular safety alarms. However, eSmart Systems and the municipality continued to enact the planned version of VKA, the version that was a short time clinic that was cost-efficient and award-winning. In addition, they also sometimes made VKA present as a future vision, for example as an advanced health care platform, or a future top system for the municipality. Hence, we made the case that VKA was entangled in the past, present and future, through the continuous negotiation between the different enactments, also after implementation. We have thus argued that it can be useful to take a broader perspective than just the use-situation when examining Smart City initiatives.

Fourthly, we have also raised some questions about so-called generic or domain-agnostic technology. By attempting to "open up the black box" of VKA, we traced its history back to the energy market. The interface for the VKA-client as well as a lot of functionality was initially been developed to support grid operators in their everyday work situation, and many of the issues the ER nurses experienced was related to the fact that the VKA-client had initially been made for a different purpose, context, and domain. Here we argued that when eSmart Systems were enacting their platform as generic, they were also othering its constitutive history. This was problematic because it was creating a rigid technology in terms of limiting the design space to explore during development, being difficult for the ER nurses to ‘fit’ within their everyday work situation, and making it difficult for eSmart Systems and the municipality to implement changes to VKA to accommodate emergent local needs and issues.

Fifthly, and possibly the most essential learning we have made a case for throughout this thesis is that reality is complex and messy. Our approach to investigating the Smart City initiative, through a praxiography of following the object, and using concepts and theories from the literature on sociomateriality as a sensitising device, has demonstrated this messiness.

Based on our research into this Smart City initiative, our final section in the Discussion chapter presented some suggestions for Smart City practitioners to consider when

developing Smart City initiatives. In the following section, we describe the research contribution of this thesis.

6.1 Research contribution

The contribution in this thesis is related to the stream of Scandinavian IS research that focuses on sociomateriality, but also within research on Smart Cities. In this section, we will set forth the contribution of this thesis in the respective research fields.

Smart Cities scholars argue that there is a lack of empirical research on existing Smart City projects (see, e.g., March & Ribera-Fumaz, 2016 or Rob Kitchin, 2015). We will argue that our praxiography of a VKA is contributing to this field of research, by being an in-depth empirical research of a Smart City initiative.

Our findings add to the argument that we should refrain from treating the social and ICTs as two separate worlds in the discussions around key drivers for building Smart Cities, as efforts to build them are entangled in politics, technological heritage (see Harrison, 2017; March & Ribera-Fumaz, 2016). As we have argued, the negotiations that took place during the development process of VKA was fundamentally sociomaterial. This is in line with what many other scholars concerned with the entanglement of the social and material argues (see Bijker, 1995; Bowker & Star, 2000; Introna, 2007), that technology is the result of a socially situated and complex development process.

Opposing the dominance of positivist approaches, in particular the US-based IS field, IS-scholars (see, e.g., Myers, 2011; Walsham, 2012) have called for more methodological pluralism in the IS field. Within Scandinavian IS, this has been embarked upon by authors such as Aanestad (2003), Aanestad et al. (2017), Grisot & Vassilakopoulou, (2013), and many more. We will argue that in this thesis, we have also contributed to this, by our attempt to investigate the development and use of a technological innovation by applying theories and methods traditionally from other disciplines, in this case praxiography that draws on philosophy and ethnography.

In addition, when we have discussed our research in the context of Smart Cities, we have argued, in line with Haarstad & Wathne (2019), that Smart City should be seen as a

means to a goal, rather than a goal in itself. As we have seen in this thesis, local actors have played an active part in framing the Smart City agenda for the municipality in planning, development and implementation. Our findings have further shown how Smart City initiatives can be different things, not only for different cities but also for different stakeholders within the City. As the Smart City initiative is interpreted, negotiated and being done across different local sites and practices within the municipality it can change, slip and multiply. High-level stakeholders, involved in planning and development, does not necessarily have a good understanding of the local contexts or the everyday life of urban citizens in which the Smart City initiative will serve its function.

As we have demonstrated in this thesis, a sociomaterial lens and the use of concepts such as *actor-networks, configurations, constitutive elements* and *enactment* can serve as theoretical tools to examine and explain a design-in-use situation. As we argued in the Discussion-chapter, research into *design-in-use* often limits their scope to the use situation. Through our analysis and discussion of VKA as multiple objects being constructed within different method assemblages, we will argue that applying this theory has provided us with the tools to investigate how the VKA that emerged at the ER is entangled in many sociomaterial connections and their hinterlands. We will thus argue that our contribution to the research field is that we have suggested a way to look at both what is now, the sociomaterial assemblage at a given time, but also what is entangled in the past, present and future. We have done this by combining concepts and theories from traditional sociomaterial approaches, such as ANT, with concepts and theories from the sociomaterial creative diasporas of Mol (2002) and Law (2004, 2009). We believe that an approach similar to ours could be useful for others that want to investigate the development, implementation and use of Smart City technologies but also technology in general.

This thesis has also discussed the notion of generic technologies. Generic technologies are seen as a potential Smart City enabling technology (see, e.g., Jin, Gubbi, Marusic, & Palaniswami, 2014; Rathore, Ahmad, Paul, & Rho, 2016), and some cities are applying the idea of Smart Cities to their urban strategies by embracing domain-agnostic approaches to public management. This thesis can also be seen as a contribution to

discussions surrounding ways to conceptualise and theories about generic or domain-agnostic technology.

Technologies in the "Smart City" becomes increasingly entangled in people's lives, and we have throughout this thesis argued that technology is sociomaterial. In addition, the development of Smart Cities often involves many technologies, and welfare technologies are a big part of this. Based on our investigation of a healthcare technology in a Smart City context, with a sociomaterial lens, we will argue that this thesis may contribute to dissolving the separation between the research disciplines that we have claimed to be involved in, namely research into Smart City and research on welfare technologies.

6.2 Future work

Based on what we have seen in this thesis, this section will suggest some directions for future research.

One of the main goals of this thesis has been to accommodate the lack of empirical studies in the literature on how cities interpret and implement the concept of Smart Cities. We would argue that additional in-depth empirical studies are needed to learn more about Smart Cities, as they may become entangled in, and affect, many people's lives.

Complex health care settings, such as multiple institutions and agencies having a role in providing care, are becoming more common in urban care environments (Maniatopoulos et al., 2009). As we have seen in this thesis, some Smart City initiatives are attempting to transcend the silo-based organisations that can be typical for public management. Because of this, we would suggest that future research should inquire further into domain-agnostic approaches within Smart City development. In addition, we believe it is important to explore methodological and theoretical approaches further to be able to capture the complexities of these new urban health care-realities.

Epilogue

When all is said and done, we really do hope that Virtual Short-time Clinics in Halden will succeed. We believe it is a good idea and great initiative, and throughout this research, we have met many dedicated and capable people within the municipality and eSmart Systems, devoted to creating an improved future for everyone in Halden.

We would again take the opportunity to thank the people we got to know in Halden, and we do hope that some of the suggestions we presented for Smart City practitioners also could benefit the further development of Virtual short-time clinics.

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Appendices

Appendix A

VKA development project timeline

PROJECT TIMELINE

Here we provide an overview of the case by describing the different phases in a timeline-fashion. The different phases range from the initiation of the project, through the development and the implementation of the system, and to a briefly portray the plans for further development.

PHASE

0 INITIATING A PUBLIC-PRIVATE COLLABORATION

2015

In 2015, the municipality initiated a collaboration with NCE Smart Energy Markets located in Halden, which is a cluster of companies, academia and public actors working within the fields of ICT and energy. The purpose of the collaboration was to explore innovating ways to utilise technology in public health-care services to solve some of the challenges faced by the municipality.

Establishing a research and development project

The municipality received project funding from the county governor to run a research and development project (R&D) which including the municipality, NCE and Østfold University College - creating an equal partnership. This was the inception of VKA.

1 THE R&D-PROJECT

2015 - 2016

The goal

It was determined that the overall goal of the R&D-project was to develop a virtual short-term clinic. This represented a new way of organising the care service of home-based patients in need of close monitoring after being discharged from public hospital care.

Defining the collaborative arrangement

The emergency room (ER) was chosen to should be the location of the response centre. The response centre's function was to enable patients to communicate and get assistance form health professionals from their own home. A collaborative arrangement between the nurses at the ER, home care nurses, patient coordinators and patients were defined.

Choosing the provider of the technology

One of the companies within the NCE-cluster, eSmarts Systems, was chosen as the provider of the technical solution in VKA. eSmart Systems is a software developing company with around 80 employees, working within the energy industry, service providers and smart cities.

Choosing the provider of the technology

Technological choices were made to transform the collaborative arrangement into a virtual clinic, by configuring existing technologies together in new ways as well as with new developments. The open system platform developed by eSmart Systems was chosen to also serve as the platform in VKA.

2 IMPLEMENTATION (PILOT)

Dec. 2016 - 2017

On the 1st of December 2016, VKA was implemented into its use context and entered its pilot stage. At the local emergency room, the VKA-client was installed on a computer. The patient coordinators had recruited potential candidates to the pilot-project of VKA, and the system was installed in the homes of 10 patients enrolled in the project. The home nursing care was provided with an app as well as the VKA-kit.

The pilot stage was described by the involved actors as a stage of extensive testing. The technology that now was implemented both at the ER, home health nurses and in the home of ten patients was characterised by considerable startup issues, such as breakdowns and sound errors.

3

DAILY OPERATIONS (SAAS-AGREEMENT)

2017 -

The system was expected to be operational at this point, but because of technical difficulties, a trial period that gradually progressed into everyday use was initiated. At this point, Halden municipality was no longer a collaborator in the project, but rather a client of eSmart Systems. They established what is called a Software as a service (SaaS) agreement. The trial period gradually evolved into what the systems is today, a part of the involved actors' day-to-day operations. Responsibility for the daily operation of VKA was at this stage transferred from the project group to the municipal department for home-based care.

4

FUTURE VISION

Future

Currently, the VKA-project is at a crossroad. The project group in Halden and eSmart have several ideas for the further development of VKA. As in most development projects, all of these ideas for the future of VKA are dependent on financing. Halden municipality is currently applying for project funding from the county governor (Fylkesmannen), however, he will not fund the project unless they collaborate with other municipalities in the county. At this point, Halden municipality is planning and negotiating a collaboration with two other municipalities in the county (Sarpsborg and Fredrikstad).

Appendix B

Data gathering activities

DATA GATHERING OVERVIEW

Methods	Participants	Topics covered
Meeting	**1:** Former Head of Products (eSmart)	Smart City vision, eSmart Systems open platform, breaking down silo-structures, opportunities for municipal innovation. Business strategy and products.
Skype-meeting and technology demonstration	**1:** Product owner for VKA (eSmart) **2:** General practitioner/ domain expert for VKA	Demonstration of the VKA-client's user interface. Functionality, use, care coordination support. The VKA-projects background.
Skype-meeting	**1:** Product owner for VKA (eSmart) **2:** General practitioner/ domain expert for VKA (eSmart) **3:** Municipal councillor in the department, and project leader in the R&D project.	The cooperative work arrangement in VKA. The development process. Current issues related to VKA. Future development.

Methods	Participants	Topics covered
Interview	**1:** Municipal councillor in the department, and project leader in the R&D project.	Background, roles, activities, decisionmaking, private-public collaboration, user involvement. The informant's role. Smart city agenda.
Interview	**1:** General mamnager at the emergency room.	The informant's role. Use of technology at the ER. The implementation and use of VKA. Usability. Coordination.
Observation	Nurses working at the Emergency room and managing VKA.	
Interview	1: Product owner for VKA (eSmart)	The informant's role. Private-public collaboration. Dev. process. Smart city. Assumed use and user context.

Methods	Participants	Topics covered
Interview	**1:** Patient coordinator	The informant's role in the project. VKA-patients, use of VKA, coordination.
Observation and Interview	**1:** Home care nurse assigned with the responsibility for VKA **2:** Home care nurse	Use of technology in everyday work situations. VKA implementation and user involvement. Use of VKA.
Interview	**1:** General practitioner/ domain expert for VKA (eSmart)	The informant's role. Intermediary role between eSmart and ER. Use and context of use. Future development, prototyping.
Interview	**1:** Nurse at the ER	VKA user involvement. Coordination between ER-nurse, home care nurse and patient. Use, usability, user interface.

Methods	Participants	Topics covered
Observation	Nurses working at the Emergency room and managing VKA.	
Interview	**1:** Department manager, Home care	**The informant's role in the project. Decisionmaking, project activities, design alternatives, user involvement. Implementation, managing of daily operations.**
Interview	**1:** Nurse at the ER	**Use of VKA. Coordination between ER-nurse, home care nurse and patient. Usability, user interface. Safety alarms, testing.**
Observation	Nurses working at the Emergency room and managing VKA.	

Methods	Participants	Topics covered
Interview	**1:** Chief architect at eSmart Systems **2:** General practitioner/ domain expert for VKA (eSmart)	**The informant's role in the project and practice. System architecture, generic and shared platform, assumed user and context of use, change requests. Energy domain.**
Focus group	Representatives from eSmart Systems and the municipality	**Issues related to use and usability, discussing improvements and alternatives, plans for future development.**

Appendix C

Approval letter from NSD

NSD NORSK SENTER FOR FORSKNINGSDATA

NSD sin vurdering

Prosjekttittel

Design av digitale helseløsninger i hjemmet

Referansenummer

983753

Registrert

05.09.2018 av Emil Harald Säll Fuglerud - ehfugler@ifi.uio.no

Behandlingsansvarlig institusjon

Universitetet i Oslo / Det matematisk-naturvitenskapelige fakultet / Institutt for informatikk

Prosjektansvarlig (vitenskapelig ansatt/veileder eller stipendiat)

Hanne Cecilie Geirbo, hannege@ifi.uio.no, tlf: 91586648

Type prosjekt

Studentprosjekt, masterstudium

Kontaktinformasjon, student

Emil Harald Säll Fuglerud, Ehfugler@ifi.uio.no, tlf: 93860145

Prosjektperiode

20.08.2018 - 01.09.2019

Status

01.03.2019 - Vurdert

Vurdering (1)

01.03.2019 - Vurdert

BAKGRUNN
Prosjektdesignet innebærer observasjon av helsepersonell som bruker digitale helsesystemer, og det er dermed en risiko for at prosjektmedarbeiderne vil få tilgang til taushetsbelagte opplysninger. Prosjektleder har søkt, og fått innvilget, dispensasjon fra taushetsplikten fra REK (REKs ref: 2018/2473/REK sør-øst C) for det formål å gjennomføre observasjonen.

Det er vår vurdering at behandlingen av personopplysninger i prosjektet vil være i samsvar med personvernlovgivningen så fremt den gjennomføres i tråd med det som er dokumentert i meldeskjemaet med vedlegg den 1.3.2019, samt i meldingsdialogen mellom innmelder og NSD. Behandlingen kan starte.

MELD ENDRINGER
Dersom behandlingen av personopplysninger endrer seg, kan det være nødvendig å melde dette til NSD ved å oppdatere meldeskjemaet. På våre nettsider informerer vi om hvilke endringer som må meldes. Vent på svar før endringer gjennomføres.

TYPE OPPLYSNINGER OG VARIGHET
Prosjektet vil behandle alminnelige kategorier av personopplysninger frem til 01.09.2019. Det understrekes at prosjektet kun skal registrere personopplysninger om helsepersonell og andre brukere av digitale systemer, og at behandlingen ikke innebærer registrering av særskilte kategorier av personopplysninger om verken utvalget eller andre.

LOVLIG GRUNNLAG
Prosjektet vil innhente samtykke fra de registrerte til behandlingen av personopplysninger. Vår vurdering er at prosjektet legger opp til et samtykke i samsvar med kravene i art. 4 og 7, ved at det er en frivillig, spesifikk, informert og utvetydig bekreftelse som kan dokumenteres, og som den registrerte kan trekke tilbake. Lovlig grunnlag for behandlingen vil dermed være den registrertes samtykke, jf. personvernforordningen art. 6 nr. 1 bokstav a.

PERSONVERNPRINSIPPER
NSD vurderer at den planlagte behandlingen av personopplysninger vil følge prinsippene i personvernforordningen om:

- lovlighet, rettferdighet og åpenhet (art. 5.1 a), ved at de registrerte får tilfredsstillende informasjon om og samtykker til behandlingen
- formålsbegrensning (art. 5.1 b), ved at personopplysninger samles inn for spesifikke, uttrykkelig angitte og berettigede formål, og ikke behandles til nye, uforenlige formål
- dataminimering (art. 5.1 c), ved at det kun behandles opplysninger som er adekvate, relevante og nødvendige for formålet med prosjektet
- lagringsbegrensning (art. 5.1 e), ved at personopplysningene ikke lagres lengre enn nødvendig for å oppfylle formålet

DE REGISTRERTES RETTIGHETER
Så lenge de registrerte kan identifiseres i datamaterialet vil de ha følgende rettigheter: åpenhet (art. 12), informasjon (art. 13), innsyn (art. 15), retting (art. 16), sletting (art. 17), begrensning (art. 18), underretning (art. 19), dataportabilitet (art. 20).

NSD vurderer at informasjonen om behandlingen som de registrerte vil motta oppfyller lovens krav til form og innhold, jf. art. 12.1 og art. 13.

Vi minner om at hvis en registrert tar kontakt om sine rettigheter, har behandlingsansvarlig institusjon plikt til å svare innen en måned.

FØLG DIN INSTITUSJONS RETNINGSLINJER
NSD legger til grunn at behandlingen oppfyller kravene i personvernforordningen om riktighet (art. 5.1 d), integritet og konfidensialitet (art. 5.1. f) og sikkerhet (art. 32).

For å forsikre dere om at kravene oppfylles, må dere følge interne retningslinjer og/eller rådføre dere med behandlingsansvarlig institusjon.

OPPFØLGING AV PROSJEKTET
NSD vil følge opp ved planlagt avslutning for å avklare om behandlingen av personopplysningene er avsluttet.

Lykke til med prosjektet!

Kontaktperson hos NSD: Rådgiver Pernille E. Grøndal.
Tlf. Personverntjenester: 55 58 21 17 (tast 1)

Appendix D

Approval letter from REK

REK
REGIONALE KOMITEER FOR MEDISINSK OG HELSEFAGLIG FORSKNINGSETIKK

Region:	Saksbehandler:	Telefon:	Vår dato:	Vår referanse:
REK sør-øst	Claus Henning Thorsen	22845515	11.02.2019	2018/2473/REK sør-øst C
			Deres dato:	Deres referanse:
			11.12.2018	

Vår referanse må oppgis ved alle henvendelser

Hanne Cecilie Geirbo
Universitetet i Oslo

2018/2473 Teknologiforståelser i "smart by"-initiativer - design av et informasjonssystem for "virtuell kortidsavdeling" i Halden kommune

Forskningsansvarlig institusjon: Universitetet i Oslo
Prosjektleder: Hanne Cecilie Geirbo

Vi viser til søknad om dispensasjon fra taushetsplikt i ovennevnte prosjekt. Søknaden ble behandlet av Regional komité for medisinsk og helsefaglig forskningsetikk (REK sør-øst) i møtet 17.01.2019. Vurderingen er gjort med hjemmel i forskrift av 02.07.09 nr.989, helsepersonelloven § 29 første ledd og forvaltningsloven § 13 d.

Prosjektomtale
Masteroppgavens problemstilling er: Hvordan blir ulike forståelser av teknologi forhandlet gjennom design og bruk av et system for oppfølging av trygghetsalarmer i Halden kommune? Formålet er å gi innspill til hvordan dette systemet kan utformes slik at sykepleiere kan bruke det på en enkel, effektiv og trygg måte, og innspill til hvordan man kan planlegge en designprosess der kunnskap om sykepleieres arbeidspraksis inngår som et sentralt element fra en tidlig fase. Data vil bli samlet inn gjennom kvalitative intervjuer og observasjon. De som skal intervjues er sykepleiere som bruker systemet samt nøkkelpersoner i utvikling, implementering og drift av systemet. Det planlegges 3-9 timers observasjon av sykepleieres bruk av systemet på bakrommet på legevakt. Pasienter vil ikke være til stede. Helsedata er ikke av interesse for prosjektet og vil ikke bli samlet inn, registrert og analysert.

Vurdering
Dette er et masteroppgaveprosjekt med følgende problemstilling: «Hvordan blir ulike forståelser av teknologi forhandlet gjennom design og bruk av et system for oppfølging av trygghetsalarmer i Halden kommune?» Prosjektet har som mål å gi innspill til 1) hvordan systemet kan utformes slik at sykepleiere kan benytte det enkelt, effektivt og trygt 2) hvordan man kan planlegge en designprosess hvor en benytter kunnskap om sykepleieres arbeidspraksis.
Halden kommune samarbeider med selskapet eSmart om å utvikle systemer som skal effektivisere driften av kommunene og skape et bedre tilbud til innbyggerne. Et samarbeid går på utviklingen av en «virtuell korttidsavdeling» der pasientene skal få oppfølgingen i hjemmet via informasjons- og kommunikasjonsteknologi. Masteroppgaven omhandler den delen av «virtuell korttidsavdeling» som knytter seg til sykepleiernes oppfølging av trygghetsalarmer.

Søker skal gjennomføre kvalitative intervjuer med sykepleiere og nøkkelpersoner i utvikling, implementering og drift av systemet (personer som er ansatt i Halden kommune og selskapet eSmart systems, totalt ca. 25 deltakere). I tillegg skal sykepleiernes bruk av systemet observeres i 3-9 timer.

Prosjektet skal ikke benytte helsedata, men observasjonen skal foregå i et miljø der studentene kan komme til å overhøre navn og helseopplysninger om pasienter, eller uforvarende se dette på dataskjermer. Derfor søkes det om fritak fra taushetsplikt.

REK er gitt myndighet til å kunne gi dispensasjon fra taushetsplikten for tilgang til taushetsbelagte helseopplysninger fra helsepersonell eller helsetjenesten for annen forskning, jf. helsepersonelloven § 29 med tilhørende forskrift «Delegering av myndighet til den regionale komiteen for medisinsk og helsefaglig forskningsetikk etter helsepersonelloven § 29 første ledd og forvaltningsloven § 13d første ledd».

Komiteen er av den oppfatning at de samme vurderinger skal gjøres her, som ved vurdering av fritak fra lovpålagt taushetsplikt etter helseforskningsloven § 35, jf. §§ 15, 28. Dette innebærer at dispensasjon fra taushetsplikten bare kan gis dersom det er vanskelig å innhente samtykke, forskningen er av vesentlig interesse for samfunnet og hensynet til deltakernes velferd og integritet er ivaretatt.

I søknad er begrunnelsen for ikke å innhente samtykke som følger: « *Dette prosjektet skal ikke forske på taushetsbelagte opplysninger, men siden masterstudentene som skal gjennomføre prosjektet trenger å gjøre observasjon av sykepleieres bruk av et informasjonssystem kan de komme til å se navn på pasienter på en skjerm, og de kan komme til å overhøre navn og helseopplysninger. Vi vurderer det slik at det verken vil være hensiktsmessig eller praktisk mulig å innhente samtykke fra disse pasientene, og søker derfor, etter anbefaling fra REK, om dispensasjon fra å innhente slikt samtykke.»*

Komiteen anser ut fra ovennevnte at det ikke er praktisk gjennomførbart å innhente samtykke i dette prosjektet.

Søker opplyser at det er viktig å skaffe mer kunnskap om hvordan informasjonssystemer kan utvikles slik at helsearbeidere kan bruke dem på en enkel, effektiv og trygg måte, og å utvikle designprosesser der kunnskap om helsearbeideres arbeidspraksis inngår som et sentralt element fra en tidlig fase. Komiteen legger ut fra dette til grunn at den vitenskapelige og samfunnsmessige nytte er godtgjort.

Komiteen finner videre at hensynet til deltakernes velferd og integritet synes å være ivaretatt. Man må likevel vurdere hensynet til tredjepersoner, her pasientene. Komiteen har merket seg at studentene som skal gjøre datainnsamling i prosjektet så langt det lar seg gjøre vil unngå å sette seg i situasjoner der de vil overhøre eller se helseopplysninger. Under observasjonen vil de se på dataskjermene som brukes i minst mulig grad. Dette lar seg gjøre fordi de kan bruke testversjonen av informasjonssystemet til å få en detaljert forståelse av hvordan systemet fungerer. Under observasjonen av hvordan systemet brukes vil fokus være på sykepleiernes umiddelbare tilbakemeldinger om hvordan systemet fungerer, og det vil sjelden være behov for å se nøye på skjermen for å tilegne seg disse tilbakemeldingene. De vil også forsøke å holde seg utenfor hørevidde av resepsjonen på legevakten for å unngå å overhøre sensitive opplysninger derfra.

Komiteen har etter en samlet vurdering kommet til at vilkårene for å dispensere fra taushetsplikten er oppfylt.

Vedtak
Med hjemmel i *Forskrift av 2.7.2009 nr. 989, Delegering av myndighet til den regionale komiteen for medisinsk og helsefaglig forskningsetikk etter helsepersonelloven § 29 første ledd og forvaltningsloven § 13d første ledd*, har komiteen besluttet å gi fritak fra lovpålagt taushetsplikt i forbindelse med observasjonen av sykepleieres bruk av informasjonssystemet.

Dispensasjonen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknad og vedlegg.

Dispensasjon fra taushetsplikten gjelder til 31.08.2019.

Komiteens avgjørelse var enstemmig.

Komiteens vedtak kan påklages til Den nasjonale forskningsetiske komité for medisin og helsefag, jfr.

helseforskningsloven § 10, tredje ledd og forvaltningsloven § 28. En eventuell klage sendes til REK sør-øst C. Klagefristen er tre uker fra mottak av dette brevet, jfr. forvaltningsloven § 29.

Med vennlig hilsen

Britt Ingjerd Nesheim
professor dr. med.
leder REK sør-øst C

Claus Henning Thorsen
Seniorrådgiver

Kopi til: hannege@ifi.uio.no, Universitetet i Oslo ved: postmottak@uio.no

Appendix E

Consent form template

(Samtykkeskjemaet vil bli tilpasset i henhold til ulike type deltaker og metode for datainnsamling)

Samtykkeskjema for deltakelse i prosjektet

Design av digitale helseløsninger i hjemmet

Dette er et spørsmål til deg om å delta i et forskningsprosjekt hvor formålet er å *få innsikt i utvikling og bruk av digitale helsesystemer i hjemmet*. I dette skrivet gir vi deg informasjon om målene for prosjektet og hva deltakelse vil innebære for deg.

Formål
Formålet med dette prosjektet er å få innsikt i utviklingen og bruken av VKA-systemet (Virtuell korttidsavdeling) i Halden kommune. Dette prosjektet er en masteroppgave ved Universitetet i Oslo, hvor oppgaven skal leveres 1. mai 2019. Oppgaven vil bli publisert i UiO sitt system for masteroppgaver kalt DUO.

Hvem er ansvarlig for forskningsprosjektet?
Ansvarlige for dette forskningsprosjektet er masterstudentene Emil Säll og Irene Solberg, ved Universitetet i Oslo. Veileder for masterprosjektet er Hanne Cecilie Geirbo. Studentene har i forbindelse med prosjektet et samarbeid med eSmart Systems i Halden.

Hvorfor får du spørsmål om å delta?
Grunnen til at du er ønsket som deltaker i dette prosjektet er på bakgrunn av din stilling som x.

Hva innebærer det for deg å delta?

Hvis du velger å delta i prosjektet innebærer det at vi holder et intervju med deg angående utvikling og bruk av VKA-systemet i Halden Kommune. Dine svar blir registrert elektronisk og ved hjelp av lydopptak.

Det er frivillig å delta
Det er frivillig å delta i prosjektet. Hvis du velger å delta, kan du når som helst trekke samtykke tilbake uten å oppgi noen grunn. Alle opplysninger om deg vil da bli anonymisert. Det vil ikke ha noen negative konsekvenser for deg hvis du ikke vil delta eller senere velger å trekke deg. Dersom du ønsker å trekke samtykket ditt kan du ta kontakt med prosjektansvarlig på e-post, telefon eller annen ønskelig måte.

Ditt personvern – hvordan vi oppbevarer og bruker dine opplysninger
Vi vil bare bruke opplysningene om deg til formålene vi har fortalt om i dette skrivet. Vi behandler opplysningene konfidensielt og i samsvar med personvernregelverket.

(Samtykkeskjemaet vil bli tilpasset i henhold til ulike type deltaker og metode for datainnsamling)

- Masterstudentene Emil Säll og Irene Solberg er de eneste som vil ha tilgang til personopplysningene.
- For å sikre at ingen uvedkommende får tilgang til personopplysningene dine vil navn og kontaktopplysninger bli erstattet med en egen kode som lagres på egen navneliste adskilt fra øvrige data.

Det vil ikke gjengis opplysninger i publikasjonen som kan direkte eller indirekte identifisere deg som fysisk person, med unntak av om du er ansatt i Halden kommune eller eSmart System da du i kraft av din stilling vil kunne bli identifisert. Om du som ansatt i Halden kommune eller i eSmart System ønsker å ikke bli indirekte identifisert vil vi sørge for anonymisering.

Hva skjer med opplysningene dine når vi avslutter forskningsprosjektet?
Prosjektet skal etter planen avsluttes 1.09.2019. Eventuelle opptak og lagrede personopplysninger vil bli slettet før prosjektperioden er avsluttet.

Dine rettigheter
Så lenge du kan identifiseres i datamaterialet, har du rett til:

- innsyn i hvilke personopplysninger som er registrert om deg,
- å få rettet personopplysninger om deg,
- få slettet personopplysninger om deg,
- få utlevert en kopi av dine personopplysninger (dataportabilitet), og
- å sende klage til personvernombudet eller Datatilsynet om behandlingen av dine personopplysninger.

Hva gir oss rett til å behandle personopplysninger om deg?
Vi behandler opplysninger om deg basert på ditt samtykke.

På oppdrag fra Universitetet i Oslo har NSD – Norsk senter for forskningsdata AS vurdert at behandlingen av personopplysninger i dette prosjektet er i samsvar med personvernregelverket.

Hvor kan jeg finne ut mer?
Hvis du har spørsmål til studien, eller ønsker å benytte deg av dine rettigheter, ta kontakt med:

- Universitetet i Oslo ved student Emil Harald Säll Fuglerud, på epost (ehfugler@ifi.uio.no) eller telefon: 93860145. Irene Solberg, på epost (irensolb@ifi.uio.no) eller telefon 97190736. Eller veileder Hanne Cecilie Geirbo på epost (hannege@ifi.uio.no) eller telefon: 91586648.
- Vårt personvernombud: Morten Opsal, epost (personvernombud@uio.no) eller telefon 22856314.

Appendix F

Collaboration agreement with

Halden Municipality

HALDEN KOMMUNE

Avtale
Om
studentsamarbeid

Mellom:

Halden kommune
og
Mastergradsstudentene Irene Solberg og Emil Säll

1. Formålet med avtalen: I sitt mastergradsarbeid ved Universitetet i Oslo, Institutt for Informatikk ønsker Irene Solberg og Emil Säll å bruke Halden legevakt som forskningsarena for sitt arbeid med: *Design av digitale helseløsninger i hjemmet*. Formålet med deres datainnsamling er å få innsikt i utviklingen og bruken av Virtuell korttidsavdeling (VKA). VKA er et konsept utviklet av eSmart basert på ide og innspill av Halden kommune. I masterarbeidet skal det fremkomme forslag til ytterligere forbedringer og videre utviklingen av konseptet. Masterstudentene ved UiO ønsker en avtale som sikrer dem å få publisere avhandlingen som bygger på de intervjuer og observasjoner som er utført og vil bli gjennomført. Halden kommune på sin side ønsker å sikre at ideene og konseptet fremstår som kommunens i publikasjonen – så langt dette dekker de faktiske forhold, samt å sikre sine private leverandørers og sin egen rett til evt. vederlagsfri bruk av sluttprodukt i mastergradsarbeidene.
2. Programutvikler eSmart inngår egen avtale med studentene som regulerer hvordan studentene kan benytte og formidle informasjon om programvaren.
3. Halden legevakt/Halden kommune påtar seg å stille det daglige arbeidet og driften ved Halden legevakt til disposisjon som forskningsarena. Det innebærer at studentene får tilgang til legevaktens lokaler og også kan bli observatører til de arbeidsoperasjoner som pågår der (i dette tilfelle på legevakten). Kommunen har frihet til å begrense adgang under arbeidsoperasjoner som anses spesielt sensitive.
4. Studenter kan foreta intervjuer med sentrale personer i Halden kommune under forutsetning av at de har klargjort gjennom samtykkeskjema hvordan de vil ivareta personvern for de som deltar. Studentene vil også få innsyn i de dataverktøy og rutiner som legevakten har.
5. Kommunen får en tidsubegrenset og vederlagsfri rett til å utnytte programvare og ethvert annet resultat som utvikles, utarbeides og/eller tilpasses spesielt for Halden kommunes helsetjenester. Dette medfører rett til å bruke, kopiere, modifisere og videreutvikle programvare, idéer og løsninger som kommer ut av avhandlingene, enten direkte eller ved hjelp av tredjepart.
6. Halden kommune forbeholder seg retten til å gå gjennom avhandlingen før innlevering for å sikre at det tydelig fremkommer hvilke idéer og konsepter som stammer fra kommunen eller har sitt opphav der, samt også å drøfte avhandlingen med sine avtaleparter. Både studentene og kommunen har risikoen og ansvaret for at deres ytelser ikke krenker tredjeparters opphavsrett eller andre immaterielle rettigheter.
7. Kommunen skal få tilsendt minst ett eksemplar av ferdig avhandling og kommunen har også rett til å få innsyn i sensors vurdering.
8. Mastergradsstudentene påtar seg i egen underskrevet standard taushetserklæring alminnelig taushetsplikt vedrørende opplysninger han/hun får tilgang til i kraft av dette arbeidet jf. fvl. §

HALDEN KOMMUNE

13. Dette gjelder både evt. klientopplysninger om noens personlige forhold og forretningshemmeligheter (opplysninger om tekniske innretninger og fremgangsmåter samt drifts- og eller forretningshemmeligheter). Dette er et eget standard dokument kommunen har til bruk for alle sine ansatte, og det blir oppbevart på Halden legevakt
9. Denne avtalen løper så lenge mastergradsarbeidet varer frem til innlevering av avhandling, men ikke lenger enn 3 år fra inngåelsen.

Halden 24/10-18

Irene Solberg

Mastergradsstudent Irene Solberg

Emil Säll

Mastergradsstudent Emil Säll

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For Halden kommune

Appendix G

Collaboration agreement with

eSmart Systems

AVTALE OM BRUK OG UTNYTTELSE AV PROSJEKTOPPGAVE

Mellom

Emil Säll, fødselsnr. 22 04.91
og
Irene Solberg fødselsnr. 13.02.91
(heretter studentene)

Instituttnavn, Universitetet i Oslo (heretter UiO)

Og

eSmart Systems AS (org. nr. 998 927 854)

Det videre betegner "oppgaven" masteroppgaven og verktøy (for eksempel programvare, konsepter, design, prototyper, eksperimentelt materiale, metoder, stoffer apparatur) utviklet under arbeidet med oppgaven. Eventuell dokumentasjon regnes som en del av verktøyet.

1. Avtalens gjenstand.
Bedriften skal oppnevne en veileder som skal sikre at studenten kan utføre arbeidet under optimale forhold. Studentens veileder ved bedriften er:

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Oppgavens tittel er

.....Design av digitale helseløsninger.....

.....i hjemmet.....

2. Studenteus rettigheter og plikter.
Studenten har rett til å publisere sin besvarelse, eller deler av den, som en selvstendig avhandling eller som del av et større arbeid, eller i popularisert form, etter samtykke med eSmart Systems AS (heretter bedriften). Det er signert en taushetserklæring, som er et vedlegg til denne avtale (Vedlegg 1). Det kan være aktuelt å unnta deler av oppgaven fra offentlighet hvis sensitive opplysninger behandles i oppgaven. Det kan også være aktuelt at deler av oppgavepresentasjonen ikke skal være offentlig, dette avtales med bedriften før publisering.

3. Universitetets rettigheter og plikter.
UiO skal stille med intern veileder til oppgaven i henhold til retningslinjene på vedkommende institutt/fakultet. Oppgaven kan vederlagsfritt benyttes av UiO til undervisnings- og forskningsformål, under den forutsetning at det ikke forekommer sensitive opplysninger. Annet bruk krever samtykke fra de andre partene.

4. Rettigheter til verktøy.

Rettighetene til verktøy, for eksempel programvare, konsepter, design, prototyper, eksperimentelt materiale, metoder, stoffer apparatur m.v. tilfaller bedriften dersom ikke annet er avtalt.

5. Rettigheter i forbindelse med kommersialisering
Denne avtale innebærer at studentene samtykker til at de kommersielle rettigheter, som resulterer av prosjektoppgaven, som hovedregel vederlagsfritt tilfaller bedriften, dersom annet ikke avtales. Dersom studentenes resultater har betydelig påvirkning på bedriftens produkt, skal det inngås en egen avtale om rimelig kompensasjon til studentene.

6. Tvister.
Tvister søkes først løst partene imellom. Partene vedtar Oslo tingrett som verneting for tvister som springer ut av avtalen.

7. Reisekostnader og utlegg
Bedriften dekker rimelige utgifter til reisekostnader i forbindelse med reiser til Halden. Reisekostnader vil bli dekket etter statens satser. Alle reisekostnader og utlegg må godkjennes av veileder ved bedrift i forkant av reise og/eller innkjøp, for å få dekket kostnadene.

8. Generelt.
Avtalen er gyldig når den er godkjent og underskrevet av instituttleder eller administrerende instituttleder ved UiO.

Hver av partene beholder ett signert eksemplar av denne avtalen.

På vegne av

Signature: .....

Name: Emil Säll
Title: Student
Date: August 22, 2018

På vegne av

Signature: Irene Solberg

Name: Irene Solberg
Title: Student
Date: August 22, 2018

På vegne av
eSmart Systems AS

Signature: .....
På vegne av

Name: Knut Johansen
Title: CEO
Date: August 22, 2018

Tina Skagen, COO

På vegne av UiO,

Signature: Ellen Munthe-Kaas Ellen Munthe-Kaas

Name: Institutt for informatikk,
Title: Instituttleder UiO
Oslo, 8.11.2018

Vedlegg 1: Taushetserklæring fra Emil Säll og Irene Solberg.

Appendix H

Mutual non-disclosure agreement with eSmart Systems

MUTUAL NON-DISCLOSURE AGREEMENT

This agreement (the "**NDA**") has been made on this 22.08.2018 by and between:

Name: eSmart Systems AS
Address: Håkon Melbergs vei 16, 1783 Halden, Norway
Org.no: 998 927 854

and

Name: Irene Solberg
Address: Kjerre Grefsen Gate 16, 0479 Oslo
Date of birth: 13.02.91

(hereinafter jointly referred to as the "**Parties**" or individually as a "**Party**".)

WHEREAS

(A) The Parties have agreed to provide each other with certain information regarding the Parties and for purposes of enabling Master's thesis (the "**Permitted Purpose**").

(B) The Parties agree that information presented to each other shall be subject to the terms and conditions set forth in this NDA.

NOW THEREFORE, the Parties have agreed as follows:

1. **CONFIDENTIAL INFORMATION**

For the purpose of this NDA, the term "**Confidential Information**" shall include all information disclosed by one Party (the "**Disclosing Party**") or its representatives, to the other Party (the "**Recipient**") in connection with the Permitted Purpose, including, without limitation, information memorandum, company presentations, business plans, financial information, procedures, documentation, marketing data, business names, trade secrets, technical data, valuations, costs, rates and prices and any other information of a proprietary or confidential nature relating to the Disclosing Party or any of its subsidiaries, as well as any information created or derived from any such information, irrespective of disclosing medium and storage. For the avoidance of doubt, this NDA and any information relating to the Permitted Purpose, and the terms of or other facts relating to the Permitted Purpose shall also be regarded as Confidential Information. The Confidential Information may be labelled as "confidential", "proprietary" or similar without this being an explicit requirement for benefiting from the protection given herein.

2. **RESTRICTIONS OF USE AND NON-DISCLOSURE**

The Recipient shall use the Confidential Information solely for the Permitted Purpose, and shall not disclose any Confidential Information to third parties without the prior written consent of the Disclosing Party. The Recipient shall (i) duly handle and protect from disclosure the Confidential Information, (ii) only use the Confidential Information as is

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strictly necessary for the Permitted Purpose, and (iii) limit the internal circulation of the Confidential Information to such employees of the Recipient as have a strict "need to know" in connection with the Permitted Purpose. The Recipient shall make reasonable efforts to procure that all of its representatives and personnel are subject to corresponding obligations of confidentiality similar to this NDA prior to receiving any Confidential Information.

The Recipient shall be entitled to directly or indirectly communicate or disclose (whether in writing or orally or in any other manner) Confidential Information to any adviser (including but not limited to solicitors, financial advisers and accountants) who strictly need to receive and consider Confidential Information for the purposes of evaluating advising or otherwise assisting the Recipient with the Permitted Purpose.

The Recipient undertakes to promptly terminate the use of and to destroy (or permanently erase in relation to any Confidential Information held electronically) or return any and all Confidential Information, including copies and reproductions made thereof, to the Disclosing Party upon the request of the Disclosing Party or when the use of the Confidential Information is no longer needed for the Permitted Purpose. Notwithstanding the obligations in this paragraph, the Recipient and its advisers will be entitled to retain such copies of such Confidential Information as is required by law, bona fide internal compliance policies existing at the date of this NDA or the rules of any applicable regulatory authority to which the Recipient or their advisers are subject but no further copies and such information will continue to be held subject to the terms of this NDA.

3. EXCEPTIONS

The restrictions regarding Confidential Information as stated in Section 2 shall not apply to the extent the Recipient may substantiate that the relevant parts of the Confidential Information: (i) is or becomes part of the public domain without breach of this NDA; (ii) is known and proved to be on record by the Recipient prior to disclosure in connection with the Permitted Purpose; (iii) is subsequently lawfully obtained by the Recipient from a third party without breaching any other contractual obligations; or (iv) is disclosed pursuant to the lawful order or requirement of a government body, commonly recognized stock exchange, court or administration agency, subject to the prior written notice to the Disclosing Party. Where the Recipient is unable to give notices to or consult with the Disclosing Party unless such notice or consultation is prohibited by law the Recipient will, to the extent permitted by law, inform the Disclosing Party of the circumstances, timing and content of and manner of making the disclosure promptly after such disclosure has been made. Upon any unauthorized disclosure of Confidential Information by the Recipient, it shall immediately take all actions reasonably available thereto to recover such Confidential Information and to prevent any further publication or dissemination.

4. OWNERSHIP AND RIGHTS

All Confidential Information disclosed or transferred by the Disclosing Party to the Recipient shall remain the property of the Disclosing Party. Nothing in this NDA shall be construed, by implication or otherwise, as a grant by the Disclosing Party to the Recipient of (i) a license or any other right to make, use or sell any product using the Confidential Information; (ii) any patent, patent application, utility model, copyright, mask work right, or any other industrial or intellectual property right covering same; (iii) a right to use in

advertising, publicity or otherwise, any trademark or trade name of the Disclosing Party; or (iv) an authorization to act as an agent on behalf of the Disclosing Party for any purpose.

5. LIABILITY

The Disclosing Party makes no representations or warranties hereunder, whether express or implied as (i) to the accuracy, completeness, quality or fitness for any particular purpose of the Confidential Information, or (ii) that any such Confidential Information involves concepts or embodiments that are free of infringement of other rights. The Recipient shall indemnify the Disclosing Party from all costs and damages incurred by the Disclosing Party due to the Recipient's breach of this NDA. The Parties acknowledge that a remedy of damages for breach of the terms contained herein is inadequate and that an injunction restraining the Recipient from continuing any breach of this NDA, in whole or in part, shall be available through a competent court of jurisdiction.

No failure or delay by the Disclosing Party in exercising any right, power or privilege under this NDA shall be construed as a waiver thereof.

6. MISCELLANEOUS

This NDA constitutes the entire NDA between the Parties relating to the subject hereof and supersedes any other NDAs, written or oral, among the Parties concerning such subject matter.

The Parties may not at any time assign or transfer any of its legal, beneficial or other rights, benefits and/or obligations under this NDA without the prior written consent of the other Party hereto

If any of the provisions of this NDA is found by any competent authority to be void or unenforceable, it shall be deemed to be deleted from this NDA, and the remaining provisions of this NDA shall remain in force and effect. Notwithstanding the foregoing, the Parties shall negotiate in good faith in order to agree the terms of a mutually satisfactory provision to be substituted for the provision so found to be void or unenforceable.

Amendments or modifications of, or addition to, or waiver under this NDA shall not be effective or binding on either of the Parties hereto unless set forth in writing and executed, in the case of a waiver by the Party effectuating same, and in all other cases by each of the Parties hereto.

7. GOVERNING LAW AND DISPUTE RESOLUTION

This NDA shall be governed by and construed in accordance with Norwegian law.

Any dispute that may arise from this NDA shall be subject to the exclusive jurisdiction of the Norwegian courts with Oslo City Court as agreed venue.

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8. **REVIEW**

Both parties agree on that eSmart shall approve the content and text in the Master's thesis that is directly related to eSmart. eSmart has the right to correct text and illustrations that is directly related to eSmart, to ensure that the information is correct, before the Master's thesis is delivered to the University.

For and behalf of
eSmart Systems AS

Signature: .....
Name: Knut Johansen
Title: CEO
Date: August 22, 2018

Tina Skagen, COO

For and behalf of

Signature: .....
Name: Irene Salberg

Date: August 22, 2018