UiT
THE ARCTIC
UNIVERSITY
OF NORWAY

School of Business and Economics

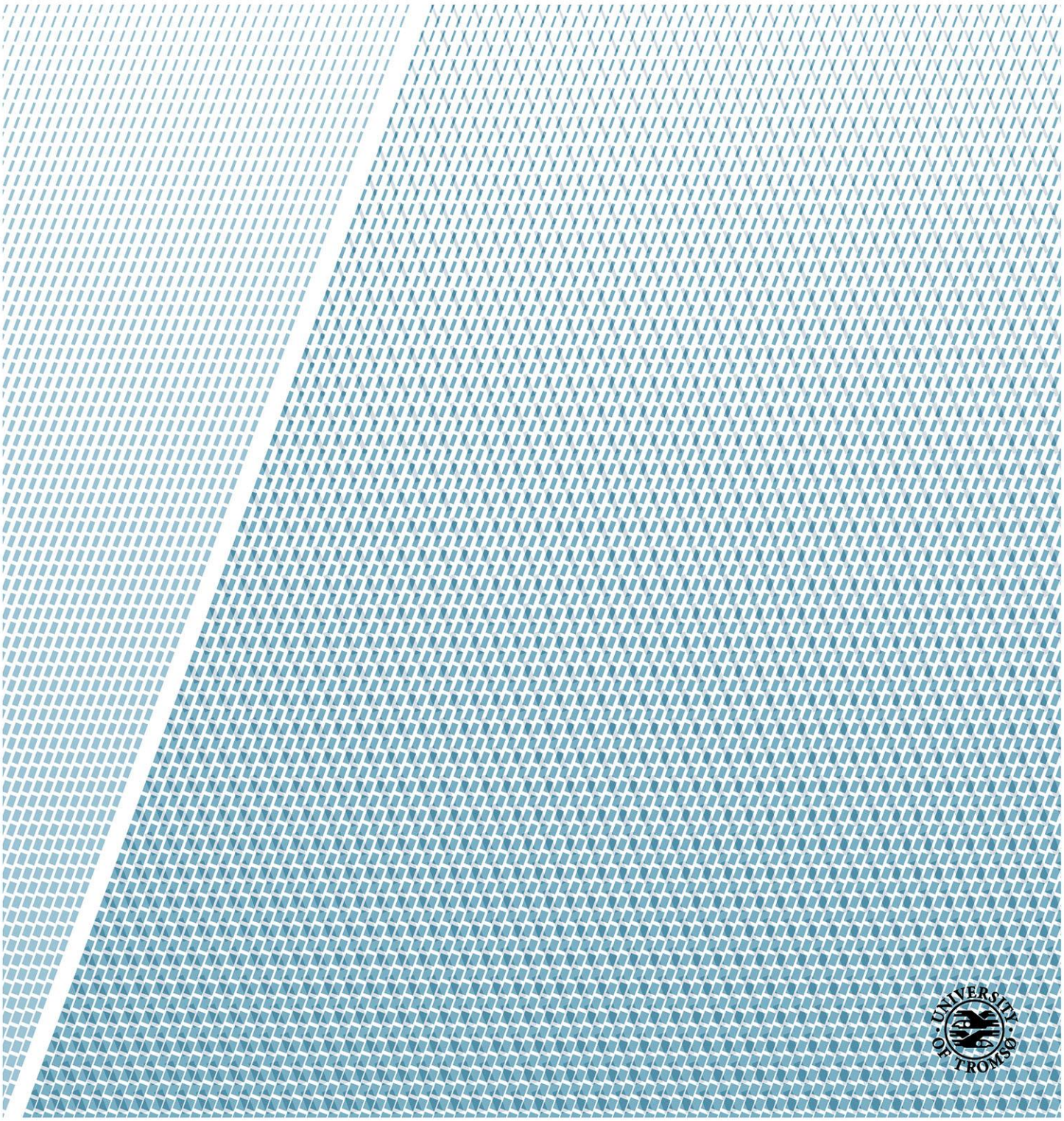
Innovation adoption in a hospital

The role of perceived innovation attributes in the adoption intention

—

Haakon Worum

Master's Thesis in Leadership, Innovation, and Marketing - May 2014



Abstract

Research on innovation attributes- and adoption is an inconclusive branch that has been deemed highly dependent on its context. Attempts to create general scales of measuring innovation attributes as an antecedent of adoption have all failed as evident by the amassed critique of such scales. The only concurrence within this research discipline is that scales that intend to explain innovation adoption as a consequence of perceptions of certain innovation attributes, needs to be adjusted to their context. The purpose of this study is not to develop a general scale of such attributes, nor is it to test existing scales. Instead, this study focuses on *how* the relationship between perceptions of innovation attributes and innovation adoption unfolds in a specific context.

The context in this study is the hospital sector, where one department within the University Hospital of Northern Norway is currently facing a decision of whether or not to adopt an innovation that might potentially the work procedures within department. I felt that the hospital sector was particularly interesting in terms of explaining how innovation adoption occurs. The reason for this this is that hospitals are highly research-intensive institutions with a high demand for innovative solutions. Prior to this study, it was assumed that the course of the adoption-decision process was unique in hospitals due to organizational and professional complexities. An existing framework that can be used to explain the relationship between innovation attributes and innovation adoption was applied, and modified in order to adjust to the assumed complexities of the hospital sector. The result was a context-adjusted model that attempted to explain how perceptions of innovation attributes affected the intention of adopting the innovation.

The findings in this study confirmed that this particular case within the hospital sector was distinct in terms of how perceptions of innovation attributes affected the adoption intention. This distinction turned out to be a result of a high focus on task-efficiency among the personnel at this department. Additionally, difficulties related to the usage of the innovation were not important to the users as long as the innovation was perceived to have an impact above some subjective and undefined threshold. These findings deviated from the theoretical assumptions related to existing theories on innovation attributes. Even though the conceptual model applied in this study was able to explore these relationships to a great extent, several unanticipated events were an indication that it needed further adjustment. A revision of this

conceptual model was presented before the concluding section of this paper. This model illustrated how the relationship between innovation attributes and adoption intention actually turned out to be.

Key words: Innovation adoption, adoption intention, innovation attributes, innovation-decision, hospitals, diffusion of innovations theory.

Acknowledgements

Five consecutive years of education has culminated in the submission of this paper. It is with mixed emotions that I leave the student life behind. These years have been rewarding in so many ways, but first and foremost educationally, and socially. I have acquired knowledge that will be invaluable in my professional career, and I have acquainted great people that I am proud to call my friends. There are several people I want to thank for this. First, my friends and co-students, Tony Liafjell, Joakim Henriksen, and Ida Jakobsen. You have all been an important part of making these years an unforgettable experience. I am grateful for having had the opportunity to work with you, and I am without doubt that you have greatly contributed to my academic achievements.

I also want to thank my supervisors Kristin Woll and Lene Foss for showing great interest in my study, for your confidence in me, and for your indispensable counseling throughout a stressful semester. I also thank Elin A. Nilsen for being an inspiring lecturer and for her dedication to the students.

I would like to thank all the nurses and employees at the UNN cancer ward who took their time to talk with me during data collection. I also thank Terje Solvoll, developer of CallMeSmart, for granting me insight in his project, and introducing me to the UNN cancer ward. Additionally, I want to thank Norinnova Technology Transfer AS for having me and my co-students in their offices during this last year of the master's program.

Finally, I want to thank my closest family: My girlfriend Ida Karoline for supporting me, and for putting up with my late work hours during this last semester. My daughter Kornelia for putting in a decent amount of sleep during nights. My father for inspiring me to pursue a tertiary education, and for motivating me throughout the course of my studies.

Haakon Worum

May 2014, Tromsø

Contents

List of figures

1 Introduction

1.1 Background and topic

Innovation research was termed a fashionable topic for social sciences as early as the 1970's (Downs & Mohr, 1976; Rogers, 2003). Even to date, innovation seems to be a trendy research topic, perhaps because the term itself represent novelty. This topic can be divided into several disciplines by acknowledging the fact that innovation is a progressive process (Rogers, 2003; Van de Ven et al., 1999). Nooteboom (1994) identified five stages of the innovation process; *invention*, *development*, *production*, *market introduction*, and *diffusion.* Rogers (2003) claimed that, despite its significance, the latter stage of this process has received less attention than it deserves. Innovation diffusion can be defined as *"…the process by which (1) an innovation (2) is communicated through certain channels (3) over time (4) among the members of a social system*" (Rogers 2003:11). A related sub-concept of innovation diffusion is innovation adoption, which Rogers defines as the decision to make full use of an innovation due to being the best choice of available actions. In other words, innovation diffusion is the cumulative adoption of an innovation within a certain social system. Rogers' call for recognition is, by far, legitimate as innovation adoption, and consequently diffusion research are among the most inconclusive stems of innovation research (Downs & Mohr, 1976; Moore & Benbazat, 1991; Rogers, 2003; Venkatesh et al., 2003). This phase of the innovation process is perhaps the most critical, since innovation adoption is the underlying mechanism that makes diffusion possible. Without innovation adoption, there would be no diffusion. And without diffusion, innovations would have little or no social and economic impact on society (Hall, 2005).

Innovation adoption is a concept that has been subject to many different research approaches. Damanpour and Schneider (2008) noted that there has been extensive research on facilitators and inhibitors of innovation adoption, and that these approaches have primarily been done with regards to environmental and organizational conditions. Even though existing research on antecedents and consequences of innovation adoption is extensive, very few studies have considered the role of innovation attributes at the individual level (ibid.).

There have been several attempts to develop general scales for measuring innovation attributes' influence on innovation adoption (Davis, 1986; Moore & Benbazat, 1991; Rogers, 2003), but as Rogers argued, no unifying framework for innovation attributes exists to date. Rogers (2003) claims that this is due to adoption research being highly context specific. In lack of such a unifying framework, studies of innovation attributes and their effects on adoption have shown to utilize adapted versions of existing innovation attribute scales to fit certain contexts (Damanpour & Schneider, 2008). A context where innovation adoption is important is the healthcare sector, and particularly within hospitals, which are considered major consumers of innovations (Kimberly & Evanisko, 1981). Healthcare is the most research intensive sector in Norway, and uses extensive resources on innovative solutions (Reve & Sasson, 2012). Because of the magnitude of Norwegian public healthcare, there is a need for research on innovation adoption within hospitals, since wrongful adoption decisions may have major impact on societal health. Up to date, and as far as my knowledge, no attempts have been made to explain the relationship between perceptions of innovation attributes and innovation adoption at the individual level in hospitals.

As a response to the lack of research within this context, the topic of this study will be innovation adoption within hospitals. The focus will be on the individual level, and more specifically, individual perceptions of innovation attributes. The innovation of interest for this study is the CallMeSmart technology (henceforth referred to as CMS), which is due to pilot testing at the University Hospital of Northern-Norway (UNN), over the course of spring 2014. Before the problem statement for this study is presented, an introduction to the CMS technology and the circumstances of the pilot test is given. The reason for this is that these circumstances is determinant for how the problem is formulated.

1.1.1 The CallMeSmart technology

The problem that initiated the development of the CMS technology was observations regarding how communication devices interrupted hospital practitioners during inappropriate situations. This problem revealed the need for an interruption management system. At the time, future CMS developer Terje Solvoll took on the challenge to develop a system to solve this problem under employment of the Norwegian Centre for Integrated Care and Telemedicine (NST). The CMS technology is a context-aware system based on the existing communication infrastructure at UNN. A context-aware system can be defined as a system

that *"…uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task*" (Solvoll, 2013:15). The core function is to automatically monitor the degree of availability of the users, and moderate communication inquiries based on the location of the recipient, ultimately avoiding disruption of normal activity (Solvoll, Scholl, & Hartvigsen, 2013). An illustration of how this particular service is intended to function is given in appendix 2. The purpose of the CMS is also to decrease the number of communication devices carried by the users, and to provide more efficient internal communication. The CMS software runs on the Android operating system, and the hardware devices are comprised of Samsung smartphones. The hard- and software that comprises the basis for the CMS technology is referred to as middleware, which operates between the existing communication infrastructure at UNN and the smartphones carried by the users. A complete visual overview of the technological infrastructure that comprises CMS is presented in appendix 1. One of the challenges in the software development was coding the CMS onto the existing communication infrastructure at UNN, referred to as ASCOM, which was originally developed for their current calling system. The overall purpose for the pilot test is to replace this old calling system with the CMS if it turns out to solve the problems that were initially described.

1.1.2 The UNN oncology department

The oncology department at UNN is an integral part of the Surgery-, Cancer-, and Women's Health clinic. The oncology department is comprised of the cancer ward, the cancer policlinic, the radiotherapy unit, and the section of palliative medicine. The pilot testing of the CMS technology will mainly be concerned with the cancer ward, and the nurses specifically employed therein. Forty nurses from the cancer ward, working opposite shifts, will be participating the pilot testing starting May 5. 2014. The initiative for the CMS pilot testing came from the Chief Department Physician of the oncology department, after the nursing staff had expressed their willingness to test out alternative technology to the existing pager calling-system. This entails that the oncology department assumes the financial cost associated with the testing, regardless of the remainder of the UNN organization. The Chief Department Nurse administers the pilot testing while the ultimate decision-making unit regarding the testing, and potential adoption, is the Chief Department Physician. Her decision will be based on the experiences that the participating nurses are left with after the test period. This means that there is a democratic decision-making structure in terms of potential adoption of the

CMS. Because of this, the nurses will be treated as decision-making units for this study, since the adoption-decision of the Chief Department Physician inevitably will be a reflection of the opinions expressed by the nurses.

1.2 Problem statement

Innovations aimed at the hospital sector inarguably go through complex decision processes before they are ultimately adopted, or rejected. From an innovation management point of view, the preconditions for making these decisions need to be considered as they may prevent innovations from being adopted. Since the innovation of interest currently is subject to a test pilot, no decision regarding innovation adoption will be taken during the course of this study. The preconditions for making such a decision, will however emerge during this test period as experiences from the usage inevitably will result in some favorable or unfavorable attitude towards the innovation, and thus reflect the *intention* of adoption. The purpose of this study is therefore to examine how perceptions of the innovation attributes affect the attitude towards the innovation and how the attitudes unfold regarding intentions of adopting the innovation. The problem statement for this study is therefore formulated as follows:

"*How does the perception of innovation attributes affect the intention of adopting an innovation within a hospital?*"

This problem statement means in turn that the dependent variable of this study is the intention of adopting the innovation. The independent variables will be the perception of innovation attributes which will be presented in detail in the theoretical section of this paper. These conditions are illustrated below in figure 1, which is a conceptual overview for this study. This model will serve as the basis for the forthcoming theoretical framework for this study.

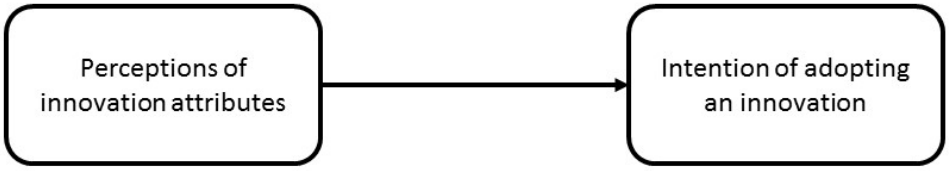


Figure 1: Conceptual overview

1.3 Structure of the paper

In this chapter, the theoretical and practical background for the topic selection was discussed, and the result was the formulation of a problem statement for this study. Chapter two of this paper will present the theoretical perspectives of this study. This chapter will include a discussion of the innovation concept, which will be the basis for defining the CMS as an innovation. Further, the innovation-decision process is described in order to situate the case in terms of what decision-stage the CMS is currently at. Then, a presentation of an existing theoretical framework on innovation attribute is given. This framework will be the starting point for the development of the theoretical framework for this study. The theoretical chapter concludes with the construction of a conceptual model that will be the basis for the data collection. Chapter 3 represents the methodological section of the paper. In this chapter, the research design for this study will be presented. Additionally, any choices regarding the execution of this study will be discussed throughout this chapter. In chapter 4, the empirical findings from the data collection will be presented and analyzed. Chapter 5 will include a discussion of the analyzed data with the purpose of linking the findings to the problem statement of this study. The final chapter will comprise the conclusion of this study. This chapter will include subsections that discusses the theoretical and practical implications from this study. A brief discussion on weaknesses and limitations of the study, as well as suggestions for future research will also be given.

2 A theoretical framework for innovation attributes

Prior to constructing the theoretical framework of this study, a brief literature review on some of the most prominent, and consequently most cited studies of innovation attributes and adoption, were carried out. This was essential in order to get a perspective on different theories within this particular discipline. In this section, a theoretical framework for measuring perceptions of innovation attributes will be presented. Further, a brief description of how this framework can be utilized to explain individuals' intention of adopting an innovation will be given. This section concludes in the development of a conceptual model and a set of propositions that will be based on the theories presented.

2.1 The innovation concept

Before the theoretical framework is presented, a clarification of the innovation concept is necessary. The reason for this is that depending on how the term innovation is defined, its meaning might be quite ambiguous regarding the innovation of interest. Often claimed to be the first to define innovation, Joseph Schumpeter stressed the novelty aspect of innovation, referring to something that has not been done before (Crossan & Apaydin, 2010). But as Crossan and Apaydin noted from Hansen and Wakonen (1997), it would be practically impossible to do things identically, which would make any change an innovation by definition. While Schumpeter's definition might be too inclusive, several other definitions tend to be too exclusive. A few examples is the requirement of successful implementation (Hobday, 2005; Klein and Knight, 2005 after Crossan & Apaydin, 2010), and even diffusion (Holland, 1997) in order to justify the definition of an innovation. In any of these definitions, the CMS technology would be neglected as an innovation. Some definitions also discriminate between innovation as a process, and as an outcome with the latter of the two implying that some entity external to the organization is necessary in order to determine whether something is an innovation. For CMS, the outcome of the technology is not yet fully evident, as the test-phase is currently ongoing, and adoption and implementation has yet to occur. Regardless, innovation as a process will always precede innovation as an outcome (Crossan & Apaydin, 2010), and a process does not necessarily need to be novel to any other than the organization itself. For this study, a definition that includes the circumstances of the CMS technology needs to be applied. One definition that consequently would support the CMS technology was proposed by Amabile et al. (1996). They defined innovation as *"…the successful*

implementation of creative ideas within an organization" (Amabile et al., 1996:1155). This definition refers to the implementation of ideas rather than the innovation as an outcome. This means in turn that CMS, in its current state is necessarily the result of the implementation of creative ideas within the confines of the organization, which in this case is NST. When referring to CMS as an innovation, this definition will be the basis throughout this paper.

2.2 Innovation attributes and adoption

Rogers (2003) have conducted and collected much of the pioneering work within innovation diffusion and adoption, and not surprisingly, scholars of these topics have previously tended to favor Rogers' theories over the alternatives (Mahajan, Muller, & Srivastova, 1990). On a more contemporary basis, Rogers' diffusion of innovations theory (DIT), which is a comprehensive framework that seeks to explain how and why new technology spreads through a social system, have been subject to extensive critique. This critique and other limitations will be discussed continuously in this chapter. Nevertheless, the DIT's prevalence well into the 21st century underlines its potency within innovation diffusion- and adoption research. Within research on innovation adoption, and specifically measuring determinants of innovation adoption, well established theoretical models such as the theory of planned behavior (Ajzen, 1991), theory of reasoned action (Ajzen & Fishbein, 1977), and the technology acceptance model (Davis, 1986) has all been utilized in adapted forms (Venkatesh et al., 2003). The only theory that attempts to explain the direct relationship between perception of innovation attributes and innovation adoption is Rogers' (2003) scale of innovation attributes, also referred to as innovation characteristics. Keeping its critique in mind, several studies have shown that adapted versions of this scale have shown valid results (Damanpour & Schneider, 2008; Moore & Benbazat, 1991). Because the purpose of the innovation attributes scale is more applicable for studying innovation adoption, it will be the starting point for developing the theoretical framework for this study.

In order to fully grasp how, why, and when perceptions of innovation attributes occur, there is a need to examine it through a procedural perspective. Rogers (2003) argued that individuals forming an attitude about an innovation, which eventually leads to a choice of adoption or rejection, occurs as part of the innovation-decision process. A brief introduction to the innovation-decision process is given below.

2.2 The innovation-decision process

The innovation-decision process represent the process that potential innovation adopters go through when they are deciding whether to adopt or reject an innovation. The steps of this process include (1) *knowledge*, (2) *persuasion*, (3) *decision*, (4) *implementation*, and (5) *confirmation* (Rogers, 2003). Rogers' five-step innovation-decision process has been critiqued for assuming that this process is in fact linear (Fitzgerald et al., 2002). However, Rogers contemplated that adopting units may jump back and forth in this process, giving it some form of dynamism. Another approach to determine this process is presented by Van de Ven et al. (1999) which is non-linear, dynamic, and both unique and ambiguous to the participants of this process (Fitzgerald et al., 2002). Nevertheless, research so far has tended to favor Rogers' model for studying decision processes (ibid.). The reason why this process is important is that it represents the time dimension related to innovation adoption and rejection, and is evidence that certain events that may affect the adoption decision does not happen at random, but at specific stages in this process. The steps of this process are explained below based on Rogers' (2003) framework.

Figure 2: The five stages of the innovation-decision process (Rogers, 2003).

2.2.1 The knowledge stage

The knowledge stage commences the moment when the decision-making unit first gains knowledge of the innovation. Three different types of knowledge about innovations are relevant from the adopter-perspective: *awareness-knowledge* (what is the innovation*?), how-to-knowledge* (how does it work?), and *principles-knowledge* (why does it work?). When measuring adopter characteristics' relation to the perception of innovation attributes, it is important to consider the significance of all these types of knowledge. Obtaining awareness-knowledge may require potential adopters to have well developed social networks or higher levels of education. How-to-knowledge will naturally require adopters to have some form of technical or functional skill, while principles-knowledge will require a deeper understanding for why the innovation works, for example, the understanding of the environment in which

the innovation is used, or some form of tacit knowledge. Because of the different knowledge types, specific traits related to acquiring these types of knowledge may lay the foundation for the adopting units' perceptions of the innovation attributes. This implies that certain characteristics of the adopting unit may affect the relationship between the individual's perception of innovation attributes, and its adoption-decision. The initiation of the knowledge-stage may be a result of either an active, or a passive approach by potential adopters. An active approach means that the individual has a perceived need for this particular innovation, and thus actively seek information about this innovation. A passive approach means, in turn, that the individual has not been aware of his/her need for this innovation, and exposure to the innovation is likely to have happened by chance. Within the context of this study, the knowledge-stage has already occurred, as the adopting unit took on an active approach in acquiring knowledge about the CMS innovation. The Chief Department Physician at the UNN cancer ward inquired about the possibility of conducting a pilot-test for CMS at their department at their own initiative. The individuals employed therein had felt a need for an interruption management system for quite a while. However, it can be debated whether there was some aspect of passivity involved, as the adopting unit felt a need for *an* interruption management system, rather than *the* CMS system. Since the development was the result of observations of an external party, it was not until knowledge about the CMS technology was acquired that the Chief Department Physician actively inquired about a pilot test. It is reasonable to assume that the active approach is most applicable to public hospitals, because of the political complexity and centralized decision-making structure. The knowledge-stage may be particularly important within hospitals, especially since innovations aimed at this sector are less likely to be promoted through traditional marketing channels. This means that adopting units might rely more on their social networks to acquire knowledge about innovations.

2.2.2 The persuasion stage

The persuasion stage is when the individual starts to form his or her attitude towards an innovation. A requirement for initiation of this stage is that the knowledge stage has already occurred. This is natural since an individual cannot form an attitude towards an innovation he or she does not know about. The term persuasion may imply that this is an activity performed by a change agent (i.e. salesperson or marketer), but more accurately, it refers to the individual's use of his or her own cognition to make sense of the information received from

such external actors. This stage is of particular interest for this study as it represents the formation of potential adopters' attitudes towards the innovation based on their perceptions of innovation attributes. It is at this stage that the nurses in the UNN cancer ward is situated during the entire pilot test of the CMS technology. Since the persuasion stage lasts until an adoption decision is made, it will be in this stage that the nurses' intentions of adopting the CMS emerge.

2.2.3 The decision stage

Rogers (2003) claims that the decision stage starts when the individual starts engaging in activities that lead to a choice of whether or not to adopt the innovation. The actual adoption is the decision to make full use of the innovation, while rejection simply is the decision not to adopt. Since no adoption decision regarding CMS will be taken at the UNN cancer ward during the course of this study, the decision stage slightly falls out of the focus of the study. It is still of interest, however, as the purpose of the study is to examine the events that take place in the preceding decision-stages. These events will form an attitude towards CMS among the potential adopters, which will be the equivalent to their intention of adopting CMS. This intention will then necessarily reflect what the adoption decision will be, regardless of whether the decision has been made. Still, one should keep in mind that intending to adopt an innovation, does not automatically mean that a decision to adopt will be made. Individuals going through the persuasion stage may form a positive attitude, and intend to adopt an innovation, while still ending up rejecting it due to a change of mind. This issue, and its relevancy for this study, will be discussed in the concluding section of this paper.

The latter two stages of the innovation-decision process, which is the implementation- and confirmation stages, fall outside the focus of this study. For special interest in these stages, see Rogers (2003).

2.3 Innovation attributes

The attributes of an innovation refers to the characteristics of the innovation that affects the rate at which it is adopted. Rogers defined rate of adoption as "*the relative speed with which an innovation is adopted by members of a social system*" (2003:221). Rates of adoption is not the interest of this study, as it represents adoptions made by an entire social system. Studies of rates of adoption is more suitable for extensive macro-level research, and would rather be

considered as part of the diffusion discipline. Even though Rogers' framework on innovation attributes (forthcoming) is intended to measure adoption rates, there is no reason to believe that it cannot be used to explain adoptions by *parts* of the social system. Several studies (Damanpour & Schneider, 2008; Moore & Benbazat, 1991) have already used adapted forms of this framework to measure adoption without emphasizing the cumulative aspect of the concept. The purpose of developing innovation attribute scales is to categorize potential adopters' perceptions of the innovation, for example, how it looks, how it feels, how easy it is to use, or how beneficial it is. Such perceptions are, naturally, what forms potential adopters' intention of adopting an innovation. This will ultimately be what they rely on when forming an intention or making a decision regarding innovation adoption.

Rogers noted that creating a general classification system to characterize the attributes of an innovation, is an eventual objective within innovation adoption and diffusion research. Such a unifying framework does not yet exist, but there are however attributes that have been widely accepted throughout the innovation adoption literature as a general approach when measuring perceptions of innovation attributes. These attributes derive from the past research on innovation diffusion and adoption and include (1) *relative advantage*, (2) *compatibility*, (3) *complexity*, (4) *trialability*, and (5) *observability* (Rogers, 2003). The attributes will be discussed below based on Rogers' (2003) framework.

2.3.1 Relative advantage

The relative advantage of an innovation is defined as *"…the degree to which an innovation is perceived as being better than the idea it supersedes*" (Rogers, 2003:229). He further describes the relative advantage as a variable dependent on the nature of the innovation. Thus, the relative advantage may differ significantly across different types of innovations. On a general basis, the relative advantage of an innovation may be economic factors (i.e. cost less), social factors (i.e. prestige and respect), performance factors (more efficient in use), etc. In other words, anything that is subjectively perceived as more advantageous with an innovation, over the existing alternative, would be considered a part of this attribute. Needless to say, a higher degree of perceived relative advantage will have a positive effect on intentions of adopting the innovation. This attribute will be prominent in all innovation-decision processes, regardless of context, as the innovation needs to be better than the alternative that it supersedes in order to justify a decision to adopt it. Because of this, Rogers claims that

relative advantage often will explain most of the variance in adoption decisions, and consequently, this attribute may very well be the most important one in the persuasion stage of any innovation-decision processes. A problem may occur when an innovation are in fact better than the existing alternative, but are not adopted due to other factors such as cost. This issue is prevalent within hospitals since it challenges ethical values related to putting a price on sustained health or even life.

2.3.2 Compatibility

The next attribute described by Rogers is *compatibility*. He defines it as *"…the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters*" (2003:240). Rogers explains that an innovation's compatibility can be regarded threefold: By *sociocultural values and beliefs*, *previously introduced ideas*, and the decision-making unit's *existing need*. Sociocultural values and beliefs refers to whether the innovation fits, or are appropriate based on cultural paradigms within certain regions. Compatibility with previous ideas is a factor that can either hinder or promote the adoption of an innovation, because overadoption, or even misadoption may occur (Rogers, 2003). An example of this could be if a user adopts an innovation, and uses it the same way as the alternative it supersedes when, in fact, it should be operated differently. This means that compatibility with existing ideas is not necessarily a good thing for an impending innovation adoption. The reason for this is that past experience is embedded in people's cognition and works as a mental tool to evaluate novel ideas (ibid.). Finally, an innovation may, or may not be compatible with existing needs among individuals or the adopting entity. If an innovation fulfills a felt need, it is naturally more likely to be adopted (ibid.). Since procedures and practices within the public hospital sector in Norway are heavily regulated, an innovation's incompatibility with such rules may be a significant factor when innovations are rejected.

2.3.3 Complexity

The third innovation attribute presented by Rogers is *complexity*. He defines it as *"…the degree to which an innovation is perceived as relatively difficult to understand and use*" (2003:257). This suggests that an innovation can be perceived as either complex, simple, or somewhere in between. Naturally, Rogers suggest that high innovation complexity has a negative effect on innovation adoption. The hospital sector may deviate from other contexts in terms of coping with innovation complexity. If an innovation can greatly improve treatment

in terms of quality or pace, there will likely be some entity within- or external to the organization who assist adopters in overcoming potential innovation complexities. In the case of this study, the pilot testing administered by CMS developer serves this purpose. It does not however change the fact that the potential adopters in the UNN cancer ward is currently undergoing the persuasion stage of the innovation-decision. This means that even though they are assisted in coping with complexities, their initial perceptions of complexity will remain unchanged. The next attribute deals with this issue in more detail.

2.3.4 Trialability

Trialability is the fourth innovation attribute and can be defined as *"…the degree to which an innovation can be experimented with on a limited basis*" (Rogers 2003:258). Although this definition may be ambiguous, it refers to pre-adoption activities of testing and experimenting that may ultimately lead to adoption of the innovation. A pair of jeans may for example be tried according to its full potential purpose in the changing room of a clothing store. If we consider a complex technological device, the opposite is usually true as it would be too time consuming to explore all its features in-store prior to a potential purchase. Potential adopters within hospitals may be more dependent on testing out innovations within their own environment, meaning that personal guidance may be vital for an innovation to be adequately trialed. The circumstances of the CMS pilot testing already confirms that the innovation has a high degree of trialability. Because of this, applying the trialability attribute in the context of this study may not be as purposeful as it would in an open market for certain consumer durables, as Rogers intended for it to do. In such cases, perceived trialability would naturally be expected to positively affect the adoption decision.

2.3.5 Observability

Observability is the final of the generally recognized attributes of innovations. Observability is defined as *"…the degree to which the results of an innovation is visible to others*" (Rogers 2003:258). This means that innovations where the usage is visible to others tend to be more easily adopted by those who are observing the usage. This attribute may be particularly important within hospitals, because decision makers may observe better practices at different locations, and thus want to adopt a similar practice. Considering the circumstances of the CMS pilot testing, perceptions of the innovation's observability cannot be examined without changing the focus of the study. It would require capturing the perceptions of individuals

external to the CMS testing. A compromise could be to examine how observable the test personnel *think* the innovation is to others. This may however result in invalid data since test personnel's perceptions may not be representative for perceptions of external individuals.

2.3.6 Limitations of the DIT's attributes

An initial problem with Rogers' innovation attribute scale is that the taxonomy of attributes does not consider whether attributes are primary or secondary (Moore & Benbazat, 1991). As noted by Downs and Mohr (1976) primary attributes are those directly associated with the innovation, and is more or less "fixed" like the cost of an innovation. However, even though the cost is fixed, people with different financial predisposition might perceive the cost differently, and therefore the secondary attribute would in this case be *perceived* cost. In other words, there is a significant difference between an innovation attribute, and a perceived innovation attribute.

Another problem is that of convergence of meanings between Rogers' five original attributes. For instance, Damanpour and Schneider (2008) argued that the complexity-, and trialability attribute may have some degree of convergence. Moore and Benbazat (1991) noted that the observability-, and trialability attributes may not be distinct enough to emerge as separate constructs. There is also some consensus throughout the literature that the relative advantage attribute is too broadly defined and consequently may reflect a variety of different advantages (Davis, 1986; Moore & Benbazat, 1991; Tornatzky & Klein, 1982).

The validity issues with Rogers' five original attributes as discussed above are likely due to contextual differences, and as a result, researchers of innovation attributes and adoption have modified this scale by removing invalid attributes and replacing them with context specific attributes that have been subject to construct validity tests. Some of the most prominent additions to innovation attributes throughout the innovation adoption literature are discussed below. *Ease of use* (Davis, 1986; Moore & Benbazat, 1991) is an alternative variable to complexity. Because the term complexity may have different meanings depending on individual perceptions, ease of use have been utilized due to its more explicit meaning. Damanpour and Schneider (2008) included *cost* and *impact* in their measurement due to cost being assumed too significant to be measured as part of relative advantage. Impact would still incorporate facets of relative advantage due to its attempt to measure the impact the

innovation adoption has on public organizations. Moore and Benbazat (1991) also included *image* and *voluntariness* to their scale of innovation attributes. Image represented the increase of status adopting units may acquire due to adoption. They also had a need to measure voluntariness, as whether adoption was voluntary or compulsory would affect perceptions of the remaining attributes. This latter attribute is redundant within this study. This is due to the democratic decision-making structure that were mentioned previously. This means that the nature of the potential adoption of the CMS is voluntary among the users.

2.4 Factors influencing perception of innovation attributes

It is impossible to assume that everyone perceives in the same way. Of course, individuals may have the same perception of an innovation attribute, but the way in which that perception was conceived is fundamentally different from person to person. The explanation is that people have different preconditions for perceiving innovation attributes. Rogers (2003) categorized such preconditions into socioeconomic characteristics, personality, and communication behavior. The former of these includes characteristics such as age, level of education, income and wealth possession. Personality includes traits such as degrees of empathy, dogmatism, rationality, intelligence, risk aversion, and attitude towards change. Within communication behavior, traits such as social participation, network, cosmopoliteness, and exposure to certain communication channels, are considered preconditions for perceiving innovation attributes.

Examining the role of such preconditions would be a study in itself, and due to the limiting scope of this study, these variables cannot be included in detail. A few of these variables are however applicable to the context of this study, and might have interesting implications for the further CMS development.

2.5 Conceptual model development and propositions

Based on the literature review on innovation attributes, a conceptual model adapted to the context of this study has been developed with corresponding propositions that are based on the theoretical framework presented in this study. This model will serve as the basis for the eventual data collection. The conceptual model and the reasoning for its concept composition is presented below.

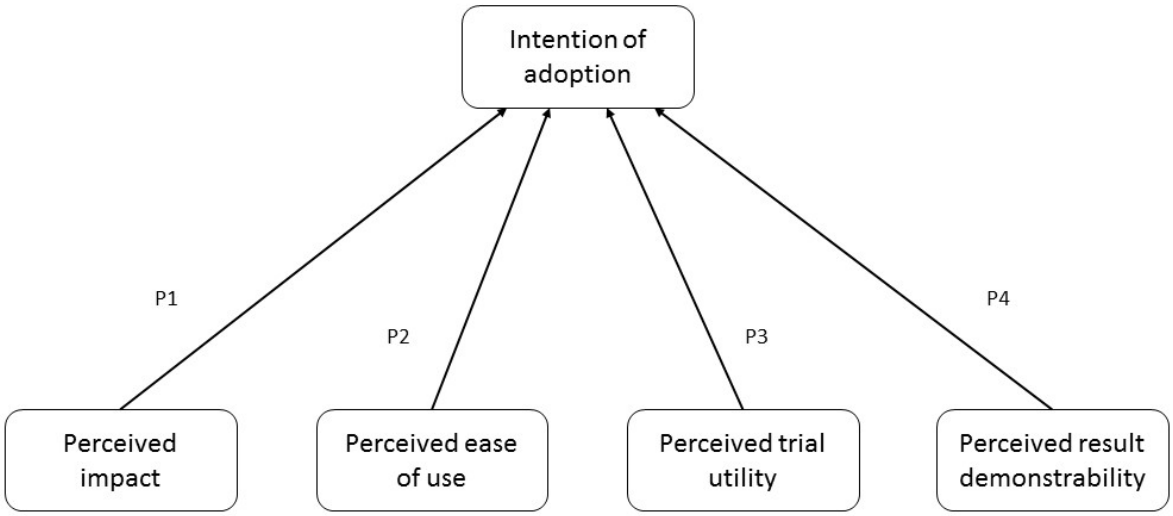


Figure 3: Conceptual model and propositions 1-4

Several of the innovation attributes proposed thus far has been omitted in the development of this conceptual model. The reason for this is that certain of these attributes is expected to be inapplicable because of the contextual circumstances in this study. The specific reasons for omitting these attributes are discussed in turn. The cost attribute, as proposed by Damanpour and Schneider (2008) is considered insignificant in this study. Adopting the use of the CMS will not result in any expense for the potential adopters. Thus, they assume no financial risk by adopting the innovation. Image, as proposed by Moore and Benbazat (1991) is also assumed to be insignificant within this context. Because of the professional environment in which the decision-process takes place, individuals may be less likely to adopt innovations due to desires of increased social status. The actual adoption decision of CMS was previously determined to be voluntary, but still subject to collective influence. Since the nature of the adoption decision is already known, there is no need to include voluntariness, as proposed by Moore and Benbazat (1991), in this study. Compatibility, which was part of Rogers' five original attributes, have been excluded in this model. There are several reasons for this. First, CMS has already been determined to be fully compatible with existing technology. This was a requirement prior to development in the first place, as an interruption management system needed to be compatible with the existing technological infrastructure at UNN. Second, it is known that CMS is compatible with existing needs since the test-users had already expressed needs for an interruption management system prior to the development of CMS. Lastly, there is no indications so far, and no reason to believe that the CMS is incompatible with any values or beliefs among the test-users.

2.5.1 Conceptual model

The first attribute in this model is **perceived impact**. As previously discussed, the limitations of relative advantage may cause it to measure a whole range of different advantages, and thus become a "garbage bin" for all elements that the nurses perceive as advantageous with the CMS. This issue would become problematic if several nurses would regard the CMS as less complex than the existing alternative, and feel that this element was advantageous relative to their old system. This would result in convergence between the two attributes, and it may not be as clear how-, or to what extent the nurses' perceptions affect their intention of adopting the CMS. Another important note is that relative advantage relies on the technology it supersedes. Since it is already an established fact that CMS is more advantageous than the existing alternative based on its specifications, it may be less relevant to measure advantages relative to existing technology. Instead, the perceived impact of an innovation will explore what impact the use of the innovation has on nurses' work processes, with no (explicit) reference to the existing alternative. This means that it will be entirely up to the nurses to describe what they feel the concept of perceived impact entails. The intention behind the perceived impact attribute is that it will force the respondents to focus on the tasks that the CMS is intended to perform, rather than the physical aspect that comprise the CMS. This is perhaps the biggest difference between the relative advantage, and the perceived impact attribute, which is assumed more applicable in this study due to its contextual circumstances.

Proposition 1: The perceived impact of an innovation is positively related to the intention of adopting it. The more impactful the innovation is, the more likely is it intended to be adopted.

The second attribute of this model is **perceived ease of use**. CMS is without doubt a complex innovation due to the underlying system architecture and all its corresponding devices and software. However, the end users of CMS are likely never to be exposed to this complexity, and are naturally interested in the actual use of the innovation. Since the nurses of the UNN cancer ward is not required to operate, or have any knowledge about the system architecture, it is more purposeful to omit the complexity attribute since nurses may state that the CMS is complex, even though they feel it is easy to use. Even though some might perceive the actual usage as being complex, the complexity attribute as suggested by Rogers is more likely to be too inclusive in terms of explaining innovation complexity. Ease of use was therefore imported from Davis (1986) Technology Acceptance model, since it is explicitly focused on

the usage of the technology, as a substitute for complexity. Davis claimed that the perceived ease of use attribute would have a significant effect on attitudes toward usage, which is an intermediate variable in his technology acceptance model. It is safe to assume that perceived ease of use also will have a strong effect in the intention of adopting the CMS in this study. Davis further suggests that perceived ease of use affects the perceived usefulness of an innovation, which is another attribute in his model. The attribute of perceived usefulness is very similar to the perceived impact attribute utilized in this study, with both of these focusing on the outcome of the usage associated with the innovation, as opposed to Rogers' relative advantage. Even though exploring the relationship between these attributes is not part of the purpose of this study, it might still be interesting to see if Davis' proposed relationship between perceived ease of use and perceived usefulness unfolds between perceived ease of use and perceived impact in this study.

Proposition 2: The perceived ease of use of an innovation is positively related to the intention of adopting it. The easier an innovation is to use, the more likely is it intended to be adopted.

The third attribute of the conceptual model, **perceived trial utility**, derive from Rogers's (2003) original framework and specifically the trialability attribute. It will however be operationalized in a different way than Rogers originally intended. Since this case study focuses on a pilot test for an innovation, measuring trialability as initially described will generate no interesting results. The reason for this is that the innovation, at this stage, is very trialable. In fact, this is the purpose of the pilot testing in the first place. Instead, this study will focus on the perceived importance of this trial period of testing the CMS. The perceived trial utility attribute will therefore be operationalized by exploring how important this testing period was in order for the individuals to form positive intentions toward adoption of this innovation. To my knowledge, the perceived utility of a trial period is a concept that has not yet been explored in studies of innovation adoption. Even so, the theoretical assumption behind this attribute will be based on Rogers' discussion for the trialability attribute. He claimed that the trialability of an innovation was positively associated with its adoption. There is no reason to believe that the perceived utility of this trial period will not have a similar effect on intentions of adopting the CMS.

Proposition 3: The perceived utility of the trial period is positively related to the intention of adopting the innovation. The more beneficial the trial period is, the more likely is the innovation intended to be adopted.

The fourth attribute in this model is **perceived result demonstrability**. Observability was previously claimed to reflect how observable the use of the innovation was to *others*, i.e. outsiders that are exposed to persons using the innovation. This measurement would fall outside the interest of this study, as it would attempt to predict adoption intention beyond the case of interest. The reason for this might be that Rogers' original attribute framework was intended to measure adoption *rates*, and thus predictions of adoption decisions throughout the entire social system in which the innovation is being adopted, would be a relevant measure. Moore and Benbazat (1991) developed an alternative construct, result demonstrability. Their items revealed it aimed to measure how demonstrable the results were to the user *and* others. Since this study does not focus on adoption rates, it will be more interesting and purposeful to investigate how the users' perception of the result demonstrability affect their intentions of adopting the CMS. Additionally, it might be interesting to explore what result demonstrability towards others means in terms of intentions of adoption among the users. Even though the impact attribute might be perceived as implicitly focusing on the results of using the innovation, it would still be conceptually distinct from result demonstrability. Put simply, impact will focus on the belief that the innovation has had a positive impact on the individuals' work processes, while result demonstrability partly seek to examine whether this was the case. Perceived result demonstrability is therefore assumed an important attribute in this study, as it may uncover how visible the results from usage was to the nurses during the pilot testing. Because of this, perceived impact and perceived result demonstrability is likely to be somehow related in terms of their effect on intention of adopting CMS.

Proposition 4: The perceived result demonstrability of an innovation is positively related to the intention of adopting it. The more demonstrable the results from using an innovation is, the more likely is it intended to be adopted.

Because the individuals studied are assumed to be a relatively homogenous group in terms of socioeconomic traits, variables such as level of education, occupation, and income are likely to be rather similar among the users of the innovation. There are however, one variable that are assumed to moderate certain perceptions of innovation attributes, and that is **age**. In a

study of managers and innovation adoption, older managers were found to be more likely to accept organizational conditions and routines, and thus being less likely to commit to innovations that would cause changes (Huber et al., 1993 after Damanpour & Schneider 2008). This means in turn that younger managers are believed to be more receptive to innovation. The opposite was found to be true in public service organizations as managers had greater insight into performance improvement along with being respected for their seniority, and thus age would positively affect their receptiveness to innovations (Kearney et al., 2000 after Damanpour & Schneider 2008). Since age is generally believed to affect attitudes towards innovations, it will be included as a control variable in this study. Impact and result demonstrability are assumed to be equally important regardless of age in this study. It will be assumed that age is a precondition for perceiving ease of use and trialability. No assumption on whether lower- or higher age is associated with the perception of these attributes will be made. Instead, exactly *how* age might affect the perception of ease of use and trialability might be determined during the impending data analysis.

In addition to age, prior experience with using smart phones will also be controlled for. This characteristic is directly linked to the innovation, and more specifically to the part of the innovation that the users are exposed to. Since people have different prior experiences with using smartphones, it is reasonable to assume that people who have never used smartphones will perceive the innovation as more difficult to use than those with more experience will. The same is assumed for the perceived trial utility attribute: people with less experience in using smartphones are assumed to rely more on the ability to test the innovation during the pilot testing.

The composition of the conceptual model presented above, has an apparent divergence from Rogers' original framework. Nevertheless, the model is quite similar to Rogers' framework as its attributes are equivalents of the original ones. As the discussion above has shown, perceived impact is quite similar to relative advantage, and ease of use represents the complexity attribute. The operationalization of perceived trial utility is slightly different from that proposed by Rogers in his trialability attribute. Finally, result demonstrability represents Rogers' observability attribute, except from having an extended perspective. These modifications to Rogers' original five innovation attributes were made in order to adapt the conceptual model to the context of this study. These modifications is a form of theory triangulation, which will be discussed in section 3.4 of this paper.

3 Methodology

The most acknowledged studies on innovation attributes and adoption that are cited in this paper have based their findings on quantitative data. There seems to be a rather uniform approach to empirical testing by developing conceptual measurement scales and hypotheses. The research question in this study calls for a different approach. In the following sections, discussions regarding choice of research methods- and design will be given. In section 3.2, it will be elaborated on how the independent variables of the conceptual model will be operationalized. Further, a discussion regarding the philosophical point of view in this study is given. Additionally, any measures taken in order to improve the quality of this study will be presented and discussed.

3.1 Research design

Although quantitative data has its benefits in these types of studies, such an approach quickly becomes inadequate when the goal is to seek a deeper understanding of the opinions expressed by the respondents. As evident by the problem statement for this study, acquiring such elaborative data is the purpose of this study. This means in turn that a qualitative design will be applied. A conceptual model serves as the basis for data collection in this study. Aside from exploring the propositions related to this model, it will also acknowledge that new concepts may emerge during data collection. Doing this is important in terms of the theoretical contribution of this study, and may propel research within this discipline by exploring any divergences related to the context of the study, which existing theories fail to consider. This means that this study has an abductive research approach, rather than a purely inductive or deductive one. An abductive design simply means inclusion of both deductive and inductive approaches to research, where either of the two usually emerge as dominant (Saunders, Lewis, & Thornhill, 2012). Practically speaking, an abductive approach will use a theoretical foundation prior to obtaining data, while at the same time using the data to modify or create new theories within the research topic (ibid.). Opting for an abductive approach was rather natural as the problem statement for this study has an explanatory orientation, but because the conceptual model and the context of this study is unique compared to existing theories and past research, it will be natural to raise more exploratory questions after the data collection. This further emphasizes the purpose of this study, which is to use elements of existing theory in order to obtain rich and unique qualitative data about a phenomenon that is

highly dependent on its context. Depending on the quality and novelty of this data, it may be used to propose modifications to the existing theories on innovation attributes and adoption. A suitable research method for abductive approaches is the case study, which will be discussed in the following subsection.

3.1.1 The case study

Based on the phenomenon being studied and the research questions, a case study design emerges as the most suitable for this study. Studies of innovation adoption have previously been deemed highly dependent of context, and according to Yin (2014), a case study is well suited to address this challenge. The utility of a case study is further evident as the pilot testing of the CMS technology is currently ongoing. Case studies have been argued to be the most appropriate design for research on such contemporary events (ibid.). A major advantage for doing research on contemporary events within innovation diffusion- and adoption is that it eliminates what is described as the *recall problem*. The recall problem is particularly prominent within innovation diffusion- and adoption research, because the innovation-decision process of the decision-making unit is likely to have occurred in the past. The problem arises when respondents are asked to recall, or reconstruct their past in order to obtain information regarding their innovation decision process (Haider & Kreps, 2004; Rogers, 2003). Because of time difference between the occurring events and the researcher's inquiry, the information obtained may not be completely accurate. Instead, this case study will gain this information in real-time when perceptions and opinions are being created which effectively eliminates the recall problem, since the perceptions and experiences are still top of mind in the respondents.

The case in this study is the pilot test of CMS and the circumstances related to it. This means that the case is in fact a process within a bounded period that has a clear point of initiation- and conclusion. According to Yin (2014), this case would represent what he refers to as a critical case. The reason for this is that the pilot test is occurring within a limited timeframe, and thus any data related to the context of this case, can hardly be collected at any other occasions than the ongoing pilot testing. The unit of analysis in this case study is the cancer ward at UNN, and more specifically, the forty nurses employed therein who are participating in the CMS pilot testing. This indicates that a single-case might be the most expedient approach to study the unit of analysis. The rationale for applying a single-case design is

primarily the circumstances regarding the CMS pilot testing. Since the pilot testing is undertaken at one specific department of UNN, this study cannot examine the phenomenon under different contextual circumstances. Nevertheless, single-cases have the ability to explain phenomena in greater detail than multi-cases, with the latter rather being a favorable approach in terms of generalization and comparative studies (Eisenhart & Graebner, 2007). Since no logical sub-units can be identified in this case, there is no basis for doing a comparative case study among multiple units of analysis that are embedded in the case. Instead, this case study takes on a holistic approach. This involves observing a certain phenomenon from multiple perspectives, which enables the researcher to gain a better understanding of the complexities related to the specific case of interest (Stake, 1994).

3.1.2 The case selection process

In order to find a suitable case for this study that would incorporate the hospital sector, a natural starting point was the Norwegian Centre for Integrated Care and Telemedicine (NST). NST is a supplier of telemedicine solutions for the public healthcare sector in Norway, and integrated in the UNN organization. A review of the project portfolio of NST was conducted, in which the selection criteria was projects that were either currently ongoing, or concluded within a reasonable period. An evaluation of the novelty value of the projects was also necessary. For projects of particular interest, several contact persons at NST were asked to elaborate on details regarding the project that could not be extracted from the portfolio. The CMS project and its upcoming pilot test emerged as the most suitable case for this study, with the contemporariness of the project emphasized in the decision. The pilot test was due to commence the last week of March 2014, but due to technical difficulties related to the ASCOM infrastructure, the testing period was postponed. The developer had to set up a temporary communication infrastructure for the CMS system, which delayed the pilot test until May 5. Because of this, a decision had to be made whether to abandon this case, or to continue and accept the postponement and any limitations this entailed. The limitations were determined not as severe that they would significantly affect the purpose of this study. The limitations were mainly consequences of bypassing the ASCOM infrastructure. Some functions of the CMS that were supposed to be included in the pilot test became unavailable during the course of this study. This included the patient alarms, and the automated context detection. The patient alarm was intended to be received on the CMS devices, but had to remain at the old calling system. The context detection had to be set manually by the nurses.

This means that they had to set their availability status on their phones, in order to appear as "busy" in the CMS software. A brief review on how this may have affected this study will be given in the concluding section of this paper.

3.1.3 Qualitative interviews

Interviews have shown to be an important source of case study evidence (Yin, 2014). Since this study focuses on obtaining respondents' perceptions, and a deeper understanding of why they perceive in a specific manner, interviews will be the most appropriate approach to data collection, and was therefore used in this study. Although this method of data collection, is widely utilized within both quantitative and qualitative research, one important distinction lies in the structure of the interviews (Rubin & Rubin, 2005). In quantitative research, a rigid structure is desirable in order to ensure that the respondents answer the same questions. In qualitative research, interviewing might have no structure at all, often referred to as un-structured-, or in-depth interviews (Yin, 2014). Interviews conducted as part of this study were of a semi-structured nature, as some structure was necessary in order to explore the propositions in the conceptual model. In order to capture any attitudes beyond what was proposed in the conceptual model, respondents were allowed to digress from the original questions.

A total of eight interviews was desirable in order to obtain a data base that was comprehensive enough in order to address the problem statement of this study. In the process of scheduling the interviews, it turned out to be more challenging than anticipated to obtain eight full interviews. Most of the nurses felt that they could not leave their work duties in order to take part in interviews. This was naturally respected due to the stressful work-environment and the severity of the conditions of the nurses' patients. Needless to say, the availability of the nurses was overestimated, as several of the nurses even aborted their lunch, or had it "on the go" if there were matters they had to attend to. Even so, I was allowed to attempt to conduct interviews by the department nurse, as long as it was ok for the nurses of interest. As a result, six full interviews were made as opposed to the eight that were desired.

All the interviews were recorded, and later transcribed by the author. All interviewees consented to the recording of the interviews. Complete confidentiality was maintained for the respondents as they were assigned fictive names in the transcriptions. The interviewees were

informed that I would delete any records when they had served its purpose, as part of their confidentiality. This was done in order to reassure the interviewees that any negative perceptions regarding the CMS or the pilot test could not be linked with any specific person. Because of this, all transcripts and voice recordings were deleted following the submission of this paper. Even though vast amounts of data was collected, no assistants were used in the transcription process. This was particularly important, as any individual without knowledge of the context or theoretical perspectives might fail to notice any critical implications that may emerge during the course of listening to the interviews.

3.1.4 The observations

The CMS pilot test is taking place in the real-world setting-, and natural environment of the nurses at the cancer ward, which makes observations even more beneficial. Direct observations are claimed to be an invaluable means of data collection when the case study involves the use of new technology (Yin, 2014). The reason for this is that observations enable the researcher to better understand aspects of the technology that are related to the actual usage of it. Andersen (2013) claimed that one of the strengths associated with case studies is the ability to develop relations with the informants by taking part in their environments and thus capturing information that would otherwise be hard to obtain. This is exactly what occurred during the observations that were conducted as part of this study. The observations were conducted prior to, and during the CMS pilot test. I spent approximately 15 hours total in the UNN cancer ward and got familiar with many of the nurses, which greatly benefited the course of the six full interviews that were conducted. As a result, initiating the interviews became a lot easier than I anticipated, and the conversations remained rather fluent throughout the interviews. The initial observations were important in order to get a sense of the expectations the nurses had to the pilot test. The observations that took place during the pilot test were made in order to observe the nurses using the CMS device in their natural environment, so that the perceptions more easily could be related to specific events in the nurses' workday. The intention behind these observations was for it to supplement the data collected during the interviews. This made it possible to crosscheck any ambiguous responses that may emerge during the interviews. This particular technique is a form of methodological triangulation which is discussed in section 3.4 of this chapter. Throughout the course of observations, informal conversations with around twenty nurses were held during their breaks. These conversations were based on questions from the interview guide. None of these

conversations completed the interview guide in its entirety, but the data material acquired from these conversations was nonetheless substantial.

3.2 Operationalization of concepts

Prior to the interview phase, an interview guide was developed. This guide mainly contained questions that aimed to operationalize the concepts presented in the conceptual model for this study. The interviews were carried out in Norwegian as this was assumed the mother language of most of the interviewees. Conducting the interviews in Norwegian was important in order to avoid any misinterpretations due to lingual difficulties. The questions in the interview guide was phrased in both Norwegian and English, in case any interviewees had a mother language other than Norwegian. The translation of the questions were done by myself, and to the best of my ability. This was particularly crucial since sub-optimal translations may cause questions to be interpreted differently than intended. Both a Norwegian and an English version of the interview guide is presented in appendixes 3-4.

The interviews were initiated by letting the interviewees elaborate about themselves without any reference to the CMS technology. During this phase, a set of questions to control for certain predispositions were asked. These included questions about their age, role in the cancer ward, attitude towards new (and complex) technology in general, and prior experience with operating smartphones. This introduction allowed both interviewer and interviewee to build mutual trust, and establish a form of relation in the transition into the questions regarding the conceptual model. These initial questions was also important due to my lack of knowledge of the nursing profession, and their work processes. The questions related specifically to the conceptual model partly derives from items included in corresponding past research on the topic. For each concept, interviewees were asked to state the significance of the particular perception in relation to their intention of adopting the innovation. For example, an interviewee would be asked how much impact the innovation had on his or her work process. Interviewees were then prompted to elaborate on the answers given in the initial questions, in order to understand why certain attitudes had formed.

The control variables in the conceptual model has more than a sample sorting function. Age and prior experience will not be operationalized per se, but it will make it possible to uncover any perceptive trends related to these control variables. This will be done by checking for any

discrepancies in the perceptions for respondents with varying predispositions. The purpose is not to establish any causal relationships between the control variables and the perceptions, but any perceptive discrepancies based on these control variables are highly valuable to the further CMS development. Any findings related to these variables will not be emphasized in the conclusion of this study, as the sample would be too small in order to establish any relationships between these controls and certain perceptions. Findings related to these controls will however be reported to the CMS team as it was desirable for the developer to acquire this information about this particular pilot test.

As evident by the interview guides in appendixes 3-4, academic concepts such as "innovation(s)" were omitted in the interviews and replaced with terms such as "technology" that are generally more comprehensible. This measure was taken in order to ensure that interviews were carried out efficiently, and without any misinterpretations that could result in invalid data. Another problem that needs to be considered in these types of studies is *pro-innovation bias*. This issue is primarily related to bias regarding the analysis of data in innovation studies. Pro-innovation bias can occur if scholars of the innovation discipline exclusively regard innovation as a positive phenomenon. This means that innovation researchers tend to perceive all innovations, by definition, as something that should be adopted in any circumstances, effectively neglecting the study of ignorance of innovations (Haider & Kreps, 2004; Rogers, 2003). This issue was also considered during the interview phase of this study, since it was desirable to obtain data that were not the result of a disbelief that questions aimed to generate positive responses regarding the CMS innovation. The pro-innovation bias issue was addressed by informing the interviewees that this study was not a direct part of the CMS development. Additionally, no personal perceptions or opinions were expressed towards the nurses in order to appear as a neutral external party, independent of the CMS development. This way, any negative perceptions related to the attributes of CMS could more easily be detected.

3.3 Epistemological and ontological views

Even though the philosophy behind research presented in a paper might be more or less implicitly expressed, an explicit statement has its benefits. The philosophical view in this study is primarily concerned with assumptions regarding knowledge, and the nature of reality of the phenomenon being studied. Such assumptions will inevitably shape how research

questions are understood, the methods being used, and the interpretation of findings (Saunders et al., 2012). In other words, different philosophical views may cause different analytical results due to divergence in the interpretation of the same data.

The concept of ontology is concerned with the nature of reality, i.e. how researchers understand reality, and how the world operates (Saunders et al., 2012). There are two different ontological views, namely objectivism and subjectivism. Objectivism emphasizes that social entities exist as a meaningful reality external to the social actors concerned with their existence (ibid.). This means the objectivist view emphasizes that the social entity defines the role of its social actors. In other words, an objectivist view would acknowledge that different phenomenon might occur in similar situations, but that the frames in which this phenomenon occurs is pretty much the same. If we recall Rogers' (2003) statement that no unifying framework to measure perceptions of innovation attributes across contexts exists, a belief that such a framework is even possible would be considered an objectivist view. By developing a conceptual model specifically aimed at the context for this study, a subjectivist view is already applied. Subjectivism emphasizes that phenomena are socially constructed, and derives from the perceptions and actions of the social actors (Saunders et al., 2012). They further state that social interaction between actors are a continual process, and that social phenomena are in a constant state of revision. Because of this, it is necessary to study the details of a situation in order to understand the reality behind what is happening. This is much more akin to this study, since its purpose partially is to uncover the reason behind perceptions of a phenomenon that has already been considered highly context specific. Because of this, and in terms of ontology, a subjectivist view will be applied in this study.

Aside from ontology, it is also purposeful to assume an epistemological position. While ontology concerns the nature of reality, epistemology concerns what constitutes acceptable knowledge (Saunders et al., 2012). This means that depending on what position one takes in terms of epistemology in a given research topic, there are different views of what knowledge is considered important. Positivism and interpretivism emerge as two, somewhat opposing, views within epistemology. Research within a positivistic view is generally more concerned with facts rather than impressions, and data is collected from an observable reality in an attempt to establish causal relationships between certain phenomena (ibid.). This study leans more towards the interpretivistic view, as perceptions, and consequently impressions, are considered important knowledge in this case. In terms of research, interpretivism emphasizes

that the social world is far too complex in order to create definite and law-like theories (ibid.). In this case, an interpretivistic view would rather interest researchers to pursue, and understand these complexities, as opposed to covering them up with some form of unifying generalization. Because of this, the epistemological view in this study will be based on interpretivism.

3.4 Quality criteria

Several measures have-, and will be taken in order to improve the quality of this study. The assessment criteria for the quality of this study is based on Lincoln and Guba's (1985) four trustworthiness criteria. This method of assessing research quality was a response to the absence of criteria specifically aimed at qualitative research. Lincoln and Guba (1985) argued that the traditional reliability and validity criteria was less applicable to qualitative research, and the result was the trustworthiness criteria consisting of *credibility, transferability, dependability,* and *confirmability* (Bryman & Bell, 2007). Measures taken in order to improve the quality of this study is presented below in accordance to the trustworthiness criteria.

The first criterion, credibility, is somewhat associated with the ontological angle of the research. Within the subjectivist view, which takes into the account that multiple realities may exist, and that reality is socially constructed, credibility becomes an increasingly important quality criterion. The explanation is that the reality which a researcher uncovers through the findings in a study will determine the acceptability of the results to others (Bryman & Bell, 2007) who may in fact have a different view in what constitutes reality. This issue may emerge during interviews where the researcher constructs his or her reality of certain events based on perceptions that are conceived within the reality of the interviewee. One way to avoid misinterpretations due to diverging realities is respondent validation. This entails having the respondents review the interpretations made by the researcher after the interviews (ibid.). This technique was applied after interviews where any ambiguous responses had been acquired. Another technique that may increase the credibility of the research is triangulation. According to Patton (2002) there are four main triangulation techniques. These include *(1) data triangulation,* (2*) investigator triangulation,* (3) *theory triangulation,* and (4) *method triangulation*. Data triangulation may be achieved by using multiple sources of data for a study. This will be achieved by interviewing multiple individuals who have different socio-demographic traits, and thus are assumed to have differing perspectives on the innovation

attributes. Investigator triangulation is the use of several different researchers and/or evaluators during a study. Theory triangulation represents the use of multiple theoretical perspectives in a study. Recall from the theoretical section of this paper that Rogers' (2003) original innovation attribute framework were modified by substituting certain attributes with those of other frameworks. This was essential in order to create a conceptual model with a set of propositions that could relate to the specific context of this study. Since Rogers' framework for innovation attributes have apparent validity issues in certain contexts, elements from different theories were used in constructing the theoretical framework for this study. By doing this, several of the limitations associated with Rogers' framework could be avoided. Methodological triangulation is defined as using multiple methods to study a single problem. The only notable form of method triangulation performed in this study is the use of both interviews and observations during data collection. The benefit of using both of these data collection methods is the ability to validate the data obtained from one source by the other.

Transferability is concerned with whether findings in one study of a particular context is relevant for other contexts (Bryman & Bell, 2011). Acknowledging that qualitative studies have difficulties with generalizing findings beyond its own context, Lincoln & Guba (1985) argued that such studies should rather attempt to create a *thick description* about the context of interest. This entails acquiring rich accounts of the details of a culture (Bryman & Bell, 2007). The value of a thick description is that external peers will have a wider basis for making judgments about whether findings are transferable to other contexts. The transferability of this study's findings will primarily be ensured by acquiring a thick description of both the phenomena, and its context through in-depth interviewing and observations. Additionally, an analytic generalization will be made in the conclusion of this paper, which entails comparing the findings from this study-, and checking for consistency with the theoretical framework applied.

The dependability criterion is concerned with how data is depicted by the researcher, and how this is ultimately presented (Bryman & Bell, 2011). One way of achieving dependability is to adopt what Bryman and Bell (2007) refers to as an auditing approach. To do this, records of all phases of the research needs to be kept, and stored in an accessible manner. As previously mentioned, all interviews were recorded and made accessible through transcripts. By doing this, the researcher may acquire important feedback from external persons with an objective, and bias-free point of view. Such external persons are the auditors, and the utility of these

constitute the auditing approach. One problem in using auditors within qualitative research is that it generates large amounts of data, which may be too comprehensive for auditors to handle (ibid.). The initial intention was to conduct interviews together with the CMS developer so that he, as part of the auditing approach, could review the any ambiguities in the data. This strategy was abandoned due to concerns of the interviewees failing to express their negative perceptions due to the developer being present. Even though the auditing approach was abandoned, this decision may have benefited the total quality of the study in terms of the credibility of the data.

The confirmability criterion has much to do with the behavior of the researcher, i.e. how actions and decisions regarding the research are executed. In order to fulfil this criterion, the researcher needs to act in good faith, set his or her personal values aside, and make it apparent that the research is not a reflection of any form of adverse bias (Bryman & Bell, 2007). One way to achieve this is to use auditors as previously proposed under the dependability criterion. The pro-innovation bias issue was addressed during the interview phase as previously discussed, but was also continuously considered during the data analysis. Since no external peers was included in analyzing the data, the pro-innovation bias issue was solely up to myself to judge what I believed gave a bias-free presentation of the analyzed data. Additionally, all decisions regarding this study has been documented to the best of my ability in order to assure that that every action has been made as transparent as possible. Transparency is particularly important in terms of limitations related to a study, which will be further emphasized in the concluding section of this paper.

3.5 Analysis techniques

The analysis technique applied in the subsequent chapter of this paper is mainly concerned with pattern matching logic. This is a technique that Yin (2014) claims to be particularly suitable for explanatory case studies, which is akin to the nature of this study. The pattern matching logic entails comparing patterns from the empirical findings with those that were predicted (Yin, 2014). In this case, the predicted patterns derive from propositions 1-4, which are based on the theoretical perspective applied in this study. If the patterns from the empirical findings coincide with those that were predicted, it will benefit the internal validity of the study (ibid.). Internal validity is an alternative quality criterion that was not included in the quality criteria discussed in section 3.4. This criterion is overlapped by the dependability-,

and confirmability criterion in this study. The interviews and field notes from the observations in this study were all transcribed and coded according to the corresponding proposition. In doing so, the NVivo 10 software for qualitative analysis was used. This allowed me to get a comprehensive overview of the data material, and reduced the chance of wrongful exclusion of valuable data. By coding data in NVivo 10, the accessibility of the data was also improved, which is an important part in achieving dependability as discussed in section 3.4.

4 Empirical findings and analysis

In this chapter, the empirical findings of the study will be presented and analyzed. The presentation and analyses will be based on the theoretical section of this paper, and more specifically, the conceptual model that was the basis for the data collection. The analysis will be driven by the innovation attributes, which will be presented and analyzed individually, and in turn. The initial focus in the analysis will be on how perceptions emerged, which will be the basis for linking each individual attribute to the intentions of adopting CMS. The combined effect of these attribute perceptions, their relation to each other, and the overall potency of the conceptual model will be discussed in section 5 of this paper.

During the preliminary observations, it quickly became evident that the nurses were very enthusiastic about the pilot testing. All the nurses I was in contact with during this phase was eagerly waiting the pilot test to commence. Some even seemed to be considerably annoyed that the pilot test had not started as a result of the delay. The six interviews that were undertaken during the testing comprised of five nurses that was part of the CMS pilot test. Additionally, one oncologist at the cancer ward was interviewed. This oncologist was not included in the CMS pilot test to begin with, since this initially was intended to exclusively include nurses. The role of this physician and the circumstances regarding how he came to be considered part of the test pilot will be elaborated in the forthcoming presentation of empirical findings. In table 1, a complete list of the six interviewees that completed the interview guide in this study, is presented. This list also includes the characteristics of the interviewees that are relevant to the analysis.

Interviewee	Profession	Age	Exp. w/ smartphones	Positive intention?
A	Nurse	32	Yes	Yes
B	Nurse	50	Yes	Yes
C	Oncologist	30	Yes	Yes
D	Nurse	56	Yes	Yes
E	Nurse	44	Yes	Yes
F	Nurse	41	Yes	Yes

Figure 4: List of interviewees

Note that the interviewees in the above list are the only respondents who completed the interview guide. Informal conversations with approximately twenty other respondents were

also held during the observations at the cancer ward. Several of the perceptions described in this chapter derive from these informal conversations. As evident in figure 4, all the interviewees had prior experience with smartphones. Nevertheless, several of the nurses that were contacted aside from the interviews had no prior experience with smartphones. Additionally, all the interviewees expressed overall positive intentions of adopting the CMS. In fact, only two other respondents outside the interviews expressed overall negative or neutral intentions of adopting CMS.

4.1 The perceived impact attribute

The intentions of the impact attribute was to identify all the facets of the impact the CMS technology had on the nurses' work. This was assumed one of the more prominent variables in terms of intending to adopt CMS. As evident in the interview guide, the questions related to this attribute was kept simple and few, in order to let the interviewees elaborate on how they felt that the CMS had affected their workday. Follow-up questions were structured around the initial responses of the interviewees, which resulted in both breadth, and depth of data.

Not surprisingly, impact was the attribute that the respondents spent the most time talking about. The responses from the interviewees regarding impact were quite consistent with each other. The most frequently impact mentioned was time saved. Most the respondents emphasized how CMS had cut time off several of their daily tasks. These perceptions occurred because of the ability to directly contact other staff, as opposed to page them with the old system. One of the interviewees explained the difference between the old calling system and CMS:

> "*Usually, we spent a whole lot of time running around looking for each other. With the old system, we could page each other, but first we had to get to a phone, and then find the right number, actually dial the number, and still rely on that the person would hear and respond to your page. And then, all of a sudden you've spent a whole lot of time.*" *– Interviewee A*

The same interviewee explained that CMS allowed them to access a preset contact list on their mobile devices, containing the contact information of all the other participants of the

CMS pilot test. They would just dial their number, and instantly know their location, as well as being able to deliver their message promptly. A more unanticipated aspect of the impact attribute was the embedding of the mobile application for "Felleskatalogen" into the CMS software. Felleskatalogen was originally a manual registry where medical practitioners could look up pharmaceutical preparations for the treatment of patients. One of the nurses explained during a lunch break that Felleskatalogen had been made digitally available a while back in the form of a mobile application. This application had been available in the recent years on iPads inside the medicine rooms. One of the interviewed nurses, and the oncologist who was not originally part of the CMS pilot test, said that they frequently used the Felleskatalogen application on their private mobile devices, and consequently had carried their private phones in their pockets. Since this application was embedded in the CMS software, they did no longer have to carry their private cell phones. The remaining nurses who were present in the break room concurred in how purposeful this application was as part of the CMS software. This was further investigated during the interviews, and when one of the nurses was asked how the Felleskatalogen application had influenced her work, she responded:

> "*...I actually used it today. I looked up something in Felleskatalogen, but this time I did not really find what I was looking for. Anyway, I did not have to go to the medical room to look it up, and physically get access to the room, which saved some time for me." – Interviewee E*

Again, the timesaving aspect is emphasized. An interesting note is that one of the other nurses expressed the impact as being fewer steps made, rather than time saved. She mentioned some survey that had shown that nursing was one of the professions that required the most walking. Consequently, she said that her feet tended to get sore on days that required a lot of walking between rooms, and searching for other personnel. Another impactful feature that seemed to be very important to the nurses was the decreased noise from their current pager system. All of the nurses that took part in conversations brought up the notification sound of their current pagers, and described it as overly annoying. One of the nurses said that she would usually become "immune" to the sound throughout the day, which would result in not noticing the notification at all, and thus the whole point of carrying a pager was gone. Even a kitchen employee that was not part of the CMS test pilot felt that the notification sound of the nurses' pagers was annoying, since they would constantly go off during their lunch break. Some of the nurses included in the test pilot felt that the annoyance from the pagers was already

decreasing since other nurses who also used the CMS would call them on the phone instead of paging them. The problem was naturally not entirely eliminated, since the nurses were also carrying their old calling system simultaneously with the CMS during the test period.

One thing that frequently occurred during the interviews was that the interviewees tended to digress from the initial question of how the CMS technology had influenced their work, and rather express their thoughts about how CMSs impact could be improved. Interviewee D explained during the interview that she would love to see the CMS as a bundled product consisting of a series of applications that would allow her to administer certain procedures through her phone. She wanted every manual registry to be included in the CMS system, and for the commuting nurses to be able to schedule and book travels to their home municipality through the CMS system.

All of the nurses that were interviewed could easily state ways that the CMS system had influenced their work in a positive way. When asked about their perceptions of impact in relation to their intention of adopting the CMS system, most of the nurses felt that their perception of impact was essential. Two of the nurses even had problems in understanding the question, and it turned out that it was so obvious in their minds that perceived impact was critical in the formation of their intention towards adopting the CMS, because this had been the purpose of testing out new technology in the first place. This is consistent with Rogers' (2003) theory, and the findings of Damanpour and Schneider (2008). Rogers argued that the relative advantage attribute would be prominent in the perceptions of all types of innovations, while Damanpour and Schneider made similar claims for the impact attribute. It is safe to claim that the findings related to the perceived impact attribute supports proposition 1 in this study.

4.2 The perceived ease of use attribute

The ease of use attribute aimed to explain how the users perceived the user friendliness of CMS, and how this ultimately influenced their intentions of adopting the CMS. The focus was on the user-end of the technology, which was the smartphone device that the nurses operated. This was also the only part of CMS that the nurses were expected to physically be exposed to.

The overall findings from the data collection was that the nurses had varying perceptions of the user friendliness of CMS. Their use-related challenges was mainly concerned with operating the smartphone, and navigating through its operating system rather than the features included in the CMS. The reason for this was very likely that only a few of the originally intended CMS functions were available during the data collection of this study. The reason for this was the technical difficulties related to the pilot testing that were previously discussed. Nevertheless, some nurses had struggled to the point that they were reluctant to pick up the device from the charging station when their shift started. This was a clear trend for the older nurses who did not have any experience with using smartphones. However, older nurses who already had experience with using a smartphone device, seemed to be more comfortable with using the CMS devices. Even so, it was common to see the older nurses enter the break room in order to ask, "How do I get rid of this?" while pointing at the display of their CMS devices. They would usually receive help from another nurse who had no difficulties in using the devices. Those that had problems would seek the same few nurses to ask for help, as if these nurses had unwillingly been labelled "super-users" of CMS because they had no difficulties in operating the devices. A nurse that was probably in her late 50's and felt she was having difficulties using the CMS said the following:

> *"I don't even know how to call or to send messages. It's been too long since the CMS training, and I can barely remember any of it."* - *Nurse*

As a result, she did not even bother using her device, and felt that she was more comfortable using the old calling system with the pager that she had to carry during the test period anyway. Two nurses expressed dissatisfaction with the size of the keyboard on the device display. One of these nurses said that she probably felt this way because she was old, while the other, younger nurse said she had impaired vision. All the interviewees, except for one expressed dismay by having to enter the PIN code in order to access their device every time they used it. One explained the inconvenience in the interview:

> "*Well, we have to enter the PIN every time to get in, and it's terribly cumbersome. And if we forget our PIN, we have to go to the break room and look it up on the note board*." *– Interviewee B*

It is not known whether this was a feature that could be edited in the settings on the phones by the users, or if the CMS software prohibited the users from altering the original settings. None of the test pilot participants, not even those with prior experience with the Android OS claimed to have changed the settings of the PIN code prompt.

An interesting thing that tended to occur during the interviews was that when the interviewees were asked about their perceptions of the user friendliness, they would also include elements that were beyond their own control. These elements included problems with the Wi-Fi coverage, poor sound quality, Felleskatalogen being "unavailable" etc. When asked if she knew any others nurses who had experienced any user-related difficulties, one nurse described an incident that had occurred to another nurse on the night shift the day before. She said that this nurse had experienced that her mobile device became so hot that it burned her thigh from inside the pocket of her pants. This was another example of how the nurses described events when they were asked about user-related challenges. Such unanticipated events could not be labelled as issues related to user-friendliness, since it was not the users' fault. These "bugs" related to the immature nature of the technology did however create unnecessary annoyances for the nurses, which may have influenced their intention of adopting CMS.

The relationship between the nurses' perceptions of user friendliness and their intention of adopting the CMS was more complex than that described for the impact attribute. Ease of use was something that all the nurses was concerned with, but surprisingly few had expressed any use-related challenges that were based on their own ability to cope with the CMS technology. During the interview, the oncologist that was asked why he felt this was the case, to which he responded:

> "*... [the usage] is very intuitive, and something that most are already familiar with. Cell phones, smartphones…These are concepts that are widely implemented, so it is easy to use." – Interviewee C*

Even though very few nurses had expressed any concerns regarding the ease of use, most of them had very strong opinions on the importance of it regarding their intentions of adopting the CMS. Those who had not experienced significant challenges with the user friendliness could explain quite detailed how the absence of such challenges had been important in the

formation of their intention of adopting the CMS. A nurse described the relationship between her perception of user friendliness and her intention of adopting CMS like this:

> "*It is very easy to use, and that is very important. We do not have to spend lots of time getting familiar with the phones, and how the CMS works. […] This is something that we do not really have time to do at this department. We cannot let our patients wait while we are spending time trying to learn to use this system*." *– Interviewee F*

Several of the other nurses that were interviewed also brought up the time aspect in terms of user friendliness and intention of adopting the CMS, which further underlines the importance of the time dimensions in their line of work. An interesting finding is that the nurses who in fact had trouble with the usage, did not seem to have more negative opinions in terms of how the user friendliness had influenced their intention of adopting CMS. This was further investigated during the interviews, and these particular nurses had similar explanations to why this was the case. The first responded:

> "*I will deal with any challenges as long as it improves our unit's operations."*
> *- Interviewee D*

The other nurse said that her perception of CMSs impact was so positive thus far that she did not mind spending time to overcome her use-related challenges. She felt that the time she spent in dealing with the issues was a good investment that would pay off when she hopefully could use CMS in full scale in the future.

Prior to the interviews, it was assumed that none of the users was concerned with the parts of the CMS technology that were not directly exposed to. This included all the hardware elements of the CMS technology that is depicted in figure 5 of appendix 1. As evident by the interview guide, this was investigated in case this might turn out to be important aspect in terms of their perceptions of ease of use, and consequently, intention to adopt. As expected, none of the interviewees had given any thought to the technological infrastructure. All interviewees expressed that this was a part of CMS that they expected to be managed by IT professionals.

The relationship between perceived user friendliness and intention of adopting CMS, as described by the nurses, is in accordance with the theoretical assumption related to this attribute. Even though several nurses had expressed the user friendliness to be very good, they did not feel that the perceived ease of use was redundant in the process of forming intentions to adopt the CMS. This means that perceived ease of use was important to both those who had experienced use-related challenges, and those who had not, which was not expected. This indicates that perceived ease of use might be as important for intending to adopt the CMS as Davis (1986) suggested that it would be for attitudes toward usage in his model. It is also evident that there is some internal relationship between perceived ease of use and perceived impact, which is in accordance with the equivalent relationship in Davis' (1986) technology acceptance model. The way certain perceptions of this attribute unfolded in terms of adoption intentions was not anticipated, but still, the overall findings supports proposition 2.

4.3 The perceived trial utility attribute

The trial utility attribute was operationalized differently compared to previous research. Instead of explaining how trialable an innovation is, as Rogers (2003) originally intended for it to do, it aimed to explore the utility of the CMS trial period for the nurses. More specifically, the intention of this attribute was to determine how important it was for the nurses to have the opportunity of a trial period, and how this could affect their intention of adopting CMS. The reason for the deviation from Rogers' suggested operationalization is that it was important to adapt this attribute so that it could explore any distinctions that may be unique to innovations going through a trial period before any adoption-decision is made. Since there are no existing theories that states exactly how this relationship is expected to unfold, the analysis of the findings concerning perceived trial utility will be more exploratory than for the other attributes.

The findings concerning the trial utility attribute is mainly split between two opposite perceptions: Those who felt little or no need for the trial period in terms of intending to adopt CMS, and those who felt that the trial period was important. Those who felt that the trial period was less important was, naturally enough, the ones who were comfortable with operating the devices with the CMS software in the first place. On the other hand, those that felt more dependent on the trial period were the ones who had expressed difficulties regarding

the usage. Both parties did however feel some convenience by carrying the old pager system in addition to the new devices, in case the CMS would malfunction in any way.

The utility of the trial period for the more use-challenged nurses was quite evident throughout my observations. The nurses discussed the devices and its functions during lunch breaks and sent test-messages to each other. The lunch breaks seemed to be the only period where the nurses had time to actually discuss the devices. This was confirmed in several of the interviews, and one nurse explained the utility of the trial period to her:

> "*We've done a whole lot of testing with text messages, and there has been a lot of joking around with silly texts to each other. But that's just…we've just had a little fun. And, yeah…we've learned what we need to learn from what's available…*"
> *– Interviewee A*

Several of the other nurses stated that, even though the trial period was not critical for them, they appreciated that they were not expected to immediately substitute the old system for CMS. A number of nurses in the cancer ward was either temporary substitutes for regularly employed nurses who were absent. Some of the nurses only worked every other weekend at the cancer ward in addition to their position at other departments. These nurses had not taken part in the training prior to the test pilot. At least two of these had come to work the first week of the test period, clueless of the ongoing CMS testing. One of these elaborated on her first encounter with the CMS:

> *"…it's possible that the others in the work-group got information on some meeting that I didn't attend. But I just noticed it laying there at the department, and then someone told me "you're going to start using this". I thought this was really poorly informed, but it may have something to do with me being a substitute*."
> *– Interviewee D*

These two nurses seemed more appreciative for the fact that it was a trial period rather than a full-scale implementation. When these attitudes were investigated, it turned out that the nurses were quite used to immediate implementation of new technology, with no trial period. When asked to describe how it would have felt if there were no trial period with CMS, a nurse compared it to another technology that had been a compulsory adoption at the department:

> "*Yeah, it would have been to just…dive into it. We have to do that with many other things so we would probably handle it if we had to. […] It would have been, as with DIPS, we would just have to be tormented with it until we got the hang of it.*"
> *– Interviewee A*

Even though the perceived need for the trial period varied from unnecessary to very purposeful among the nurses, it does not seem to be critical for any of the nurses' intentions of adopting the CMS. It is hard to tell exactly how the perceived need for the trial period affects the intention of adopting the CMS, because elements from their perceptions of impact and ease of use seems to come into play when the nurses are asked to talk about the importance of the trial period. The two nurses who had no experience with using smart phones expressed that the trial period had been important to their intention of adopting the CMS, which was expected. This is also consistent with the nurses' claims that their perceptions regarding user friendliness was mainly associated with the operation of the mobile device and the Android OS. All the nurses who appreciated the test period claimed that they would get by without the possibility of testing the CMS. None of them claimed that the absence of a trial-possibility would have any major effect on their intention of adopting the CMS. The findings implies that perceived trial utility is less important than both perceived impact- and ease of use. These two attributes seem to overshadow the perception of trial utility, which might indicate that the perceived trial utility attribute is dependent on how the nurses perceived impact and ease of use in the first place. Because of this, there is no basis for stating that the findings were consistent with proposition 3. There were, however, some interesting implications from how the interviewees expressed that they perceived this attribute, which might be an important aspect of innovations going through pilot testing. This will be discussed in chapter 5.

4.4 The perceived result demonstrability attribute

The purpose of the result demonstrability attribute was to examine how demonstrable the nurses felt the results from the usage was to themselves, and to others, and ultimately how important they felt this was in terms of their intention of adopting CMS. The operationalization of this attribute focused on results from the usage that were related to the tasks the CMS was intended to perform.

The overall findings is that result demonstrability is associated with the nurses' perceptions of impact, which was expected. The nurses tended to describe events that they had perceived as impactful in a quantitatively measurable way. All of the interviewed nurses used either of two metric dimensions to describe the result demonstrability of CMS, namely time and distance. They seemed to have no problem with estimating how many steps or meters that a function in the CMS system had saved them. Likewise, the remaining interviewees could easily give an estimate of how many seconds or minutes they had saved because of an event of CMS usage. One of the interviewed nurses described several events where she had saved certain amounts of time:

> *"You know, it may take up to two to three minutes before I find [my colleague], and when I'm in patient rooms, I just send a message or call the person who is in another room. So that's…I think it might be many minutes saved every time I text, and even more minutes when I have a message to deliver. For example, when I had received a message that a cyt. treatment had arrived, I received it right away and was able to plan in my mind that I would pick it up the next time I stopped by, instead of maybe receiving the message after, like, ten minutes when she had found me."*
> *– Interviewee B*

This description seemed to be very representative for what kind of events that consume time in the nurses' workdays, and how specific the nurses could be when they were describing the perceived result demonstrability of CMS. Many of the nurses seemed to have already made up their mind in how much time the CMS had saved them, even before being asked to describe it. This may indicate that many of the nurses "think" in minutes when addressing certain tasks during their workday. Certain results like the decreased annoyance from the notification sound of the old calling system was however less demonstrable to the nurses. Those that had felt decreased annoyance because of the CMS usage, had difficulties in stating *how much* less they had been annoyed. Even though this result seemed to be less demonstrable, the nurses tended to talk about their expectations for a full implementation of CMS, and argue that this would be more demonstrable if the old calling system was entirely replaced.

Initially, when the nurses were asked about how demonstrable the results of the usage was to others, they seemed to have difficulties naming examples. Several of these nurses said that they were not as much in contact with personnel outside of their ward, and even less with people outside their department, and that this was the reason they felt the results were not visible to others. During a lunch break, a nurse was able to tell a story that had occurred two days before. She had been with a patient at the radiotherapy unit, when a physician approached her, and asked if she could deliver a message to one of the other nurses up at the cancer ward. She immediately took out her CMS device, and called the nurse, who picked up the phone and got the message right away. The physician had been astounded by how efficient it was, and became very interested in the CMS system. Another event that had occurred, and that the nurses in the cancer ward found very amusing, was when one of the oncologists who had an office in the ward had felt that it was unfair that only the nurses were part of the CMS test pilot once he noticed them using it. This oncologist had went to pick up one of the phones at the charging station, and used the login details for one of the absent nurses, and started using the CMS on the very first day of the test pilot. None of the nurses could give any good description of how such perceived result demonstrability for others had affected their own intention of adopting CMS. This physician did however claim during the interview that it was critical that the results from the usage was visible to him, as it persuaded him into acquiring a CMS device for himself. He explained that he had intention of adopting the CMS, but not as a direct result of its result demonstrability to him. Rather, he claimed that its result demonstrability had *enabled* him to start forming an intention of adopting the CMS. This is consistent with how Rogers (2003) depicted his original observability attribute. The purpose of his observability attribute was only concerned with how observable the usage was to others, and not the user. Thus, usage of an innovation that was more observable to others, were more likely to be adopted by the observer.

During the first four interviews, the nurses had focused exclusively on other employees at the hospital when they attempted to describe to whom the results of the CMS usage had been demonstrable. The fifth interview took an interesting turn when the nurse brought up result demonstrability towards patients:

> *"…But sometimes when I'm in patient rooms I use to explain [to the patient] if there is a message that I have to read. I would just tell the patient "this is a new calling system that we're using and not some private phone". So that's also something I have to do*

because it's not like we're in the rooms and texting private messages, right, but it can be misinterpreted."- Interviewee E

I chose to investigate this further during the last interview, but this nurse had no problems using the CMS while in patient rooms. She felt that it was obvious to the patients that the device was work-related. When she received text messages, she would just finish up with the patient, and answer it once she left the room anyway. She did however say that when she informed relatives of the patient's status, she would never bring her CMS device out for the same reason as the other nurse described. These interesting turns of focus were not taken into account in the theoretical section of this paper, and might very well be an important element of result demonstrability. For incidents where the CMS usage challenges ethical values, and common values, there might be reason to believe that the reluctance to use it in certain situations may affect the users' intentions of adopting it.

With the exception of the patient and relatives example, the nurses generally felt that result demonstrability had been important in forming their intention of adopting the CMS. One of the interviewed nurses claimed that there was an essential difference between knowing that CMS was *supposed* to work, based on its specifications, and actually *seeing* that it did work. Another nurse was asked about the relationship between her perception of result demonstrability, and intention of adopting CMS, to which she responded:

"*Yes, it's nice to get some confirmation that this is actually working out well. For this is something that we've heard about for a long time, and one might think, "ok, this is just another new thing that doesn't work", right? But now…I just have positive intentions so far. It is really great to get visible confirmation that this might actually turn out a good thing.*" *– Interviewee B*

This nurse's perception seemed to be rather concurrent with the other interviewees. They had all mostly used the perceived impact as a reference for their perceptions of result demonstrability, which may indicate that there are some relationship between the two attributes. Here, the difference between primary and secondary attributes seems to come into play. As one of the interviewees noted, a new technology might seem impactful based on its specifications, but if its results are not demonstrable, perceptions of its impact is negatively affected. Based on this, it might seem that perceived result demonstrability is just as

important as the perceptions of impact in forming intentions of adopting the CMS, and that the perceptions of these attributes are mutually depended to some extent. Time is without doubt an important dimension in the nurses' chaotic and stressful workdays. The indication that several nurses constantly uses time as a reference when planning their tasks during a workday may indicate that, how demonstrable the results from the usage is to themselves, is absolutely essential in order for them to form intentions of adopting the CMS. Perceived result demonstrability towards others turned out to be harder to explain. Some nurses could describe incidents where the results had been demonstrable to others after being guided by my follow-up questions. These nurses did not however show any signs that this had been influential in their intention of adopting the CMS even though the persons they talked about gave them positive feedback, with the exception of the patients and relatives mentioned by two of the nurses. Even though the external aspects of perceived result demonstrability was not prominent in terms of intentions of adopting CMS, there is still strong support for proposition 4.

Based on this analysis, 3 out of 4 of the propositions have been confirmed. The only proposition that lacked support was perceived trial utility and its relationship to adoption intention. These propositions were only concerned with the individual attributes' effect on adoption intention. Several of the implications that has emerged due to this analysis suggest that the attributes combined, and their effect on adoption intention, is more complex than the conceptual model originally depicted. These complexities, and what they mean in terms of the problem statement of this study, will be discussed in the subsequent chapter.

5 Discussion

In this section, the analyzed data will be discussed according to the problem statement of this study. Additionally, any new implications that has emerged as a result of the preceding data analysis will be discussed. The focus of the discussion will be the totality of the conceptual model, with emphasis on how the attributes combined, could explain intentions of adopting CMS. The attributes' relations to each other, and the complexities related to these relationships will also be addressed. The overall potency of the conceptual model for this type of research will be discussed continuously throughout this chapter, and compared to Rogers' (2003) original framework. A model that attempts to visualize how the relationship between perceptions of innovation attributes and adoption intention actually turned out to be will be presented at the end of this chapter.

The starting point for the theoretical framework of this study was Rogers' (2003) five innovation attributes. As previously discussed, this framework had to be modified in order to study the perceptions of innovation attributes and their relations to intention of adopting the CMS. These modifications was essential in order to avoid convergence and redundancy among the attributes, and to shape the framework to fit the context of this study. Because of this, the conceptual model used in this study is unique in both composition and utility. A natural question that arises is; how well does this model capture perceptions of innovation attributes, and to what extent can it explain these perceptions' relation to intention of adopting an innovation? Based on the empirical findings and the analysis of these data, the overall potency of this model seems to be quite good within the confines of qualitative research, but far from perfect. All the attributes applied in this study, with the exception of perceived trial utility, had anticipated effects on the nurses' intentions of adopting the CMS. Perceived impact and perceived result demonstrability was without doubt the most prominent attributes in terms of explaining the nurses' adoption intentions. For perceived impact, the implications from the data analysis show that this might be a superior alternative compared to equivalent attributes when applied in similar contexts to this study. There are several reasons for this. First, juxtaposed to relative advantage, perceived impact did not focus on the innovation itself, but outcomes as a result of using it. None of the interviewees expressed any opinions on how the CMS looked, how it felt, or any physical aspects of the innovation. Nor did they mention any of these aspects for their old system, which indicates that these are features they are not concerned with. Because of this, using the relative advantage attribute might have

shifted the nurses' focus to aspects they felt was advantageous, but not important in terms of their adoption intention. Second, based on the specifications of the CMS, it was expected to be very advantageous relative to the old calling system. The nurses confirmed this, and felt that the CMS was so advantageous compared to the old calling system, that it even affected their perceptions of the other attributes. It might seem that, in circumstances where the relative advantage is fundamentally huge, perceived impact is a better-suited attribute within innovation adoption research in hospitals. The reason for this is that it focuses on what is important, and more easily can explain *why* the difference between the old technology and the innovation is so big. Consequently, relative advantage might be a desirable attribute within unprofessional consumer markets and in situations where the innovation is more incremental compared to existing alternatives where features such as design come into play.

The perceptions of ease of use and its relationship with adoption intensions corresponded with the propositions in this study, but the way it did so was not anticipated. This attribute was important for the adoption intentions of both those who had experienced use-related difficulties, and those who had not. Even so, it was expected that perceived ease of use would be much more important than the nurses expressed. There were several implications that the extent of perceived impact was the reason for this. Since the benefits of using CMS was so positive for the nurses, their perception of impact turned out to lower the importance of the user friendliness in terms of their adoption intention. Some implications of an opposite relationship also emerged. Because time saved was the major perceived impact among the users, perceptions of ease of use turned out to have a negative effect on perceived impact. The reason for this was that those who experienced the user friendliness as poor felt that they had to use extra time in learning how to use the CMS efficiently. Overall, perceived ease of use is an important attribute for intentions of adopting an innovation within this context. Compared to the complexity attribute that Rogers (2003) proposed, the logic behind ease of use is similar to the differences between perceived impact and relative advantage; it avoids perceptions that are not important to the adoption intentions. Since none of the interviewees expressed any care for the technological infrastructure that effectively was an element of the CMS innovation, perceived ease of use turned out to be a more appropriate attribute than complexity. It should be noted, however, that several interviewees mentioned the Wi-Fi, which should be considered an integral part of the technological infrastructure. The reason this element was continuously brought up might be that Wi-Fi networks is a technology that is so well incorporated in the lives of most Norwegians who are reasonably familiar with it, and

thus is not perceived as a complexity. Even if perceived ease of use is very purposeful in this type of research, its relationship with the remaining attributes needs to be thoroughly considered in order to fully comprehend its effect on intentions of adoption.

The perceived trial utility was the only attribute that was operationally distinct from any previous research. The main implication from the analysis was that trial utility was something that several of the users were concerned with. Despite this, their perceived utility of the trial did not seem to have any strong relationship to their intentions of adopting the CMS. In many situations, the users described events that were more related to their perceptions of ease of use when they were inquired about trial utility. This may be an indication that several would-be important facets of trial utility had already been incorporated in their perceptions of user friendliness. Needless to say, there is a high degree of convergence between the trial utility- and ease of use attribute. The operationalization of these attributes were quite distinct, but the reason for the convergence is likely due to the users perceiving certain elements of trial utility as part of their understanding of user friendliness. This is perhaps natural, but this implication clearly needs to be taken into account for innovation adoption research within similar contexts. The intention behind applying the perceived trial utility attribute in this study was in fact to make it distinct from perceived ease of use, due to the convergence issue that was proposed by Damanpour and Schneider (2008), which was discussed in the theoretical section of this paper. Failing to distinguish trial utility from ease of use is an indication that the trial utility attribute needs more work. It needs to either be made more operationally complex, or fundamentally rethought in terms of considering why this is an attribute that should be included in research within this context. I would still argue that an attribute that attempts to explain perceptions of trial utility, for innovations that are due to trial testing, is necessary. The reason for this is that many of the nurses had expressed discontent with technological bugs and malfunctions that were not related to their ability to use the CMS. This seemed to cause annoyances for the nurses, and was frequently mentioned among negative aspects that had affected their intention of adopting CMS. These perceptions could hardly be coded on to any of the attributes applied in this study, not even on perceived trial utility. Thus, any trial-related attribute needs to be operationalized in a way that captures these perceptions in a purposeful manner.

The analysis of the nurses' perceptions of result demonstrability was quite consistent with the theoretical assumption for the attribute. Along with perceived impact, it was clearly

prominent in terms of intentions of adopting CMS compared to the remaining attributes. In fact, it turned out to be challenging to make any claims on whether impact or result demonstrability was more important in terms of their adoption intention. As mentioned in the analysis, these two attributes seem to have some internal relationship, to the point of being mutually dependent. Their influence on the nurses' intentions of adopting CMS seems so proportional that they may not have separate effects on the intention of adopting CMS. It might be that, it is rather the sum of these two attributes that influences adoption intentions. This would challenge the idea of these being separate concepts due to another event of convergence. Even if these attributes form a combined effect on adoption intention, I would still argue that they are conceptually distinct since an innovation might be perceived as impactful, even though the perceived result demonstrability is low, and vice versa. One example is the seatbelt. It is perhaps the most important safety mechanism in the automobile, and was surely at some point in time considered an innovation. It is without doubt considered by most as an impactful innovation, but the perceived result demonstrability is absent until you survive a would-be lethal car crash because of using it. A person might tell you how many lives the seatbelt had saved, but it would be the same as having the CMS developer tell you how many problems the CMS *can* solve. Likewise, it is not hard to imagine an innovation that has a low impact, but high result demonstrability. For the CMS, both perceived impact and perceived result demonstrability turned out to be high, but this relationship needs to be considered in studies of innovation attributes in order to comprehend exactly how these attributes contributes in the formation of adoption intentions. The external aspect of result demonstrability was harder to discover. Even though the nurses could point out certain events where the usage had been demonstrable to others, there were no indications that this affected the nurses' intention of adopting the CMS. The most apparent explanation might be that this is not important to the nurses at all. As mentioned in the previous chapter, the nurses tended to be very task-oriented in their elaborations of perceived impact- and result demonstrability, and because of this, result demonstrability towards others might be irrelevant for them. Additionally, how demonstrable the results were to others was based on the nurses' own opinions. In order to fully comprehend how results were demonstrable to others, it would be necessary to inquire about the perceptions directly from such external people. A contrary note on result demonstrability towards others were made from the nurses who brought up reluctance of usage due to being observed by patients and relatives. Since the two nurses who brought it up had very strong opinions on the issue, it is likely that it has a negative effect on their adoption intention. This is akin to Rogers' compatibility attribute that was omitted in the

conceptual model of this study due to reasons discussed in the theoretical section. This attribute incorporated compatibility with values and beliefs that would effectively consider these issues, and take them into account in terms of how they would affect intentions of adopting the CMS. Since the conceptual model applied in this study has apparent difficulties in explaining certain relationships to the adoption intention, a revised model was developed based on the findings and the above discussion. This model is presented in figure 4 below.

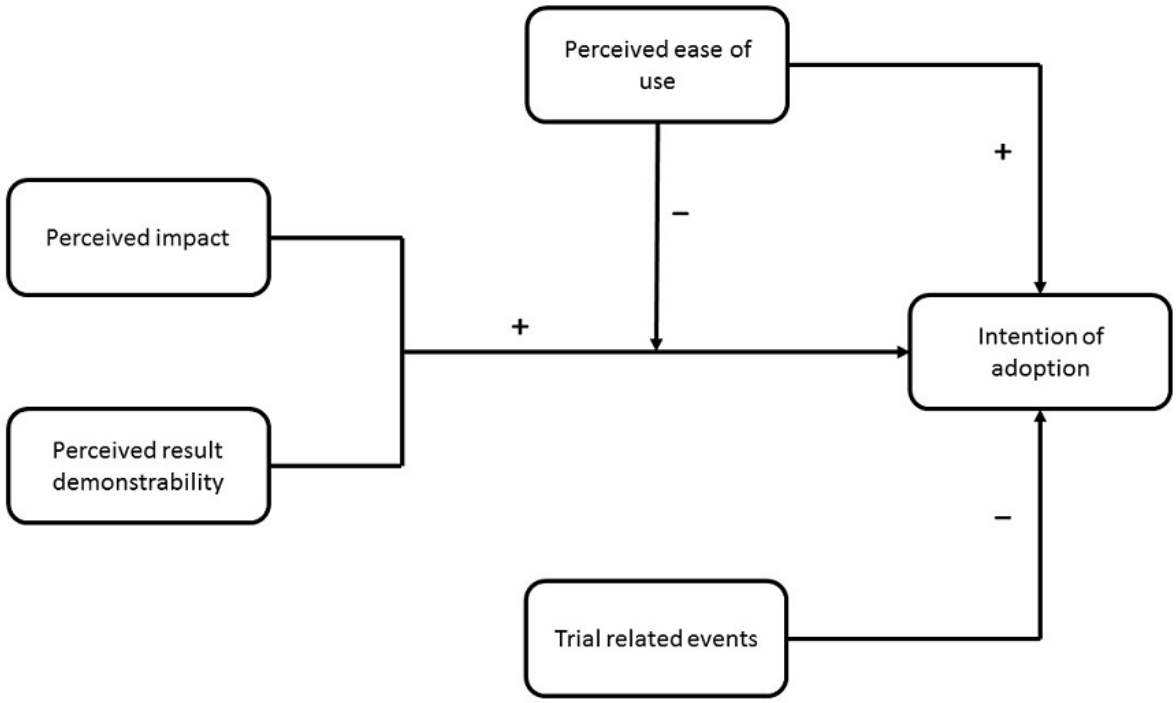


Figure 5: Revised conceptual model

The revised conceptual model illustrates how the relationship between the attributes and the adoption intention actually unfolded in this study. These relationships are depicted as either positive or negative depending on their apparent influence on adoption intentions. Perceived impact- and result demonstrability had a mutual relationship to intention of adoption. Even though they were clearly two different perceptions, the nurses seemed to merge these perceptions in terms of their effect on adoption intention. Perceived ease of use had two different effects on intentions of adoption. Positive perceptions of ease of use were directly related to intention of adoption. The interesting part was that negative perceptions of ease of use was dependent on how the nurses had perceived impact and result demonstrability. The perceptions of impact and result demonstrability seemed to go through a "filter" among the nurses who had negative perceptions of ease of use. This means that as long as perceived

impact- and result demonstrability is high enough, they will effectively smother the relationship between negative perceptions of ease of use, and adoption intention. The interesting thing about these two attributes is that their relationship resembles that depicted in Davis' (1986) original TAM model. In his model, perceived ease of use had a direct effect on perceived usefulness, which is an attribute equivalent to perceived impact. The only difference in this study is that this relationship is indirect in the sense that negative perceptions of ease of use moderates the relationship between perceived impact and adoption intention. Further, there were indications that perceptions of trial utility had no direct relationship to intentions of adoption. However, trial related events such as bugs and malfunctions seemed to affect the intentions negatively. This means that perceived trial utility should be replaced with an attribute that can generate richer data about the relationship between unanticipated trial events and intentions of adoption.

6 Conclusion

The main purpose of this study was to explore how perceptions of innovation attributes affected the intention of adopting an innovation in a hospital. In fulfilling this purpose, Rogers' (2003) framework for innovation attributes were used as starting point for constructing the theoretical framework of this study. Due to the contextual distinctiveness of this study, and the amassed critique towards Rogers' framework, several modifications were made to his original attributes. This resulted in a conceptual model that was adjusted to the context of this study. Because of the contextual modifications, the model was assumed a superior measure in terms of capturing perceptions that were influential in forming intentions of adopting the innovation.

Based on the data analysis, perceptions of impact, result demonstrability, and ease of use all had anticipated effects according to the propositions. Perceptions of impact and result demonstrability were particularly prominent. The effects of ease of use was also strong, but not essential in forming intentions of adoptions. This was a result of impact and result demonstrability being perceived as very high for the CMS technology. The trial utility attribute does not appear to have any clear relationship to intentions of adopting the CMS. Several important implications emerged due to this attribute and, particularly, trial-related events that were out of the control of the users seemed to have an effect on the adoption intentions. Aside from this, the conceptual model served its purpose as it made it evident how perceptions affected the individual intentions of adopting the CMS. There is no doubt that research within this context needs careful consideration in terms of measuring adoption intentions- and decision. The nurses in this study had distinctive motives in determining what perceptions had been important in the formation of their intentions of adopting CMS. These motives were focused around work- and task efficiency, which is likely a result of their profession and specifically their stressful work environment. Because of the differences in existing innovation attribute models, and the revised conceptual model that was proposed in this study, there is reason to believe that potential innovation adopters within hospitals might be distinctive from potential adopters in other circumstances. The findings of this study confirms that existing frameworks for measuring adoption intentions-, and consequently decisions, would be incapable of doing so under similar circumstances.

6.1 Theoretical and practical implications

Several theoretical implications have emerged from this study. The most important one was related to the contextual circumstances of this study, and particularly the case, which was a process in the form of a pilot test. For similar research, an attribute for trial related events needs to be included as there is evidence that such events can affect adoption intentions and decisions. The nurses' distinctive preferences in the functionality of the CMS might also be present in other personnel within hospitals. This means that any theoretical framework that is constructed with the purpose of conducting research on innovation attributes within hospitals needs to consider the relationship between the attributes. The attribute relationships that were unveiled in this study shows that it is important to examine these in order to fully comprehend how perceptions of innovation attributes unfolds in terms of adoption intentions- and decisions. This is particularly important for qualitative studies, but should also be considered for quantitative studies that attempts to establish causal relationships between innovation attributes and the adoption decision. In any case, this study has been yet another example that general scales for explaining innovation adoption based on innovation attributes can hardly be developed.

The practical implications from this study should be of particular interest to technology developers and innovation managers. When talking about their perception of impact, many of the nurses mentioned problems that they felt the CMS could potentially resolve, that were not part of the current specifications of the CMS. By consulting users within hospitals for their suggestions, developers and innovation managers may be able to modify the innovations so that they are perceived as more impactful, which will make them more prone to adoption. Additionally, managers of innovations that are due to pilot testing needs to be proactive towards unanticipated events that may have negative effects on adoption intentions and decisions. The results from this study also has implications for central decision-makers within hospitals. For innovations that are currently going through the innovation-decision process, it is important for the decision-makers to know how hospital personnel perceive, and behave towards new technology. Even though an adoption-decision inevitably will be made in some cases, this will still be an important implication for adoption decisions that are compulsory to the user. By being familiar with the motivation behind the behavior of hospital personnel in these situations, decision-makers might respond appropriately in order for the adoption to be a success. This might make the innovation less likely to be rejected because the adoption later

turned out to be a failure, which might in turn avoid financial losses associated with the rejection. For hospitals, these implications is particular important since an innovation that has the potential to improve treatment or patients in some way, might be rejected due to the way its attributes are perceived by the users.

6.2 Weaknesses, limitations, and suggestions for further research

This study has several weaknesses and limitations, and I will discuss these in turn. Due to the limited time frame of this study, it was not possible to conduct a longitudinal case study of the CMS pilot test. A longitudinal study would be desirable for multiple reasons. First, by extending the case study to last throughout the entire pilot test, it would be possible to study perceptions of innovation attributes' effect on the adoption *decision*, rather than the adoption intention. Even though intentions of adoption, to some extent, will reflect what the adoption decision will be, it is still desirable to measure effects on the actual decision since individuals may change their mind between the expression of intention and the decision to adopt. Second, a longitudinal study would likely have enabled the inclusion of the CMS functions that were unavailable due to the temporary technical difficulties. These functions were considered important parts of the CMS technology, and could effectively have altered the nurses' perception of the innovation attributes, and consequently their decision of adopting CMS. Third, only six out of a desired eight interviews were obtained. Due to the work conditions at the cancer ward, getting interviews was a time consuming process since I did not want my data collection to come at the expense of the nurses' tasks. A longitudinal study would benefit the data collection as I could have spent more time at the cancer ward in trying to get more interviews. Fourth, a longitudinal approach would enable me to investigate the evolution of the nurses' perceptions as they got more used to operating the CMS. Such progression could be an important part, and an essential difference, between intentions and decisions of adopting the CMS. Another weakness lies in the theoretical composition of this study. Rogers' (2003) framework for innovation attributes was originally intended to explain adoption rates, and not adoption intentions- or decisions. Measuring adoption rates would not be interesting in terms of CMS, because the innovation is at such an early stage that it is not yet available for other parts of the social system. Modified versions of this framework has however been successfully used to explain adoption decisions in prior research.

An apparent suggestion for future research is to test the revised conceptual model presented in chapter 5 of this study, within a similar context. Applying this model in innovation adoption research might explore, and possibly confirm, the theoretical implications from this study. Overall, this case study has uncovered the complexities related to individual intentions of adopting innovations in a hospital. By addressing innovation adoption in this particular context with qualitative methods, this study has paved the way for more extensive and perhaps quantitative research within the same context. With the findings of this study in mind, it would be particularly interesting to study innovation adoption rates- or diffusion within hospitals. Such research would require focusing on an innovation that is at a later stage in the innovation process than the CMS. Now that the nature of the persuasion stage and the motives for the perceptions that occurs at this stage is known for one department in a hospital, there is a need for a larger study that aims to generalize the findings towards the entire population of departments at a single hospital, or even towards several hospitals. Such research may establish causal relationships between perceptions of innovation attributes and adoption intentions, or decisions. The result of this might be a complete theoretical framework for studying perceptions of innovation attributes within the hospital sector, which would greatly benefit the innovation research discipline.

7 References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179-211.

Ajzen, I., & Fishbein, M. (1977). Attitude-Behavior Relations: A Theoretical Analysis and Review of Empirical Research. *Psychological Bulletin, 84*(5), 888-918.

Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. (1996). Assessing the Work Environment for Creativity. *Academy Of Management Journal, 39*(5), 1154.

Andersen, S. S. (2013). *Casestudier* (2nd ed.). Bergen: Fagbokforlaget.

Bryman, A., & Bell, E. (2007). *Business research methods*. Oxford: Oxford University Press.

Bryman, A., & Bell, E. (2011). *Business research methods*. Oxford: Oxford University Press.

Crossan, M. M., & Apaydin, M. (2010). A Multi-Dimensional Framework of Organizational Innovation: A Systematic Review of the Litterature. *Journal of Management Studies, 47*(6), 1154-1191.

Damanpour, F., & Schneider, M. (2008). Characteristics of Innovation and Innovation Adoption in Public Organizations: Assessing the Role of Managers. *Journal of Public Administration Research and Theory, 19*(3), 495-522.

Davis, F. D. (1986). *A Technology Acceptance Model for Empirically Testing New End User Information Systems: Theory and Results.* (Ph.D), Massachusetts Institute of Technology, Massachusetts.

Downs, G. W., & Mohr, L. B. (1976). Conceptual Issues in the Study of Innovation. *Administrative Science Quarterly, 21*(4), 700-714.

Eisenhart, K. M., & Graebner, M. E. (2007). Theory Building from Cases: Oportunities and Challenges. *The Academy of Management Journal, 50*(1), 25-32.

Fitzgerald, L., Ferlie, E., Wood, M., & Hawkins, C. (2002). Interlocking Interactions, the Diffusion of Innovations in Health Care. *Human Relations, 55*(12).

Haider, M., & Kreps, G. L. (2004). Forty Years of Diffusion of Innovations: Utility and Value in Public Health. *J Health Commun, 9*(1), 3-11.

Hall, B. H. (2005). Innovation and Diffusion. In J. Fagerberg, D. C. Mowery & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.

Hansen, S. O., & Wakonen, J. (1997). Innovation, a Winning Solution? *International Journal of Technology Management, 13*, 345-358.

Holland, M. (1997). Diffusion of Innovation Theories and Their Relevance to Understanding the Role of Librarians when Introducing Users to Networked Information. *Electronic Library, 15*, 389-394.

Huber, G. P., Kathleen, M., Sutcliffe, C., Miller, C., & Glick, W. H. (1993). Understanding and Predicting Organizational Change. In G. P. Huber & W. H. Glick (Eds.), *Organizational Change and Redesign* (pp. 215-265). New York: Oxford University Press.

Kearney, R. C., Feldman, B. M., & Scavo, C. P. F. (2000). Reinventing Government: City Manager Attitudes and Actions. *Public Administration Review, 60*(6), 535-547.

Kimberly, J. R., & Evanisko, M. J. (1981). Organizational Innovation: The Influence of Individual, Organizational, and Contextual Factors on Hospital Adoption of Technological and Administrative Innovations. *Academy Of Management Journal, 24*(4), 689-713.

Klein, K. J., & Knight, A. P. (2005). Innovation Implementation - Overcoming the Challenge. *Current Directions in Psychological Science, 14*, 243-246.

Lincoln, Y. S., & Guba, E. G. (1985). Establishing Trustworthiness. *Naturalistic inquiry*, 289-331.

Mahajan, V., Muller, E., & Srivastova, R., K. (1990). Determination of Adopter Categories by Using Innovation Diffusion Models. *Journal of Marketing Research, 27*(1), 37-50.

Moore, G. C., & Benbazat, I. (1991). Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation. *Information Systems Research, 2*(3), 192-220.

Nooteboom, B. (1994). Innovation and Diffusion in Small Firms: Theory and Evidence. *Small Business Economics, 6*(5), 327-347.

Patton, M. Q. (2002). *Qualitative Research & Evaluation Methods*. Thousand Oaks: Sage.

Reve, T., & Sasson, A. (2012). *Et Kunnskapsbasert Norge*. Oslo: Universitetsforlaget.

Rogers, E. M. (2003). *Diffusion of Innovations* (5 ed.). New York: Free Press.

Rubin, H. J., & Rubin, I. (2005). *Qualitative Interviewing: The Art of Hearing Data*. Thousand Oaks: Sage.

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2012). *Research Methods for Business Students*. Harlow: Pearson.

Solvoll, T. (2013). *From Being Interrupted by Mobile Devices to CallMeSmart* (Ph.D), University of Tromsø, Tromsø.

Solvoll, T., Scholl, J., & Hartvigsen, G. (2013). Physicians Interrupted by Mobile Devices in Hospitals: Understanding the Interaction Between Devices, Roles, and Duties. *Journal of medical Internet research, 15*(3), e56.

Stake, R. E. (1994). Case Studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of Qualitative Research* (pp. 236-247). Thousand Oaks: Sage.

Tornatzky, L. G., & Klein, K. J. (1982). Innovation Characteristics and Innovation Adoption-Implementation: A Meta-Analysis of Findings. *IEEE Transactions on Engineering Management, 29*(1), 28-45.

Van de Ven, A. H., Polley, D. E., Garud, R., & Venkataraman, S. (1999). *The Innovation journey*. Oxford: Oxford University Press.

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425-478.

Yin, R. K. (2014). *Case Study Research: Design and Methods*. Los Angeles: Sage.

Appendix 1 – CMS technological infrastructure

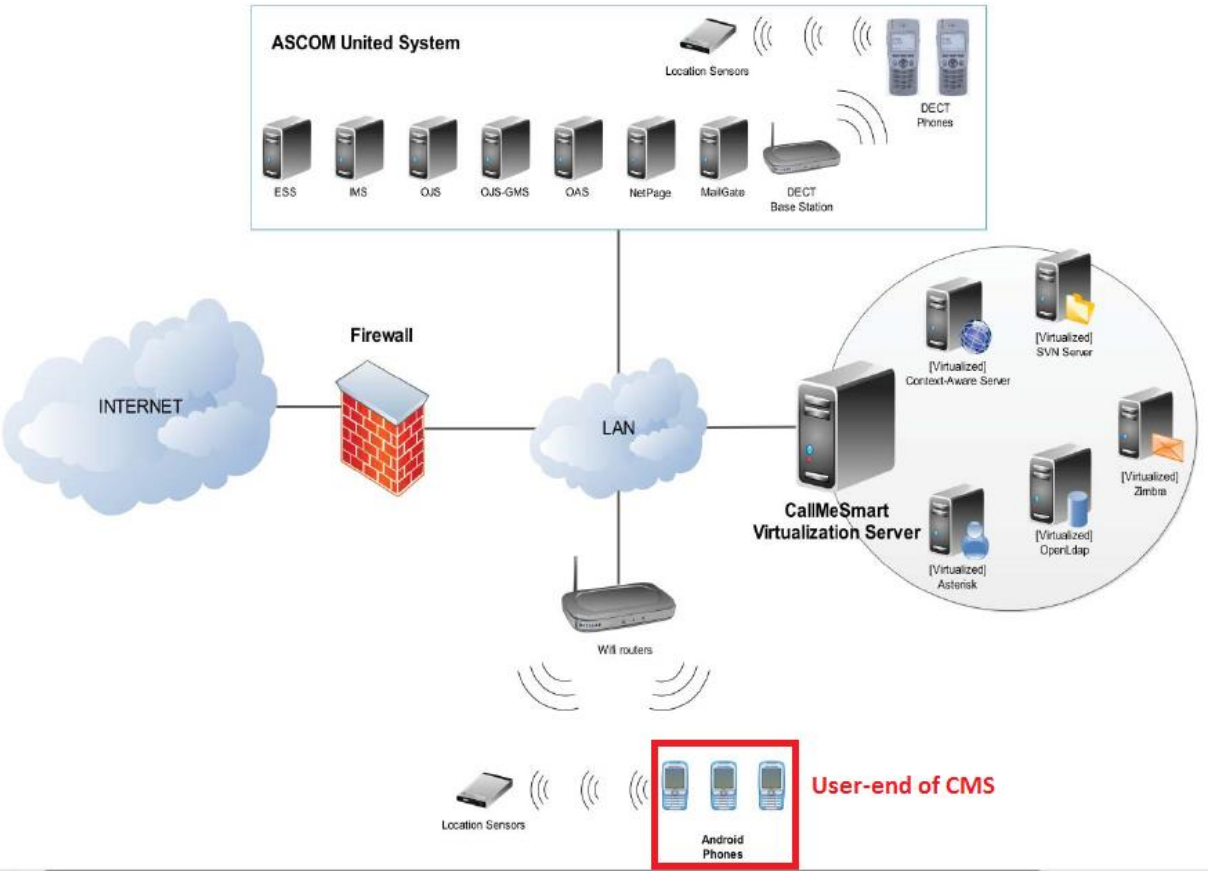


Figure 6: Technological infrastructure of CMS (Solvoll, 2013).

Appendix 2 – CMS interruption management service

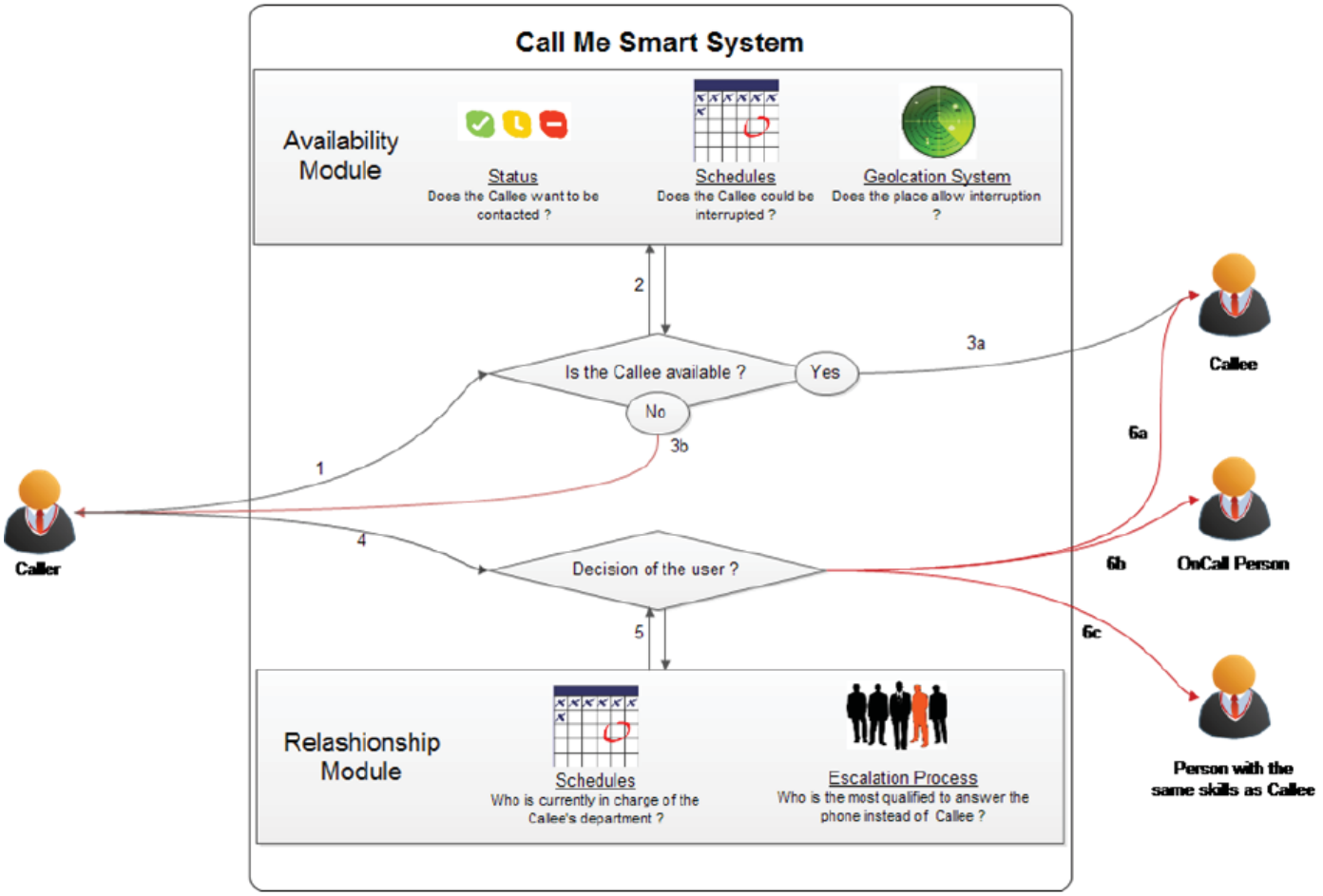


Figure 7: CMS interruption management service (Solvoll, 2013).

Appendix 3 – Interview guide (NOR)

1 Innledning

1.1 Hva er din alder?

1.2 Hvor lenge har du jobbet som sykepleier?

1.3 Hvor mange år høyere utdanning har du?

1.4 Hva er forholdet ditt til å ta i bruk ny, og muligens kompleks teknologi?

1.5 Hva er din rolle eller ansvarsområde på kreftavdelingen?

1.6 Hvilke erfaringer har du i forbindelse med bruk av smart-telefoner generelt?

2 CallMeSmart

2.1 Hvordan synes du testingen av CMS har gått så langt?

2.2 Basert på testingen så langt, hvordan vil du beskrive holdningen din til CMS generelt?

2.3 På bakgrunn av holdningen din til CMS, kan du si noe om dine intensjoner i forhold til å ta i bruk CMS i full skala?

3 Teknologiens innflytelse (Impact)

3.1 Hvordan har bruken av CMS påvirket arbeidsdagene dine?

3.2 Har innflytelsen du beskriver vært viktig i forhold til bruks-intensjonen som du beskrev tidligere?

4 Brukervennlighet (Ease of use)

4.1 Hvordan opplever du at brukervennligheten på CMS er?

4.2 Hvilke bruksrelaterte utfordringer har du støtt på i testperioden?

4.3 Hva mener du kan forbedre brukervennligheten på CMS?

4.4 Hvilke tanker har du gjort deg om den underliggende teknologien som gjør det mulig å bruke CMS?

4.5 På hvilken måte føler du at brukervennligheten (eller mangelen på dette) har bidratt til å skape den bruksintensjonen som du beskrev tidligere?

5 Testperiodens betydning (Trial utility)

5.1 Hvilken nytte har du hatt av testperioden?

5.2 Hvilke vanskeligheter føler du at du ville hatt dersom du skulle tatt i bruk CMS uten å ha fått prøve det ut først?

5.4 Hvordan føler du at du hadde opplevd CMS hvis du ikke hadde tatt del i test-perioden?

5.5 Kan du si litt om hvordan testperioden har påvirket intensjonen din om å ta i bruk CMS i full skala?

6 Synlighet av resultater (Result demonstrability)

6.1 På hvilken måte har resultatet av CMS-bruken vært synlig for deg?

6.2 Hvis enkelte resultater har vært mindre synlig for deg, hva tror du dette skyldes?

6.3 Hvilke tilbakemeldinger har du fått fra personer utenfor testgruppen, som vet at du prøver ut CMS?

6.4 Hvordan opplever du at synlighet av resultatene rundt bruken av CMS har påvirket intensjonen om å ta i bruk CMS?

Appendix 4 – Interview guide (ENG)

1 Introduction

1.1 What is your age?

1.2 For how long have you been working as a nurse?

1.3 How many years of tertiary education do you have?

1.4 What is your relationship towards using new and possibly complex technology?

1.5 What is your role, or area of responsibility at the cancer ward?

1.6 What experiences do you have in terms using smartphones in general?

2 CallMeSmart

2.1 How do you feel that the CMS testing has worked out so far?

2.2 Based on the testing so far, how would you describe your attitude towards the CMS in general?

2.3 Based on your attitude towards CMS, can you elaborate on your intentions in terms of using the CMS at full scale?

3 The impact of the technology (Impact)

3.1 How has the CMS usage affected your workdays?

3.2 Has the impact you described been important in terms of the use-intention you described earlier?

4 User friendliness (Ease of use)

4.1 How do you perceive the user friendliness of the CMS?

4.2 What use-related challenges have you had during the test period?

4.3 What do you feel might improve the user friendliness of CMS?

4.4 What thoughts have you given to the underlying technology that makes it possible to use CMS?

4.5 In what way do you feel that the user friendliness (or absence of this) has contributed in forming the use-intention you described earlier?

5 Benefits from trial period (Trial utility)

5.1 What benefits have you had from the test period?

5.2 What challenges do you feel that you would have had if you were to use the CMS without getting to try it first?

5.3 How do you feel that you had perceived CMS if you had not taken part in the test period?

5.4 Can you elaborate on how the test period has affected your intention of using CMS at full scale?

6 Visibility of results (Result demonstrability)

6.1 In what way has the results from the CMS usage been visible to you?

6.2 If certain results have been less visible to you, what do you think this is due to?

6.3 What feedback have you gotten from persons outside the test group that knows you are trying out the CMS?

6.4 How do you feel that the visibility of the results associated with the CMS usage has affected you intentions of using the CMS at full scale?