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Participatory Customization of Platforms in the Public Sector

A case study of the role of testing

Master's thesis

NTNU

Norwegian University of
Science and Technology

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Abstract

This study examine the process of implementing a generic platform in the public sector. The aim is to better understand the role of testing in platformization processes and how it contributes to participation. A case study was conducted on Helseplattformen as a generic platform that is currently being implemented in Central Norway. The aim of Helseplattformen is to introduce a common electronic health record (EHR) for primary and secondary health care. As part of the national objective "Én innbygger - én journal", Helseplattformen will serve as a pilot project for the rest of the country. Epic Systems Corporation is the vendor of Helseplattformen that will provide the generic core as a foundation for building a large number of applications and integrations. A number of studies have emphasized the value of involving future users in system development processes. However, user participation in large-scale projects is a far less explored area. Such projects often creates challenges related to participation which is why a deeper understanding of the participation process in Helseplattformen would be useful for a number of future development projects, in both the private and public sector.

The findings from this research show that testing is an activity for participation that perhaps has become increasingly important as platform models are being adopted. The knowledge needed to customize a platform is distributed and the distance between the core and periphery might increase due to language, terminology, and the context of health care services. The findings also indicate that the vendor's predefined and formal roles and communication structures might challenge the implementation process.

Keywords Participation, platformization, customization, testing, generic systems, participatory design, large-scale

Sammendrag

Denne studien undersøker prosessen for implementering av en generisk platform i offentlig sektor. Målet med studien er å få en bedre forståelse av rollen til testing i platform-iseringsprosesser og hvordan det bidrar til deltakelse. En case-studie ble gjennomført på Helseplattformen, en generisk plattform som skal innføre felles journalløsning for primær- og spesialisthelsetjenesten i Midt-Norge. Som en del av det nasjonale målbildet "Én innbygger - én journal", er Helseplattformen et pilotprosjekt for resten av landet. Helseplattformen leveres av amerikanske Epic Systems Corporation, og på deres "foundation system" skal det bygges et stort antall applikasjoner og integrasjoner for å tilpasse plattformen det norske helsesystemet. Det er forsket mye på verdien av å involvere brukere i systemutviklingsprosjekter, men deltakelse i stor-skala prosjekter er et langt mindre utforsket område. Ettersom slike prosjekter ofte skaper utfordringer knyttet til deltakelse, vil en økt forståelse av deltakelsesprosessen i Helseplattformen være nyttig for fremtidige utviklingsprosjekter, både i privat og offentlig sektor.

Funnene viser at testing er en aktivitet for deltakelse som kanskje har blitt viktigere etterhvert som flere har adoptert platformmodellen. Kunnskapen som behøves for å tilpasse en plattform er distribuert, og distansen mellom kjernen og periferien kan øke på grunn av språk, terminologi, og kontekst for helsetjenester. Funnene indikerer også at leverandørens predefinerte og formelle roller og kommunikasjonsstrukturer påvirker implementasjonsprosessen.

Nøkkelord Deltakelse, platformisering, tilpasning, testing, generiske systemer, deltakende design, stor-skala

Preface

This report is a master's thesis written spring 2021 as a final delivery of the study in Computer Science at the Norwegian University of Science and Technology (NTNU).

The thesis build on a literature review that was conducted fall 2020 on platformizaton, participatory design and large-scale projects. The aim of the study is to understand what is required of user participation in order to successfully implement Helseplattformen.

I would like to thank the interviewees for their time and participation in the study, as well as PlatVel's representative in Trondheim Kommune and the research coordinator of Helseplattformen, Liv Johanne Wekre.

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Nora Othilie Ringdal

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Abbreviations

Subject Matter Expert (SME)	=	Fagekspert
Proffesional coordinator	=	Faglig koordinator
Primary healthcare	=	Primærhelsetjenesten
Secondary healthcare	=	Spesialisthelsetjenesten
Health authorities	=	Helseforetak
Error	=	Feil
Change request	=	Endringsønske
Targets of profit	=	Gevinstmål
Targets of impact	=	Effektmål
Home care unit	=	Hjemmetjenesten
Health and welfare office	=	Helse- og velferdskontoret
Health center	=	Helsehus
Discharge letter	=	Epikrise

1   Introduction

1.1   Background and motivation

Municipalities and central authorities in Norway have adopted the "digital-first" ("digitalt førstevalg") principle, which entails digital communication and service delivery in preference to physical channels (Digitaliseringsdirektoratet, 2017). Digitization of public services provide major social benefits for both citizens and organizations (Regjeringen, 2019), but how do you ensure that the system that is developed will fit thousands of users' needs?

The Norwegian health care system is under vast technological change and Helseplattformen has been commissioned as a pilot project for the national objective "Én innbygger - én journal" which translates to "One citizen - one medical record" (Helseplattformen, 2019f). In hopes of improving the quality and efficiency of their service delivery they have adopted the platform model. The platform architecture enables a combination of a generic core and locally relevant components (apps) (Li, 2019). When developing generic software, direct user-involvement is near to impossible, which is why generic solutions often require implementation-level design or customization (Li and Nielsen, 2019). The complex institutionalized work settings that characterizes the public sector makes design on the generic level even more challenging. Many argue that participatory customization on implementation-level is necessary for achieving usability in such projects (Li and Nielsen, 2019). There is general consensus in the literature that users need to be involved in the development process in order to implement a system that will fit the users' needs (Orlikowski, 1992; Bano and Zowghi, 2015).

The development process usually involves requirement specification, designing, building, testing, and training. An interesting question that rise in the context of generic platforms is what kind of user participation the customization process requires. Testing is an essential activity in software development projects, that is no longer simply focused on the technology alone (Rooksby et al., 2009). In the context of platforms, testing has perhaps become increasingly important as an activity for participation (Kawalek and Wood-Harper, 2002). This research therefore focus on the testing process in particular, and how testing contributes to participation. Looking into the testing process can also provide valuable insight into whether the solution that has been built reflect the end-users wishes and needs.

1.2   Scope

This case study focus on the implementation of Helseplattformen in Central Norway - a project that involves several different stakeholders, organizations, vendors, and thousands of end-users. There are two main groups of end-users: health care workers and patients. A scope was set to concentrate the study which is why the focus of this research is on

Helseplattformen as a work tool for health care workers. Furthermore, the research explore the implementation of Helseplattformen in primary health care as this is an area that is new to the vendor. The case study is a snapshot of the state of the project from mid-January 2021 to the end of May 2021.

1.3   Research questions

The purpose of this study to understand the role of testing in the process of customizing a generic platform and how it contributes to participation. Three research questions were defined to contribute to the understanding of user participation in large-scale platform customization projects.

> RQ1: How does E2E testing contribute to participation?
>
> RQ2: What kind of participation does platform customization require?
>
> RQ3: How can large-scale platform customization processes improve?

1.4   Method

The overall strategy to answering the research questions is through an exploratory case study. Data is collected through interviews, observations, and document analysis enabling the researcher to look at the phenomenon in different ways. The research questions were answered using a qualitative analysis of the data.

1.5   Contribution

This research will contribute to the topics of generic platforms, participation, and testing. The hope is that the findings from the study can contribute to knowledge about participation in platformization processes and how the implementation process can improve. The findings show that testing is an activity for participation that perhaps has become increasingly important as platform models are being adopted. The knowledge needed to customize a platform is distributed and the distance between the core and periphery might increase due to language, terminology, and the context of health care services. The findings also indicate that the vendor's predefined and formal roles and communication structures might challenge the implementation process

1.6 Structure

This thesis consists of seven chapters and is structured as followed:

Chapter 1 provides an introduction to the thesis and briefly describe background and motivation behind the study, the scope of the research, the research questions, the method, the contribution, and the structure of the thesis.

Chapter 2 consists of the necessary background theory for conducting the case study and discuss the findings. The chapter is divided into three main sections: generic platforms, participation, and testing.

Chapter 3 is a description of the case under study. This chapter include all the information that is necessary to understand the findings.

Chapter 4 consists of the conceptual framework for the study, along with the research strategy used to answer the research questions. Furthermore, information about the pre-study, the methods used for data generation, and how the data was analyzed is provided.

Chapter 5 presents the findings of the case study.

Chapter 6 is the discussion of the findings presented in Chapter 5 in light of the information provided in Chapter 2. The last section describe the limitations of the research.

Chapter 7 presents the conclusion of the study by answering the research questions based on the discussion in Chapter 6. This chapter also contain a section about future work.

2 Background

This chapter will present relevant background theory to get an understanding of the process of platformization and the importance of user participation. The first section address digital platforms and the concept of platformization as well as how platforms in the public sector differ from commercial platforms. The focus of section two is generic systems and the process of customization, while the last section focus on the topic of participation. In this section the participatory design (PD) method is explored along with participation in large-scale projects and platformization processes. The section ends with an exploration of testing as an activity for participation.

2.1 Platformization

To contextualise we start by defining the term platform from where the concept of platformization has been derived. Some of the largest companies in digital economy, like Google, Facebook and Amazon, base their business models on digital platforms (Øverby, 2018). Digital platforms have changed the way we work, communicate, do business, socialize, and in essence the way we live our lives. Øverby (2018) argue that there is still huge potential for an expansion of platforms in the public sector.

Digital platforms and platform oriented infrastructures have spread beyond social media and consumer-oriented platforms due to their decoupled and flexible approach (Hydle et al., 2021). From a technical view a digital platform is defined by de Reuver et al. (2018, p. 127) as "an extensible codebase to which complementary third-party modules can be added". As the definition suggests the platform architecture enables a combination of a generic core and locally relevant components called applications or apps. These apps can be built using an application programming interface (API) to support variation and thus enable usability. Resources that enable third-party development are referred to by Ghazawneh and Henfridsson (2010) as boundary resources and typically consist of software development kits (SDK), APIs, and other tools for application development. The architecture of the platform model can be seen in Figure 1.
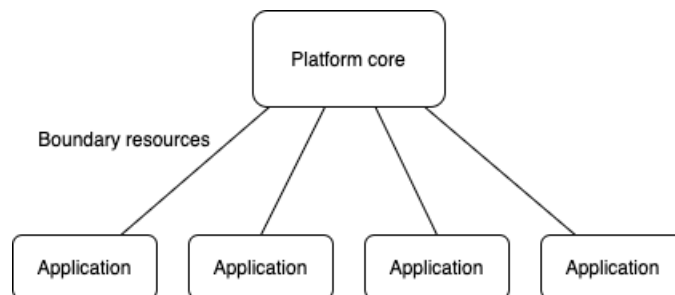

Figure 1: Platform architecture

The concept of platformization was explored and developed by Bygstad and Hanseth (2019, p. 3) who define platformization as "a process where IT silo solutions are gradually transformed to a platform-oriented digital infrastructure". IT silo solutions are a combination of large, diverse and unintegrated systems that are frequently ageing (Bannister, 2008). Because of these conditions information is not adequately shared between systems and it is difficult to make productive use of the data. Platforms on the other hand are adaptable, scalable, and extensible, and hence an attractive alternative to the inefficient "silo systems". Cunningham Dahl-Jørgensen and Parmiggiani (2020, p. 35) note that the term platformization "is increasingly used to describe the emergence of the platform model over time at the organizational and technical level".

2.1.1 Platforms in the public sector

While the objective of a commercial platform is usually profit maximization and monetization of network effects (Øverby, 2018), platforms in the public sector is a new form of public good (Vassilakopoulou et al., 2017) that seek to improve the collaboration between citizens and government agencies (Zissis and Lekkas, 2011). Based on partnerships within and between levels of government and with the private sector, the public sector is attempting to transition towards new models of service delivery (Vassilakopoulou et al., 2017). The motivation for platformization of the public sector is to improve efficiency, do more with less, breaking the silos, open innovation, and co-production of public services.

In recent years, there has been an increasing interest in how the platform model drastically transforms the processes by which public services are produced, and the value these services deliver to citizens (Cordella and Paletti, 2019). Although there are many studies on the impact of citizens, the implementation of a platform usually involve adaption of a new work tool for public sector employees, which remains a limited research topic.

2.1.2 Generic systems

The platform architecture make platforms suitable for *generification* which is a term to describe the strategy of making a software system work in different contexts. Most organizational software in use today are systems that are recycled from one context to another (Pollock et al., 2007). "Diverse organizations and standard technologies can be brought together" was the conclusion of Pollock et al. (2007, p. 20)'s study addressing "the seemingly implausible project of establishing a 'generic' organizational information system". Johannessen and Ellingsen (2009) support this conclusion by stating that the bottom-up approach to developing systems may emerge successfully.

Custom development "in which developers and users work under the same corporate roof" was the original context of system development (Grudin, 1991, p. 62). The obvious advantage of user participation in design for this paradigm is that the developers and the users are known when the project is initiated. In commercial off-the-shelf software

development, the uncertainty about the eventual user population is an important facet when designing the system (Grudin, 1991). According to Li and Nielsen (2019) direct user-involvement is near to impossible when developing generic software. Some generic software suppliers are said to actively keep users at a distance to avoid the risk of not becoming widely marketable. A way of avoiding this risk and revealing characteristics common across many users is to shift from involving a few isolated users to a larger extended "community". According to Pollock et al. (2007, p. 1) generic systems are "brought into being through an intricately managed process, involving the broader extension of a particularised software application and, at the same time, the management of the user community attached to that solution".

Although the initial design phase of off-the-shelf or packaged systems differs from custom development, organizations expect better solution when buying packaged systems. A reason for this is that the solution is already in use and has proved good, thus the organization avoid going through the same mistakes or inefficiencies that might have occurred in the start (Krabbel and Wetzel, 1998). The provided functionality also get more extensive as the software is further developed to capture various requirements (Krabbel and Wetzel, 1998). Long term development is usually guaranteed, and the vendor is trusted to cope with rapid changes that might occur (Krabbel and Wetzel, 1998). In order to fully utilize the potential of generic software they should be made customizable (Sawyer, 2000).

2.1.3 Customization

In the context of generic software the term customization has emerged to describe the process of adapting software to local needs. A series of studies has indicated that user participation is necessary for achieving usability when implementing generic solutions (Li and Nielsen, 2019; Cresswell et al., 2012). Krabbel and Wetzel (1998, p. 52) claim that "in the context of organizational package information systems the customization work in the user organization is comparable with the necessary participation during system development projects". In order to achieve a sufficient fit between software and organization, customization is typically done during implementation, which is why Li and Nielsen (2019) introduce two levels and types of design when discussing generic software - generic-level design and implementation-level design. In the same way Simonsen and Robertson (2012) use the expression "designing for design after design" in the context of reconfigurations, Li and Nielsen (2019) use "design for use" and "design for design" to describe the two types of design. Generic-level design unfolds during the development of the generic software, while implementation-level design unfolds during the implementation of the software product (Li and Nielsen, 2019). At the level of implementation the software is customized by leveraging upon the design infrastructure built and maintained by generic level design (Li and Nielsen, 2019). Thus, it is at the implementation-level the customization takes place.

The process of customization demands a great effort by the users to provide information and perform the customization. Krabbel and Wetzel (1998, p. 49) describe the process as "nearly as task-intensive as a development of a system is". The process of customizing large-scale information systems is not a well researched topic. In an attempt to structure the highly complex customization process, Krabbel and Wetzel (1998) define six categories of customization tasks, in which many have to be performed by the user.

1. Provision of organizational knowledge in system catalogs

2. Setting-up work places

3. Arranging cooperation facilities

4. Testing adaptions and extensions

5. Planning the training of the staff

6. Planning and structuring the process and cooperation with the vendor

The first task involves the users structuring information that is organization or region dependent in catalogs, while the task of *setting-up workplaces* involves a detailed check of system functionality and determining adjustments of system modules. Change or extension requirement documents also need to be written. Cross-workplace and cross-department *cooperation facilities needs to be arranged* such as working out an information flow. After customization of catalogs and the setting-up of workplaces, users again have to *test the adaptions and extensions*. It is emphasized that the customization process is an iterative process that needs to be done in cycles. When customization is finished the users need to receive *training* - which is a process that needs to be planned carefully in order to achieve successful implementation. Last but not least, users will find errors or missing functionality which is why it is important that there exists a *plan and a structure* for arising tasks the vendor has to carry out. The author distinguish between three categories: errors, usual customization, and extensions or changes (Krabbel and Wetzel, 1998).

In the context of participatory design Roland et al. (2017, p. 10) note that "platform architectures may allow PD practitioners to address the age-old challenge of catering for new users that were not part of early design process and allow them to adapt software in unforeseen ways". This type of user participation is made possible by the platform architecture and the boundary resources.

2.1.4 EHR-systems

Electronic health record (EHR) systems is a typical generic software that require customization to fit outside their origin (Winkler et al., 2020). An EHR system is defined by Gunter and Terry (2005, p. 1) as "a longitudinal collection of electronic health information about individual patients and populations". An EHR-system is an inter-organizational system,

unlike electronic medical records (EMR) which is usually considered an internal organizational system (Heart et al., 2017). Several countries in Europe, North-America, and Australia have already implemented EHR systems with different levels of success. According to Cresswell et al. (2012, p. 1) small- and medium-scale EHR systems often encounter problems that stem from "users' difficulties in accommodating the new technology into their work practices". These challenges may be exacerbated in the context of large-scale (Cresswell et al., 2012). An international survey was conducted by Fragidis and Chatzoglou (2018) to identify the best practices applied during the implementation process of a national EHR system. The study revealed that the most significant success factor of a nationwide EHR system implementation process is the commitment and involvement of all stakeholders (Fragidis and Chatzoglou, 2018).

In Macedonia and Serbia there were initiated projects for the development and implementation of a national e-health system including an EHR system in 2011 and 2015, respectively (Velinov et al., 2017). Success factors that was found in these projects include that the development and the implementation of the system were organized in phases and users were informed timely and appropriately of the benefits of the system and its proper application. Other success factor relates to a strong management, quick and appropriate legislative change before and during the implementation, as well as synergy and competence of project teams (Velinov et al., 2017).

There are various approaches and methods to help users participate in the development of health information systems like EHR, including surveys, usability tests, interviews and focus groups - which is a common way of involving large groups of participants (Martikainen et al., 2020). On site observations of clinicians may also be conducted by developers.

2.2 Participation

There has been numerous studies to investigate the importance of involving users in the process of developing a software system (Martikainen et al., 2020). Conventional wisdom has it that user involvement is critical to the successful development and implementation of an information system. Within the field of Information Systems (IS), user involvement has generally been referred to as participation in the system development process by potential users or representatives (Barki and Hartwick, 1989). Barki and Hartwick (1989, p. 53) proposed a separation of the constructs of *user involvement* and *user participation*, defining user involvement as "a subjective psychological state reflecting the importance and personal relevance of a system to the user" and user participation as "a set of behaviors or activities performed by users in the system development process". Following the suggestion of Barki and Hartwick (1989) and Kappelman and McLean (1992), Hwang and Thorn (1999) also distinguish between user involvement and user participation in their research. They define user participation as "the observable behavior of users during the development process of a system", and use "engagement" as a general term to refer to both involvement and participation (Hwang and Thorn, 1999, p. 230). According to Hwang and Thorn (1999),

both involvement and user participation are beneficial for system success.

Damodaran (1996, p. 364) presents five benefits of user participation in system design:

1. Improved quality of the system arising from more accurate user requirements.

2. Avoiding costly system features that the user did not want or cannot use.

3. Improved levels of acceptance of the system.

4. Greater understanding of the system by the user resulting in more effective use.

5. Increased participation in decision-making in the organization.

Most, if not all, social design approaches share the opinion that user participation in all stages of planning and design is crucial in order to achieve these benefits. Planning and design are two important steps in the process of software development. The steps in this process are often referred to as the software development life cycle (SDLC). According to Elliott (2004) it is the oldest formalized methodology for building information systems, consisting of four generic stages: analysis, design, implementation, and evaluation. These steps comprise different activities and can be performed in different ways depending on the system requirements, level of risk, budget, estimated completion timeline, and the size of the project (Alshamrani and Bahattab, 2015). Activities in the analysis phase comprises project planning/scoping and requirements elicitation, analysis and verification (Bano and Zowghi, 2015). The design phase is about software design and architecture, while the implementation phase involves coding, testing and installation (Bano and Zowghi, 2015). Although involving users in the early stages of development such as requirements analysis contribute to accurately capturing the users needs, involving users is also important in other phases like design and testing according to Bano and Zowghi (2015). One of the benefits of involving users in testing is that it helps in overcoming implementation and installation failures (Bano and Zowghi, 2015).

2.2.1 Participation and development method

The intensity of involvement required in the development process as well as the complexity of the project are important factors for selecting a particular method for user involvement (Bano and Zowghi, 2015). According to Cavaye (1995) there are two underlying philosophies when it comes to participation and the choice of development method, the functionalist and the neo-humanist paradigm. Participation in the functionalist tradition may not be even be sought unless it is necessary, while in the neo-humaist paradigm users play a much more central role and great importance is placed on their input. Participatory Design is an example of a method within this tradition.

2.2.2 Participatory Design

Participatory design (PD) is an approach to design of information technology (IT) that actively seeks to involve the stakeholders of a system in the process of developing it. According to Saad-Sulonen et al. (2018, p. 4) the main purpose of PD "is to bring people who may be affected by the introduction of new technologies and systems together with researchers and designers to ensure their views, wants and concerns are accounted for in technology design". The aim is to establish mutual learning situations between users and designers in order to develop a product that is close to what the users want and understand (Simonsen and Hertzum, 2008). This is emphasized in the definition by Robertson and Simonsen (2012, p. 5) who says that "participation" in Participatory Design means to "investigate, reflect upon, understand, establish, develop, and support mutual learning processes as they unfold between participants in collective "reflection-in-action" during the design process". The designers aim to learn about the practices and contexts of those who will use their designs, while users and other participants learn about possible technological options (Robertson and Simonsen, 2012). Although there are similarities with the user-centered design approach, Bannon et al. (2018, p. 2) emphasize the importance of differentiating between "participatory" and "user-centered" design:

> the label "participatory design" seems to have become synonymous with a more banal form of "user-centered" design, concentrating on local issues of usability and user satisfaction. This is a far cry from earlier work in the field, where Participatory Design not only sought to incorporate users in design, but also to intervene upon situations of conflict through developing more democratic processes.

Bratteteig and Wagner (2016, p. 425) define PD as an approach to design "where the designers invite future users to participate in all phases of the design process". These definitions and explanations emphasize that participation in every phase of the design process is what separates "participatory" from "user-centered" design. Bratteteig and Wagner (2016, p. 425) explore what exactly it is that users participate in when being involved in participatory design and see design as involving "creating choices, selecting among them, concretizing choices and evaluating the choices".

The PD method should be interpreted broadly according to Simonsen and Robertson (2012), citing Checkland (1981, p. 161) who stated at PD "set of principles of method which in any particular situation has to be reduced to a method uniquely suitable to that particular situation". The perspective of the method is essentially what constitutes whether you are doing participatory design or not and in PD methods the perspective on design and information technology favor user participation (Simonsen and Robertson, 2012).

Bødker et al. (2017) describe activities and processes in which participants are not only engaged in while designing technology, but also while creating the structures, networks,

and agreements that are crucial to creating a sustainable system. The terms front stage and back stage activities are used to refer to the different types of activities users engage in. Front stage refers to the "workshops or cooperative prototyping, where designers, researchers, participants, and stakeholders come together to work on the object of design" (Bødker et al., 2017, p. 248). Bødker et al. (2017, p. 248) point out that we need to look beyond these activities and examine their context: "(..) we do see the need to expand the understanding of PD work beyond the micro-dynamics of PD interventions, towards a focus on the sometimes fuzzy and chaotic processes that emerge before, between and after these interventions". Backstage activities is therefore used as a term to describe the "preparations, negotiations, and political work that fundamentally shapes the set-up and outcomes of the entire process" and that "orients us to the activities and the processes that tie together particular design activities, such as workshops and meetings" (Bødker et al., 2017, p. 250). In the case study of Helseplattformen conducted by Øien (2020), research on back stage activities in large-scale participatory design shows little participation in the back stage activities, even though the need for organizational work keeps increasing when the project's size reaches a certain point.

Bødker et al. (2017)'s division into the different types of activities can be linked to the three arenas for participation defined by Gartner and Wagner (1996).

A. Designing systems - The project arena where specific systems are designed and new organizational forms are created (Gartner and Wagner, 1996).

B. Designing organisational frameworks for action - The company arena in which "breakdowns" or violations of agreements are diagnosed and hitherto stable patterns of organizational functioning questioned and redesigned (Gartner and Wagner, 1996).

C. Designing the industrial relations context - The national arena in which the general legal and political framework is negotiated which defines the relations between the various industrial partners and sets norms for a whole range of work-related issues (Gartner and Wagner, 1996).

Arena A is the arena in which we will find the most direct collaboration between users and designers. Workshops and prototypes are typical activities for this arena since the focus is on the use of a computer system. This is closely affiliated with Bødker et al. (2017)'s definition of front-stage activities as activities like workshops and prototypes that bring together designers, participants and stakeholders to work on the product. The backstage activities on the other hand is conceptually similar to both the company arena (Arena B) and the national arena (Arena C), covering the processes that tie together design activities as well as the negotiations and political work shaping the entire process.

Bjerknes and Bratteteig (1995) also describe four levels of technological influence and arenas for participation: (1) the work situation level, (2) the workplace or organizational level, (3) the inter-organisational level, and (4) the working life level. At the work situation

level, users can participate in development projects or by selecting applications to influence the technology. Participation on this level is similar to participation in front stage activities and in the project arena (Arena A). The influence at the workplace level is more indirect because the use of technology is argued for with reference to an overall organizational goal. This level of technological influence can be tied to Arena B for participation at the organizational or company level. Arena C cover the inter-organizational and national level, which has been an area of concern in the PD community - stressing the importance of participation at this level (Bjerknes and Bratteteig, 1995).

2.2.3 Participatory customization

The tasks of customization defined by Krabbel and Wetzel (1998) can be categorized into front stage or back stage activities (Bødker et al., 2017). As tasks 1 (provision of organizational knowledge in system catalogs), 2 (setting-up work places), and 4 (testing adaptions and extensions) are activities in which designers, researchers, participants and stakeholders come together to work on the object of design, it can be argued that these are front stage activities. While tasks 3 (arranging cooperation facilities), 5 (planning the training of the staff), and 6 (planning and structuring the process and cooperation with the vendor) are backstage activities because these are activities that tie together particular design activities. Table 1 provide an overview of how the customization activities defined by Krabbel and Wetzel (1998) are linked to the arenas defined by Gartner and Wagner (1996), the divsion of front-stage and back-stage by Bødker et al. (2017), and the activities for participation defined by Bjerknes and Bratteteig (1995).

Gartner and Wagner (1996)	Bødker et al. (2017)	Bjerknes and Bratteteig (1995)	Krabbel and Wetzel (1998)
A	Front stage	1	1,2,4
B	Back stage	2	3,5
C	Back stage	3,4	6

Table 1: Activities for participation linked to the arenas defined by Gartner and Wagner (1996)

All front stage activities are on the work situation or workplace/organizational level (Bjerknes and Bratteteig, 1995), or in Arena A and B using the definition by Gartner and Wagner (1996). Task 3 and 5 are on the organizational level (Arena B), although it can also be argued that they involve other organizations (Arena C). Task 6 is on the inter-organizational and working life level (Arena C). All these levels and areas are categorizations of possible areas for user to participate in, in the process of acquiring, designing, and implementing software. Although the conceptualization provide a more in-depth understanding of the political and social forces that shape the practice of design and participation (Gartner and Wagner, 1996), when projects scale the question of who should participate in what is still raised.

2.2.4 Large-scale participation

Although PD has proven to be a successful approach to achieving usability in numerous small-scale projects (Oostveen and van den Besselaar, 2004), a number of studies have identified challenges that occur when traditional PD is applied to the development of large-scale information systems (Dalsgaard, 2012; Simonsen and Hertzum, 2008). Large-scale systems development projects in the have been notorious with regard to being late, over budget, or functionally inadequate - especially in the public sector (Simonsen and Hertzum, 2008). Dan Shapiro argues that these failures can be explained from a participatory design perspective and that PD would do better "if its paradigm is given a serious chance" (Shapiro, 2005, p. 29). Shapiro (2005) set out an agenda for placing PD at the centre of designing and developing large-scale information systems, especially in the public sector.

Large-scale information systems touch many people throughout an organization who have different desires and expectations which raises the issue of who should participate in such projects (Blomberg and Karasti, 2012). Many different users with different cultural backgrounds, opinions, norms and values does not only present challenges related to logistics, but also in terms of empowerment and located accountability (Blomberg and Karasti, 2012). Platforms usually involve multiple stakeholders and users, which is why they can be characterized as large-scale projects. Participation in platformization processes often takes place over a long period of time and partly in other places than the organization. This contribute to an increased distance between the developers and users.

Complex systems require that users play a much larger role, with greater responsibility in the development process (McKeen and Guimaraes, 1997). This entails a requirement that the participants receives sufficient information about their role in the project. Damodaran (1996, p. 363) argue that

> In most organizations surprisingly little briefing on the users' role in design projects is provided. Users are therefore confused about their brief and concerned about their lack of expertise in computing.

2.3 Testing

According to Myers et al. (2012, p. 2), testing is a "process, or a series of processes, designed to make sure computer code does what it was designed to do and, conversely, that it does not do anything unintended".

It is widely reported that testing is an essential activity in software development (Bertolino, 2007; Rooksby et al., 2009; Jorgensen, 2018), although the challenges of testing are growing bigger as software grows more complex (Whittaker, 2000). Rooksby et al. (2009, p. 576) argue that "such complexity is not just along technical lines (although we are certainly not claiming that software testing does not face technical challenges) but is also along human

and organisational lines". Testing is no longer simply focused on the technology alone "but on socio-technical issues such as acceptability, usability and fitness for purpose" (Rooksby et al., 2009, p. 561).

Software testing encompass a wide spectrum of different activities ranging from the developer testing a small piece of code (Unit Testing), to the user validation of a large information system (User Acceptance Testing) (Bertolino, 2007). Earlier, testing was a project phase that followed development and took place before its installation. Since that time, testing has become more integrated in the development phase in hopes of mitigating problems at an earlier stage (Rooksby et al., 2009).

2.3.1 Participation in testing

In a longitudinal case study of a software development project, Bano et al. (2017) explore user satisfaction in relation to user involvement and system success. Data was collected during four different stages of the software development process: pre-implementation, during implementation, post-implementation, and post-installation. The activities conducted in the different stages can be seen in Table 2.

Stage of development	Description
Pre-implementation	Participation in requirements elicitation, analysis, design related activities, negotiation and prioritization of requirements
Implementation	Review of prototypes, providing feedback about the development processes, attending stand-ups and project meetings
Post-implementation	User Acceptance Testing, training, raising change requests, attending the post-implementation review meetings and to resolve outstanding issues
Post-installation	1 year after the users have been using the system

Table 2: Stages for data collection in the case study conducted by Bano et al. (2017)

The case study was conducted over two sequential projects. In the first project the waterfall methodology was adopted which led to limited and largely ineffective user involvement. Users were involved during the pre-implementation and post-implementation phase but not much during the implementation. This created a feeling of isolation and once it was time to perform User Acceptance Testing (UAT) they had to be reminded about what the system was all about. This situation was exacerbated by the delay of the UAT. A case study participant also argued that the reason why they did not get well enough acquainted with the software was due to their lack of involvement in UAT.

During the second project a few agile practices were introduced to actively involve users in the implementation phase. They were also frequently given prototypes to review and provide feedback. Going into UAT the users already knew the system and had developed a sense of ownership. Case study participants later reported an increased level of satisfaction with both the development process and the delivered system. One of the informants reported a feeling of "being heard" and that is was satisfying to know that "what you say matters and make a difference".

"UI [user involvement] should be conceived as a continuum, a wave, not a particle" is the conclusion of Zowghi et al. (2015, p. 10) referring to the involvement of users in scoping and requirements elicitation, before they disappear, only to reappear at UAT and again in training.

Kawalek and Wood-Harper (2002) explore how user participation is used to promote efficient and effective implementation of Enterprise Systems (ERP) through a case study. ERP systems are usually large, generic software packages which embraces many organizational functions (Markus and Tanis, 2000). The development method used by the manufacturer in the study by Kawalek and Wood-Harper (2002) consists of two phases: design and implementation. The design phase is largely technical, concerned with the building, configuration, and review of requirements. The implementation phase is concerned with gathering business knowledge, identifying testing criteria, and the process of installing the system. In essence the design phase can be characterized as "getting the system ready for the business" while the implementation phase can be characterized as "getting the business ready for the system". In the context of this Enterprise System, integration testing is categorized as an implementation activity because of the close link to UAT, even though it is strictly a design activity.

Furthermore Kawalek and Wood-Harper (2002) apply the Multiview2 framework for IS development to the implementation case. The Multiview framework was originally defined to take into account the human and organizational aspects of information systems development, as most methodologies had a very technology-oriented approach (Avison and Wood-Harper, 2003). According to Avison et al. (1998, p. 131) the framework propose that information system development is comprised of four components:

- Organizational analysis

- Information system modelling

- Sociotechnical analysis

- Software development

In addition to these components there exists activities that address conflicting demands and tensions that arise between activities in the different components. These activities are referred to as meditation activities. When placing the activities from the development method used by the manufacturer in the study by Kawalek and Wood-Harper (2002), both

integration testing and UAT are placed within mediation activities. In this way integration testing can be seen as an arena for participation that can assist the project management in navigating through conflicts.

2.4 Conclusion

Organizations are increasingly adopting the platform model to increase the efficiency of their service delivery. The platform model enable users that were not part of the early design process to adapt the software in unforeseen ways. The process of customizing a generic platform is similar to the process of developing traditional software. Mutual learning situations still needs to be established during customization due to the distance between the builders and users. Users participate to varying degrees in the different phases of the process. Testing is one of the phases were users traditionally have not been heavily involved. While customizing generic software testing has become more of a transition activity than a purely technical activity.

EHR-systems are an example of generic software that often require customization. Implementing platforms in the public sector demands a different kind of participation than commercial platforms due to the different objectives of the platforms. Large-scale IT projects, like platform customization, often involve challenges related to a multitude of stakeholders, organizational and political complexities, as well as time and budget. Figure 2 shows the relations between the main concepts of this thesis.
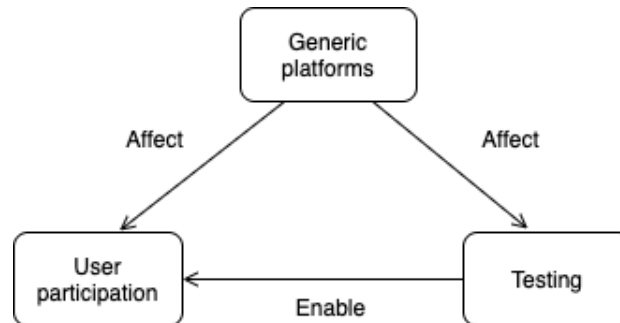

Figure 2: Connection between the main concepts: platforms, participation, and testing

3 Case description

This chapter describes the case under study in this master's thesis. Helseplattformen is a generic electronic health record system (EHR) that is currently being implemented in the region of Central Norway. The implementation of platforms in the public sector is a complex sociotechnical process that involves multiple actors, values, and interests, which is why this chapter attempts to give a simplified, but correct, overview of the project. The first section is an introduction to the project of Helseplattformen to get an overview of how it is organized. The next section describe the local implementation project in Trondheim Kommune in more detail, as this is the focus of this study. Some information about the vendor is then provided, before it is explained how testing is conducted in Helseplattformen.

3.1 Helseplattformen

Fall 2012 it was decided that Helse Midt-Norge will implement a new medical record system as a joint procurement between the primary- and secondary healthcare in Central Norway (Helseplattformen, 2019a). The program of Helseplattformen was established in 2014 by Helse Midt-Norge and Trondheim Kommune (Helseplattformen, 2019a), and was later commissioned as a pilot project for the national objective "Én innbygger - én journal", which translates to "One citizen - one medical record" (Helseplattformen, 2019f). The directorate of eHealth has presented three strategic initiatives to achieve this national objective - one of them being Helseplattformen. The others include further development of existing solutions for secondary healthcare in the other health regions, as well as the establishment of a national solution for primary healthcare (Akson) (Direktoratet for e-helse, 2018).

Helseplattformen AS was established in 2019 by Helse Midt-Norge RHF and Trondheim Kommune (Helseplattformen, 2019c). Spring 2019 Helseplattformen AS signed a contract with the vendor Epic Systems Corporation for a generic platform solution, in hopes of improving the quality and efficiency of their service delivery (Helseplattformen, 2019f). The contract was signed after a major public procurement based on a comprehensive requirement specification involving health personnel from all over the region (Helseplattformen, 2019a). IBM will provide the solution for identity and access control (Helseplattformen, 2019f). Figure 3 shows the timeline of Helseplattformen from 2012 until the contract with the vendor Epic Systems Corporation was signed.
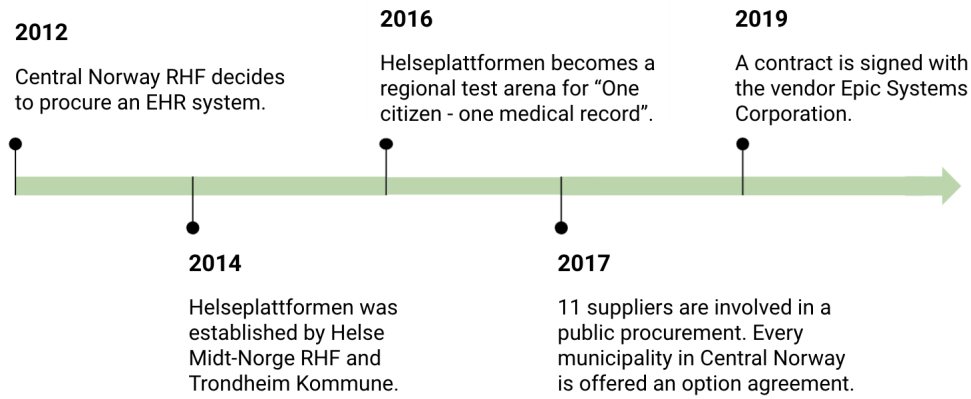
Figure 3: Timeline of Helseplattformen from 2012-2019 (Helseplattformen, 2019a)

An option system was designed for the municipalities to enable them to sign an agreement without having to commit financially or technically to the final solution (Mjåset, 2020). As of May 19th 2021, 19 municipalities have converted from option to acquire (Helseplattformen, 2021a). Helseplattformen AS is responsible for implementing the new, common solution as well as managing the contract with the suppliers Epic Systems and IBM (Helseplattformen, 2019c).

Figure 4 shows a timeline of the implementation of Helseplattformen. Go-live was originally planned for fall 2021, but in January 2021 the board of Helseplattformen AS approved a revised plan - postponing go-live until May 2022 (Helseplattformen, 2021b). According to Helseplattformen AS, the pandemic is the main cause of this delay.
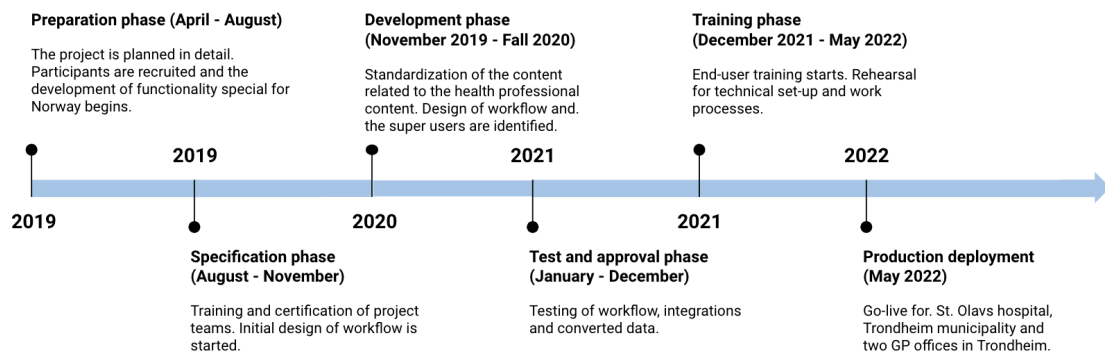
Figure 4: Timeline showing the phases of implementing Helseplattformen from 2019-2022 (Helseplattformen, 2019g)

The purpose of implementing a common electronic health record (EHR) is to improve the efficiency and productivity in hospitals and municipalities, as well as providing citizens of Central Norway with access to their records and the possibility to influence their treatment process. The stakeholders of the project of Helseplattformen are many and include patients, nurses, general practitioners (GP), specialists, hospitals, and municipalities in Central Norway (Helseplattformen, 2019f). Helseplattformen will affect 720 000 regional citizens,

including 40 000 health care workers in Central Norway and approximately 8 500 employees in Trondheim Kommune (Trondheim kommune, 2021). The estimated cost of the program is NOK 3,3 billion (EUR 320 million) (Storvik, 2021). In order to develop a system that fits thousands of users needs, health personnel from hospitals, municipal health- and welfare services, and general practitioners (GP) have to work side by side.

3.1.1 Decision-making structure

To facilitate the process of health personnel from completely different areas to collaborate and agree on a common design solution, a decision-making structure was established as seen in Figure 5 (Helseplattformen, 2019f).
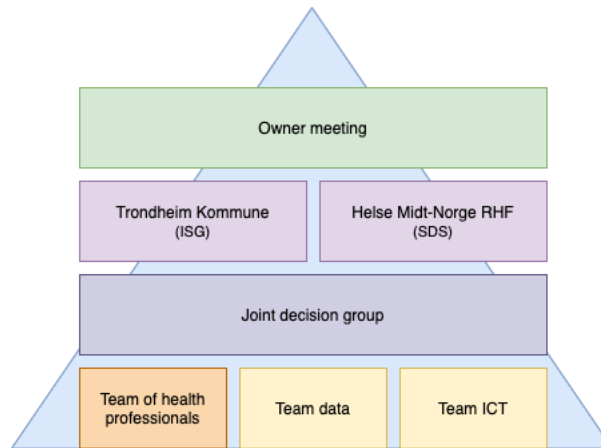
Figure 5: Decision-making structure in Helseplattformen (Helseplattformen, 2020)

There is a desire to make decisions as close to where the health service is provided as possible (Helseplattformen, 2020). Decisions must be based on consensus and if no agreement is reached, the matter should be raised to the next level in the structure. The team of health professionals (Fagteam Helse), has the mandate to make decisions regarding configuration and setup of the solution, and shall verify that the solution produced is in accordance with the decisions made (Helseplattformen, 2020). In order to make such decisions and achieve sufficient user participation, the role of subject matter experts (SME) was created. SMEs are hospital or municipality employees that act as a representative for their domain. There are more than 400 SMEs in this project (Helseplattformen, 2019f). Fagteam Data make decisions related to use of data, information standards and coding schemes, while Fagteam IKT's mandate cover use of technology, integrations, and technical solutions and standards (Helseplattformen, 2020). Efforts are being made to migrate data from existing medical record systems to HP in a way that safeguards patient safety to ensure that the data ends up in the right place in Helseplattformen. In the same way, work is being done to ensure that integrations between Helseplattformen and 3rd party systems (for example the National Population Register) will work when using Helseplattformen (Basso, 2021).

3.1.2 Targets of impact

Helseplattformen AS has summarized the ambitions for the effect of Helseplattformen in 11 points:

- Higher quality of treatment and fewer patient injuries

- Access to continuously updated clinical knowledge based on best practice

- Easy access to your own medical record and greater opportunity to influence your own course of treatment

- Better collaboration in and between the primary and secondary health services

- Improved data and information for research and innovation

- Increased efficiency and improved use of resources

- Better management information as a basis for quality and improvement work in daily operations

- Reduced time spent on documentation and searching for health information

- Satisfy national requirements and standards

- The inhabitants of Central Norway will be given the opportunity to live longer in their own housing

- Reduced need for public services by ensuring that services offered through generic processes ensure a comprehensive functional assessment

Some of these ambitions concern saving time and increasing efficiency which is necessary to face the growing demands the demographic change toward an aging society puts on health care (Dahl et al., 2013). Between the years of 2011 and 2020 the population in Norway has increased by 9.6 %, while the age-group 67-79 years has increased with as much as 47.5 % and the age group 90 years and older has increased by 20.5 % (SSB, 2021). In addition to the increasing need for health and welfare services, citizens expect independence to a greater extent which Helseplattformen aims to facilitate.

3.1.3 Joint implementation project

Helseplattformen AS is the joint implementation project that serves as a connection between the supplier and the four organizations: St. Olavs HF, Trondheim Kommune, Helse Nord-Trøndelag (HNT) HF, and Helse Møre og Romsdal (HMR) HF. A simplified view of the relations is shown in Figure 6. The focus of this study is the local implementation project in Trondheim Kommune.
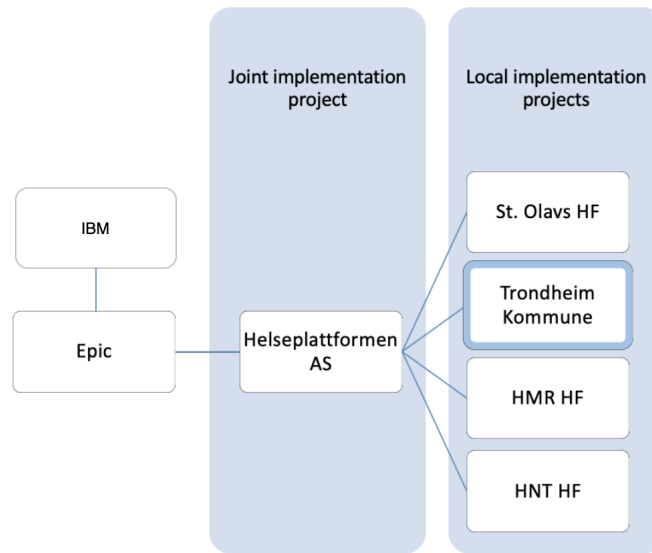
Figure 6: Simplified overview of the relations between implementation projects (author's representation)

The main activities in the project of Helseplattformen are conducted in the joint implementation project, while the local implementation projects organize activities related to the implementation of Helseplattformen in each organization. The joint implementation project (Helseplattformen) is divided into seven subprojects (Helseplattformen, 2019b). The subprojects and their focus area can be seen in Table 3.

Subproject	Description
Information Management	Has the overall responsibility for how information is managed in the solution and to maintain the connection between all information elements across the applications.
Applications	Responsible for developing and customizing clinical content and functionality in the applications.
Application Support	Responsible for data migration, integrations, establishing necessary infrastructure and capacity for operation, and Identity and Access Management (IAM).
Reporting	Responsible for the development of good and adequate solutions for both internal and external reporting.
Development and Requirements follow-up	Consists of developing new functionality and follow-up of requirements in the contract with Epic.
Testing	Responsible for picking, planning, facilitate for, and conduct various tests in relation to the implementation of a new medical record system.
Training	Responsible for offering relevant and customized training for everyone who will use the new solution.

Table 3: Subprojects of the joint implementation project (Helseplattformen, 2019b)

3.1.4 Local implementation projects

St. Olavs HF, Trondheim Kommune, Helse Nord-Trøndelag (HNT) HF, and Helse Møre og Romsdal (HMR) HF have established local implementation projects for activities related to the implementation of Helseplattformen in each organization (Helseplattformen, 2021c).

Helseplattformen will be partly delivered to the different organizations. The overall timeline of the partial deliveries (PD) can be seen in Figure 7. PD1 at St. Olavs Hospital Trondheim Kommune is planned for May 2022.
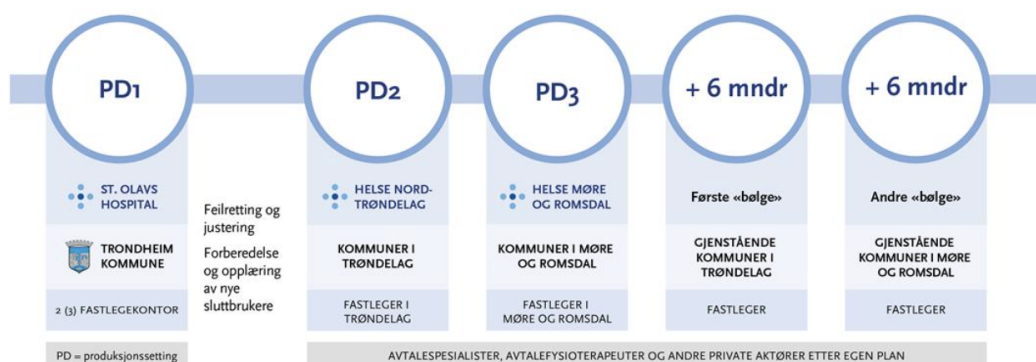
Figure 7: Overall timeline of delivery from Helseplattformen (2019f)

3.2 Local implementation project in Trondheim Kommune

The purpose of the local implementation project in Trondheim Kommune is to ensure that the organization (Helseplattformen, 2019e):

- Is well prepared and has a well defined plan for utalization of Helseplattformen.

- Is quorate in meetings with partners and suppliers.

- Can realize Helseplattformen AS ambitions for the effect of Helseplattformen (see 3.1.2).

The project is organized into five sub-projects with a common project manager and a project owner. The sub-projects include Organizational Development, Health, Care, Information and Communication Technology (ICT) and Data (Trondheim Kommune, 2019). The main focus area of organizational development is within readiness, training and benefit realization. The sub-projects of Health and Care work closely together to design and establish the functionality of the solution and to provide the professional competence from primary health care services into the decision-making structure. ICT will contribute to making sure that the technological solutions work together with the solutions that the municipality use today. The sub-project Data, mainly ensure that the municipality utilizes the data that is entered into the solution for reporting, analysis, and research.

3.2.1 Subproject: Organizational development

Being responsible for ensuring that the organization is well prepared means that the sub-project must work on creating knowledge about, skills in, and attitudes towards the new solution that meets the organization's ambitions and desired effects. As mentioned in 3.2, the sub-project of organizational development have three main focus areas: readiness, training and benefit realization.

Readiness
Readiness is an area of activities focused on ensuring that the organization is ready for system adaption. One of the main activities related to this area is the Maturity analysis that has been conducted once in 2019 and once in 2020. The purpose of the maturity analysis is to get insight into the maturity of the organization and gain knowledge about the employees' motivation and willingness to change, as well as the leaders competence on change management. This insight can be used to consider measures and their effect. An overview of the activities in the area of readiness can be seen in Table 4. Most of these activities are developed in cooperation with the joint implementation project and St. Olavs HF.

Activity	Description
Maturity analysis	Plan and conduct maturity analyzes related to ICT and change management. The analysis will provide the project with an overview of areas in which extra efforts should be made in order to contribute to increased maturation in the organization.
Organizational change measures	Identify and initiate need for change in the project, line organization, or in collaboration with other actors.
Competence-building for managers	Develop a training program for leaders to make sure they have the skills and knowledge to lead the change process.
Review, change and update of current routines	Ensure coherence between processes and routines in the municipality's quality system "Kvaliteket" and Helseplattformen.
Preparation programme	Ensure that all stakeholders are prepared and ready to use the solution.

Table 4: Activities related to Readiness

Training

The focus of this area of activities is on training and teaching future users how to use Helseplattformen. Trondheim Kommune have recruited close to 700 super users that will play a key role in the training work back at their units. Approximately 8500 employees in Trondheim Kommune shall receive training to ensure that they are able to use the solution. This group of people include everything from uneducated to highly educated people, new employees with little experience to people who have been working in health care for many years, young people and older people etc. For this reason there will be different needs in terms of approach and training. According to the detailed project plan for training, Helseplattformen AS and the lines are responsible for developing the content for training. An overview of the activities in the area of readiness can be seen in Table 5.

Activity	Description
Learning culture	Assisting units in developing a culture for learning that ensures proper use of the solution.
Super user organization	Build and develop a super user organization in relation to capacity and knowledge, and identify super users, leading super users and super user coordinators.
Super user training	Conduct super user training in line with prepared learning strategy and developed training material
Organization and conduction of end-user training	Organizing and conducting end-user training in line with a prepared learning strategy and developed training material, in collaboration with the operating organization and Helseplattformen AS.
Preparation program	Ensure that all stakeholders are prepared and ready to use the solution.

Table 5: Activities related to Training

Benefit realization

The last area of activities is responsible for ensuring that the benefits are planned and documented, and that realization of the eight strategic targets of benefit is facilitated. The targets of benefit are a concretization of the eleven targets of impact, to help define measurable desired improvements. The targets of benefit include:

- Citizen involvement

- User-friendly system for employees

- Medication management

- Medical distance monitoring

- Research (advanced use of data)

- Information management (advanced use of data)

- Logistics

- Interaction

There are several actors involved in the area of benefit realization: the local implementation project in Trondheim Kommune, other option municipalities, Helseplattformen AS, subject matter experts, and units. Local targets of benefit will be developed for all service areas that will adopt Helseplattformen.

3.3   Epic Systems Corporation

Epic Systems Corporation provides the platform core in Helseplattformen as a foundation for building a large number of applications and integrations. Epic's generic foundation system (EFS), contains standardised workflows and functionality that can be configured to fit a variety of different contexts (Helseplattformen, 2019d). Epic delivers the technology behind electronic health records and other digital healthcare services to both small and large healthcare providers worldwide (Epic, 2021a). Several leading hospitals and health- and education institutions in the USA use their technology, as well as countries like the Netherlands, Australia, United Kingdom, Denmark and Finland (Epic, 2021b).

In addition to the platform core, Epic provide dedicated modules for anesthesia, radiology, rheumatology, surgery, urgent care, wound care, and more. All these modules share the same common database, which means that all courses of treatment that the patient receives are documented in the same place. Since Epic's system is made primarily for hospitals, their experience with primary health care is limited. Working with Norwegian municipalities introduces new needs and features that make them a vital source of information for development. Being an American company, the system is also primarily designed for the American market.

Entering the European eHealth-market has led to challenges both technically and culturally in both the United Kingdom and Denmark, while the implementation in the Netherlands has been more successful (Helseplattformen, 2019d). In Denmark the challenges became so extensive that the National Audit Office (Rigsrevisionen) published a report criticizing the training, testing, benefits estimation, and benefits follow-up of the implementation (Winkler et al., 2020). The biggest system challenges they experienced was related to medication, code- and billing, and new roles and standardized work flows (Jensen, 2020). With regards to the latter, a lesson learned was that IT-architects and health professionals should collaborate, through an iterative process to build the solutions. Serial development where health professionals define the workflow, then the builders customize, before the application is released does not work well for complex applications (Jensen, 2020). "Sundhedslpattformen" in Denmark is a system that is used exclusively in secondary health care. As Helseplattformen is significantly more ambitious, the decision of awarding Epic with the contract to deliver Helseplattformen has received criticism.

Epic divide the services they provide to enable their customers to get the most out of their software, into five categories: Implementation, Training, Technical Services, Ongoing Services, and Continuous Improvement (Epic, 2021c). The service of implementation is about Epic's implementation team working side by side with the customer to make sure that the project meets the customer's goals and stays on time and on budget (Epic, 2021c). Training is about providing resources for the customers to become confident owners of the system, while technical services is about providing designated support 24/7, system monitoring and regular check ups (Epic, 2021c). Ongoing services relates to Epic staying close to make sure that the customer is happy users of the software, while continuous improvement

is about providing advice and assistance on performance improvement, value from data, monitoring and regulatory support (Epic, 2021c). Epic differs from other generic platform vendors, because all software is developed in-house and they do their own implementations.

3.3.1 The implementation process

Epic has completed about 500 implementations for approximately 200 different organizations in different countries, which has resulted in extensive experience with the process of platform customization. The process of implementing Helseplattformen follows a series of six phases. Although Epic's process keeps changing based on new experiences, these six phases are always completed. The first phase after the procurement process is the *groundwork and discovery phase*. In this phase the project scope is defined, along with the goals and the timeline of the project. It is made clear what applications are in scope and that a team of people are staffed to support it, both from Helseplattformen and from Epic. The decision-making structure and governance is also decided in this phase, in collaboration with the project leadership. The second phase is the *direction phase* in which Epic go through a series of demonstrations for the actors that are involved. The goal is to get as many eyes on the software in order to make as many decisions as possible. An example of decisions that are made at this stage is "can nurses at St.Olavs order medication for patients who are bedded or do they need a doctor?". The third phase is the *building phase* where the Helseplattformen team make configurations based on the decisions made in phase 2. Adoption sessions are also conducted, in which end-users have a look at the configurations that are made and decide whether that is still the right thing to do, or if changes needs to be made. The workflows that have been adopted move into the fourth phase, which is *testing*. The system goes through about 50 different types of tests, some of which include end-users. The generic core of the platform has already gone through various tests, like performance tests, although the functionality that is context specific still need to be tested. An example of this would be performance testing of the servers of Helseplattformen. After testing has been performed the *training* can begin. In this phase all users receive training, while super users receive more in-depth training. A "technical dress rehearsal" is also performed to make sure that the hardware is ready for *go-live*, which is the last phase. In this phase the system is continuously fixed, stabilized, and optimized. After go-live comes roll-outs where the different organizations install Helseplattformen in turn. The timeline for the roll-outs can be seen in Figure 7.

3.4 Standardization

Helseplattformen as a medical record will be more standardized than the various systems in use today. Significantly more than today, documentation will be done by choosing between predefined alternatives and by using standard templates for textual content (Basso, 2021). The benefit of standardization is that information will be searchable and thus more easily

accessible (Basso, 2021). The disadvantage of structured information is that nuances and individual characteristics in a professional assessment can fade. For this reason it will still be possible to write free text in Helseplattformen. Searchable information is desireable for the purpose of reuse for various displays of information, reports and research (Basso, 2021). Health professionals might also eventually agree more on the meaning given to medical and other health-related words and expressions when information is structured and standardized (Basso, 2021).

3.5   Testing

Helseplattformen is conducting several types of tests, from small tests like application tests to end-to-end tests (E2E) and acceptance tests. Core tests are another example of tests that are performed, which tests the workflows. After the workflows have been tested, integrated tests (E2E) are performed to test the interaction between modules. This is done in two rounds: Pass 1 and Pass 2, where Pass 1 only involve Epic and Helseplattformen to make sure that it works before and avoid confusion when involving the end-users (SMEs and super users) in Pass 2. The value of involving end-users in E2E tests is the feedback they can provide as well as preparing the users for acceptance testing and training. The SMEs can provide information regarding what is right and what is not in addition to make sure that processes that seem confusing although it is the right thing to do, gets into the training material. Pass 2 also serves as a preview for super users of what acceptance testing is going to look like. Going into end-user acceptance testing, super users will not have been fully trained which is why E2E is used to give super users an idea of what they are going to see. Involving end-users in testing is not something that Epic normally does, but something that Helseplattformen has decided to do.

All testing will be arranged by Helseplattformen AS. Examples of tests that will be conducted on the solution include Application tests, End-to-End tests, and End User Acceptance Test. The execution of the tests is done in collaboration with other projects in Helseplattformen as well as the local implementation projects. This means that Trondheim Kommune will facilitate and coordinate for their own actors in the tests that are relevant for the municipality. Other aims of the subproject of testing include ensuring a common test methodology and tools for Helseplattformen as well as common templates for test plans, test scripts, and test reports.

3.5.1   End-to-end testing

E2E or integrated testing is the first test where workflows, integrations and messages/prints are tested collectively and across applications. Smaller tests like application tests are a prerequisite for conducting E2E tests. In order to explain to the participants how Helseplattformen works with functional tests they arranged two separate Kick-offs; one for SMEs and one for leading super users. The aim was to clarify expectations and make SMEs and

leading super users ready to participate in E2E tests. Trondheim Kommune also arranged a kick-off for the municipal test participants in order to make sure that they understand their role on behalf of the primary health care service. There are about 110 scenarios that will be reviewed in E2E, of which 45 involve primary health care.

During the kick-offs it was explicitly explained that E2E testing is not:

- A demonstration of solution.

- Training.

- A dedicated test for all possible variations within each individual integration.

- Terminology.

In Helseplattformen a E2E test describe the sequence of events for a patient which is called a scenario. The scenario tells a patient's story and involves several applications, workflows and relevant integrations. For every scenario there is a script that describe step by step how the procedure is performed, in addition to important points to be verified during the test. Application analysts from Helseplattformen prepare the test scripts in collaboration with SMEs from primary health care and health authorities. The primary health care has created their own scenarios, while the health authorities have base theirs on basic scripts from Epic.

During test sessions there will be an application analyst and a SME that represents each application. The leading super user will also be present for teaching purposes. The role of the application analyst is to carry out the test practically as well as report and deal with errors. The SME verifies that adopted processes work properly, points out errors and omissions, and take notes of any change requests. The SME shall also reflect on what changes the solution might entail in the organization. The role of the leading super user is to observe in order to build competence for their participation in the end-user acceptance test. According to Helseplattformen the leading super user's participation in E2E test contribute to the maturation and identification of changes caused by the solution in the organization. Due to the Covid-19 pandemic, a fully digital process has been planned. The test sessions will therefore be conducted digitally using Skype.

Errors and change requests
The aim of the E2E test is to verify the regional solution as agreed upon through requirements and adoption, detect errors so that these can be corrected prior to the commencement, and identify change requests and areas of improvement. Trondheim Kommune distinguish between errors and change requests. Errors mean deviations from expected results, where expected result means decisions made in approval/adoption of workflows. An example of an error is if there is discrepancy between what is adopted or ordered, and what Epic delivers. A change request is a request to change an existing adopted (approved) solution.

Through test activities, application analysts and SMEs might detect errors and the need for changing workflows. The SMEs are encouraged to point out errors and omissions using the chat or verbally during the E2E test. Any change requests should be noted. As the leading super user has an observing role, Helseplattformen wish that any discussions are taken locally or communicated to the relevant expert. The focus of the leading super users should be on identifying changes in their own organization. Figure 8 shows how errors are handled for themselves and how change requests go through a different process.
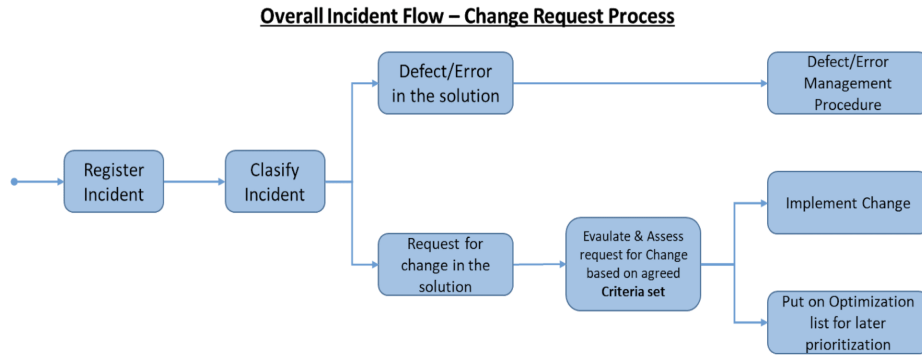
Figure 8: A representation by Helseplattformen of the overall incident flow

No change requests are sent directly to the HP Test Team immediately after the completion of the E2E scenario test. Change requests must go through the relevant leading subject matter expert and SME-group that has adopted the work process. A separate form must be used to fill out the change request before it can be quality assured and validated by the leading professional coordinators. If the change request is confirmed by the professional coordinators, an additional check is done to make sure that the change request form is completed before it is sent to the HP Test Team. Change requests must be submitted no later than 2 weeks after the E2E scenario was tested.

4 Method

In this chapter, the methods used to collect and analyze data are explained in detail. Firstly, an overview of the research is provided using the conceptual framework developed by Mathiassen (2017). The research strategy is then described, before the pre-study leading up to this research is introduced. Lastly, the data generation methods are presented along with an explanation of how the data was analyzed.

4.1 Conceptual framework

The framework used for designing this research and writing is a guide for moving from real-world problems to research publications, developed by Mathiassen (2017). This process can be managed by "designing the key components of a study, designing the resulting publication, and iteratively revising these two designs in light of the problem setting and the relevant literature" (Mathiassen, 2017, p. 17). In other words, Mathiassen (2017) proposes designing two documents, research design and publication design, and continually update and revise them until the research has converged toward a stable and consistent design.

The idea of engaged scholarship "is to draw on the perspectives and understandings of key stakeholders in real-world problem situations to frame research according to related knowledge areas and, in turn, to leverage theory and empirical findings to help address the problem situation" (Mathiassen, 2017, p. 18). The same idea can be applied to this research in the sense that the perspectives of Trondheim Kommune are drawn on to frame the research according to related knowledge on platformization, customization and participation, and in turn, leverage theory and empirical findings to help address the challenges. Table 6 shows the components presented by Mathiassen (2017) in Figure 9 that has been used to guide the writing of this thesis.
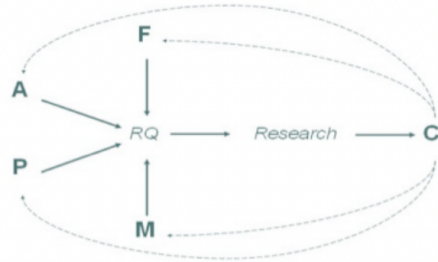
Figure 9: A generic structure of engaged scholarship study (Mathiassen, 2017)

Component	Definition	Specification
P	The problem setting represents people's concerns in a real-world problematic situation.	The Norwegian healthcare is in lack of an information system where data is accessible for quality improvement, health monitoring, management and research. A digital platform for common electronic health records in hospitals and municipalities is being implemented in Central Norway. The challenge is how to ensure that it will fit thousands of users needs.
A	The area of concern represents some body of knowledge in the literature that relates to P.	Customization of platforms in the public sector
F	The conceptual framing helps structure collection and analyses of data from P to answer RQ; F_a draws on concepts from A, whereas F_i draws on concepts independent of A.	F_a: Testing (Rooksby et al., 2009) F_i: Participation (Bratteteig and Wagner, 2016; Bødker et al., 2017)
M	The method details the approach to empirical inquiry, specifically to data collection and analysis.	Qualitative case study, over a 5 month period, of the implementation of a generic platform in Norwegian healthcare.
RQ	The research question relates to P, opens for research into A, and helps ensure the research design is coherent and consistent.	RQ1: How does E2E testing contribute to participation? RQ2: What kind of participation does platform customization require? RQ3: How can large-scale platform customization processes improve?
C	Contributions influence P and A, and possibly also F and M.	C_P: Lessons for how such implementation processes might improve. C_A: A detailed empirical account of how testing is performed when implementing an EHR system in Central Norway, describing the value of user participation in testing and the key challenges.

Table 6: Components of Engaged Scholarship Research (Mathiassen, 2017)

4.2   Research Strategy

The strategy to answering the research questions of this thesis is through an exploratory case study. A case study focuses on one instance of a "thing", or case, which is studied in depth, using a variety of data generation methods (Oates, 2006). This "thing" can be a person, an organization, a department, an information system, a development project, a decision and so on (Oates, 2006; Thomas, 2021). Qualitative data is the main type of data or evidence created by case studies (Oates, 2006). While quantitative methods are based on numerical data or quantifiable measures, qualitative methods are well suited when wanting an in-depth understanding of a topic.

Even though case studies are about the particular rather than the general some factors in the case will typically be found in other cases too (Thomas, 2021). By obtaining a rich and detailed insight into the case, knowledge can be generated that might be generalised and relevant to other situations (Oates, 2006). When conducting case studies the aim is to explain 'how' and 'why' something might have happened or might be the case. To answer these questions it is necessary to gather data using a variety of data generation methods such as interviews, observation, document analysis and/or questionnaires. The research questions are best answered using a qualitative analysis of the data.

Case studies can vary in their approach to time, although this is a short-term, contemporary study that examines what is occurring *now*. Conducting a longitudinal study to analyse the processes that are continuous and those that changes could provide an even deeper understanding of this case.

4.3   Pre-study

During fall 2020 a narrative literature review was conducted in order to provide literary context and justify why further research is required. The focus of the pre-study was participatory customization of generic platforms (area of concern in Table 6), and how it differs from participatory design in traditional software development projects. There exists an extensive literature on the topic of digital platforms and participatory design. However, the research conducted on user participation in platform customization is limited.

The findings of the pre-study indicate that there are several parallels that can be drawn between large-scale participatory design and participatory customization, and that establishing mutual learning situations has proven to be a successful part of making usable software. Nevertheless, there are differences that are important to consider when PD is applied to platform customization. These differences are related to the installed base, boundary resources and decision linkages. Distance between users and developers is also often increased in large-scale projects and can affect the establishment and conduct of mutual learning situations. Some of the these challenges can be seen in the development of EHR systems in other countries that have been implemented with different levels of

success. Challenges in such projects often related to a large scope, multiple stakeholders, and user training .

The pre-study also included looking into the case of Helseplattformen by analysing public documents. The subject matter experts (SMEs) seem to be an important part of the customization process, and whether Helseplattformen ultimately is a success seems to largely depend on their work and effort. Super users are in addition an important part of the implementation process in preparing colleagues and employees on Helseplattformen and the changes to come. The important role of the SMEs as and super users has motivated RQ1 and RQ2.

4.4 Data generation methods

This section outlines the specific data generation methods used within this research. As qualitative data is the main type of data or evidence created by case studies, the methods used in this research include document analysis, observations, and interviews.

4.4.1 Documents

Existing documents, also called found documents, were used as a method for generating data in this study. Oates (2006) describe found documents as documents that exists prior to the research, such as the documents found in most organizations: production schedules, job descriptions, procedure manuals, and so on. The documents used in this research are listed in Table 7. All documents were made available in a shared, access controlled Google Drive by PlatVel's contact person in the municipality. In addition to the documents listed in Table 7, public documents have been used to get a better overview of the project as an outsider and researcher. Knowledge gained from the documents in Table 7 was used to get a better understanding of the context and history of the project along with public newsletters from Helseplattformen and newspaper articles. Newspapers were also read throughout the study to stay updated on Helseplattformen from the perspective of the media.

Title	Source	Description
Kick-Off SMEs	Helseplattformen	Power Point presentation of how Helseplattformen work with functional tests and how they will be performed with an emphasis on the role of the SMEs.
Kick-Off Super users	Helseplattformen	Power Point presentation of how Helseplattformen work with functional tests and how they will be performed with an emphasis on the role of the super users.
PILOT Testing - Pass 2	Helseplattformen	E-mail with an invitation to the test pilot. Includes the agenda for the meeting and a short description of the tasks of the different roles.
Test script Pilot	Helseplattformen	An excel sheet displaying the test script for the test pilot that was observed. The steps are described in detail in the order they will be performed.
Test script	Helseplattformen	An excel sheet displaying the test script for the test that was observed. The steps are described in detail in the order they will be performed.
Project Plan Change and Maturation	Trondheim Kommune	Project plan for Change and Maturation which is one of three main activities within the sub project of Organizational Development.
Project Plan Profit Realization	Trondheim Kommune	Project plan for Profit Realization which is one of three main activities within the sub project of Organizational Development.
Project Plan Training	Trondheim Kommune	Project plan for Training which is one of three main activities within the sub project of Organizational Development.
Maturity analysis change management spring 2020	Trondheim Kommune	A power point presentation of the results from the maturity analysis conducted spring 2020.
Stakeholder analysis Trondheim Kommune	Trondheim Kommune	Excel spreadsheet of stakeholders and their associated stakeholder group, contact person, meeting structure and communication channel.
Preliminary identified activities 2021-2022	Trondheim Kommune	A timeline of planned activities for spring 2021, fall 2021, and spring 2022.

Table 7: Documents included in the analysis

Title	Source	Description
Kick-off test primary healthcare	Trondheim Kommune	Power Point presentation for introducing the participants to testing from a primary healthcare perspective.
Anonymized answers to the questionnaire E2E - Sheet 1	Trondheim Kommune	Anonymized answers to the questions SMEs and super users were asked to answer after the pilot test.
Sub project Organizational Development	Trondheim Kommune	Project plan for the sub project of organizational development in the local implementation project in Trondheim Kommune.

Continuation of Table 7

4.4.2 Observation

Observations as a data generation method is commonly used in case studies. They are used to find out what people actually do, rather than what they report they do when questioned (Oates, 2006). An important distinction is the difference between "overt" and "covert" observation. In covert observation, the people being observed are not aware of the researchers presence. The observations conducted in this study were overt, meaning that the participants knew they were being observed. The advantage of overt research is that the people can give consent, making the research more ethical. However, it can be questioned whether people are always able to give or refuse consent (Oates, 2006). For example if a senior manager has decided that a researcher may observe their regular Friday morning meeting, the employees may feel that they can not refuse the presence of the researcher. Another disadvantage of overt research is that people might modify their behavior because they know they are being observed - known as the "Hawthorn Effect" (Oates, 2006). In this research, the researcher participated in the observations as a complete observer, taking no part in the proceedings. This way the situation could be experienced from the point of view of the others in that setting (Oates, 2006).

Due to the ongoing pandemic the activities that were observed were conducted online through Skype and Google Meet. Most participants had their camera turned on during the meetings, but since the testing activities required screen-sharing for most of the meeting, the researcher mostly observed the spoken communication between the participants as well as what was happening on the screen. The richness of gestures and facial expressions was therefore lost during most of the activity.

Information from the observations was reported taking notes. Shortly after the observation these notes were fine-tuned and inital thought were written down. During the first observation (E2E Test Pilot) the researcher tried to be non-selective and observe everything that was going on, rather than starting with preconceived ideas about what the researcher is going to observe (Oates, 2006). The next test observation (E2E Test Session), a more

focused observation was made, concentrating on what seemed particularly significant for the research. The activities that were observed can be seen in Table 8.

Activity	Host	Location	Duration
E2E Test Pilot	Helseplattformen AS	Skype for Business	2,5 hours
Debreif after pilot	Trondheim Kommune	Google Meet	25 minutes
E2E Test Sessions	Helseplattformen AS	Microsoft Teams	2,5 hours

Table 8: Observations

4.4.3   Interview

In addition to documents and observations, interviews are much used as a method for data generation in case studies. The primary purpose of the interviews in this study was 'discovery' and not 'checking' information. For this reason, semi-structured interviews were used to enable the interviewer to change the order of the questions and add additional questions depending on the flow of the "conversation" (Oates, 2006). Four interview guides were made for the different roles of the interviewees: SMEs, super users, application analysts, and Epic employees. The interviewees were asked similar, but not identical questions as new knowledge was accumulated and interview guides were updated. Figure 10 shows the iterative interview process that made it possible to adapt to new knowledge and remove or add questions from the interview guides.
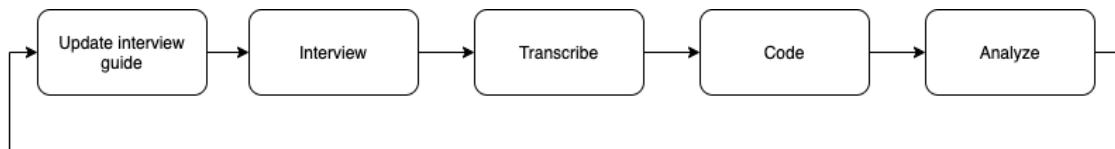

Figure 10: The iterative interview process

The participants were contacted to set up an interview date and obtain consent in advance. The document with the declaration of consent included the purpose of the research and the likely duration of the interview. All interviews lasted between 30 minutes and one hour. Table 9 shows the number of interviewees and their role in Helseplattformen.

Interviewee	Role	Employment	Activity
SME 1	Subject Matter Expert	Trondheim Kommune	E2E Pilot test
SME 2	Subject Matter Expert	Indre Fosen Kommune	E2E Pilot test
LSU 1	Leading Super User	Trondheim Kommune	E2E Pilot test
LSU 2	Leading Super User	Trondheim Kommune	E2E Test
LSU 3	Leading Super User	Trondheim Kommune	E2E Test
AA 1	Application Analyst	Helseplattformen AS	E2E Pilot test
AA 2	Application Analyst	Helseplattformen AS	E2E Pilot test
Epic 1	Application services	Epic	Not linked to activity
Epic 2	Implementation services	Epic	Not linked to activity
Epic 3	Implementation services	Epic	Not linked to activity

Table 9: The interviewees with their reference, their role, employer, and related activity

Due to the ongoing Covid-19 pandemic, all interviews were conducted digitally using Microsoft Teams. Interviews over phone, Skype and other digital platforms have been conducted for years, the difference now is that researchers *must* use mediated approaches (Howlett, 2020). Because memories are unreliable and prone to bias and error, the recording function was used to record the interviews with the permission of the interviewee (Oates, 2006). The recording function in Teams captures both audio and video which provided a complete record of events during the interview. The recordings allowed for full concentration during the process of the interview, and gave the possibility to transcribe and code the interview afterwards. Although video recording is a useful tool for the researcher, they can be perceived as intrusive and inhibiting to the interviewees, who might also be reluctant to be filmed (Oates, 2006). Baskarada (2014) and Oates (2006) both argue that recording devices might make interviewees nervous and uncomfortable. Opinion is also divided about whether online interviews are appropriate for establishing good interpersonal relationships. Some argue that it can not be established online, while others believe that warm relationships can develop online. Howlett (2020, p. 12)'s reflections on conducting online research during a global pandemic show that interviews conducted digitally "can generate valuable insight not otherwise available through the use of in-person methods which may actually be richer and more insightful, especially when discussing personal or sensitive topics". Even though this research looks into a less sensitive topic, Howlett (2020)'s findings indicate that it is possible to establish good interpersonal relationships in online interviews.

Recordings may introduce additional transcription and analysis related complications (Baskarada, 2014), which is why they always should be backed up by written field notes. One of the most obvious challenges when conducting online interviews is that all participants require stable and regular internet access, in addition to technological competence and platform familiarity (Howlett, 2020). All interviewees were familiar with having meetings and communicating through online communication channels due to their offices being moved to their homes during the pandemic.

Recruitment of informants

It was agreed that the recruitment of informants from the municipality would happen through PlatVel's contact person in Trondheim Municipality. After observing the E2E test pilot, a request for three informants that participated was made to Trondheim Municipality. The contact information of two SMEs and a leading super user was provided, and all of them were contacted and interviewed. The recruitment of informants from Helseplattformen AS and Epic went through the research coordinator of Helseplattformen, Liv Johanne Wekre. A request was made for three application analysts that participated in the E2E pilot, as well as three people involved in test from Epic. One of the application analysts were asked not to participate due to the high pressure and workload at that time, although two application analysts were contacted and interviewed. The contact information of an Epic employee was provided by Liv Johanne Wekre, who in turn provided the contact information of two colleagues. The three Epic employees were all contacted and interviewed. During the last year, the health sector has been under high pressure due to the on-going pandemic. Helseplattformen has suffered delays which has led to the testing phase being postponed. For this reason data was collected at a later time than planned and less empirical data was collected, than originally intended.

4.5   Data analysis

The video recordings from the interviews were transcribed in Microsoft Word. To maintain the anonymity of the informants, their names and other sensitive data was kept out of the transcription. Apart from this, the interviews were transcribed in their entirety as the entire dialogue could be relevant due to the research being exploratory. The transcribed interviews were then coded using NVivo which is a software that facilitates organizing and analyzing qualitative data. By coding the interviews you create a personal database that makes it easy to categorize and create an overview of recurring topics.

As seen in Figure 10, a simple analysis was made after every interview. This analysis was done by writing down initial thoughts rising from the conversation and briefly discussing them in the context of already accumulated knowledge on a piece of paper. After the interviews were coded in NVivo, the codes were categorized. These categories were used as a starting point for exploring recurring or interesting themes. These themes were written down as headlines in a Word document, and as data was collected, examples and quotes from interviews, observations, and documents were added to the document. Subheadings were used to describe the data in more detail and put it in context by adding some of the initial thoughts supported by the handwritten notes. This way it was easier to contextualize and make connections between the themes to build a coherent argument from the collected data (Bazeley, 2009).

All documents in Table 7 and interview transcriptions were coded in the same project in NVivo. While categorizing the codes from just the interviews, 240 codes became 26

categories that was further divided into 8 themes. These can be seen in Table 10. While categorizing the codes, some of them were modified to better fit the context. Some of the 26 categories seen in Table 10 include more categories of code. There are many ways to categorize the codes of qualitative data. This way of doing it provided an overview of what topics have emerged during the interviews and how they can be linked to different themes.

Theme	Category/code
Building	Customization
	Integrations
	Development
	Limitations
	Lack of knowledge
	Certification
Testing	Participation in testing
	E2E
	End User Acceptance Test
	Error
	Kick off
	Technical
	Iterative process
	Success criteria
Training	Wrong use
	Training plan
	Willingness
Participation	Feedback
	Workflow
	Expectations
	Improvement
Generic core	Existing system
	Possibilities
	Norwegian primary health care
	American vendor
Information flow	Terminology
	Information overflow
	Physical vs digital communication
Large-scale	Decision-making structure
	Who is who
	Roles
	Collaboration
	Time
Trondheim vs small municipalities	One system
	Municipal representatives
	Option system

Table 10: Theme analysis

According to Klein and Myers (1999), there should be several iterations between data analysis and literary studies to be able to see possible contradictions between theoretical preconceptions and actual findings. As it was decided after the conducted literature review that the focus of this research would be on the testing activity in Helseplattformen, it was necessary to take a dive back into the literature to get an understanding of the role of testing in software development projects. It was also planned to carry out a new literary review based on the empirical data, but due to the delayed data collection, this iteration was not conducted. For this reason, Figure 11 illustrates the overall research process for this study. The activities that were performed are marked in the figure.
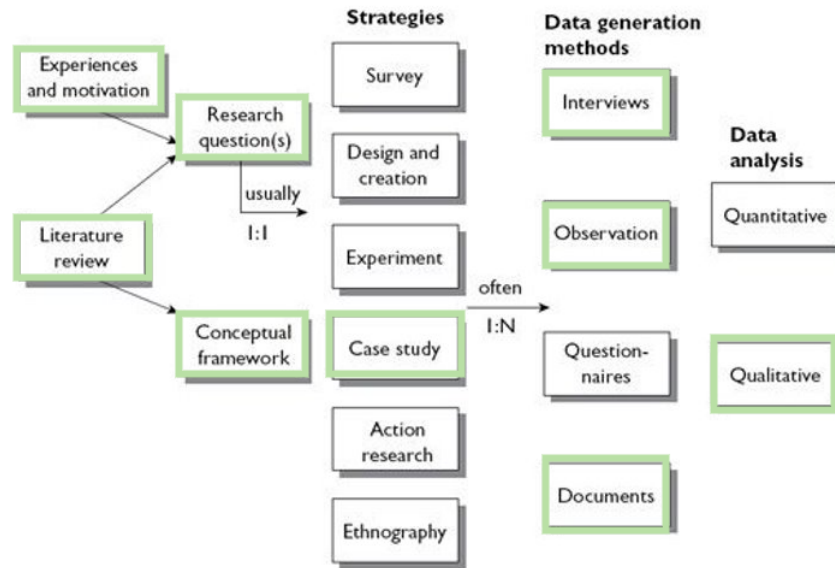
Figure 11: The research process and the performed activities (Oates, 2006)

4.6 Reflection

Oates (2006) distinguish between a deductive and inductive approach to data analysis. The deductive approach can be described as a top-down approach where the analysis of the data is based on existing theories found in literature, while the inductive approach is a bottom-up approach that is empirically driven (Oates, 2006). In this approach data is categorized by categories observed in the data, such as those used by the informants or the authors of the documents (Oates, 2006). While coding the written material in NVivo, an inductive approach was taken as the coded categories were categories observed in the data. As the literature review described in section 4.3 did have an impact on the data analysis, the approach of the data analysis in this research was not entirely inductive. One could argue that the approach to this research is abductive as it builds more on refinement of existing theories than on inventing new ones (Dubois and Gadde, 2002).

Accoding to Dubois and Gadde (2002, p. 559), abductive studies differ from deductive and inductive studies in that "the original framework is successively modified, partly

as a result of unanticipated empirical findings, but also of theoretical insights gained during the process". Since the theoretical framework of this research was developed and changed during the research process, the abductive approach seemed most suitable. Dubois and Gadde (2002)'s model for abductive reasoning can be seen in Figure 12.

The documents included in the document analysis contributed to the researchers knowledge about the case. The case description is therefore partially built on the knowledge gained from these documents. This might be another argument why the abductive approach was most suitable, as knowledge about the case was gained continuously throughout the project and affected the analysis of the data.
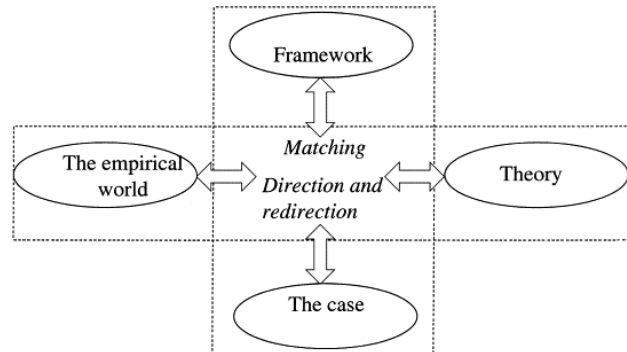
Figure 12: The process of abductive reasoning (Dubois and Gadde, 2002)

As cited in Oates (2006), Yin (2003) suggests that there are three basic types of case studies: exploratory, descriptive, and explanatory. Oates (2006) argue that exploratory case studies are used to define the questions or hypotheses to be used in a subsequent study, while explanatory case studies tries to explain why events happened as they did or particular outcomes occurred. Even though these are usually not combined, it can be argued that this case study is both exploratory and explanatory referring to the definitions by Oates (2006). The research seeks to identify factors that have an affect on participation and compare it to what was found in existing theories. For this reason the research is explanatory. It is also exploratory because as the study was being conducted the researcher became more familiar with the case and the research problem and the interview guides were refined accordingly. The study has therefore been referred to as exploratory previously in the thesis.

5 Findings

This chapter will present the findings from the analysed data material that has been collected through interviews, observations and documents. Due to the Covid-19 pandemic all findings presented come from digitally conducted interviews or test sessions. As Helseplattformen is an on-going project it is necessary to remind the reader that the findings represent a snapshot of the project, and that the findings presented here relate to the time period of this study.

5.1 E2E testing in Helseplattformen

Before the E2E testing, Helseplattformen arranged a digital kick off to provide the end-users with information about what E2E is and their role during the test. In addition, a kick off for the local implementation project in the municipality was arranged to provide more specific information about the E2E for the end-users in the municipality. The subject matter experts (SMEs) and leading super users were later invited to participate in the test session(s) that involve their unit. The first E2E tests were called pilots. There was one pilot for primary health care and one for secondary health care. Due to the ongoing pandemic the test sessions were performed digitally through Skype. There were several different roles present during the pilot for primary health care, including the E2E coordinator and the E2E manager from Helseplattformen, the test coordinator from Trondheim Kommune, three SMEs, four application analysts, and two super users. End-users are usually not involved in E2E-testing according to the vendor, but Helseplattformen decided to include end-users in Pass 2 as a preparation for End User Acceptance Testing. An Epic representative express that

> The idea is that if end-users are participating in E2E their comments/questions will be addressed earlier than if we waited for End User Acceptance Testing. This is a strategy we've seen before on other installs. (Epic 1)

From the vendor's perspective it is important to make sure that testing does not turn into training.

> Testing is putting the system through it's paces to make sure that it will work when we turn it on. So that is an important thing when we get end-users involved and I have seen this across all the implementations I have worked with, [..] end-users would love to be on the phone the entire time of the implementation, but they also have their own jobs to do. We want to make sure they are still providing patient care and there is going to be a whole other effort devoted to them getting their training, so making sure that we are using testing to test the system. (Epic 1)

After the the test sessions, the SMEs and super users are invited to a debrief hosted by Trondheim Kommune, to share their immediate thoughts and experiences. Both SMEs and super users are asked to fill in a questionnaire after the test to help them identify changes in their day to day work routine when using the new solution.

5.1.1   The role of the Subject Matter Experts

When a vendor representative was asked what the value of involving the SMEs in PASS 2 of E2E is, the answer was that

> They can say "I don't think that's right", they can say "oh that's confusing but it's the right thing to do so I need to make sure that gets into training materials" or "I need to tell my colleague that this is going to be what that is". So that is what we expect from the [SMEs]. (Epic 1)

This description is similar to the information that was communicated to the SMEs during the kick offs by Helseplattformen and Trondheim Kommune. According to the Power Point presentations presented at the kick off the role of the SME is to verify that the adopted process works, comment on errors and omissions, and reflect on what changes the solution brings to their organization.

The SMEs perception of their role in the test session is not necessarily equal to that of the vendor. One of the SMEs was asked about their participation in E2E testing and replied that:

> For me, as a subject matter expert I feel like if I had something to say, I should have said it already. (SME 1)

SME 2 reports that the reason why they are there is to "see that it works". Both SMEs also mention that they are uncertain about what they are supposed to comment on.

During the test one of the SMEs discover that a word that says "hjemmebesøk" should have been translated to "forebyggende hjemmebesøk". Although the SME is sure this change has been requested a year ago there is uncertainty if "forebyggende hjemmebesøk" is a code that can be chosen, of if "hjemmebesøk" is the only option. The SME ended up not asking about it during the test, but sent an e-mail after the session instead.

> I could have asked about it during the test, but it didn't have anything to do with the integration between the different applications, so that is why I couldn't bring it up. (SME 1)

The same SME mentioned that it might have been easier to give feedback during the test if the pace was slower and that the end-users were given more respite.

5.1.2   The role of the super users

According to a vendor representative super users are involved in Pass 2 of E2E to observe and this way get familiar with the system.

> We are using Pass 2 as a preview of what End User Acceptance testing is going to look like. When they go into End User Acceptance testing they will not have been fully trained so we are using this so they are not going in blind. We are using this to make sure they have an idea of what they are going to see.
> (Epic 1)

Involving leading super users in E2E is something that the different health authorities and the primary health care is invited to do, but it is up to them to decide how they want to use this participation in further work within the health authority or the unit.

By Helseplattformen it is communicated that the leading super users are invited as observers for two reasons: to build competence before End User Acceptance test and identify changes caused by the solution in the organization. More specifically they are asked to observe and note any identified changes in their organization. In the kick off by Trondheim Kommune it is also mentioned that that the primary health care wants to use the leading super users to identify possible changes and areas of improvement - in addition to SMEs, and that this is the reason why they are involved in the E2E test sessions.

A leading super user reports during an interview that:

> During the kick-off I got the impression - there was kind of two messages - one was that I was supposed to be an observer and the other one was that we were supposed to [..] have something to write with and sort of take notes along the way. (LSU 1)

The same super user also mention how the fact that the super users were not introduced in the beginning of the test, in the same way as the application analysts and SMEs led to confusion.

> Then I saw there were 30 participants or something like that, that were present, and I was not introduced, so I became very unsure - should say something now or should I not say anything at all? So I ended up just thinking about that the whole way through. (LSU 1)

Not only was there uncertainty about the purpose of their participation, the super user was also unsure about what type of feedback could be provided.

There was just a bit of uncertainty about my role and what I was really doing there. Because [...] I sat and took notes, and there was a lot, but then again that might be about content and that might not be what they were supposed to be testing at that moment. But if that is not what they were testing then there was kind of no need for me to participate, that's like the thing. (LSU 1)

Despite the uncertainty that the leading super user reported, the opportunity to see the system live led to curiosity about the solution:

It made me a little curious about what it's like to use it. I got a quick glimpse of the screen, so it's a bit exciting, but I think I would have thought the same even if for example the leading super user in my department had shown us that we can do this and this [..], and this is what it looks like for us, I think that would have been the same as the test. (LSU 1)

Another leading super user that participated in a regular E2E test (not the pilot) also reported a growing curiosity and excitement towards the solution.

Now I have seen an example from Helseplattformen and it looks like we will get a lot of information about a patient on one page. The way the journal system works today, you have to go into separate journal codes to find the information you need, nothing is gathered in one place. So I am looking forward to getting lots of information gathered in one place. (LSU 2)

5.1.3 Participation in E2E

All end-users that participated in the E2E pilot reported that the test was carried out too quickly. Even though it was not the first time the SMEs saw the system, they found it difficult to follow the script and at the same time follow what was happening on the screen. Despite the uncertainty related to their own role in the test session, all leading super users reported a growing curiosity for the solution. The leading super users that participated in a test session that was not a pilot, mentioned an increased motivation to use the solution and that it was reassuring to see that the application analysts who preformed the test were so thorough on reporting errors.

Now, it must be said that I am not particularly happy with the system we use today, so I am super positive and believe that this just has to be better - and it looks much better. (LSU 2)

The same leading super user mentions how

> The interest did perhaps grow even more, just by kind of having some names and some faces [to the people] that are actually working with this, that you can maybe ask questions to later, that is nice to have. (LSU 2)

It was also mentioned by another leading super user that

> It is also the case that it won't be great right away, at least that's what I believe, that it will be great eventually. And then it will be really great.
> (LSU 3)

Since the scenario that was tested included both the hospital side and primary health care, one of the leading super users mentioned that one of the benefits of participating in the test was to get insight into the information flow between the hospital and the unit.

> For me, it [..] was more an insight into what is going on in secondary health care, but also the information that is sent from [the hospital] to the municipality, via the Health and welfare office and to the Health center. So [..] you get some insight into a process that you don't know much about. You know that it is done, but not always what kind of information is sent. Except for a discharge letter or a final note. (LSU 3)

The test is also described as a "wake-up call" by one of the leading super user saying that

> I believe that everyone would benefit from participating in a test like this, because [..] the process has lasted for so long and it is so periphery to the employees. It is kind of like - I am afraid that people forget that this is actually coming. So it is sort of a wake-up call that this is happening and that we just have to keep up. (LSU 2)

5.2 Information flow

Several informants mentioned that it has been an ongoing challenge during the implementation process to know who should know what and when. It has therefore been a struggle knowing where to provide feedback and what type of feedback can be provided. In addition, the challenge of communicating decisions that have been made seems to be an on-going challenge, as well as end-users receiving a lot of information.

5.2.1 Communication channels

In the above mentioned example an SME discovered that the word used in the solution is not the word they wanted it to be. The SME decided not to say anything about it during

the test because it did not have anything to do with the integration with other applications. After the test the end-users were asked to respond to a questionnaire by Trondheim Kommune. This questionnaire was only about identified changes in their current workflow, which made the SME unsure of where to provide the feedback about the choice of words. The SME decided to send an e-mail to the test team in Trondheim Kommune to ask who should receive such feedback. In the e-mail the SME stated that there was a need for providing some feedback regarding word choices and some other small changes in the solution and that the SME did not remember how to do it. The SME ends the e-mail by asking "should I send it to the application analyst, if so which one?". After receiving an insufficient response by the municipality, the SME decided to contact one of the application analysts directly. The application analyst thanked the SME for not bringing the questions up during the test and cleared up the uncertainties for the SME.

The same SME notes how this has been an ongoing challenge during the implementation process:

> It is difficult for us to manage to sort exactly - it has been like that all along - who am I talking to now? What is it that this person does? And then I comment on something that is completely different than what was on his application. I think that has been challenging - to know *to whom*, because I do not have one person that I can throw anything at. (SME 1)

5.2.2 Making decisions visible

Another challenge that loops into a larger challenge of communication is related to translation. One of the vendor representatives describe translation as one of the main challenges of implementation in non-English speaking countries. This challenge occur in the testing phase the most when the translations show up in the system and some people do not agree with them. Especially if an end-user is watching E2E and they see a translation that they personally would not have used. The Epic representative states that the discussion around translations loops into a larger challenge of communication and communicating the decisions that have already been made. Because of the massive scope of Helseplattformen, no one can know all of the decisions that have been made. A vendor representative says:

> So the challenge with every organization that we work with, every organization I have dealt with, is what is the right method of communicating those decisions. Is it that there is a massive one-note, on a share point that lists every decision? Is it that we have point-people who if an end-user disagrees with something they can go to that person? How do we communicate that this is something that has already been thought of? Because what we don't want to have happen is we don't want one group of people to make a decision and later another group of people makes a conflicting decision. (Epic 1)

The vendor representative goes on to say that this *will* happen and that the key is how to make it productive and work it through.

An SME similarly states that it has been a challenge during the whole process to find information about what has been discussed and what decisions have been made

> That is perhaps the downside I want to say has been there all the way - that I believe it has been difficult to [find information about] what I have said about something. What did we say then [..] and what has happened since? There is no flow, at least for me, I have only hoped for the best and trusted that the ones who are doing their job is doing it - and it seems like they have. (SME 1)

5.2.3 User briefing on E2E testing

As mentioned in 5.1.2 it was perceived as though there were two different messages about the role of the leading super user during the test. The super user goes on to mention that there was quite a lot of information that was given during both kick offs and that it might have been sufficient if the SME at the unit took 10 minutes and told the super user about their role in the test and when and where it was happening. Although the super user do make a comment saying

> I might have missed the point if I am wondering if 10 minutes would have been enough. (LSU 1)

One of the SMEs reports that in addition to there being a lot of information in the two kick offs, the information was presented in a terminology that they were not familiar with:

> They speak in a language that I don't understand at all with English computer expressions that are completely foreign to me. It might not even be computer expressions, but it's a completely foreign terminology. (SME 2)

The SME therefore spent quite a lot of time in advance to prepare for the test by trying to go through the script several times and look at the workflows that were involved.

The leading super users that were involved in a test session that was not the pilot, could not remember participating in a kick off dedicated to testing. According to them, they received an invitation by e-mail to participate in E2E, that also explained their role during the test and did not receive any further information about the testing.

5.2.4 Providing feedback

During the kick offs the SMEs were presented with the steps for how to notify errors and change requests that are discovered during the test. One of the SMEs mention how the

foreign terminology and systems made it seem as if the threshold for making comments about the solution was quite high.

> The threshold for notifying change seemed to be quite high and [the test co-ordinator] talks about systems and ways to notify changes that I have never heard of before, so it gets kind of like [s***], how bad does it have to be before one dares to say something? (SME 2)

The other SME found it challenging to sort out what was relevant for the test and what was not, because of the rules they had been asked to follow in advance. The SME also mention how there was a long sequence in the beginning of the test session where none of the end-users dared to say anything and everyone was "holding their breath", before it gradually became easier to take the floor and speak up.

A leading super user that was taking notes during the test ended up not saying anything during the test since it was more content related. As the end was approaching the leading super user asked to share the written comments, to which the Helseplattformen test team responded "bring them on". After receiving answers to some of the questions the super user possessed, it was mentioned by Trondheim Kommune that it is common to get a feeling of uncertainty when seeing the solution like this for the first time and that there will be a debrief for the municipality shortly after the test session is finished. The leading super user responds by saying "then I will save my comments until then".

Both SMEs and the super user found the debrief by the municipality useful for sharing their immediate thoughts and experiences. The leading super user is not sure whether the input will be taken further, but thinks that it was nice to be able to share their experiences right away anyways.

5.3   Platform customization

According to both application analysts and SMEs, limitations do appear while building the solution. Sometimes these limitations are only imagined limitations, as much of the functionality is already available in the system, but knowing the underlying possibilities demands knowledge and experience by the application analysts. One of the application analysts believe that their lack of knowledge and maybe a lack of fantasy cause these perceived limitations.

> I think that in many cases the functionality is there in the system we are just not aware of it yet because it is very new to us all. (AA 1)

The primary health care is perhaps experiencing the greatest limitations according to an application analyst, because this is the area that the vendor has the least experience with

and the product was not initially developed to support primary health care. An example that is given by the application analyst during the interview is when a build is made for the home care unit and the application analyst is informed by the SMEs that this does not work. At that point they really did not have another solution, but they had to find one due to the fact that this functionality was critical for the home care workers to do their job properly. After several conversations back and forth with Epic, it turns out that it was not a limitation with the system, but rather a limitation with the knowledge of the application analysts in addition to the fact that the second solution required a lot more time from the analyst. In collaboration with the vendor, the application analysts came up with a solution that was approved by the SMEs. The application analyst also mention how it is understandable that the SMEs rejected the solution as the first proposal required 300 clicks, and after doing "quite a lot of work" the new proposal required one click to do the same.

It was also reported by one of the application analysts that a closer collaboration with application analysts working on other applications from the beginning might have made it easier to get a broader understanding of what they are building.

> Because when you are new, there is no one knows the job and no one who has done it before, you kind of wear blinders and you're very focused on yourself and yours, so perhaps you lift your gaze a little too late [...] to get a better understanding for what you are building and the things you're working on. (AA 1)

If the application analysts were to encounter a limitation that is not possible to solve, they can request a development from Epic. Since this is a cost issue, the application analysts do not have the last word when requesting a development. Either the health authorities or the municipality make the final decision if it is a cost that they are willing to make to get the functionality that they want. It is therefore necessary that the requested functionality is crucial for the health personnel to be able to do their job properly if one is to pursue development on it.

One of the application analysts experienced that a crucial functionality was missing with regards to sending information to the vaccine register. This functionality was not available in Epic's foundation system, which is why a development process was started. The application analyst and SMEs were invited into meetings with Epic to discover how this could be solved in the best possible way.

With regards to testing, one of the application analysts mention that the building and testing activities have been conducted more in parallel than expected.

> I was kind of expecting that it would be more like 'okay, now you you are going to build and when you are done with building you are going to test' (laughs).

But the processes have been more in parallel, than I thought they would be. (AA 2)

And that:

For me as an [application] analyst, it would have been more tidy to split them in into two [activities]. (SME 2)

The vendor explains the reason why they are conducting these activities in parallel:

So one of the things I brought up is to me and from talking with my team, it seems the traditional Norwegian software testing is linear. Bit by bit by bit by bit by bit system is completely built and all the content is there then it is basically frozen while it's tested, they fix everything then it is frozen while the end-users are looking at it. In Epic's experience that would take about ten years to do. And by the time you get the system live, it's going to be already outdated because of how long it has taken. (Epic 1)

6 Discussion

This chapter discusses the findings presented in chapter 5. The focus of this chapter is to explain the findings in relation to the literature presented in chapter 2 Background and the research questions. The first part discusses participation as an activity for testing as well as suggestions for how it can improve. The second part focuses on how the knowledge need to customize a platform is distributed and affected by the large-scale of the project. The third part looks at the implementation process and the struggles that seem to occur in regards to predefined roles and communication structures. Table 11 summarize the main findings related to the different topics. Lastly, the limitations of this research will be addressed.

Theme	Findings
Testing is an activity for participation	Helseplattformen decided to involve the end-users in integrated testing as a preparation for User Acceptance Test. The briefing that the end-users received in advance of the test sessions seems to have led to confusion about their role. The leading super users reported an increase in curiosity and motivation after the test, especially the ones that did not receive in-depth information about the test session in advance.
The knowledge needed to customize a platform is distributed	The generic core of a platform might limit the customer's possibilities to customize the solution. Sometimes these limitations are not actually limitations, but rather a question of who possess the knowledge about the system. If there is an actual limitation, development might be done by the vendor.
The project seems to struggle with predefined and formal communication structures and roles	Some of the challenges that occur in Helseplattformen relates to following the implementation process defined by the vendor. In the same way that the product was developed in USA, the process was also developed in the USA. This process seem to introduce many roles and channels that might not be an exact match for Norwegian municipalities.

Table 11: Main findings

6.1 Participation through testing

When implementing a digital platform in the public sector user participation is necessary for a successful implementation (Shapiro, 2005). User participation in Helseplattformen begins already during the requirement specification and the procurement process, and continues all the way to testing and training. As platforms are increasingly used to improve service delivery in both public and private sector the process and methods of systems development have changed. Previously, the design phase has been highly prioritized as an activity for user participation. In-house projects in particular, often emphasize upstream participation. Customizing a generic platform require a different kind of user participation due to the platform's generic core and the requirements that have already been implemented. The design phase is no longer about building a system from scratch, but rather to see the system that already exists and decide how that will fit the needs of the organization and what changes needs to be made. The solution is built based on the requests made by the user in the design phase, which is an iterative process than continues until the subject matter experts (SMEs) adopts the workflow. The testing phase is then entered to verify that the workflows and applications are integrated and works as intended. As initial ideation and design phases are normally not relevant for an already existing platform, participation needs to focus more on down-stream activities such as testing. As mentioned by one of the application analysts it is first during testing they have really gotten to know the solution and where things can go wrong.

The overall intention of testing is to make sure that the solution works as intended, but testing is not merely a technical activity (Rooksby et al., 2009). Sometimes users are involved in tests that are not usability tests, with the purpose of creating a sense of control and ownership of the system, in addition to maturing and preparing the end-users for what is to come (Bano et al., 2017). According to the vendor, it is important that testing does not turn into training as there is a separate phase devoted to this. Krabbel and Wetzel (1998, p. 49) describe training as a process that "has to be planned carefully", which involving end-users in E2E testing contribute to since one of their main tasks during test sessions is to discover what parts of the solution needs to receive extra focus during training.

Testing can be seen as a way for users to see and evaluate the results of a choice. For this reason testing is a design activity that should involve users from a PD perspective. According to Kawalek and Wood-Harper (2002) integration testing or E2E testing is strictly an activity that is conducted to get the system ready for the business. Although, in the context of implementing a generic Enterprise System, integration testing is categorized as an activity for getting the business ready for the system because of it's close link to UAT. Due to the high involvement of end-users in the testing phase of Helseplattformen, the testing activity is not only an activity for getting the system ready for the business, but also an activity for getting the business ready for the system. When Kawalek and Wood-Harper (2002) apply the multiview2 framework to their case, integration testing

is defined as a mediation activity that can assist the project management in navigating through conflicts. The definition of integration testing as a mediating activity fits well with the added value of involving users expressed by Helseplattformen and Epic.

According to the case study by Zowghi et al. (2015) the participants reported an increased level of satisfaction with both the development process and the delivered system when they already knew the system and had developed a sense of ownership going into UAT. The reported increase in curiosity and motivation by the leading super users of Helseplattformen after participating in E2E, might indicate that the involvement of end-users in integration testing is valuable to Helseplattformen in order to increase user satisfaction. As the study by Fragidis and Chatzoglou (2018) revealed, the most significant success factor of a nationwide EHR system implementation process is the commitment and involvement of all stakeholders. The increased interest and motivation that the leading super users reported might therefore contribute to a successful training phase and installation.

6.1.1 E2E testing in Helseplattformen

The findings reveal that the end-users involved in the E2E pilot experienced uncertainty around their role in the test session. There might be several reasons why this uncertainty arose. Firstly, the information that the participants received in advance was for some of the participants perceived as ambiguous. Others reported that the information was communicated in a technical language that was foreign to the end-users and that the amount of information that was given, was overwhelming. During the pilot test session some were also nervous to speak because of the many participants in the meeting. Several participants reported that the high pace of the test was confusing, as there was little room for the participants to take the floor and provide feedback. All these factors may have contributed to the uncertainty that the end-users were experiencing and that their focus during the test was on what they could say and when they could say it, instead of what was happening on the screen. In line with the ideas of Damodaran (1996), the briefing on the users' role led to confusion as well as concerns about their lack of expertise in computing due to the technical terminology. The value of user participation in the E2E pilot would perhaps have been greater if the end-users had a clear understanding about their role. Despite the uncertainty, the leading super users reported an increase in curiosity with the system and an excitement of adopting a work tool that, according to themselves seem to be more efficient than the solution they are using today. This suggests that involving leading super users in E2E is not only useful for them to get to know the system, but also for creating engagement, interest, and a sense of ownership of the system.

The leading super users that participated in a regular E2E test that was not a pilot, did not report the same uncertainty about their role. Neither did they remember participating in a kick off related to testing. The information they received in advance was limited to an e-mail with an invitation to the test session and a brief description saying that their role is to observe. These leading super users reported to a much greater extent, an increase

in motivation and interest in the solution. The findings therefore may indicate that the leading super users that only received an e-mail in advance, describing their role during the test was more motivated and satisfied by the test than the leading super users that received information through the kick offs and participated in the test pilot.

6.2   Distributed knowledge

In traditional PD projects the knowledge about the system is ideally possessed by the stakeholders that are directly involved in the project. In a platform project like Helse-plattformen, a lot of this knowledge is somewhere else, i.e. in the core of the platform. Epic possess the knowledge about the platform, as well as the process they are following for implementation. This introduces a distance between the developers and the users that is not present in traditional development projects due to the role of the application analysts. The distance between the core and periphery might increase due to language, terminology, and context for health care services.

In order for the application analysts to be able to work on an application, they receive training and a certification for the application they will be building. After gaining the knowledge that is needed for building their application, the application analysts need to know the system well enough to communicate what can and can not be done to the SMEs. There are thus several steps in the process of customization where knowledge is passed on, as opposed to traditional development projects where the communication between the ones who posses the knowledge about the system and the users is more direct and contained within the PD group. The findings indicate that the SMEs know a lot less about the platform than the application analysts, who seem to know the system quite well, at least their own application. Since most application analysts only get certified to work on one application, their overall knowledge about the platform may be limited. This is perhaps one of the reasons why building is a time consuming activity, in addition to the fact that the SMEs are not working full time as SMEs.

As Epic's generic core was originally designed for American hospitals, the Norwegian primary health care is a completely new area to the vendor. Nevertheless, a lot of the same health care services exists in the USA, which means that some of the functionality needed by the Norwegian primary health care is perhaps classified using different terminology. For this reason high demands are placed on the knowledge of the application analysts regarding the platform and the opportunities that lie in the system. As the application analysts mentioned, some of the limitations they have experienced have not always required development, since the functionality is actually already in the platform. In order to find out whether the missing functionality is somewhere in the system, a dialog between the application analyst(s) and Epic is required, because this is where the knowledge is. One of the analysts reported that it might have been easier for the application analysts to understand what they are building and working on if they had collaborated closer with other analysts from the beginning.

Not only do the SMEs have to learn about the possibilities of the platform by the application analysts, the application analysts also have to learn about the work practices of the end-users. According to Robertson and Simonsen (2012) this is the essence of participation in Participatory Design. In traditional software development projects it is often the case that the developers know little or nothing about the work field of the users, which means that they have to learn what they need by familiarizing themselves with their work area. In the case of Helseplattformen, most of the application analysts are former health care workers, which gives them a different starting point than developers with little or no experience with health care. Although the application analysts have experience from the health sector, there is still a distance between the builders and the end-users that require the establishment of mutual learning situations. Mutual learning situations are established in Helseplattformen when application analysts learn about what the SMEs want and need, while the SMEs learn about the possibilities of the system. As the application analysts knowledge about the system is sometimes limited, it may appear as though the SMEs are utilized as informants, which is contradicting with the concept of mutual learning and user participation from a PD perspective. The establishment mutual learning situations is therefore affected by the fact that the ones who are learning about the practices and contexts of the users are not the ones who possess the knowledge about the platform.

6.3 The implementation process

Epic has defined a process for implementing their product that is based on their experience with other implementations. In the same way that the product was developed in USA, the implementation process was also developed in the USA. This process seems to be hierarchical and introduce several roles and communication structures that might not be an exact fit for Norwegian municipalities. The findings of this study indicate that those who have roles, do not always know what it entails. They appear in test sessions and do what they are supposed to without knowing exactly why or how. The people involved also know that they are short on time, which might result in an increased distance between the vendor and the application analysts, and the application analysts and the end-users. In order for the implementation process to be used efficiently for participation and providing feedback the people involved needs sufficient knowledge about it.

During the interviews a question is raised by an application analyst about whether building and testing should be ran in parallel. It is mentioned that the testing and the building phase has been run more in parallel than expected, and that it would have been more tidy for the application analysts to separate the two phases. The biggest challenge mentioned by the application analyst is that things that are being built that has not been built before are being tested at the same time. From the vendors perspective it would have taken way too much time to follow a linear implementation process, and that the system would be outdated by the time it was done. Nevertheless, the application analyst mention that it was not until the testing phase began that they really got to know the system and

where things can go wrong, and that it perhaps is useful to start testing while building for this reason. It is also not until the testing phase that application analysts on different applications begin to work closely together, which an application analysts mention as one of the success factors of E2E testing. The application analyst describe the collaboration across applications as "alfa omega" to understand where the errors are.

The project has also seemed to struggle with the predefined communication structures defined by the vendor. One of the SMEs reported that is has been difficult to find information about what has been discussed earlier and the decisions that have been made, due to the large amount of information available. This is a challenge Epic has seen during other implementations in non-English speaking countries and that is mentioned as one of the main challenges by one of the Epic representatives. In particular, communicating the decisions that has already been made about translations. This also relates to another challenge in large-scale projects regarding the dimension of time. When project span over several years, people come and go which adds to the challenge of communicating decisions that have been made.

The local implementation project in Trondheim Kommune will shortly begin training of the unit leaders who will be responsible for the organizational change back at their units. When the leading super users and super users will receive training, it is important that it is directly tied to the product, which is not possible if the product is not ready. If it becomes to abstract the users are going to wonder "what does this do?" and "what does that word mean?". The SMEs and leading super users do not have in-depth knowledge about the effect on their everyday work tasks, because the building of the system is not completed. If the leading super users were not involved in the test-sessions they would not have known what the solution would look like before the End User Acceptance Test.

6.4 Limitations

This section describe the limitations of this research. There are three main categories of limitations concerning the numbers of observations and interviews, a digital lab, and the time frame of the project.

Firstly, the number of observed test sessions was limited to a pilot and one regular E2E test. Only one leading super user that participated in the pilot was interviewed. The other two leading super users participated in a regular E2E test session that was not observed by the researcher. Ideally, observing more test sessions and interviewing the participants from the same test would provide a deeper understanding of how the tests are conducted and what makes a test successful. If the data from more observations would not be used as data by themselves, it would provide a more wholesome picture and support the findings from other data sources like interviews. Observing the debriefs after the test sessions would have also provided valuable insight that might not emerge from interviews and test sessions.

Secondly, all observed activities and interviews were conducted online through various video

communication tools. Loosing the ability to read body language and emotions creates room for interpretation, something that does not belong in data gathering. Observing activities conducted online made it difficult to gather data about the participants that did not speak or have their cameras on. Interviews therefore became increasingly important as way to get an understanding of their experience. It is important to take into account that all activities in Helseplattformen were conducted digitally and that the challenges that have occurred might have been affected by the pandemic.

Lastly, this case study is only a snapshot of the project of Helseplattformen. The research steps of this study was conducted from mid January 2021 until the end of May 2021, as the last couple of weeks was used to finalize the report. The pilot test was postponed three weeks from February until the beginning of March and the regular test sessions did not start before May (tests that involve the municipality). As testing is only a small part of a bigger process, it is important to remember that a lot has happened before the testing phase and a lot more is going to happen in the next months. A consequence of the short time frame might be a loss of understanding about how previous activities and events might have affected what is happening right now.

7 Conclusion

This chapter present the answers to the research questions in chapter 1 as a conclusion for this research. Suggestions for future work is described at the end of the chapter.

7.1 Conclusion by research questions

The research conducted in this study was a qualitative study aimed at investigating the role of user participation in generic platforms. The motivation was to better understand the role of testing i platformization processes and how users participate in this process.

RQ1: How does E2E testing contribute to participation?

Helseplattformen decided to involve end-users in Pass 2 of E2E, making E2E testing an activity for participation. The idea is that comments and questions by the users will be addressed earlier than if they would wait for End User Acceptance test, which is a strategy Epic has seen in other installations. The value of involving leading super users is that they can discover changes in the workflow that will need extra attention in the training material and that they get to see the system before End User Acceptance Test. Pass 2 of E2E is the first time the leading super users see the system live. In addition to the expected value of involving end-users by Helseplattformen, it turns out that their involvement made them more motivated and positive towards the new solution. The increased curiosity by the leading super users is an advantage going into End User Acceptance Test and training.

RQ2: What kind of participation does platform customization require?

Platform customization differs from traditional software development because of the generic core that a platform consists of. Future users of Helseplattformen have participated in all phases of the implementation process including the requirement specification and the procurement process. Furthermore, users have participated in designing the workflows by looking at the solutions Epic offer today and deciding what changes needs to be made. The subject matter experts (SMEs) participate in making decisions about the workflows and contribute if a development has to be made. Both SMEs and leading super users participate in E2E testing with different objectives. The overall goal is to verify the solution, discover what needs extra attention in the training material, and prepare the leading super users for what is to come. Platform customization therefore demand participation in all phases of the implementation process to build a system that fits thousands of users needs.

RQ3: How can large-scale platformization processes improve?

Large-scale platformization process offer several challenges that might be related to distributed knowledge or predefined and formal roles and communication structures. For large-scale platformizaiton processes to improve these challenges needs to be addressed and taken into account. The relationship between the vendor and the customer is an important factor in terms of both customization and further work after go-live. When Epic is no longer in the picture to the same extent as during implementation, the application analysts are the ones who posses the knowledge about the solution. When it comes to testing it may seem as if it has become a more important activity for participation in platformization processes. When users are involved in testing it is no longer an activity for getting the system ready for the business, but also an activity for getting the business ready for the system. In this way, testing can be seen as a transition activity between the two different phases of building and training that might improve the platformization process by involving users.

7.2 Future work

The findings from this research suggest that testing is an important activity for participation, especially while customizing generic software. The study supports a lot of the research done on user participation in testing, in addition to exposing some new founds regarding the value of user participation. To further explore these ideas, it is recommended that the researcher observe more test sessions and equally important, the debriefs hosted by the municipality. By observing these debriefs, you get a more clear understanding of the value of participation according to the participants, in addition to a more detailed picture of the end-users' experience through their initial thoughts. One can also get deeper insight into the interaction between the municipality and the end-users.

As Helseplattformen is still in the testing phase when this study is finished, further investigations on End User Acceptance Testing and the next phase, which is training, would provide a deeper understanding of the effect of participation in E2E testing. Following one (or a few) SMEs and leading super users would be useful to get a more wholesome picture of the testing phase and it's role in the bigger process.

The findings from this research also indicate that the participators are confused about their role because of the different expectations from Helseplattformen and Trondheim Kommune. This might be connected to the concept of *managed community*. In an implementation project like this, you potentially have several parallel managed communities which would be an interesting topic to investigate further.

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Appendix

A   Quotations

The translation of the Norwegian quotations from the interviews that appeared in the paper can be seen in table 12. It is important to note that they should be considered as paraphrases rather than a direct quotations, as every word and phrase does not correspond perfectly.

Norwegian	English
For meg som fagekspert så føler jeg jo at hvis jeg hadde noe jeg skulle sagt, så burde jeg ha sagt det før.	For me, as a subject matter expert I feel like if I had something to say, I should have said it already.
Jeg kunne ha spurt om det i test, men det hadde jo ikke noe med integrasjonen mellom de forskjellige applikasjonene å gjøre, så derfor kunne ikke jeg ta opp det da.	I could have asked about it during the test, but it didn't have anything to do with the integration between the different applications, so that is why I couldn't bring it up.
På det kick-offet og det der så fikk jeg inntrykk - det var litt to beskjeder - det ene var at jeg skulle være observatør og det andre var at vi skulle sitte og ha noe å skrive med og liksom sitte å notere underveis.	During the kick-off I got the impression - there was kind of two messages - one was that I was supposed to be an observer and the other one was that we were supposed to [..] have something to write with and sort of take notes along the way
Så så jeg det var 30 stykker som var med eller noe sånn, og så ble jeg ikke presentert på en måte så jeg ble veldig usikker på - er det nå jeg skal si noe eller skal jeg ikke si noe i det hele tatt? Så jeg satt og tenkte på det da, hele veien.	Then I saw there were 30 participants or something like that, that were present, and I was not introduced, so I became very unsure - should say something now or should I not say anything at all? So I ended up just thinking about that the whole way through
Det var bare litt sånn usikkerhet rundt min rolle da og hva jeg egentlig skulle gjøre der. For jeg fikk jo mange sånne - jeg satt nå og noterte, og da var det jo mye, men da gikk det kanskje på innhold og det var kanskje ikke det de skulle teste da, men hvis de ikke skulle teste det da hadde jeg jo ikke trengt å vært med igjen, det er litt det.	There was just a bit of uncertainty about my role and what I was really doing there. Because [...] I sat and took notes, and there was a lot, but then again that might be about content and that might not be what they were supposed to be testing at that moment. But if that is not what they were testing then there was kind of no need for me to participate, that's like the thing.

Table 12: Translation of quotations

Norwegian	English
Det gjorde meg jo litt nysgjerrig på hvordan det er å bruke det da. Jeg fikk jo en sånn kjapp glimt om det skjermbildet liksom, så det er jo litt spennende, men det tror jeg at jeg hadde syntes selv om for eksempel superbrukeren på min avdeling hadde vist oss sånn og sånn og sånn kan vi gjøre og sånn ser det ut for oss, så tror jeg det hadde vært likedan det som den testen.	It made me a little curious about what it's like to use it. I got a quick glimpse of the screen, so it's a bit exciting, but I think I would have thought the same even if for example the leading super user in my department had shown us that we can do this and this [..], and this is what it looks like for us, I think that would have been the same as the test.
Nå har jeg jo sett eksempel fra Helseplattformen og det ser ut som at vi vil få masse opplysninger om en beboer på en side. Sånn som journalsystemet fungerer i dag så må du inn på enkelte journalkoder hele tiden for å finne de opplysningene du trenger det er ingenting som er samlet på en plass. Så jeg gleder meg til å få masse opplysninger samlet på én plass.	Now I have seen an example from Helseplattformen and it looks like we will get a lot of information about a patient on one page. The way the journal system works today, you have to go into separate journal codes to find the information you need, nothing is gathered in one place. So I am looking forward to getting lots of information gathered in one place.
Jeg ble motivert av å se et journalsystem som ser veldig oversiktlig og ja - brukervennlig ut da, og det er ganske - en dramatisk endring fra det vi sitter med i dag. Og så når man og hører om funksjonalitetene i det, så blir man og veldig positiv til at det kommer.	I was motivated by seeing a journal system that seems very clear [..] and user friendly, and it is a pretty dramatic change from what we are using today. And when you hear about the functionality [in the system], you become very positive about what's to come.
Nå skal det jo sies at jeg er ikke spesielt fornøyd med det systemet vi har fra før, så jeg er super positiv og tenker at det her bare må bli bedre, og det ser mye bedre ut.	Now it must be said that I am not particularly happy with the system we use today, so I am super positive and believe that this just has to be better - and it looks much better-
Interessen ble kanskje enda større av bare det å på en måte ha noen navn og noen fjes som faktisk jobber med det her som du kanskje og da kan stille spørsmål til senere, er litt godt å ha med seg.	The interest did perhaps grow even more, just by kind of having some names and some faces [to the people] that are actually working with this, that you can maybe ask questions to later, that is nice to have.

Continuation of Table 12

Norwegian	English
Også er det sånn at det blir jo ikke bra med en gang, tror jeg da, så blir det bra etter hvert. Og da blir det veldig bra.	It is also the case that it won't be great right away, at least that's what I believe, that it will be great eventually. And then it will be really great.
For meg så var det jo mer det at det var et innblikk i hva som foregår i spesialisthelsetjenesten, men også ja, den informasjonen som sendes derfra til kommunen, via helse- og velferdskontoret og til helsehus da. Så det er vel det at man får litt innblikk i en prosess som man ikke vet så mye om. Man vet at det skjer, men ikke alltid hva slags informasjon som sendes. Bortsett fra en epikrise eller et sluttnotat da	For me, it [..] was more an insight into what is going on in secondary health care, but also the information that is sent from [the hospital] to the municipality, via the Health and welfare office and to the Health center. So [..] you get some insight into a process that you don't know much about. You know that it is done, but not always what kind of information is sent. Except for a discharge letter or a final note.
Jeg tror at alle hadde hatt nytte av å være med på en sånn test, fordi ja vi har jo hatt kick off, vi har hatt de her kursene eller treffene med superbrukere, men prosessen har på en måte vart så lenge også er det så perifert for ansatte så det er nesten litt sånn at jeg er redd for at man skal glemme at det her faktisk kommer. Så det er en sånn wake-up call da på at det her skjer, og vi må bare være med.	I believe that everyone would benefit from participating in a test like this, because [..] the process has lasted for so long and it is so periphery to the employees. It is kind of like - I am afraid that people forget that this is actually coming. So it is sort of a wake-up call that this is happening and that we just have to keep up.
Det er vanskelig for oss å klare å sortere ut akkurat - det har det vært hele tiden - hvem er det jeg snakker med nå? Hva er det vedkommende jobber med? Også kommer jeg med innspill om noe helt annet som ikke var på han sin applikasjon - det synes jeg har vært utfordrende å vite til hvem, for jeg har ikke én sånn som jeg kan hive alt til	It is difficult for us to manage to sort exactly - it has been like that all along - who am I talking to now? What is it that this person does? And then I comment on something that is completely different than what was on his application. I think that has been challenging - to know *to whom*, because I do not have one person that I can throw anything at.

Continuation of Table 12

Norwegian	English
Det er kanskje det minuset jeg vil si har vært underveis - at jeg synes det har vært vanskelig å se - å finne tilbake til det jeg har vært med å sagt noe om - hva sa vi da og sånn og hva har skjedd siden, du får ikke noe fly, jeg har ikke klart det hvert fall, jeg har bare håpet på det beste og stolt på at de som skal gjøre jobben sin har gjort det og det virker som de har det da.	That is perhaps the downside I want to say has been there all the way - that I believe it has been difficult to [find information about] what I have said about something. What did we say then [..] and what has happened since? There is no flow, at least for me, I have only hoped for the best and trusted that the ones who are doing their job is doing it - and it seems like they have.
Men da har jeg kanskje ikke fått med meg poenget om jeg sitter å lurer på om det hadde vært nok med 10 minutter.	I might have missed the point if I am wondering if 10 minutes would have been enough.
De snakker jo et språk som jeg ikke skjønner i det hele tatt ikke sant, med engelske datauttrykk som er helt fremmede, så er det ikke sikkert det er datauttrykk heller, men altså det er en helt fremmed terminologi.	They speak in a language that I don't understand at all with English computer expressions that are completely foreign to me. It might not even be computer expressions, but it's a completely foreign terminology.
Terskelen for å melde endringsønsker den virket jo ganske høy ikke sant, og hun snakker jo om systemer og måter det skal meldes på som jeg aldri har hørt om før, så det blir litt sånn at shit hvor ille må det være før man tør å si noen ting?	The threshold for notifying change seemed to be quite high and [the test coordinator] talks about systems and ways to notify changes that I have never heard of before, so it gets kind of like [s***], how bad does it have to be before one dares to say something?
Jeg tror at i mange tilfeller så ligger funksjonene klar for oss i systemet vi er bare ikke klar over enda, for det er veldig nytt for oss alle sammen.	I think that in many cases the functionality is there in the system we are just not aware of it yet because it is very new to us all.
For når man starter og man er helt ny, det er ingen som kan jobben og det er ingen som har gjort den før oss så er man veldig - altså man har på litt skylapper og er veldig fokusert på seg og sitt, veldig nedsunket i det, og så løfter man kanskje blikket litt for sent i den form at man kanskje skulle ha gjort det litt tidligere for å ha fått en litt større forståelse for de tingene man sitter og bygger og jobber med da.	Because when you are new, there is no one knows the job and no one who has done it before, you kind of wear blinders and you're very focused on yourself and yours, so perhaps you lift your gaze a little too late [...] to get a better understanding for what you are building and the things you're working on.

Continuation of Table 12

Norwegian	English
Jeg hadde kanskje sett for meg at det skulle være litt mer sånn "okei, nå skal dere bygge og så når dere er ferdig med å bygge så skal vi teste" (ler). Men de prosessene har gått litt mer parallelt da, enn det jeg trodde på en måte.	I was kind of expecting that it would be more like 'okay, now you you are going to build and when you are done with building you are going to test' (laughs). But the processes have been more in parallel, than I thought they would be.
For min del som analytiker så hadde det vært mest ryddig å delt de i to	For me as an [application] analyst, it would have been more tidy to split them in into two [activities]

Continuation of Table 12