Online Participatory Design

Lessons from Fiks contact tracing

Elisabeth Vossgård

Thesis submitted for the degree of
Informatics – Programming and system architecture
60 credits

Natural Sciences Department of Informatics
The Faculty of Mathematics and Natural Sciences

UNIVERSITY OF OSLO

Spring 2022

Acknowledgements

I want to extend my most sincere gratitude to my supervisor, Johan Ivar Sæbø, and my co-supervisor, Ragnhild Bassøe Gundersen, for the invaluable feedback and patience they have provided throughout this process. This study would not have been possible without the contact tracers taking time out of their busy schedule to perform some of the most crucial work in combating the COVID-19 pandemic. A special thanks to the municipality (which has been anonymized) for letting me observe your contact tracing team. I am immensely grateful to KS for allowing me to attend a *question*-meeting and interview the chair of the user council.

I am also grateful for my family's unwavering support and faith in me. Not to mention my classmates, *Stilrommet*, for all the stimulating conversations, insightful contributions, and boundless enthusiasm. I'd also like to express my heartfelt gratitude to the Design Lab for the informative seminars and knowledge sharing. Finally, I'd like to thank Sofie, with whom I spent a significant amount of qualitative and quantitative time with during this time. It wouldn't have been as much fun without you.

Abstract

When the COVID-19 pandemic struck Norway, The Norwegian Association of Local and Regional Authorities (KS) set out to develop a new information system for contact tracing. This thesis looks at how participatory design approaches were used in this process.

The COVID-19 pandemic posed challenges for user participation due to time constraints in developing new technology, restrictions on travel and physical meetings, a heterogeneous user group spread across the country, and an overall lack of time to participate. In this thesis, I investigate the possibilities and opportunities within these constraints and how the project owner has responded to this to involve users in the design processes. These challenges also apply to participation in many large-scale information systems.

This thesis' *empirical perspective* is the digitisation and development of new contact tracing technology. The *theoretical context* is participatory design in large-scale information systems. The following research question has been investigated in these contexts: *How can we support participatory design during a pandemic?* I used an *interpretive* epistemological approach aligned with the qualitative *case study* methodology to investigate this research question. The practical contribution is how the participatory design responses KS, the product owner, enabled during the development of Fiks contact tracing, considering the pandemic's challenges and opportunities. The theoretical analysis argues that Fiks contact tracing utilised a digitised modification of participatory design and facilitated user representation to develop a solution satisfying the users' needs.

KS used the arenas of digital participation meetings to enable participatory design during the pandemic. During these meetings, KS used digitised modifications of principles and methods from participatory design to engage the end-users and learn about their needs. By involving Fiks contact tracing users in the design and decision-making processes, the values of working life democracy are supported by increasing the users' trust in the system and openness to change. To achieve the values of participation among a more significant portion of the user group, user representatives posed as power users representing their municipalities. In addition, some municipalities utilised user representation in the form of a representative who represented multiple municipalities.

Abbreviations

API - Application Programming Interface

DHIS2 - District Health Information System

HISP - Health Information Systems Programme

KS - The Norwegian Association of Local and Regional Authorities

NIPH - Norwegian Institute of Public Health

PD - Participatory Design

WHO - World Health Organisation

MVP - Minimum Viable Product

Table of contents

Chapter 1 Introduction

The real-world problem examined in this case study is the development of the Fiks contact tracing system during the pandemic, and in particular how methods of participatory design could be incorporated.

Norway's first official case of COVID-19 was reported on February 26, 2020. Contact tracing was one of the most important tools for combating the pandemic besides isolation, quarantining, and, later, vaccination. With the pandemic, an enormous need suddenly arose, which had not previously had much focus in the Norwegian public health care system, tracing contacts and contacts of the infected. It is the municipalities' responsibility to trace confirmed and suspected infection cases (the Infection Control Act, 2019, § 7-1), but the need for contact tracing has never been of this extent. When the COVID-19 pandemic made its first entry into the country, the municipalities were not prepared for this tremendous amount of work as it quickly became, where pen and paper, or Excel spreadsheets, were the main procedure. At the same rate as the infection pressure increased, the municipalities struggled to deal with the scaling and complexity of the contact tracing. Therefore, a need for tracing contacts with digital technologies emerged rapidly (Gundersen et al., 2020).

The Norwegian Association of Local and Regional Authorities (KS) and the Norwegian Institute of Public Health (NIPH) took the initiative to find a standard solution for contact tracing. An already existing solution, District Health Information Software, version 2 (DHIS2), had been explored by a few municipalities and was chosen to be the contact tracing platform KS would offer as a general solution to all municipalities. DHIS2 already had a module for COVID-19 tracking, which became the root for further development based on directions from The World Health Organisation (WHO) and a few countries (Poppe et al., 2021). The initial module needed to be customised for covid-19 and Norwegian conditions, continuously changing.

The immense need to quickly implement a functional solution for users put pressure on system developers to release new features and improvements. Therefore, discovering the contact tracers' needs became essential. However, significant differences in the infection pressure in Norwegian municipalities and many heterogeneous users created different requirements for the contact tracing tool. For example, municipalities with low infection rates where contact tracers had time and resources to follow up on every case of infection

attentively had different needs than a municipality with high infection pressure making it hard to follow up on every close contact of the infected.

Given that there suddenly was a need for exceedingly more contact tracers than how many had the appropriate experience and education in the field, the turnover of users was high, constantly getting new users with little or no prior experience with contact tracing. The infection control measures prevented the users and developers of Fiks contact tracing from meeting physically. While the infection pressure increased and the number of users in the municipalities to train, making time for user participation became challenging. These attributes significantly impacted how user participation occurred in this chaotic situation.

Participatory design (PD) is an approach to a design strategy that invites stakeholders into the design process of a system as "experts of their experiences" to understand better and meet the user's needs (Visser et al., 2005). The principles of PD involve letting the user participate in forming and making design decisions throughout the whole span of the design process (Sanders & Stappers, 2008). These processes have been initially facilitated physically, with group workshops where the users actively engage with prototypes to discover user needs and explore and develop possible solutions. With the restrictions preventing physical workshops and meetings, user participation needed to be further digitised to fit this situation. The number of users snowballed and spread across the country. KS modified the standard participatory design approach in response to this scaling, resulting in system experts representing a group of users in digital workshops.

This thesis looks at Fiks contact tracing and the aspects of participatory design employed by various relevant stakeholders. They include contact tracers based in the municipalities, the municipal chief physician, the product owner, and developers of Fiks contact tracing.

The research question for this study is:

How can we support participatory design during a pandemic?

The focus on a pandemic incorporates three main challenges identified before the start of the study. First, it was essential to provide a possible solution to scale to many heterogeneous

municipalities. Second, the development of the pandemic put certain time pressure on creating a working solution and implementing it in the municipalities. Third, the system developers couldn't visit on-site because of the national infection control measures, as traditional PD emphasises.

The following chapter will present a literature review of scholars who have studied relevant concepts and themes to this thesis. Then, in Chapter 3, I will provide a brief description of how contact tracing is carried out in Norway and an overview of the features of Fiks contact tracing and how participation in Fiks contact tracing is enabled. Chapter 4 consists of the research framework and methodology used in this study. The study's findings are presented in chapter 5, which are discussed in relation to the literature in chapter 6. Finally, chapter 7 contains the study's conclusion and recommendations for future research.

Chapter 2 Literature review

In this chapter, I present relevant literature on participatory design and platforms. Participatory design has traditionally been associated with small scale projects, and it remains a challenge to scale participatory design. Scholars have, however, looked at the design approach concerning the architecture of platforms (Gundersen et al., 2020; Roland et al., 2017). Hence, I find it purposeful to review participatory design concerning digital platforms.

First, however, I will briefly describe how I understand two concepts important for my thesis: information systems and health information systems. Information systems collect, process, store, analyse and disseminate information for a specific purpose (Rainer & Prince, 2021). From a socio-technical perspective, I consider information systems large, complex systems under development and with multiple actors and a heterogeneous user group. Socio-technical refers to the process and humanistic set of principles associated with technology (Baxter & Sommerville, 2011). The objective of socio-technical theory has always been "the joint optimization of the social and technical systems" where the social and the technical should, whenever possible, be given equal weight (Mumford, 2006).

Fiks contact tracing is a health information system downloaded from the DHIS2 platform that stores and collects health data (*DHIS2*, 2022) and stored at the Fiks platform. Health information systems can help improve the effectiveness of health services by incorporating, processing, and reporting data (Lippeveld et al., 2000). This process of recording, storing, and evaluating health data is crucial for making informed decisions and policies during the planning, implementation, and evaluation of health programs (Nyamtema, 2010).

2.1 User participation

User participation has for a long time been recognised as an important area in system development and human-computer interaction (e.g., Baroudi et al., 1986; Bødker, 1994; Floyd et al., 1989; Hirschheim, 1985; Karlsson et al., 2012; Mumford, 1981).

User participation can be defined as the activities performed by users during system development (Barki & Hartwick, 1994). The concept of user participation emerged from a discussion in Scandinavia around 1960 regarding the relationship between work and democratic values, where it was generally agreed that the industry should mirror the general democratic principles in society (Emery & Thorsrud, 2013; Gustavsen & Engelstad, 1986).

In a development process, user participation may vary in form, structure, and degree. Therefore, the extent of influence the user has is essential in deciding how many resources are needed and how to structure the participation activity. Bjerknes and Bratteteig (1995) define influence as to which extent the users have the power to make design decisions.

User participation can improve knowledge upon which systems are built and enable people to develop realistic expectations, and reduce resistance to change. Giving the members of an organisation the right to participate in decisions that are likely to affect their work can increase democracy in the workplace (Bjørn-Andersen & Hedberg, 1977).

There are many ways and degrees of enabling user participation. Popular approaches to user participation are, among others, participatory design, user-centred design, and user innovation (Karlsson et al., 2012). The approaches share many similarities and have the core value that the design result should reflect the user's needs (Howcroft & Wilson, 2003). However, how much the users participate and the techniques vary. From user-centred design to participatory design, there is a shift in attitude from designing *for* users to designing *with* users (Sanders, 2002). With user-centred design, the focus lies within the thing being designed so that it satisfies the user's needs. With participatory design, the roles of the designers and users tend to blur, and the user becomes a critical component of the process. To support this way of thinking, it is a need for proper tools to enable the users to express themselves in a valuable way (Sanders, 2002). Lastly, user innovation entails that the users are noticeably independent and responsible for making products and services without the manufacturer's assistance (von Hippel & Euchner, 2013).

In the following subchapter, I will present the concept of participatory design and its origin and principles.

2.2 Participatory Design

Participatory design emphasises that people destined to use the system play a critical role in designing it (Gregory, 2003). The approach entails user participation in design for work practice and encourages system developers to engage users in the design processes. Participatory design research does incorporate not only the design approach but also a political and organisational agenda focusing on strengthening the *workplace democracy,* which is understood as the right of all employees to participate in decision-making about their work and how it is changing (Gregory, 2003; Kensing & Blomberg, 1998). The values of participatory design state that *those who will be affected by new technology have a legitimate reason to be involved in its design to help ensure a better fit between technology and the way people perform their work* (Schuler & Namioka, 1993). Participatory design has historically focused on democratising practices and equalising power relations between users and technical experts and between workers and managers (Hartson & Pyla, 2018; Hochwarter & A. Farshchian, 2020; Kensing & Blomberg, 1998).

The participatory design movement emerged post-war, striving for *working life democracy*, including workers' influence at the societal level and *workplace democracy* (Gregory, 2003). The first generation of Participatory Design emerged from four experiments between 1964 and 1967, investigating how social groups formed around production technologies and sought to reform workers' job distribution and wage systems (Emery et al., 1976). These experiments developed two research programs: a Scandinavian program focusing on union empowerment through "collective resources" and a British program focusing on autonomy in workgroup organisation through "socio-technical systems design". Both programs shared the concern for *workplace democracy* and the humanization of work (Asaro, 2000).

However, it was not until 1981 that the first participatory design development project was recognized, with the "second generation" of the Scandinavian approach, the UTOPIA project. This generation of participatory design focused on including *technological alternatives and alternative technologies to software vendors and involving users in designing alternatives* (Gregory, 2003, p. 64). In addition, the UTOPIA project emphasises the quality of the work and product in training, work organisation, participation and skills, and technology design (Gregory, 2003; Schuler & Namioka, 1993). The British program further focused on a concept in which workers were allowed to spontaneously develop their

work routines, make decisions, and change tasks with little or no supervision. This interpretation of the industrial process would motivate a considerable amount of the later development of the participatory design. Finally, the Scandinavian and British traditions were re-joined by 1985 under a shared banner of a democratic technological system design, and participatory design originated (Asaro, 2000).

Traditional participatory design techniques depend on an arena for end-user participation where users and system developers can interact through conversations, prototypes, mock-ups, workshops, or other physical design artefacts. The goal is to establish long-term working relations with the worksite participants. Interviews and questionnaires have been used to understand the relations between technology and work across an organisation and are often supported by audio or video recordings (Kensing & Blomberg, 1998).

The participatory design tools allow the users and designers to experiment with various design opportunities practically more easily and avoid the excessively abstract representations of traditional design approaches. The workshop activities may include developing a shared understanding of current relations between technology and the organisation's work, exploring new organisational forms, formulating system requirements, and prototyping new systems (Kensing & Blomberg, 1998). When using prototypes to design cooperatively and develop visions of technology in use, it is vital to give these visions a form that allows users to apply their knowledge and experience as competent professionals (Grønbæk et al., 1997).

It is noteworthy that the methods outlined above typically assume the co-location of developers and users. In the next sub-chapter, I will present some challenges with participatory design which are likely to occur when a situation makes it demanding to meet the traditional requirements of participatory design.

2.3 Challenges and enablers of participatory design

Some preconditions need to meet to enable participatory design. For instance, Kensing (1983) outlines five requirements for participation: (1) Access to relevant information, (2) the possibility of taking an independent position on the problems, (3) participation in decision

making, (4) availability to appropriate participatory development methods and (5) room for alternative technical and/or organisational arrangements. Creating the preconditions to meet these requirements includes bringing forward implicit knowledge and shared knowledge, which sometimes is taken for granted and usually tacit knowledge (Gregory, 2003, p. 63).

Regulations and structures that public organisations must adhere to create characteristics of the platformisation processes in the public sector and shape how citizens engage with democratic processes of decision making (Dahl-Jørgensen & Parmiggiani, 2020, p. 35). Dahl-Jørgensen and Parmiggiani (2020) studied the assessment of the possibility of participation in platformisation and defined three challenges that characterise municipality digitisation projects and their influence on participation:

1. How participation is understood and enabled by the municipalities' experts shapes the quality of how participation is performed in practice.
2. Participation is achieved through gradual integration of participation throughout the installed base, but vendor lock-in mechanisms constrain the spaces of possibility for participation.
3. Scaling processes make participation embedded in decision linkages difficult to trace.

(Dahl-Jørgensen & Parmiggiani, 2020, p. 38).

The installed base consists of the organisation and the technical architecture and is the sociotechnical base on which digitalisation projects are built (Dahl-Jørgensen & Parmiggiani, 2020). Dahl-Jørgensen and Parmiggiani (2020) experienced that user participation can be achieved through the gradual integration of participation throughout the installed base. However, vendor lock-in mechanisms constrain the spaces of possibility for participation. Both political and technical decisions previously made in the municipalities influence current contributions in design decisions, and innovation can only be achieved by iterative curation of the installed base (Dahl-Jørgensen & Parmiggiani, 2020).

In the next subchapters, I will present some challenges in enabling and executing participatory design. These are co-location, platformisation in the public sector and the scaling of participatory design.

2.3.1 Co-location

The traditional participatory design methods and techniques are intended to be conducted in a co-location. Workshops and interactions with co-design tools usually are dependent on the precondition of visualisation and physical creations and alterations of prototypes by example (Dahl-Jørgensen & Parmiggiani, 2020). Many of the methods of the traditional participatory design approach also require the possibility for immediate negotiation within the design activities, which Obendorf et al. (2009) describe as a challenge when co-location and shared work context are no longer given to the participating users (Obendorf et al., 2009). McNally et al. (2017) argue that considerations beyond the traditional participatory design need to be made to continue supporting the empowerment of users in shaping the direction of innovative technologies.

2.3.2 Scaling Participatory Design

Another challenge I present is the possibility of scaling participatory design. The traditional participatory design techniques can be difficult to employ when the set of users' scale, homogenous work practices are not given, or it is impossible to arrange design activities in a co-location, as described in chapter 2.3.1. In addition, complex information systems architectures and the widespread adoption of off-the-shelf software challenge the traditional custom participatory design (Roland et al., 2017).

These scaling processes make participation embedded in decision linkages challenging to trace. Municipalities often must purchase generic private solutions and adjust them in-house, implicating the choices for participation. Standardised solutions that are being resold may have a foundation in participatory design, but there is still a question of how the citizens can participate (Dahl-Jørgensen & Parmiggiani, 2020).

Participatory design has a long history of being associated with small scale projects (Titlestad et al., 2009). When a project is being scaled, the users become more distributed, both organisationally and physically (Obendorf et al., 2009). The issues concerning the scaling of a project have been tackled with modern technologies such as digital platforms and modifications of the participatory design techniques to fit the new arena of online tools and services. The spread of the internet is a significant factor in enabling participatory design across space and time (Gumm, 2006). This can allow users to be still involved in the design processes in large-scale information systems or when co-location participation is not possible (Kimaro & Titlestad, 2008; Roland et al., 2017).

Scholars show that co-designing in a large-scale project within the digital frames has some challenges that need to be considered (Gumm, 2006). Not all end users can be involved in the design activities, creating the need for representatives or power users, as Roland et al. (2017) described. One of the three main challenges Dahl-Jørgensen and Parmiggiani (2020) portray is how the quality of the participation is shaped by how participation is understood. Power users' attitudes towards participation can both enable or constrain the values of participatory design. Physical artefacts used in participatory design activities also need to be digitised, changing the way of interacting with them.

In a study that was done on co-designing with children online, modifications to existing co-designing techniques were done to fit the new arena for participation. Lee et al. disclosed the value and possibilities of improvisation. With synchronous video chats with the users as an online tool for participatory design, there was sometimes a need to deviate from the plan because of unpredicted behaviours of the users or online tool. Instead of regarding the unexpected as something to be avoided, the nature of change and free space was re-examined as a learning process for a new inquiry to emerge (Lee et al., 2021).

2.3.3 Power user's understanding of participation

Dahl-Jørgensen & Parmiggiani (2020) argue that how participation is understood and enabled by the municipalities' experts, shapes the quality of how participation is performed in practice. Roland et al. (2017) introduce the term parallel PD, which emerges when the user base becomes so large that it becomes challenging to facilitate participation by travelling and

engaging with users on-site. To resolve some conflicts that a growing number of heterogeneous users can create, power users represent end-users in workshops arranged by the developers or implementors. The degree of participation of end-users is influenced by the power users' understanding of participation, or as in Dahl-Jørgensen & Parmiggiani's (2020) case, the degree of citizens' participation in the municipality.

Various researchers have addressed the recurring challenges of scaling participatory design. To address the role architecture has in and surrounding an information system, I will define digital platforms in the following subchapter, reviewing the main challenges of scaling participatory design through the platform architecture and possible solutions from various scholars.

2.4 Digital Platforms and participatory design

Recently, researchers have pointed out how certain architectures can support large-scale PD, specifically related to digital platforms (Lee et al., 2021; Roland et al., 2017).

Digital platforms are technologically mediated, enable interaction between user groups and allow those user groups to carry out defined tasks (Bonina et al., 2021). While the platforms are a piece of software, it is important to note that the term "platform" has a broader meaning than the physical components, tools, and rules. It is also an intermediary and a community that connects needs and resources (Chasanidou, 2018; De Reuver et al., 2018; Farshchian et al., 2021).

There are two types of digital platforms: transactional and innovation platforms (Cusumano et al., 2019). Innovation platforms, like DHIS2, are based on a generic software core that enables innovation and creation of applications and services by third-party developers based on combining and recombining functionality from the platform core (Bonina et al., 2021).

A platform requires an "architecture of participation" that is a model for engaging people with different ambitions, mandates, employers, and communication habits to grow its ecosystem (Baldwin & Clark, 2006; Mickos, 2012). The evolution of the ecosystem surrounding the platform is dependent on the organisation of innovation in the ecosystem,

which must be willing and able to invest in creating complementary innovation around the platform and their incentives to innovate (Tiwana, 2009). It is necessary to have a loosely coupled technical architecture of the platform and a structure supporting the logistics of participation and negotiation of requirements to support the scaling of participatory design (Roland et al., 2017).

User participation in innovation platforms shows a positive effect on service innovation practices while increasing the competitive advantage of firms. Receiving feedback from actual users in the innovation processes can help create knowledge of the user needs and improve the relationship between customer and company, which can boost innovation (Chasanidou, 2018). How the user participation takes place is dependent on the size of the platform, heterogeneity of users and development of the system (De Reuver et al., 2018).

Platformization is a process that affects both how systems are designed and the participatory design process (Farshchian et al., 2021). Roland et al. (2017) present a layered architecture showing that participatory design may occur with a large base of heterogeneous users and settings. Participatory design is being categorised into four different types that have emerged in response to the challenges of scaling projects. These are singular, serial, parallel and community participatory design. When a project scales, the power of influence gravitates towards design mediators rather than the end-users. Customizers, implementers, and power users represent the end-users in influencing the system (Roland et al., 2017).

Roland et al. (2017) determine the architecture of a platform to have a generic core of features with *fringes* of more specialised apps that are more directed at specific user needs. The core developers of a platform are open to innovation and specialisations of functional possibilities at the fringes of the platform. This architectural form of platforms enables participatory design to scale, customising to the different user needs at the fringes. However, with feature roadmaps and revisions of the software core, the general movement of the software is steered based on the community's needs. Therefore, applying participatory design principles at the fringes of a platform can only be encouraged, not ascertained, by the platform's core developers and political agents (Roland et al., 2017).

Digitalization processes are emerging as a promising avenue to manage difficulties with co-location participation to elicit participation on large-scale platforms (Dahl-Jørgensen & Parmiggiani, 2020; Roland et al., 2017).

Chapter 3 Background

COVID-19 were defined as a pandemic on March 11th, 2020; however, on January 30th, it was described as a “Public Health Emergency of International Concern”. When the COVID-19 outbreak rose in Norway, contact tracing quickly became essential in managing the infection pressure. Contact tracing is the process of registering the infected and offering information about isolation rules and the illness. In addition to this, the contact tracer collects data from the infected, i.e., the time of symptom start, the potential location of infection and the source of infection. During this process, it is also important to disclose close contacts, contact them, and inform them about quarantining and the necessary symptoms to be aware of (Bahus, 2020). This process is vital to breaking chains of infection and has been done long before the COVID-19 outbreak; however, never been to this extent.

3.1 Contact tracing in Norway

In Norway, contact tracing has primarily been done in tuberculosis and sexually transmitted infections and is the municipalities' responsibility. The contact tracing of these diseases has usually been done using pen and paper or sometimes spreadsheets, which then suited the extent of the outbreak with the low transmission rate. What became clear quickly was that COVID-19 is transmitted easily, often from asymptomatic infected individuals. Therefore, the “R-number” soon became an everyday word, an abbreviation of the basic reproduction number of COVID-19, which gives an estimate of how many people an infected person infects (Madsen, 2022). By March 2020, the basic reproduction number in Norway was 1,3. Figure 3.1.1. illustrates the basic reproduction number 2 to the right and the number 3 to the left.

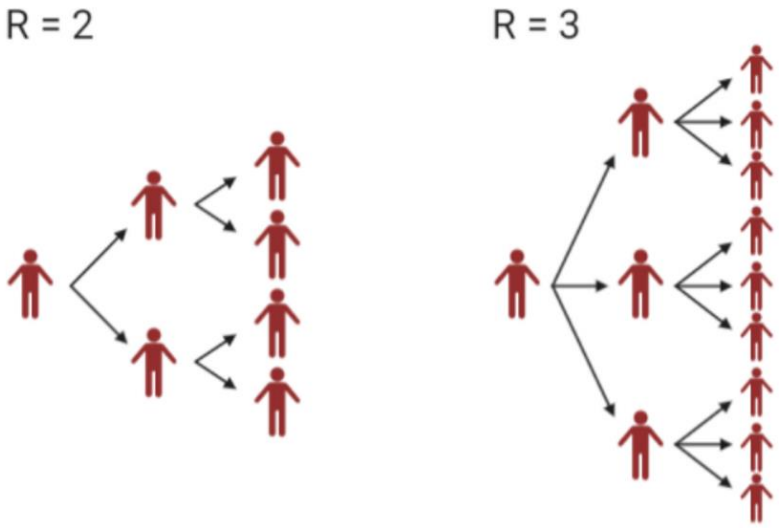

Figure 3.1.1. Illustration of the basic reproduction number (Illustration: Madsen (2022)).

At the onset of the pandemic, it was expected to be many unreported cases because only health personnel and people at the risk of getting seriously ill were tested (Indseth et al., 2021). When the test capacity was improved, the test criteria were changed to include everyone with mild symptoms and anyone who may have been exposed to infection while travelling (*Folkehelseinstituttet*, 2022). This led to a rapid increase in the number of tested persons and positive cases of COVID-19, which put a great deal of pressure on the affected municipalities' contact tracing units. By March 24th, 2020, 585 people were reported infected (Fig 3.1.2).

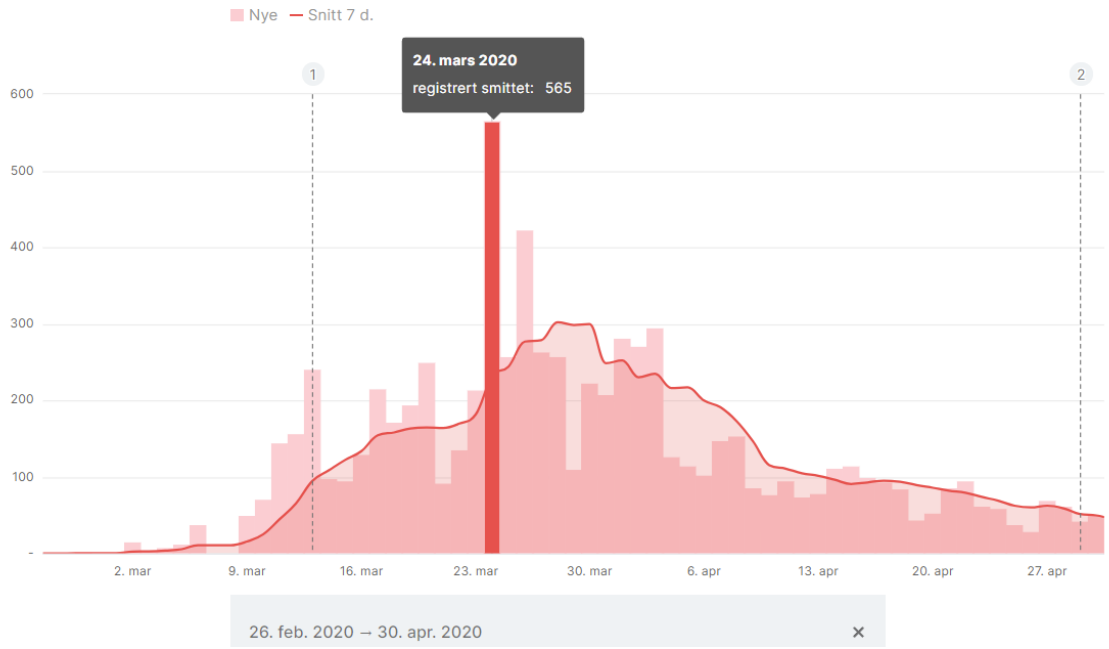

Figure 3.1.2. Screenshot of a graph representing confirmed cases of COVID-19 from the span of February 26th and April 30th (Source: VG, 2022)).

Two definitions of people affected by the covid-19 pandemic have been prominent in discussions about strategies and contact tracing, *index case* and *close contact*.

An *index case* is a person proven infected with COVID-19 that triggers the contact tracing (*Folkehelseinstituttet*, 2022).

The Norwegian Institute of Public Health (NIPH) defines *close contacts* as persons who have had close contact with someone who has tested COVID-19 positive. The contact took place between 48 hours before the onset of symptoms and until the person had finished isolation (*Folkehelseinstituttet*, 2020). In addition, the contact must have been below two metres for more than 15 minutes, direct physical contact, or direct contact with secretions (*Folkehelseinstituttet*, 2020). The guidelines for close contacts have varied throughout the pandemic. However, for most of the pandemic, it has been required or recommended that the close contacts remain in quarantine (*Folkehelseinstituttet*, 2020).

The municipalities are autonomous in the sense that they can make independent choices about how the infection control is to take place and which possible digital solution

they want. As a result, different digital solutions emerged, with two being the most implemented: Fiks and Remin.

The strategy for managing and limiting infection has been under development, and many changes have been made to fit the situation throughout the pandemic. The strategy as it is today, in March 2022, is very different from what it was at the beginning of the pandemic. In Norway, the strategy to combat the pandemic is called TISK. TISK is an acronym for testing, isolation, contact tracing and quarantining (*Regjeringen*, 2022). At the start of the pandemic, before a large part of the population had been vaccinated, municipalities that experienced a rise in infection rates also felt an increased pressure to maintain the TISK strategy. However, in early 2022 the responsibility shifted onto the citizens to do more self-tests and notify their close contacts themselves (*Regjeringen*, 2022).

Traditional contact tracing requires enough personnel to register and follow up on every index case. However, traditional contact tracing has shown to be very effective in addition to the other infection control measures, such as symptomatic isolation and testing, social distancing, and facemasks. The traditional process of COVID-19 contact tracing, as NIPH describes, starts when a positive case of infection is confirmed (Figure. 3.1.3).

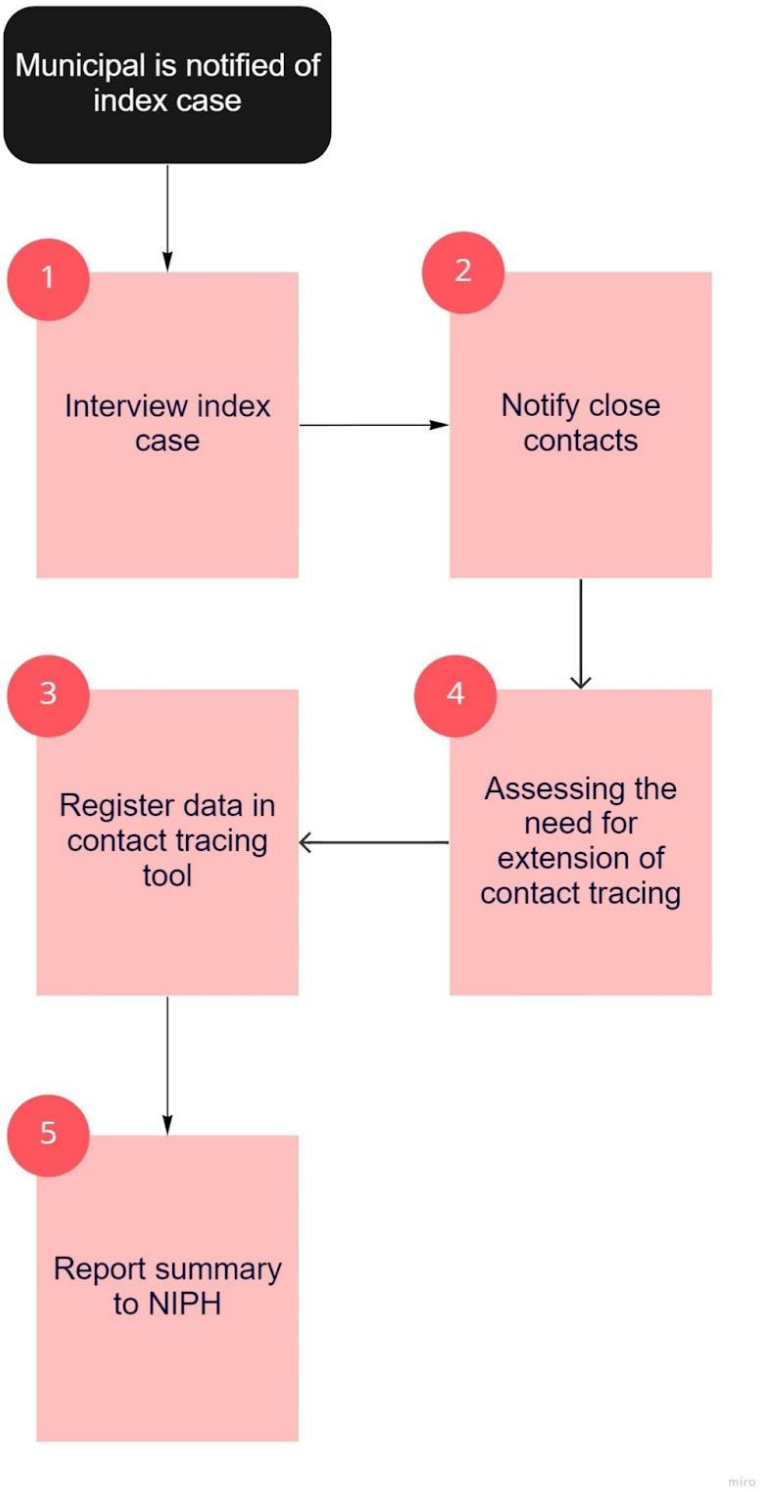

Figure 3.1.3. The process of traditional contact tracing.

The municipal chief physician in the municipality of residence of the infected is notified of the index case. Then a contact tracer in the municipality is assigned to the case. The contact tracer interviews the index case to uncover close contacts and define them based on the type of contact. If possible, the contact tracers map the source of the infection. The next step in the process is notifying and following up on close contacts. The contact tracer continuously assesses the need for extension of contact tracing based on information about possible routes of infection and probable exposure obtained from close contacts. The contact tracer registers the data from the case in a suitable tool, i.e., Fiks contact tracing system. Finally, a summary is reported with the number of infected, close contacts and relevant clusters and outbreaks of NIPH (*Folkehelseinstituttet*, 2022a).

3.2 DHIS2

DHIS2 is an open-source, web-based platform and the world's largest HMIS platform. It is in use by 73 low and middle-income countries, and approximately 2.4 billion people live in countries where DHIS2 is used. DHIS2 is a health information system platform developed by the University of Oslo, collaborating with many different partners, including the World Health Organisation.

DHIS2 has a layered architecture. The business layer consists of data models and core functional modules, while the presentation layer is user interfaces with customizable features as web modules. This modularized design, where each module has its domain, enables customizable platform use to the users' specific needs (*DHIS2*, 2019). Figure 3.2 presents the structure of the DHIS2 system.

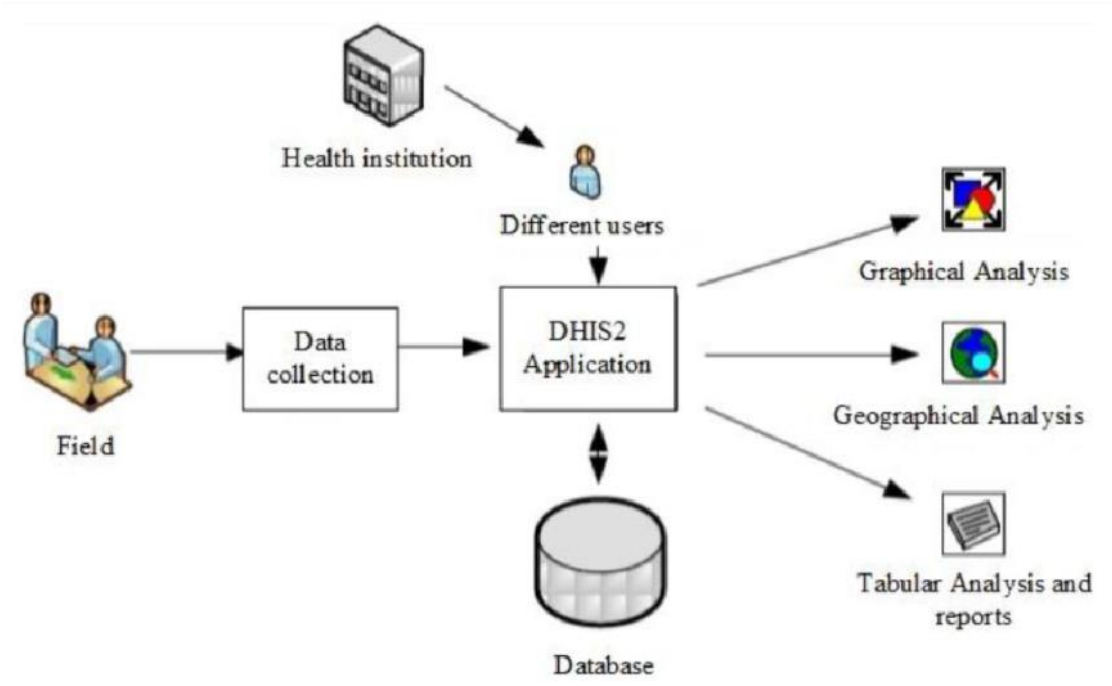

Figure 3.2. Overview of the DHIS2 system (Source: Dehnavieh et al., 2019)).

3.2.1 Participatory Design in DHIS2

DHIS2 has a long history of participatory design. The participation approach has varied throughout different phases and changes of the platform (*KS*, 2021). DHIS2 has faced many participatory design challenges, e.g., scaling making co-location difficult, expert's view on participation, and vendor lock-in mechanisms. The various challenges have been addressed over time with the development of, e.g., platform architecture, as summarised by Roland et al. (2017).

3.2.2 DHIS2's response to COVID-19

DHIS2 supports the digital health data toolkit for COVID-19 to accelerate case detection, inform response measures, and monitor equitable delivery of COVID-19 vaccines. The goal of DHIS2 is to strengthen, expand and sustain their existing systems to respond effectively and efficiently to the COVID-19 pandemic (*DHIS2*, 2022).The large installed base and the architecture of the DHIS2 platform have been important to the rapid adoption of DHIS2's

COVID-19 digital health package (Poppe et al., 2020, 2021). As an innovation platform, DHIS2 allowed for customising the implementations with tailor-made apps, filling gaps in functionality, as Msiska and Nielsen (2018) refer to as “innovation at the fringes” (Poppe et al., 2020).

3.3 Fiks Platform

Fiks is a platform for digital joint solutions that municipalities and county municipalities can use. The platform contributes to coordinated digital service development in the municipal sector. Because of the standard architecture for the municipal sector, the Fiks platform makes it possible to communicate across administrative levels, making it an essential building block in the national ecosystem for digital collaboration. The platform reuses existing standard components in the government and collaborates with the members to develop solutions that represent their needs in work for digitisation. The collection of digital services and shared solutions in the platform gives the suppliers a framework serving as a standard for the municipal sector, supporting their ability to scale and reuse solutions between municipalities and county municipalities (*KS*, 2020).

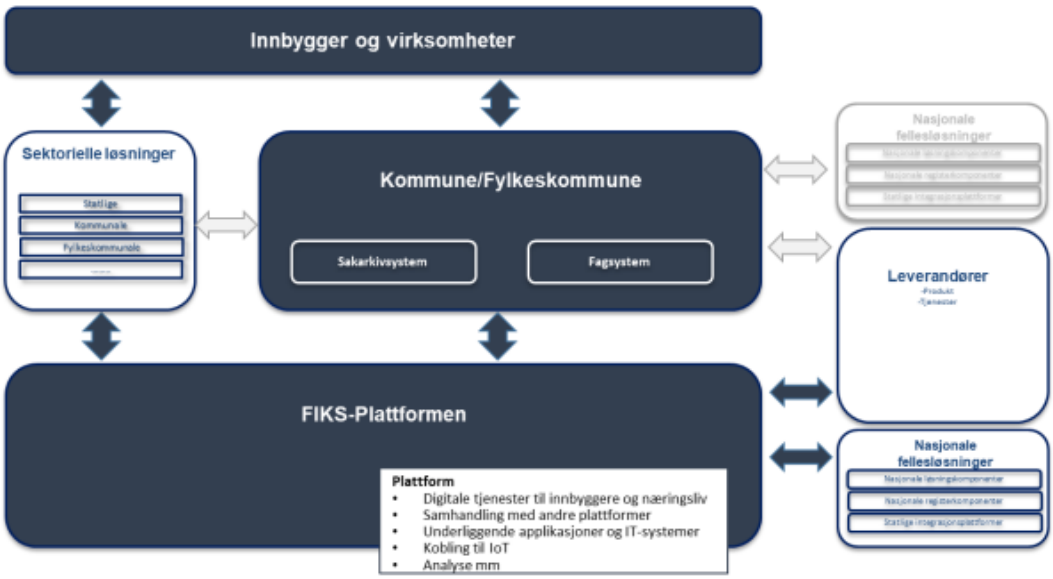

Figure 3.3. The Fiks platform's role in digitising the municipal sector (Source: *KS*, 2020).

The Fiks platform has established user meetings and user councils in multiple of the services on the platform to further develop the solutions according to the user's needs. Further development of the Fiks platform occurs after anchoring in the KS co-management model with the KommIT council and the underlying body, in collaboration projects or as independent KS projects (*KS*, 2020). The KommIT council is an advisory body in KS within digitisation and smart use of technology (*KS*, 2020).

3.4 Fiks contact tracing

Fiks contact tracing is a customised version of the DHIS2 module for COVID-19, a digital joint solution for contact tracing and a service that helps the municipalities to keep track and follow up on people in quarantine and isolation (Gundersen et al., 2020). The service lets municipalities register, retrieve lab results, send clinician reports to NIPH and register vaccinated individuals directly within the solution (Gundersen et al., 2021). The solution has a standard installation for all municipalities and is delivered as a cloud service, which provides a common understanding of the information in the system and streamlines reporting in the municipalities and to NIPH (*KS*, n.d.).

Fiks contact tracing is located on the Fiks platform and is adapted to the needs of municipalities on tracing COVID-19. The Fiks platform makes it easier to report to the National Institute of Public Health (NIPH).

3.5 Fiks contact tracing Solution

Figure 3.5.1 describes the overall processes of Fiks contact tracing service, with the users being contact tracers in the municipalities. Through interviews with the infected or close contacts, the contact tracer can register information about the cases to continue the contact tracing. Index and close contact cases are gathered in a shared personal register to avoid duplicates. Contact tracers can also use other sources such as the population register, map services, event information, etc. (*KS*, 2022).

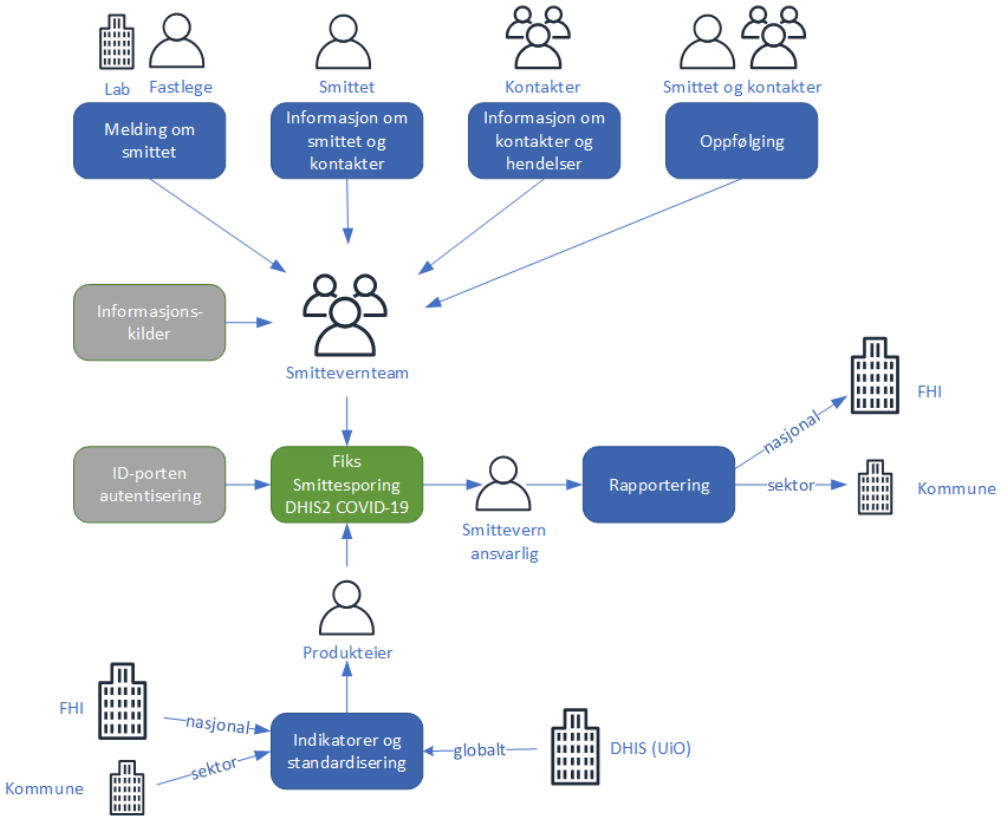

Figure 3.5.1 Illustration of the architecture of the overall processes in Fiks contact tracing. (Source: *KS*, 2020).

The users can register clusters which are events where infected and close contacts have participated, i.e., concerts, kindergartens, nursing homes etc. It is possible to submit registration of health status, background check and lab results. In parallel with reporting to the municipalities and NIPH, the index case and close contacts are being followed up based on the guided measures by the government (*KS*, 2022).

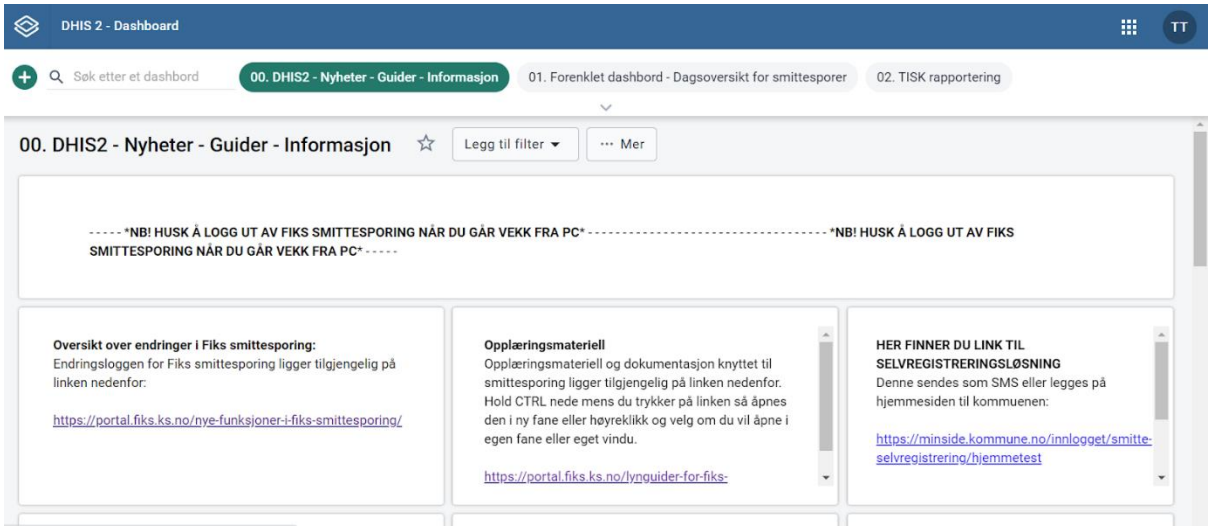

Figure 3.5.2. Screenshot of an example dashboard in Fiks contact tracing (Source: *KS*, 2022b).

Users can customise the application's dashboard by adding different filters and modules. It is also possible to send a link to self-registration of close contacts to index cases, creating relations to the index case. Self-registration of index cases identified by self-tests is also available for the residents.

3.5.1 Fiks contact tracing Services

KS has developed several APIs to extract information relevant to contact tracing with various actors and partners. The idea is to make contact tracing work more efficient by improving communication between municipalities and government and allowing contact tracers to make informed decisions based on the given data.

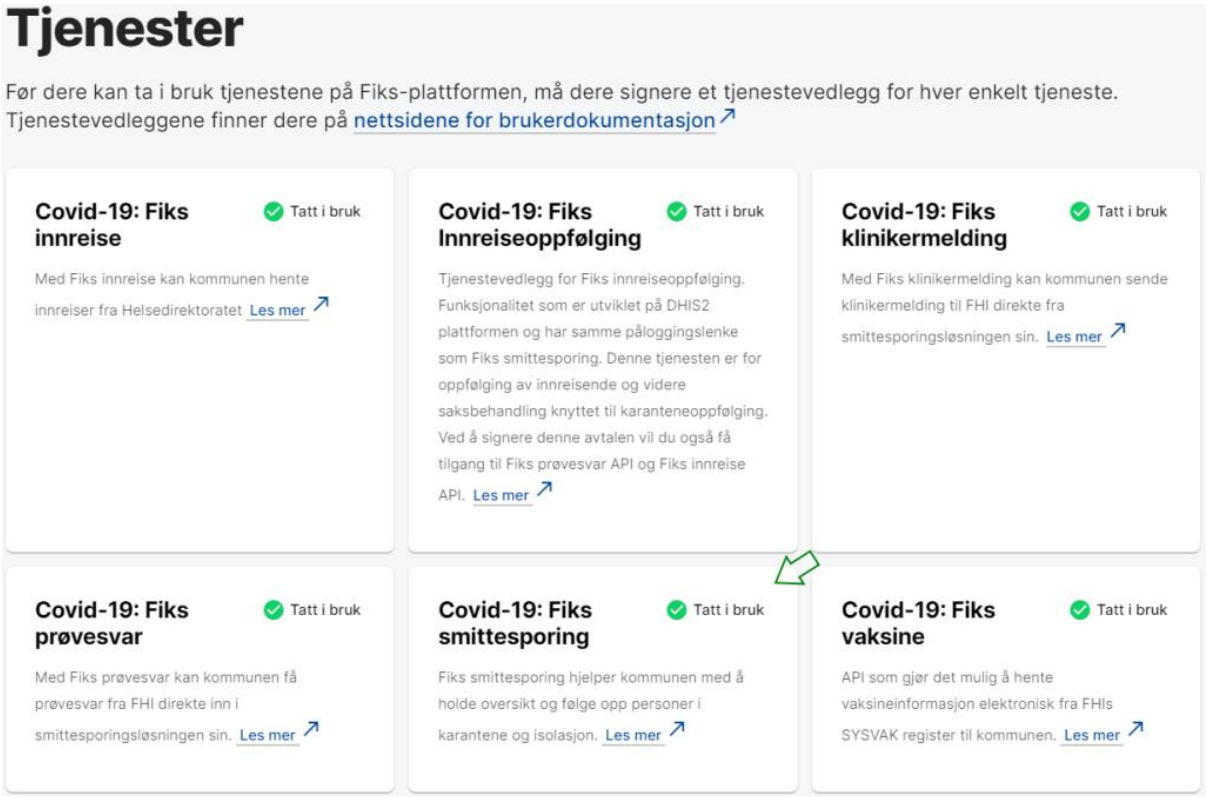

Figure 3.5.3 Screenshot of Fiks services applied in a municipality (Source: *KS*, 2022b).

The municipalities can decide whether they want to sign the main agreement to access all the features or only apply to some of the features or APIs with a service fee and the fee of implementing Fiks contact tracing. Figure 3.5.3 shows an example of a municipality that has implemented several features within the Fiks contact tracing solution.

Tracker Capture

An app inside Fiks contact tracing is called Tracker Capture and contains three programs for registering index cases, close contacts, and clusters. The service provides an overview of all infected with the option to filter by the municipality, date of registration, date of birth, latest registered index, name, and gender. In addition, the service allows users to search for specific cases using keywords, dates of birth, etc.

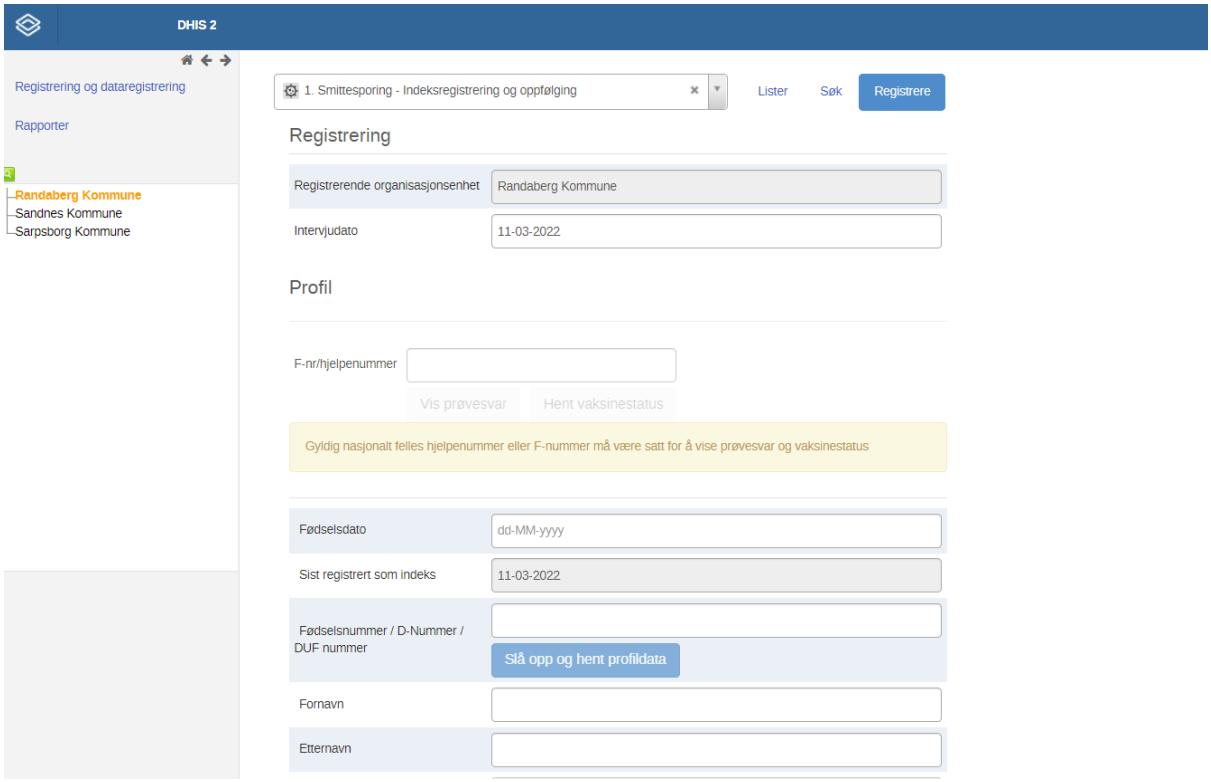

Figure 3.5.4. An example of the registration form for registering a new index case (Source: *KS*, 2022b).

Figure 3.5.4 presents the registration form for registering a new index case. The index case is registered with the personal identification number at the laboratory and retrieved at Fiks contact tracing when registering an index case. When filling out the personal identification number form, it is possible to retrieve personal information about the case from the National Population Register. This helps streamline the completion of the registration form. In addition, contact tracers can manually fill out the personal identification number form to retrieve information when adding close contacts. If the personal identification number is unknown, it is possible to manually enter all the known information about the index case and add the personal identification number.

After registering an index case, close contacts can be added with as much information as possible. If a close contact later tests positive, the case becomes an index case.

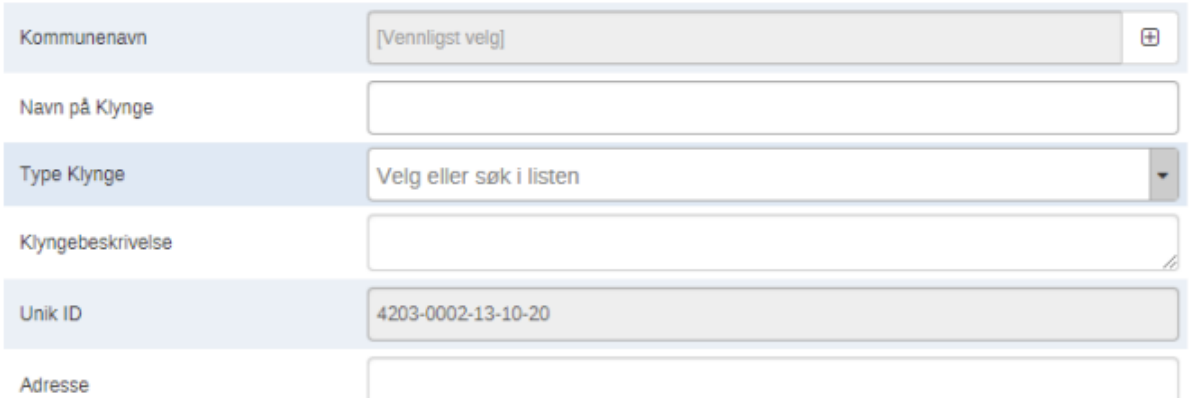

Figure 3.5.5. Screenshot of a registration form of a cluster (Source: *KS*, 2022b).

Tracker Capture allows users to view and register clusters. Figure 3.5.5 shows a cluster registration form with options for municipality, name, type, and address. A unique ID is also generated for the cluster registration, which can be used to link index cases to a specific cluster. Using Fiks contact tracing, municipalities can transfer index cases between themselves and see which ones have moved.

Fiks Laboratory Test Result

Together with the NIPH and the other contact tracing actor, Remin, KS developed an API to retrieve lab results electronically from NIPH to the municipality within the contact tracing solution, called Fiks Lab Result. This API is also available for other municipalities not using Remin or Fiks as a contact tracing service.

Fiks Clinical Report

Using the Fiks clinical report API, any municipality using Fiks or other contact tracing tools can retrieve clinical reports directly from NIPH's notification register Norwegian Surveillance System for Communicable Diseases (MSIS). Figure 3.5.6 exemplifies a clinical report of an index case with the possibility of sending the report to MSIS.

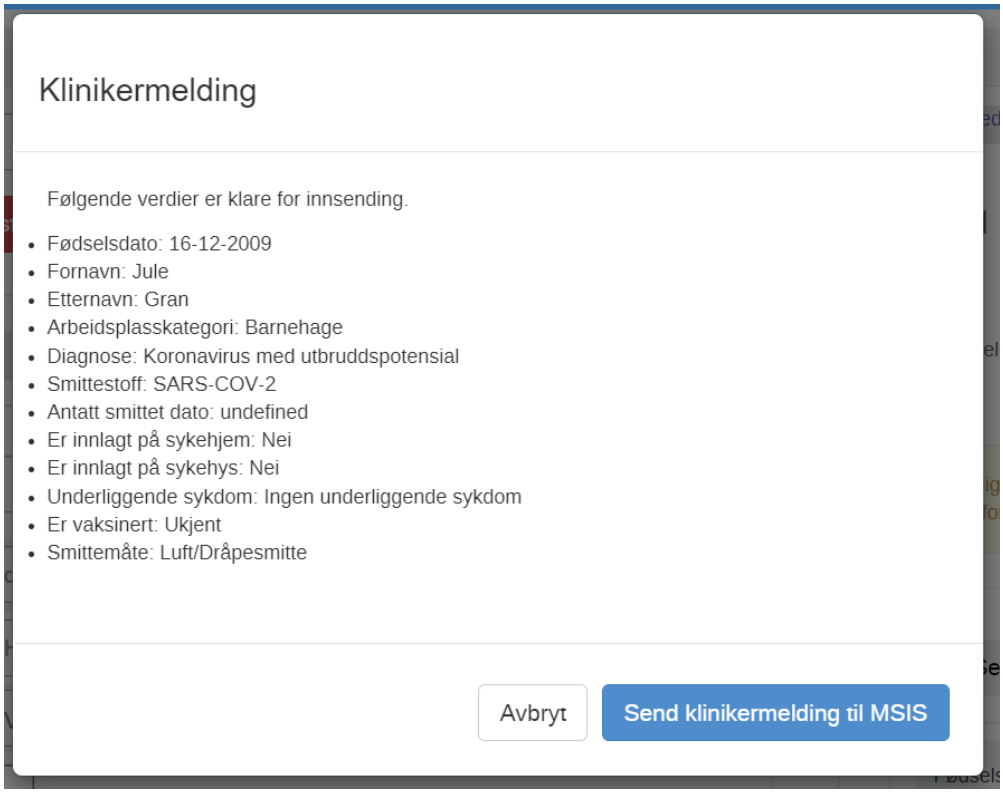

Figure 3.5.6. Screenshot of an example of a clinical report of an index case (Source: *KS*, 2022b).

Fiks Vaccination Status

In addition to the lab results and clinical report API, KS and NIPH have, in collaboration, developed an API to retrieve vaccination information electronically from NIPHS' SYSVAK register to the municipalities' contact tracing service. When registering or editing an index case, it is possible to retrieve vaccination status based on the personal identity number.

Retrieving positive lab results from MSIS

Based on a positive lab result in the municipality, it is possible to extract, create or update indexes in Fiks contact tracing. NIPH owns the MSIS Lab database, containing all positive, negative, and inconclusive lab results. Only positive results are notified as an efficiency

measure to avoid manual registration of the lab results. These index cases are retrieved based on the municipality of residence and where the test was taken (KS, 2021). Figure 3.5.7 shows how the retrieval from the MSIS Lab database is displayed within the Fiks contact tracing system.

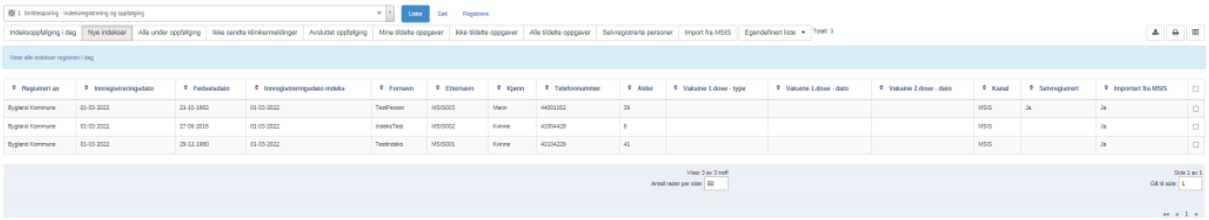

Figure 3.5.7. Screenshot of retrieval from MSIS Lab database (Source: *KS*, 2022b).

Self-registration of positive self-test

Residents can self-register their own or their children's positive tests to Fiks (*Helsedirektoratet*, 2022). The individual must document the location of the most likely infected person, the test date, and whether the index is in the risk group.

A positive index case will be imported directly into the Fiks contact tracing system when a resident registers a positive self-test via a self-registration form. Delegating a portion of the testing and registration workload to the resident will improve the efficiency of the contact tracing system, allowing contact tracers to work faster (*KS*, 2022d).

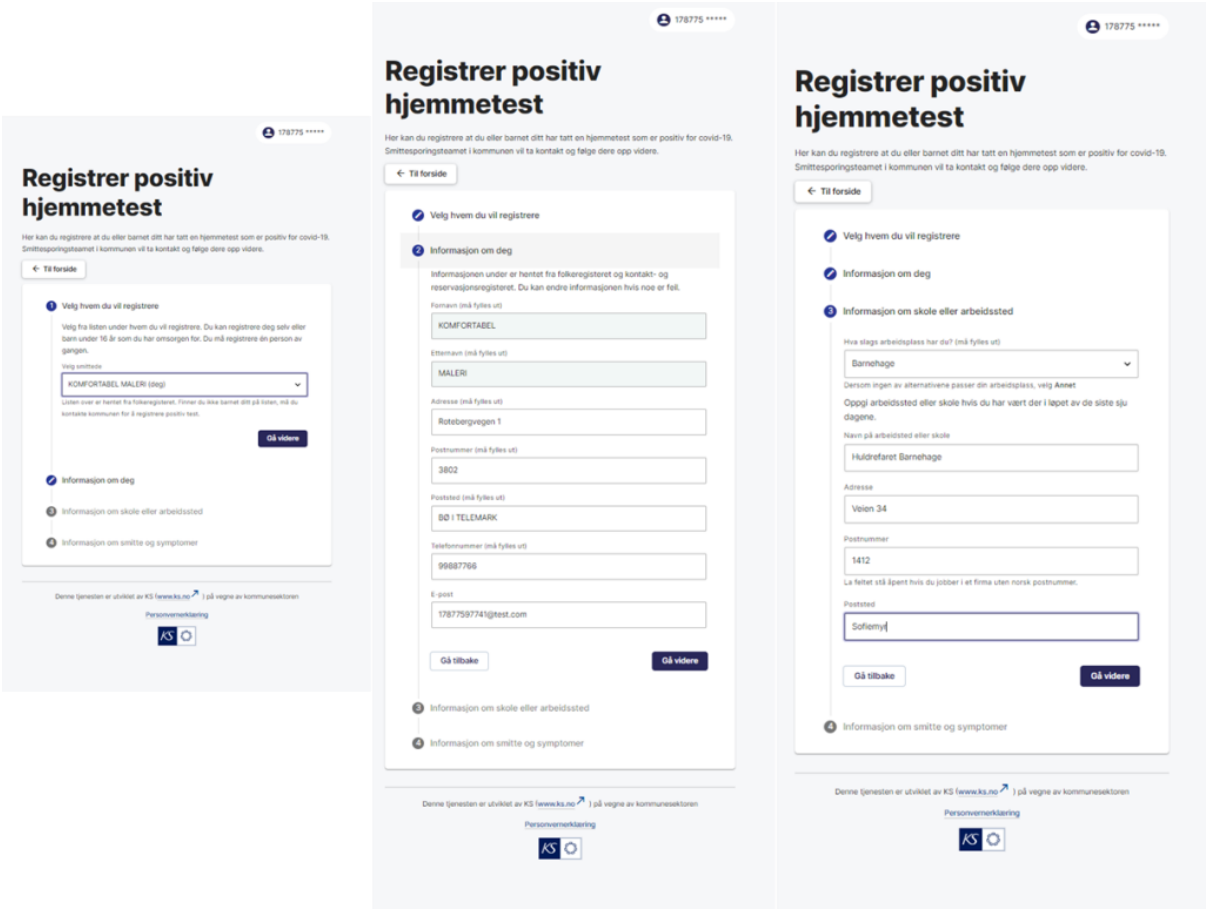

Figure 3.5.8. Screenshot of self-registration service from the resident's point of view (Source: KS, 2022).

Fiks Population Register

An integration with Fiks population register makes it easy to look up personal information based on the personal identification number of the resident. Over 300 municipalities in Norway got access to this register today, March 2022 (*KS*, 2020b).

The municipality must create different roles and assign them to employees to retrieve information from the population register. By limiting the data to only what is required, data minimization, a fundamental principle in privacy, is achieved (*KS*, 2022).

Fiks entry register

Fiks entry follow-up is a service within the Fiks solution that helps the municipality keep track of arrivals to its municipality by offering an overview of the entrant's information about the travel information, employer and quarantine. The service uses Fiks' entry register API and Fiks test answer API to retrieve data from the Norwegian Directorate of Health emergency register for arrivals. It is then the municipalities' responsibility to follow up on whether quarantine provisions comply (*KS*, 2022).

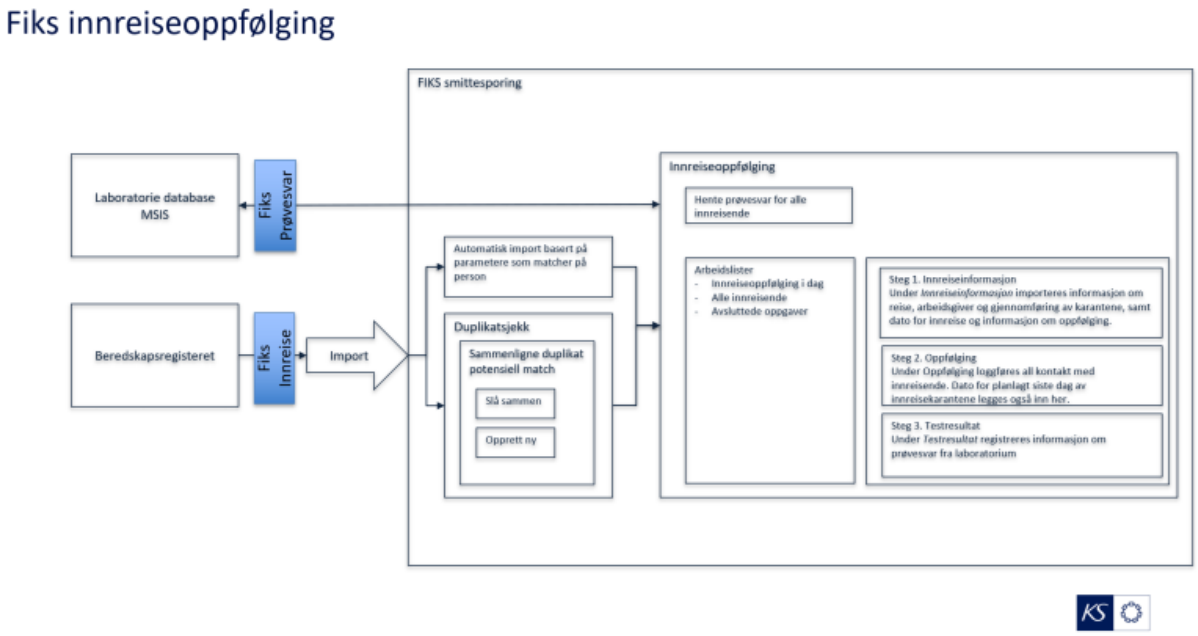

Figure 3.5.9. Illustration of components in Fiks Entry follow-up (Source: *KS*, 2021).

Figure 3.5.9 illustrates the Fiks Entry follow-up service components available in the Tracker Capture app. Fiks Lab results retrieve and send data about the index case from and to MSIS. Fiks Entry register imports from the emergency register for arrivals based on parameters matching a person performs a duplication check, and the entry case is registered in a list. Step 1 of the entry follow up is to log information about the entry case; step 2 is to log all contact with the entry case during the follow-up, such as the last quarantine date. Finally, in step 3,

users will retrieve information about the lab result, which will determine whether or not the entry case is changed to the index case (*KS*, 2022).

The different services in Fiks contact tracing together serve as a tool for getting an overview of the condition of the pandemic within the municipality, an encyclopaedia to extract information about index cases, clusters or close contacts and a channel for retrieving and sending data to national registers in addition to the work of tracing contacts.

Chapter 4 Methodology

This master thesis results from an interpretive case study (Walsham, 2006). This thesis uses interviews and other data collection methods to get an overview of the technical and social aspects of user participation in Fiks contact tracing. The interviews were conducted online, where the participants were members of the user council and the user council chair. The pandemic situation influenced the choice of methods and how they were completed. Due to travel restrictions, a large portion of the research and data collection was done online. Conducting interviews online has both advantages and disadvantages. It both enables and constrains access to participants and can be more time efficient. However, it could also affect what the participant shares and how the interviewer interprets the data and the situation.

The development of Fiks contact tracing within the context of the COVID-19 pandemic is a relatively new arena for enabling participatory design principles. Hence, I found that an interpretive qualitative case study could be a beneficial approach in revealing new knowledge about participatory design during a pandemic. The study's goal was to explore and get an overview of how user participation took place in Fiks contact tracing and how participatory design principles were supported and constrained in this.

In the first sub-chapter, I present my research paradigm and philosophical assumptions regarding my research. Then, I present the chosen methodology and the methods used to collect data during the study. Next, I demonstrate how the collected data was analysed and lastly, I reflect on the choices made and how they may pose some limitations to the study.

4.1 Research paradigm - philosophical assumptions

Guba (1990) stated that a research paradigm is characterised by its ontological, epistemological, and methodological dispositions, and the research paradigm is defined by Kuhn (1962) as a “set of common beliefs and agreements”. To position how the problems in the study are understood and addressed, it is essential to specify and understand these philosophical terms.

The ontological field of research is concerned with identifying the overall *nature* of the existence of a particular phenomenon, and ontologies are theories of what exists (Runes, 1983; Russell, 1945; Urmson & Rée, 1991).

Epistemology, however, is the philosophical problem concerned with the origin and structure of *knowledge* (Rawnsley, 1998). The methodology is the practice of science and is concerned with procedures for yielding believable information (Rawnsley, 1998). Ontology is thus about what the world is, epistemology is about how we can know about it, and methodology is how we go about creating this knowledge.

Choosing a fitting research framework was of great importance, taking the purpose of the study into account, exploring, and investigating how the user participating in Fiks contact tracing was performed. Without prior knowledge of the user participation in Fiks contact tracing, I had no known existing hypothesis or preconceived notions before the study began. However, in the belief that people use their perceptions to interpret what their senses tell them, I believe that the knowledge produced from this study is based on our understanding which is a reflection on events rather than solely on lived experiences (Ormston et al., 2014).

To perform the case study neutrally, but with the perception that as a researcher, I will never be fully unbiased or objective, I chose the interpretive approach of epistemology. The position of interpretive methods starts from our knowledge of reality and is a social construct by human actors (Walsham, 1993). In that sense, I consider it essential to conduct the study with the recognition that the way we make sense of the world includes the intersubjectivity of shared meanings rather than objectivity (Walsham, 2006).

4.2 Qualitative Case Study

The methodological framework used in this thesis has been a qualitative case study.

The case study research approach has and can be defined in various ways. Stake (1995) defines a case study as "*both the process of learning about the case and the product of our learning*" and emphasises the importance of capturing the complexity of a single case within its context. The case study research is centred on a person, a group of people or a unit,

aiming to generalise several units (Gustafsson, 2017). It allows for an in-depth exploration of complex issues in real-life settings (Crowe et al., 2011).

Yin (1999) describes the use of case studies to *explain, describe* or *explore* events or phenomena in the everyday context in which they occur. Case studies often answer *"how", "what,"* and *"why"* questions regarding a specific phenomenon that can help develop or refine theory. Focusing on the particular challenges and opportunities of participatory design within the real-life context of the pandemic necessitated a research approach that allowed for an in-depth investigation and exploration of the subject. To answer my research question, I need to describe "*how"* user participation in Fiks contact tracing is performed, *"what"* participatory design techniques are used and *"why"* participatory design techniques promote democratic values within the workplace and generate a better solution for the users.

Using a case study, I aim to give an overview of the phenomena of participatory design in Fiks contact tracing by describing and exploring the principles of participatory design in this context.

In information systems, the qualitative research focuses on the managerial and organisational issues associated with innovations in information and communications technology (Myers, 1997). As the managerial arrangements of the organisation structure the user participation in Fiks contact tracing, it seemed fit to perform qualitative research methods to discover data to answer my research question.

Kaplan and Maxwell (1994) define the goal of qualitative research to be understanding issues or situations by investigating the perspectives and behaviour of the people in these situations and the context within which they act. To employ the interpretive epistemology, the research was conducted in its natural setting, utilising people's ability to communicate and gain knowledge from the study through words rather than numbers. I am also aware of my intersubjective as a researcher, and the subjects studied. For example, I studied contact tracers in their natural settings at a *corona clinic*. Through conversations with contact tracers and observations of the work and the arena where users meet the developers of Fiks contact tracing, called *the question-meeting,* I understood the performance of the contact tracing work and the participation in the user council and the *question-meeting.*

Qualitative research methods were developed in the social sciences to enable researchers to study social and cultural phenomena; case studies, action research, and ethnography, among others (Myers, 1997). The qualitative data sources include observation, fieldwork, interviews, questionnaires, documents, texts, and the researchers' impressions and reactions (Myers, n.d.).

The degree of involvement shifted throughout the different data collection methods. I hope that the people being studied perceived me as a *natural* observer. As Walsham (2006) describes, I was not aligned with a particular individual or group within the organisation. However, as the interpretive research approach states, it is important to clarify that even though I attempted to be a *natural* observer, it is inevitable to be without bias by my own background, knowledge, and prejudices to see things in certain ways and not others (Walsham, 2006). However, as the spectrum of involvement changed throughout the study, I leaned more towards being an “outside researcher”, having no direct involvement in activities in the field and did not provide significant feedback to the field participants (Walsham, 2006).

In the next sub-chapter, I will outline the methods used for data collection in this research: interviews, observations, and reviews of documents.

4.3 Data Collection

4.3.1 Qualitative research methods

Collecting qualitative data from the field involves accessing interpretations of the informants in the study (Walsham, 2006). In this case study, I accessed these interpretations through interviews, conversations, emails, documents, presentations, encyclopaedias, and publications. Another data source was direct observation of the *question-meeting* and observation of the contact tracing team in their work environment. Figure 4.1 presents the data collection methods used in this study.

Data collection method	Details and examples
Interviews	Three formal interviews with two contact tracers also being representatives in the user council as well as an interview with the user council chair. All interviews lasted for approximately an hour.
Observation	An observation of the usage of Fiks contact tracing solution on-site in the municipality lasting for an hour. An observation of the *question-meeting* lasting for 45 minutes.
Document analysis	Reports from KS, Fiks, DHIS2 and NIPH. Press releases from the government. News articles. Homepages of KS, DHIS2, Fiks, NIPH, and various municipalities.

Figure 4.1 Overview of used data collection methods with details and examples.

Interview

An interview is a conversation between two or more people, often face to face, in which the degree of structure can vary greatly. Highly structured interviews do not deviate much from the original plan of the conversation or have the form of a written questionnaire where the interviewee answers each question in a specific order. Unstructured interviews resemble more an everyday conversation in which there is not necessarily a given agenda or plan for the direction of the interview. We find semi-structured interviews somewhere in the middle of these degrees of structure. With semi-structured interviews, the researcher may have a goal for the interview and some prepared questions; however, she is open to deviating from the plan to explore topics emerging through the conversation.

Interviews have been a primary means to grasp the context and contents of different people's everyday social, cultural, political, and economic lives (Crang & Cook, 2007). As with all social studies, learning through conversations is essential for the research. Spontaneous conversations, for example, in the search for relevant interviewees and the conversations with people one might not have thought were relevant to the study, may provide input and value to understanding the case.

A semi-structured interview was conducted in April 2021 with a municipal chief physician who was a representative in the user council, representing three municipal units that were among the first to implement Fiks contact tracing. I conducted this interview with a fellow master's student who was also writing a thesis on Fiks contact tracing. As this was the beginning of the study, we had only prepared a few questions where the goal of the interview was to learn as much as possible about the contact tracing work, the use of Fiks contact tracing within this municipality and the user council. As a result of the infection control measures, conducting a co-location interview was impossible.

Some examples of questions in this interview are:

- How did the collaboration between your municipality and KS start?
- There have been many changes in guidelines from the Norwegian Directorate of Health throughout. How has this affected the development and adaptation work in relation to Fiks?
- Is there a way for the contact tracers not participating in the user council to express their challenges with the system?

This interview helped guide the rest of the research by generating different concepts and interesting themes I wanted to explore further. The later interviews with contact tracers and eventually the user council chair involved getting an overview and answering the *"how"*, "*what*", and "*why*" questions I wanted to investigate with my case study.

Also, using a semi-structured approach, I conducted an online interview with the user council chair in January 2022. The goal of this interview was to get an overview of how the

user participation took place from the product owner's point of view and how this participation affected the development of the system. I had a few prepared questions; however, I was interested in knowing what she thought was important to inform me. This led to her showing me a presentation of previous user councils, reports and documents, which supported my overview of the participatory design in the user councils.

At the beginning of September 2021, the infection pressure was lower than previously, and the work of the contact tracers was no longer as stressful, allowing me to visit a contact tracing team in a municipality. During this visit, I performed three less structured interviews with contact tracers, which required some time for my questions. These interviews were not recorded, but I noted what was said. The interviewees shared some contact information about relevant people to talk to. In addition to this, they gave me an overview of how the contact tracing team was organised alongside the other units at the COVID-19 centre in the municipality and the nature of the communication within the contact tracing team.

Observation

To get an overview of how the contact tracing team was using Fiks contact tracing solution and how the cooperation between contact tracer took place, I conducted a physical observation of a contact tracing team in a municipality. Sapsford & Jupp (1996) describe the aim of observation to collect information about the world to guide behaviour. The purpose of my observation of the contact tracers using the Fiks contact tracing solution was to understand how the work was performed and information regarding what features had been improved and were yet to develop, and how the contact tracers experienced working with the solution.

The constraints of the pandemic made it difficult to visit multiple contact tracing teams physically. However, I did an observation of a contact tracer in a team using the Fiks contact tracing solution. The observation occurred at a municipality’s contact tracing team workplace and lasted for approximately an hour. As the infection pressure was relatively low at this time, there were no index cases to trace at the time of the observation. Thus, the contact tracer explained and illustrated how they used Fiks contact tracing when registering

an index case, close contact, and cluster, as well as how the editing of the dashboard was performed.

Furthermore, the contact tracer showed me the features that had been improved or implemented after the topic was added to the user council. The observation sought to understand how contact tracers used the Fiks contact tracing solution to follow up on index cases and notify close contacts. However, because there were no cases to follow up on at the time of the observation, I became a more active observer, asking questions to achieve information about the contact tracing solution and how the contact tracer worked. Watching the contact tracing team in action would have been valuable, following up on index cases and contacting close contacts. However, I got an in-depth presentation of many possible scenarios of tracing contacts that may not have appeared in observing a natural contact tracing process at that time.

I also observed the *question-meeting* using the digital video communication tool, Microsoft Teams. The observation was conducted at the beginning of December 2021, while the infection pressure was relatively high in many municipalities. I was introduced at the start of the observation, and then I turned off my camera and observed the meeting, which lasted about 45 minutes. First, I observed the chair present a new feature, the import of vaccination status, and solicit feedback from the participants during the meeting. Then, the meeting chair turned the focus on the participants, asking if they got any questions. Finally, the participants asked for others' experiences using different solution features. Throughout this observation, I gained a better understanding of how the *question-meeting* is conducted: the meeting agenda and how the participants interacted with one another.

Documents

To gather data regarding the pandemic, the municipality's response to COVID-19 and the solution of Fiks contact tracing, I also studied documents and written texts. In addition to giving me knowledge about the pandemic, the municipality's response to the pandemic, and learning about Fiks contact tracing service, these sources of information helped support the data gathered through the interviews and observation. Furthermore, it was helpful to personally see the training videos and the demo playground of Fiks contact tracing to understand how the contact tracers worked. In addition to this, the presentations from earlier

user councils made my understanding of the user councils more vividly than just hearing about them from others who had participated in them.

Official government reports from various eras of the pandemic helped get details about the situation and the infection control measures at specific times. Multiple municipalities also had a great deal of information regarding their response to the pandemic on their homepage and a description of how they used Fiks contact tracing. There was also some exchange of emails with a few of the contact tracers, who were previously interviewed to answer questions that arose subsequently.

4.4 Data analysis

Data analysis is the process of making sense of and transforming the complex and often large amount of data into useful information (Brown, 2014; Dey, 2003). Analysis is described by (Strauss & Corbin, 1998) as “the interplay between researchers and data”. In this interplay, there is room for the researcher to subjectively select and interpret data, causing the results of data analysis to depend on the researcher and their background (Rabiee, 2004).

Crang and Cook (2007) describe the process of analysing data as a creative, active, making process that can be done carefully and thoroughly and with more or less accountability and transparency. Throughout the research period, the analysis of the collected data has always been present, varying from less and more systematic.

The data analysis I have performed in this research has mainly been medium to less structured and systematic. Gioia et al. (2013) state that the traditional data analysis approach, rooted in rigid structures and methods, can delimit what we learn from the data as the focus on themes and concepts we already know is too strong. I wanted to have an open mind, learning as much as possible about the work of the contact tracers, the Fiks contact tracing system and how the participation took place, without necessarily linking these findings to existing knowledge. However, continuously through the data collection and analysis phase, I have constructed themes and concepts from the collected data. Interesting themes were generated from the first data collections, proceeded the research in a direction investigating these themes further.

Nevertheless, having a less rigid approach to the data analysis, previously known concepts such as user participation, user representation and participatory design has been present and considered throughout the research. In addition, the online interviews were recorded and transcribed, making them easy to revisit, and highlighting interesting details and phrases. Conversations with fellow master's students were also essential for making sense of the collected data, drawing out themes and grouping similar terms.

Gioia et al. (2013) introduce the act of constructing a data structure to provide a graphic representation of how the raw data is progressed into themes during the analysis. The data structure presents results from the data gathering as a "1st-order" analysis and a "2nd-order" analysis. In the 1st-order analysis, collected data are presented as terms and codes, but without being categorised or put into themes. However, many of the 1st-order analyses have similarities, making them possible to group. This creates the 2nd-order analysis, which are concepts, themes and dimensions encompassing groups of 1st-order analysis, providing a more theoretical level of the analysis. The last part of the data structure is the "aggregate dimensions", which is the distillation of the 2nd-order themes. Glaser and Strauss (1967) use the word "theoretical saturation" to describe a concept where analysing more data does not manipulate the concept further. These concepts are collected in the "aggregate dimensions" field of the data structure model. The number of 1st-order analysis terms could be overwhelmingly high; therefore, Figure 4.2. only displays some examples of data collected in my research.

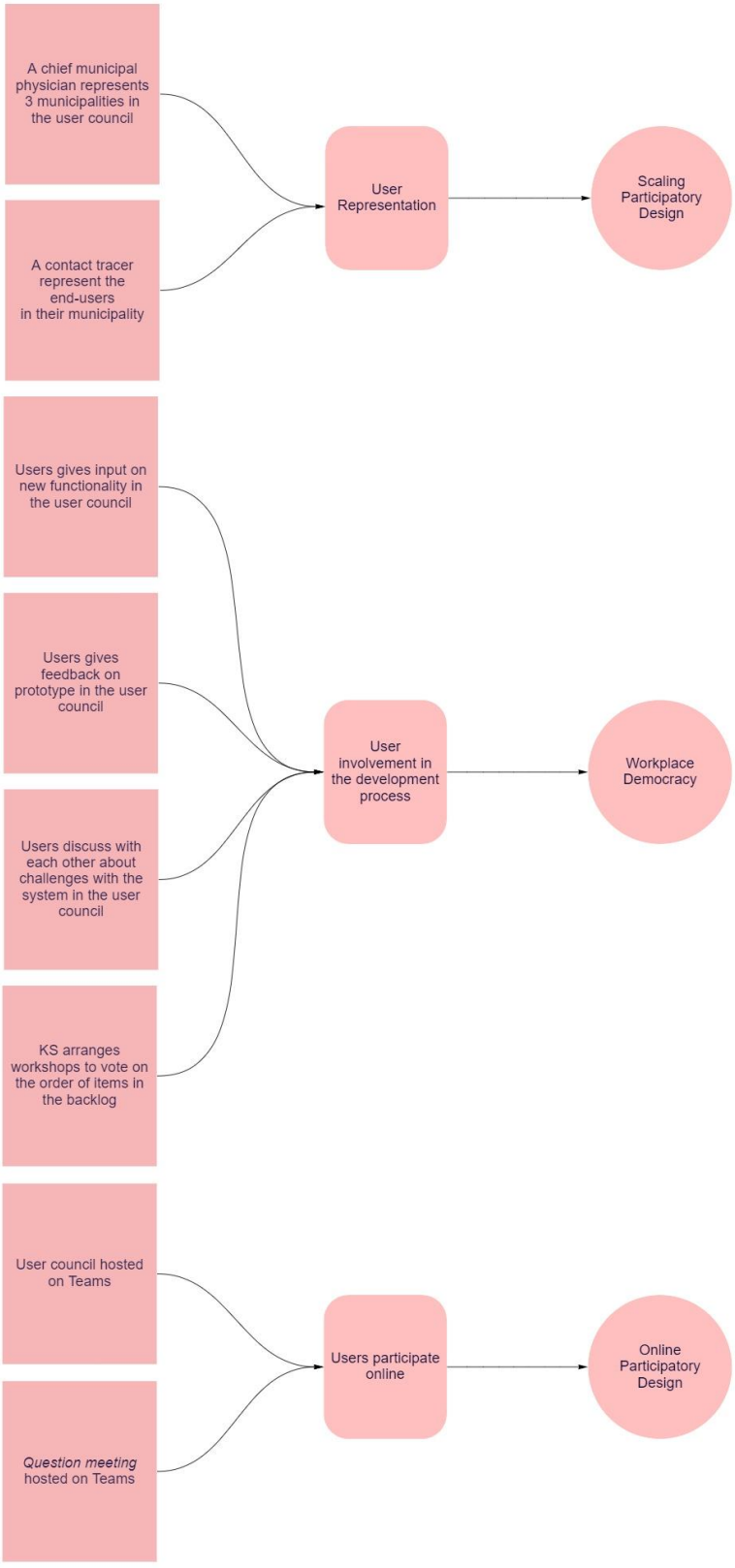

Figure 4.2 Data structure

4.5 Reflections and limitations

The choice of data collection methods was influenced by the possibilities and constraints regarding accessing relevant people, meetings, and workplaces. The conditions of the pandemic influenced these decisions; however, the constraints also gave an insight into how the intrinsical situation was, i.e., how chaotic the situation was with constantly changing infection control measures and how busy the contact tracers were. Alternatively, if the case study was performed in the aftermath of the pandemic, counting on the people being studied recalling the circumstances of the pandemic could have affected the results, possibly leading them to be less accurate, even with an immense amount of data collected.

A choice that may have enabled inaccuracy in understanding how the participation took place at the contact tracers was interviewing only contact tracers that were a part of the user council. As a result, these users could have a shared impression of the participation that is not necessarily reflected in the other end-users, not a part of the user council. This could impact the validity of the findings on how the participation is understood and how the end-users are represented in the user council.

As the infection control measures constrained the possibility of conducting physical interviews, online video communication tools were used for a synchronous interview. An advantage of conducting interviews online may be that it may have been easier to say yes to participating in the interview. In addition, it allowed the interviewees to stay located and comfortable in their office, and the time they set aside for the interview was limited to the actual interview.

Cater (2011) presents the obstacle with online video interviews: observing the interviewee's body language is hard to read when only a "headshot" is provided from the webcam. It is also hard to grasp the nature of the participant's surroundings, which can weaken the scope of the overall impression that may be desired to get through the interview. Other co-workers, i.e., may also be present in the same room as the participant without the interviewer knowing, which can create a barrier for the participant to speak freely or answer questions correctly. However, the distance created from the screens between the interviewer and participant may also create a safer setting where the participant feels more at home and speaks more freely. The advantage of saving time by eliminating the time around the interview, such as showing the interviewer in or serving a cup of coffee, can, however, also

eliminate small talk before the interview. Easing into the conversation can help remove tension and nervousness, increasing the participant's likelihood of providing truthful and valuable information during the interview.

Another constraint in collecting data during a pandemic was accessing relevant participants. As the infection pressure increased, the contact tracers and the product owner's employees became increasingly busy. It is reasonable to believe that they had less time to donate their valuable time to a student writing a master thesis. The time it took to get in touch with relevant people, and to arrange interviews, was affected by this. It was also harder to physically access a contact tracing team for observation and interviewing.

It is probable that if the number of interviews and observations had been greater and included participants from different municipalities, with various backgrounds, and end users not participating in the user council. However, as a joint decision with the master's thesis supervisors, the case study was conducted in a more reserved frame of mind to prevent contact tracers and the developers of Fiks contact tracing from their work combating this pandemic.

It is also noteworthy that the role of the researcher, as in my case, being a master's student, may affect the scope of access to relevant people, the type of data as well as the body of the data. The data provided during an interview, for example, differs depending on whether the participant is talking to someone working in the same field, has a professor title or is a master's student. Additionally, it is also possible that the participant being interviewed would have introduced or provided contact information to other relevant people; however, in this case, they might have thought that these contacts were too busy to entertain a master's student.

Chapter 5 Findings

With contact tracing being such a central part of the strategy of managing the COVID-19 pandemic in Norway, there was a lot of pressure on quality, quick deliveries, and especially creating the solutions that satisfied the users' needs. The pandemic created a situation that posed other challenges than had previously been the case in the digitalisation of public services. There was suddenly a need to develop new laws and impose responsibilities on different sections of society. Infection control measures were constantly changing, making it difficult to keep up with the latest rules, not only for citizens but also for those responsible for ensuring that the rules were followed, such as contact tracers and even government leaders. Developing a solution and arranging user participation in these conditions presented many challenges.

In the following subchapter, I will go into more detail on how the Fiks contact tracing system is structured and the main features of the system by March 2022. Then, in 5.2, I present the key stakeholders relevant to the study's findings. In 5.3, I describe how Fiks contact tracing is developed. In the last subchapters, I present my findings on how user participation is arranged in Fiks contact tracing.

5.1 Stakeholders

I now want to present the relevant stakeholders to the study of Fiks contact tracing, stakeholders from both local and national health authorities, and a third party, the product owner (KS).

Contact Tracer

The primary user of Fiks contact tracing system uses the system for logging and structuring the gathered information about the confirmed infected and the close contacts of the infected. Contact tracers' backgrounds vary, from non-qualified health workers to physiotherapists, nurses, social workers, and nurses with special training in infection control.

Municipal Chief Physician

The municipal chief physician is a function often shared between multiple general practitioners in the municipalities. It is the municipal chief physicians' responsibility to manage the infection control work in the municipality, and they are advisers to the municipality's management, personnel, and the population. Multiple municipalities can share a municipal chief physician according to size and need.

KS

The Norwegian Association of Local and Regional Authorities (KS) is an organisation for all local governments in Norway. It is the country's largest public employer organisation, where all municipalities and county municipalities are members. The focus of KS is on an efficient and independent municipal sector that meets the needs of the inhabitants (*KS*, n.d.-a).

HISP

Health Information Systems Programme (HISP) is a global movement that supports DHIS2 implementation, local customization and configuration, in-country and regional training, and the promotion of DHIS2 as a global public good (*HISP*, n.d.). The HISP program at the University of Oslo helps KS develop the Fiks contact tracing solution (*KS*, 2022).

NIPH

The Norwegian Institute of Public Health (NIPH) is a consultative organisation. The three main tasks of NIPH are to provide knowledge, emergency preparedness, and infrastructure to protect lives and improve the entire population's health. These national tasks also involve the area of infection control. NIPH manages two databases from MSIS, the MSIS register database and the MSIS lab database (*Folkehelseinstituttet*, 2018). MSIS register database contains positive tests of notifiable diseases, while the MSIS lab database contains all lab

results, but for the time being, only lab results related to COVID-19 (*Folkehelseinstituttet*, n.d.).

MSIS

The Norwegian Surveillance System for Communicable Diseases (MSIS) is a statutory health register for monitoring infectious diseases in humans in Norway through continuous and systematic collection, analysis, and reporting of the incidence of contagious diseases. Therefore, it is possible to retrieve data regarding every notifiable disease from 1977 to today. Furthermore, in the context of COVID-19, MSIS will disseminate all COVID-19 related lab results to the national core journal, which is located and can be retrieved by patients and health care professionals at the national health portal, Helsenorge (*Folkehelseinstituttet*, n.d.).

5.2 Development of Fiks contact tracing System

KS was the actor initiating the creation of a joint solution for contact tracing in the municipal sector. Because of the time-critical restraints, the emphasis was placed on implementing minimum requirements for a standard solution without compromising quality. This aligns with the development technique that the Fiks platform already had been using, called MVP (Minimum Viable Product). Using the MVP technique in projects enables the development team to get feedback and input from users and the client as early as possible in the development process. As soon as minor changes or features are developed, they should be made available to users instead of collecting many changes and launching them all in one upgrade. This technique allows a team to collect the maximum amount of validated learning about customers with the least effort (Ries, 2011).

The Fiks platform has an agile development approach, using the tool Kanban to visualise prioritisation and keep track of and control tasks that shall be delivered (*KS*, 2020b).

Fiks have established a user council for each platform's services, which also applies to Fiks contact tracing. The user council was established early in the development process to facilitate user participation (*KS*, 2020b).

5.2.1 Implementation of Fiks contact tracing System

When the pandemic hit Norway, one of the first municipalities that implemented Fiks contact tracing used spreadsheets, which were both cumbersome and fragile, as an emergency solution in anticipation of a better solution. The infection control team contacted the municipality's digitisation team, which quickly began to evaluate different solutions for contact tracing. Fiks contact tracing was chosen, and municipalities did a risk and vulnerability analysis, and an assessment of the privacy consequences were performed (*Asker kommune*, 2021).

The Fiks contact tracing pilot was implemented in three municipalities in mid-May 2020. The first municipalities that implemented Fiks contact tracing, while at this time was practically a beta program, not fully developed, also encountered bugs and issues with the system. The municipalities then needed to contact the support team in Fiks contact tracing to correct mistakes in registrations and expenses. With this frequent communication, a need for a user council was discovered to facilitate discussion and feedback from the users to the organisation. Through the user council and a close dialogue with the system developers of Fiks, new functionality is developed and implemented simultaneously based on the municipalities' needs.

After the three municipalities implemented Fiks contact tracing, other municipalities quickly implemented the solution. Today, in May 2022, 149 municipalities use the Fiks contact tracing solution to trace contacts.

When the pandemic hit Norway, a large municipality created their own contact tracing solution. However, when the infection rate increased rapidly, they needed a more streamlined solution, which they expressed they had not been able to develop on their own. In addition, some functionality Fiks had integrated, such as digital cross-municipal collaboration, was also lacking in their local solution. They later implemented Fiks contact tracing in April 2021 (*Bærum Kommune*, 2021).

All municipalities have access to Fiks. The annual cost for each municipality is NOK 10,000 and NOK 2 per inhabitant. The price is related to the operation and management of Fiks contact tracing, and the cost is distributed in the same way as for other digital shared services provided by KS (*KS*, 2020b). When the self-registration of self-tests service in Fiks contact tracing was launched, more than 70 municipalities implemented the service within two weeks (*KS*, 2022)

5.2.2 Usage of Fiks contact tracing System

In a municipality, the contact tracers use Fiks for registering index cases, close contacts, and clusters of infections. In addition to this, the contact tracers use Fiks to communicate between shifts and between contact tracers and the municipal chief physicians.

The contact tracing team assigns a responsible contact tracer to add information and messages on the Fiks Dashboard. The contact tracers register index cases in Fiks, and afterwards, they fill out a form about the index case they give to the dashboard manager. The dashboard manager then updates the numbers, for example, the number of infected in a specific school. The dashboard manager could also make notes in the dashboard on particular cases that the later shift should be aware of. The data on the dashboard is an aid for communication between contact tracers and making the numbers easily available for the municipal doctor.

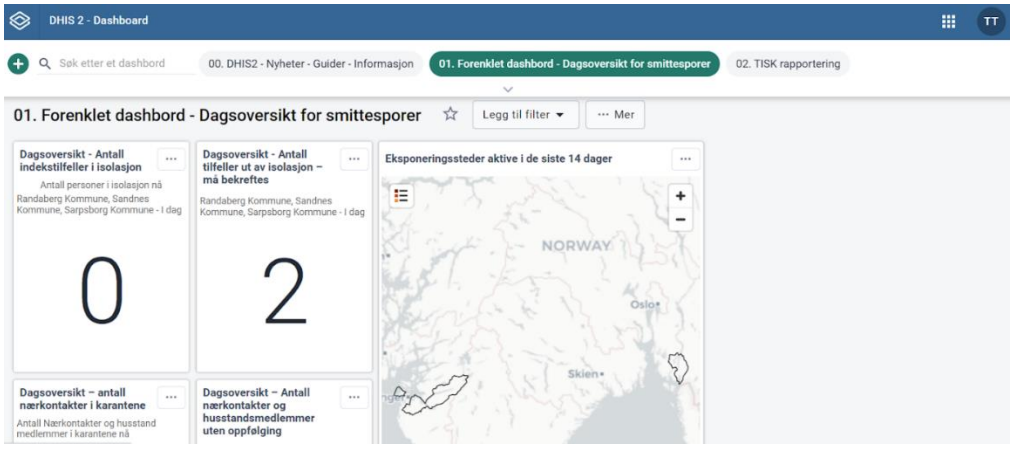

Figure 5.1. Screenshot of the simplified dashboard (Source: *KS*, 2022b).

Figure 5.1 displays an example of a simplified dashboard on the Fiks contact tracing system. The dashboard contains different customisable modules with grouping important overviews of information and statistics.

Another form of communication is arranged as a physical meeting when the shifts overlap to exchange information. The contact tracing team in a municipality expressed that this communication between shifts is essential for keeping the shifts updated about the necessary changes both within the contact tracing team or possible new infection control rules so that work is not duplicated and that every case is adequately followed upon.

At the end of the day, a report is sent to the chief physician. This report contains all the numbers of today's cases, for instance, how many index cases are fully vaccinated, how many and which schools and workplaces are affected or other clusters (*KS*, 2022b).

5.3 User Participation in Fiks contact tracing

With COVID-19, the physical distance became greater, but the digital distance decreased dramatically. When everyone is forced to meet digitally, new possibilities arise as obstacles regarding travel and access are removed. Meetings that previously were limited by room capacity, access to buildings and long travels for some participants now only needed an electronic invitation to whoever was relevant to participate in the meeting. This technology already existed long before COVID-19 made its entry, but its intensive use during COVID-19 opened opportunities, as in this case, *digitally user participation*.

As the user group of Fiks contact tracing is heterogeneous, spread all over the country, with different contact tracing practices and infection pressure in the municipality, the user needs vary greatly. And from the different cultures and history of how contact tracing was done in the different municipalities, different local practices of using the Fiks system emerged. While in some municipalities, the dashboard feature was an essential part of the contact tracing process, other municipalities did not use this feature as much or not at all. Therefore, the various practices resulted in various feedback from the different municipalities at the user councils, and the representatives wanted to get through with their wishes and needs for their municipality. It was not always obvious which feature to prioritise and which problems were most important to fix.

While some more experienced contact tracers are invited to participate in the development of the Fiks contact tracing system, the rest of the contact tracing team is invited to participate in the *question-meeting* if they have specific questions regarding the system.

5.3.1 Participation in the User Council

The user council constitutes a vital role in developing national solutions on the Fiks platform. User councils are generally hosted bi-weekly by KS. The user council was already well established at the services *Digisos* and *SvarUT* services located on the Fiks platform. Hence it was a natural step to develop this in Fiks contact tracing. The user council takes place on the digital communication platform Microsoft Teams.

A representative or a group of representatives is attending the user council on behalf of a municipality. Contact tracers not participating in the user council may register problems as they occur to their user council representative. The representative is usually a contact tracer experienced with the Fiks platform, who is chosen within each municipality.

To become a representative on the user council, you must submit an application to KS, which is either approved and invited to join the user council or rejected. Experienced or active contact tracers who comprehend the system can be approved. KS wants representatives with different backgrounds to get an overview of the different municipalities, which can be small or large and have high or low infection rates. Small municipalities have sometimes joined forces to send a representative to represent several municipalities.

A user council chair represents KS and Fiks contact tracing. Their task varies based on the state of the development of the solution. When system upgrades or new features are implemented, the user council chair presents this, and the council representatives are welcome to express their thoughts and opinions on it. When this council segment is finished, or if there are no updates to the solution, the next segment starts.

KS maintains a backlog of what is yet to be implemented. Sometimes it is clear what should be prioritised. However, other times KS needs input from the users in the municipalities on what is most needed. The user council chair then presents a list of tasks, and a vote is being made by all the representatives in the council, rating the tasks in the

backlog with priority points. The task with the most points is put first in the priority queue, followed by the task with the second most points. According to a representative from a medium-sized municipality, these polls usually result in a consensus among municipalities, large and small, on which items in the backlog deserve to be prioritised or not. A person who has chaired the user council on several occasions confirmed this, adding that the representatives were usually pleased with the outcome.

KS also uses input from the representatives about new functions or upgrades that need to be implemented in the solution. The chair of the council then establishes a room to discuss various issues and wishes for adjustments to the system. The representatives can raise their hands virtually and communicate their wishes or challenges to the solution. The other representatives can then express their agreement or disagreement. If the user council agrees on a topic, the user council chair includes this into the prioritisation plan.

The feedback given in the user councils is very likely to be reflected in later upgrades of the system because KS uses the input from the representatives to develop a solution that best suits most of the users. For example, sometimes KS wants to test a new feature on Fiks contact tracing that has been developed or is in development. The council then tries demos of the new or upgraded system parts in their municipality and gives feedback on this in the user council.

In addition to the user council chair, one or two people involved in Fiks development are members of the user council. These developers add technical depth to the discussions by offering opinions on whether the requests are feasible and, if so, how many resources are required to implement them.

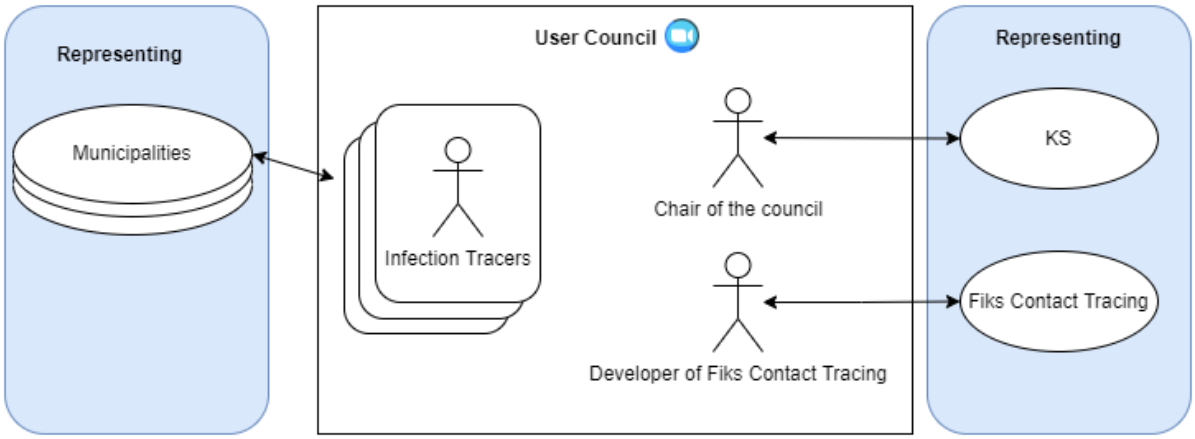

Figure 5.2. A simplified model of the structure of the User Council

Ahead of the user council, some municipalities communicate with each other, discussing issues and topics of interest. The representatives may send an email to the chair of the council with requested topics, which KS considers when setting the agenda for the user council.

On asking users in a contact tracing team if they had received approval for improvements or new service ideas expressed in the user council, users mentioned several suggestions that had been implemented and challenges taken seriously and improved later upgrades. Participants in the *question-meeting* also expressed that wishes for upgrades had been reflected in the solution afterwards.

The interviewees mentioned one such challenge. The Norwegian Directorate of Health asked KS to create an entry register, which is a list of everyone who arrives in Norway with quarantine obligations. When this service was launched, however, users in a contact tracing team expressed questions about some of the development team's decisions to develop specific services not required by municipalities rather than prioritising the development of other services. In addition, the contact tracing team in the municipalities did not have the resources to monitor every citizen arriving in Norway and therefore saw no need for this service.

5.3.2 Participation in the question-meeting

In addition to the user council, another meeting has been arranged bi-weekly throughout the pandemic, the *question-meeting*. The *question-meeting* is open to anyone using Fiks contact tracing, and there is a great rotation of participants.

If there are new upgrades to the solution, the chair of the *question-meeting* presents the new features and explains how they can be used. Other tips for the use of the system can also be presented. However, the purpose of the *question-meeting* is to answer any users' queries about the system. The participants then raise their hands virtually within the Microsoft Teams meeting and ask questions. Suppose some of the other participants, maybe from another municipality, can answer the question or have input on how to do certain tasks or avoid certain problems. In that case, they are welcome to share their experiences and tips.

The participants in the *question-meeting* are often contact tracers new to the system or have questions about certain functionality. And a large proportion of the participants are silent, not contributing to questions but observing and gaining knowledge about the system.

While the purpose of the *question-meeting* is for the participants to understand the solution's use better, the participants can also express opinions and propose suggestions for the solution. If KS is made aware of a challenge during this meeting that does not have a simple solution, it can be acknowledged and considered for future system upgrades.

The user council has a bidirectional information flow, and the *question-meeting* is more unidirectional, where the information flow is from KS to the users, not vice versa. However, there is still a possibility for the users to be heard and influence the development of Fiks contact tracing during the *question-meeting*.

5.3.3 Other channels for participation

Aside from the user council and the *question-meeting*, a few other communication channels were used to engage users in the design process. A Slack channel was set up for health professionals working on COVID-19 issues. Fiks contact tracing has been discussed in this channel in addition to experience sharing of the contact tracing work. In addition to this,

some municipality chief physicians also had direct communication with KS, discussing the development of Fiks contact tracing at the early stages.

Chapter 6 Analysis and Discussion

In this chapter, I analyse and discuss the findings through the lens of participatory design. First, I describe the challenges and the opportunities for user participation during the pandemic; then, I will thematically discuss how user participation was approached within these challenges and opportunities. Figure 6.1 lists the challenges and opportunities of participatory design during a pandemic and the responses of Fiks contact tracing to these.

In the previous chapter, we saw that participatory design during the development of Fiks contact tracing was carried out with the practice of the user council and the *question-meeting.* Both activities were performed with the adoption of online tools to facilitate participatory design principles, i.e., workshops, prototyping and discussions regarding the solution. Digital communication channels, such as Slack, were also utilised as an arena for participation.

The participatory design movement all started with the desire to facilitate *working life democracy* and increase *workplace democracy* (Gregory, 2003). With participatory design techniques involving key stakeholders in the design process, Fiks contact tracing increased the trust in the solution, and stakeholders had a reduced resistance to change in work practices (Bjørn-Andersen & Hedberg, 1977). The engagement of users in the development of Fiks contact tracing intends to create value both for the product owner, KS, and the end-users.

Most of the contact tracers in the COVID-19 pandemic had no previous knowledge or experience with contact tracing before Fiks contact tracing digitised the working routines. As a result, the work practice of contact tracing *changed,* while the practice of digital contact tracing was *introduced.* In contrast to a more traditional participatory design project, when the design process entails changes in work habits, there may be less risk of resistance to change. Workers may become fearful of losing their job when digitised tools replace former work practices. As many people were hired and the existing contact tracing practices were insufficient for the volume of contact tracing required, the workers did not fear losing their job. Furthermore, because it was the contact tracers who initiated a digital solution, performing traditional participatory design may have been easier than in a more traditional participatory design project. Gundersen et al. (2021) describe the digitalisation of contact tracing as a digital transformation creating a new institution, the digital contact tracing

institution. New and old practices must be merged while creating a new institution Gundersen et al. (2021). The contact tracers were continually replaced, and there was little time to teach each new user in the system due to the intense pressure on the contact tracers to execute contact tracing quickly. This emphasises the significance of creating a user-friendly solution that eliminates the need for extensive training of new users.

Nonetheless, because Fiks contact tracing was continually changing and improving, slight modifications to work practices were common. Furthermore, as the national contact tracing guidelines changed, the work procedures also altered. Contact tracers had to be adaptable because of the constant changes to the work practices. It also emphasised the necessity of Fiks contact tracing's usability so that contact tracers may concentrate on their task rather than fumbling with the solution.

Challenges and opportunities	**Responses**
Time pressure Co-location not possible Constantly changing work practices and contact tracing guidelines Busy end-users with little time for participation Heterogeneous user group Representatives representing every end-user in the municipality	Online participatory design Power users representing end-users in the user council Improvisation using digital tools Voting on the importance of items in the backlog Possibility to participate in the *question-meeting*

Figure 6.1. Challenges and responses to participatory design principles

6.1 Challenges and opportunities - Pandemic constraints for participatory design

Developing a solution with the constraints of the pandemic posed challenges in various areas. First, it was critical to streamlining the contact tracing process, not just for the contact tracers but also for the residents of the municipalities. Due to the time constraints, KS decided to release the solution as a beta product, an MVP, entrusting users with some of the responsibility of finding flaws in the system. On the other hand, this MVP development technique provided a unique opportunity to test the system on many real users while also learning how to improve the solution to meet the users' needs.

The pandemic created an illusion of a more extensive user base because of the heterogeneity and distributed location of the users. With the pandemic and the infection control measures, it was not feasible for the developers of Fiks contact tracing to visit the end-users on-site and facilitate co-location participation. Moreover, with the user groups growing and spreading all over the country, co-location participation with a large part of the user group would not have been possible even without the constraints of the pandemic. This situation, concerning the difficulties of physical participation, resembles the case of participation in a large-scale information system.

Obendorf et al. (2009) state that many of the traditional participatory design approach methods depend on the possibility of immediate negotiation, making it difficult to follow when co-location and shared work contexts are no longer given to participating users. Fiks contact tracing's architecture has gradually become more complex, including the implementation of integrations. The pandemic created an impossible scenario for conducting traditional participatory design methods dependent on co-location, which has been a challenge in scaling the traditional participatory design methods (Dahl-Jørgensen & Parmiggiani, 2020; Roland et al., 2017).

With the colossal infection pressure, as it sometimes was, the workload was massive, and the turnover of contact tracers was high. Meetings and conversations between the power users and the end-users could be difficult to perform in practice due to the immense workload. It would also prove challenging to prioritise participating in the user involvement hosted by KS because the contact tracing teams needed all hands on deck in the contact tracing work. Suppose the representatives in the user council managed to participate in the

user council. In that case, it is no guarantee the needs of all end-users in their municipality were represented, as the communication in these stressful times might have been lacking. If the communication between the representative and the users they are representing is poor, their influence on the system may not be as rewarding as it could have been (Curtis et al., 1988).

There is also a question of whether contact tracers having less experience and who knew that this was a temporary job had the motivation for participating or expressing their opinions regarding the system.

6.2 Approaches to participatory design during the pandemic

In this subchapter, I will present how the arena of digital participation and user representation facilitated modifications of the traditional participatory design in the development of Fiks contact tracing.

Online participation arenas

To continue the support and empowerment of users in shaping the direction of Fiks contact tracing, KS had to make considerations beyond traditional participatory design (McNally et al., 2017). As the focus of the user councils has not been to follow the participatory design approach, they have nevertheless borrowed many principles from the approach.

KS benefited from digital video communication to enable participation with the distributed and heterogeneous user group. Presenting prototypes, allowing municipalities to test out demos, providing feedback, and enabling a vote session on the relevance of items on the backlog contribute to the participatory design ideals of integrating stakeholders in the design process and decision-making.

The digital modification of the traditional participation techniques, which often require co-location, made participation possible in this new arena. The user councils served as a digitised version of a workshop from the traditional participatory design method.

User representation

The municipalities KS employed user representation to facilitate user participation among the heterogeneous users. Both in the sense of representatives for end-users in the user council and municipalities acting as representatives for other municipal units. The representatives in the user council attain the power of influence to form the design and further development of the system, with the intention that they will convey the wishes to their municipality. Because municipalities are autonomous and have the freedom to choose the contact tracing solution that best suits their needs, Fiks contact tracing competes with other alternative solutions. This freedom of choice, together with the user involvement in the development of Fiks contact tracing, supports the values of democratisation of the municipalities and their contact tracers.

Roland et al. (2017) categorise a type of users as "power users", representing end-users in meetings and workshops, shifting the power to influence from the end-users, as in traditional participatory design, to a cadre of design mediators (Roland et al., 2017). The representatives in the user council share many similarities with Roland et al.'s description of power users. However, a power shift is made from end-users in the municipalities to the representatives, in contrast to the traditional participatory approach, which focuses on the equalisation of power relations between end-users and experts of the system. Therefore, in the rest of this chapter, I will refer to the representatives in the user council as power users.

Digitising traditional participatory design methods in the user council enabled KS to learn about the users and the user needs. Through digital workshops, KS received feedback on prototypes, gained insight into the users' needs and empowered the users to participate in the decision making by voting on the prioritisation of the backlog's items.

Even though the *question-meeting* initially was meant as a help desk, where the end-users could receive help from the product owner or other users, this became an arena for participation. The user council's main purpose is for the product owner to retrieve information about the user's needs and include the representatives in the decision-making processes. In the *question-meeting,* the product owner does not include the users in the decision-making processes as prominent as in the user council. However, the product owner is open to input from the users in the *question-meeting;* these inputs have on multiple occasions been considered or added to the backlog of items to implement or improve.

In the RHINO workshop, involving key stakeholders in the design process was justified with, "information experts without involving key stakeholders usually fail to reflect

the needs and practical reality of service providers and managers and does not encourage the ownership of systems" (Braa et al., 2004; *RHINO*, 2002). Although a large proportion of the end-users never took part in the *question-meeting*, giving the users the option of participating in design and decision-making activities supports the efforts of working life democracy (Gregory, 2003), increasing the trust in the system and reducing the resistance to change.

Norwegian municipalities are users of the health platform Fiks, and the quality of their user participation performance is shaped by the municipalities' experts' views on participation (Dahl-Jørgensen & Parmiggiani, 2020). The representatives in the user councils play a central role in eliciting requirements. It is crucial that they feel that sufficient resources have been allocated to involve the users as well as recognise the value of user participation to achieve the participation of the citizens (Dahl-Jørgensen & Parmiggiani, 2020; Roland et al., 2017). The required effort of being approved as a representative in the user council demands motivation beyond the contact tracing work to enhance the solution. Kensing and Blomberg (1998) emphasise the importance of clear motivations for participation, the scope of participation and the resources allocated. It is feasible to assume that the representatives share a motivation for fulfilling the needs of the municipality they represent. By participating and improving the solution, they (hopefully) participate in making their own and others' working situation better, i.e., be more efficient, time-saving and painless etc.

To provide a good representation of the municipality and express the correct user needs, the power users need to comprehend the challenges the contact tracers in the municipality may experience with the system. Therefore, communication between the power user and the other end-users needs to be adequate and concrete (Curtis et al., 1988). Furthermore, as Kensing and Blomberg (1998) state, the relations between those taking an active part in the project's development and those who do not should be considered and attended to throughout the project.

Power users in the municipalities understand and appreciate the value of participation. This is consistent with Dahl-Jørgensen and Parmiggiani's (2020) findings, who claim that the users' perception of participation influences the quality of how participation is shaped. One possible explanation is that the users' experiences with issues expressed in user councils have been taken seriously and reflected in subsequent system upgrades. This supports the democratic values of participatory design: members of an organisation have the right to participate in decision-making that affects their work. Furthermore, the democratisation of

practices and equalisation of power relations has increased the trust of the developers of the solution and reduced the resistance to change in work practices (Bjørn-Andersen & Hedberg, 1977).

Chapter 7 Conclusion

The research reported in this thesis has focused on answering the research question: *How can we support participatory design during a pandemic?* Contact tracing is an essential part of the strategy to contain the pandemic. During the pandemic, the digital transformation of the contact tracing work has streamlined the work of the contact tracers, providing a faster contact tracing process for the affected residents in the municipalities.

As mentioned in the introduction, I identified three main characteristics that challenged user participation during the pandemic. First, the scale of the system resulted in a heterogeneity of the user base. Secondly, time pressure in developing a working solution. And lastly, co-location of participation was impossible to conduct due to the infection control measures. Therefore, the short answer to my research question is that using online arenas for user involvement and creating structures that allow for a decentralised user representation can support participatory design during a pandemic.

In this thesis, I have argued that many of the methods for user involvement in developing Fiks contact tracing support the participatory design principles. However, is the user participation in Fiks contact tracing actually participatory design? The participatory design principles emphasise the value of involving the key stakeholders in the design processes. For example, the user councils have been an arena for participation among the power users of Fiks contact tracing, which can be recognised as the key stakeholders of the solution. In addition, digital video communication tools have served as a tool for hosting workshops and may also have bridged the gap between municipalities of different sizes and locations, facilitating all of them to participate.

While participatory design is a design approach, it also has a political and organisational agenda focused on enabling *workplace democracy*. Through this research, KS' intention of the user council and the *question-meeting*, beyond the purpose of creating a solution that satisfies the users' needs, remains unclear. Nonetheless, results from my study show that user participation is used to improve the usability of Fiks contact tracing to create a better work practice. Furthermore, encouraging the user council's power users to vote on the importance of items in the backlog promotes the values of workplace democracy by allowing the end-users to participate in decision-making processes.

As challenges regarding the scale of the system share similarities with challenges created by the pandemic, responses to enabling participatory design techniques in the context of the pandemic also enable participatory design in complex and large-scale information systems. In addition, some of the challenges of enabling participatory design during a pandemic also pose opportunities to digitise participatory design methods that earlier would require co-location.

With increasing globalisation, it is reasonable to expect the number and scope of large-scale information systems to grow, with employees and users all over the globe. Enabling the principles of traditional participatory design in a large-scale setting but performing the participatory design methods online allows more users to be involved in the design processes. In addition, due to the pandemic, people are becoming accustomed to a work environment where meetings and communication occur online, which can lower the barriers to users participating online.

User representation was a response to capturing the complexity and heterogeneity of the user base across municipalities without involving a more significant portion of the end-users. As a result, KS delegated responsibility for gathering end-user requirements to power users. This information cascade about the users' needs enabled KS to perform participatory design methods. However, delegating the responsibility of passing on the users' needs to the power users increases the risk of users' needs not being captured or lost in translation.

The collected data only represents the impressions of people being a part of the user council, so whether the power users actually represented the end-users' needs has not been investigated in my research but is a topic that should be followed up. It would have been beneficial to collect more data on users from various backgrounds, gathering a more nuanced overview of how the participation was performed from multiple angles. Collecting data from numerous users, including those who are not members of the user council, would aid in the investigation of whether user participation has improved workplace democracy for users and, if so, how. It would also be interesting to dig deeper into KS' intention for user participation beyond satisfying the users' needs in the development of Fiks contact tracing.

The findings of this study show that digitising the participatory design methods and facilitating user representation can enable participatory design within a large-scale information system. However, the level of interaction in online sessions is not as high as in traditional participatory design methods. Extensive studies on online expressions of

participatory design, which allow for more interactive participation within the digital frames, can open many new possibilities for user participation in large-scale information systems. The challenge of travel restrictions due to the pandemic is a passing concern for some. For others, however, travelling to participate is a constant challenge. Online participatory design allows users who are difficult to reach, such as marginalised groups or people with chronic illnesses who live far away or have other limitations, to participate in traditional participatory design methods.

Bibliography

Asaro, P. M. (2000). Transforming society by transforming technology: The science and politics of participatory design. *Accounting, Management and Information Technologies*, *10*(4), 257–290. https://doi.org/10.1016/S0959-8022(00)00004-7

Asker kommune. (2021). Smittesporing i kommunene. https://www.asker.kommune.no/om-asker-kommune/innovasjon-og-digitalisering/smittesporing-i-kommunene/

Bærum Kommune. (2021). Fra egenutviklet løsning til nasjonal fellesløsning. https://www.ks.no/fagomrader/digitalisering/felleslosninger/fiks-smittesporing/fra-egenutviklet-losning-til-nasjonal-felleslosning/

Bahus, M. K. (2020). Smittesporing. In *Store norske leksikon*. http://snl.no/smittesporing

Baldwin, C. Y., & Clark, K. B. (2006). The architecture of participation: Does code architecture mitigate free riding in the open source development model? *Management Science*, *52*(7), 1116–1127.

Barki, H., & Hartwick, J. (1994). Measuring user participation, user involvement, and user attitude. *MIS Quarterly*, 59–82.

Baroudi, J. J., Olson, M. H., & Ives, B. (1986). An empirical study of the impact of user involvement on system usage and information satisfaction. *Communications of the ACM*, *29*(3), 232–238.

Baxter, G., & Sommerville, I. (2011). Socio-technical systems: From design methods to systems engineering. *Interacting with Computers*, *23*(1), 4–17. https://doi.org/10.1016/j.intcom.2010.07.003

Bjerknes, G., & Bratteteig, T. (1995). User participation and democracy: A discussion of Scandinavian research on system development. *Scandinavian Journal of Information Systems*, *7*(1), 1.

Bjørn-Andersen, N., & Hedberg, B. (1977). Designing information systems in an organizational perspective. *TIMS Studies in the Management Sciences*, *5*(1977), 125–142.

Bødker, S. (1994). Creating conditions for participation: Conflicts and resources in systems design. *DAIMI Report Series*, *479*.

Bonina, C., Koskinen, K., Eaton, B., & Gawer, A. (2021). Digital platforms for development: Foundations and research agenda. *Information Systems Journal*, *31*(6), 869–902.

Braa, J., Titlestad, O. H., & Sæbø, J. (2004). Participatory health information systems development in Cuba: The challenge of addressing multiple levels in a centralized setting. *Proceedings of the Eighth Conference on Participatory Design: Artful Integration: Interweaving Media, Materials and Practices-Volume 1*, 53–64.

Brown, M. S. (2014). Transforming unstructured data into useful information. In *Big Data, Mining, and Analytics: Components of Strategic Decision Making*. Taylor & Francis.

Cater, J. K. (2011). Skype a cost-effective method for qualitative research. *Rehabilitation Counselors & Educators Journal*, *4*(2), 3.

Chasanidou, D. (2018). *User participation in innovation platforms: Empirical studies and a tool to design for motivation*.

Crang, M., & Cook, I. (2007). *Doing ethnographies*. Sage.

Crowe, S., Cresswell, K., Robertson, A., Huby, G., Avery, A., & Sheikh, A. (2011). The case study approach. *BMC Medical Research Methodology*, *11*(1), 1–9.

Cusumano, M. A., Gawer, A., & Yoffie, D. B. (2019). *The business of platforms: Strategy in the age of digital competition, innovation, and power*. Harper Business New York.

Dahl-Jørgensen, T. C., & Parmiggiani, E. (2020). Platformization of the public sector: Assessing the space of possibility for participation. *PDC'20: Participatory Design Conference 2020-Participation Otherwise*.

De Reuver, M., Sørensen, C., & Basole, R. C. (2018). The digital platform: A research agenda. *Journal of Information Technology*, *33*(2), 124–135.

Dehnavieh, R., Haghdoost, A., Khosravi, A., Hoseinabadi, F., Rahimi, H., Poursheikhali, A., Khajehpour, N., Khajeh, Z., Mirshekari, N., & Hasani, M. (2019). The District Health Information System (DHIS2): A literature review and meta-synthesis of its strengths and operational challenges based on the experiences of 11 countries. *Health Information Management Journal*, *48*(2), 62–75.

Dey, I. (2003). *Qualitative data analysis: A user friendly guide for social scientists*. Routledge.

DHIS2. (2019). https://docs.dhis2.org/archive/en/2.28/developer/html/techarch_presentation_layer.html

DHIS2. (2022). DHIS2. https://dhis2.org/about/

Emery, F. E., & Thorsrud, E. (2013). *Form and content in industrial democracy: Some experiences from Norway and other European countries*. Routledge.

Emery, F. E., Thorsrud, E., Engelstad, P. H., Gulowsen, J., & Qale, T. (1976). *Democracy at work: The report of the Norwegian industrial democracy program* (Vol. 2). Springer.

Farshchian, B. A., Grisot, M., Hochwarter, S., Sigríður Islind, A., Mikalsen, M., Parmiggiani, E., & Vassilakopoulou, P. (2021). Platform-Supported Cooperative Work. *Proceedings of 19th European Conference on Computer-Supported Cooperative Work*.

Floyd, C., Mehl, W.-M., Resin, F.-M., Schmidt, G., & Wolf, G. (1989). Out of Scandinavia: Alternative approaches to software design and system development. *Human–Computer Interaction*, *4*(4), 253–350.

Folkehelseinstituttet. (n.d.). Meldingssystem for smittsomme sykdommer (MSIS). Retrieved 12 May 2022, from https://www.fhi.no/hn/helseregistre-og-registre/msis/

Folkehelseinstituttet. (2018). Folkehelseinstituttet. https://www.fhi.no/om/fhi/

Folkehelseinstituttet. (2022). *Om koronatest*. https://www.fhi.no/nettpub/coronavirus/testing/om-koronatest/

Gioia, D. A., Corley, K. G., & Hamilton, A. L. (2013). Seeking qualitative rigor in inductive research: Notes on the Gioia methodology. *Organizational Research Methods*, *16*(1), 15–31.

Gregory, J. (2003). Scandinavian approaches to participatory design. *International Journal of Engineering Education*, *19*(1), 62–74.

Grønbæk, K., Kyng, M., & Mogensen, P. (1997). Toward a cooperative experimental system development approach. *Computers and Design in Context*, 201–238.

Guba, E. G. (1990). The paradigm dialog. *Alternative Paradigms Conference, Mar, 1989, Indiana U, School of Education, San Francisco, CA, US*.

Gumm, D. C. (2006). Distributed participatory design: An inherent paradoxon. *Proceedings of IRIS29*, 1–17.

Gundersen, R. B., Dynestøl, E. B., Nielsen, P., Sæbø, J. I., Thorseng, A. A., Ulshagen, A., & Utvik, V. A. (2020). Digital Transformation under a pandemic: A case study of Covid-19 contact tracing in Norway. *NOKOBIT-Norsk Konferanse for Organisasjoners Bruk Av Informasjonsteknologi*, *28*(1).

Gundersen, R. B., Utvik, V. A., Thorseng, A. A., Sæbø, J. I., & Nielsen, P. (2021). *AN INSTITUTIONAL ANALYSIS OF DIGITAL TRANSFOR-MATION OF COVID-19 CONTACT TRACING DURING A PANDEMIC*.

Gustafsson, J. (2017). *Single case studies vs. multiple case studies: A comparative study*.

Gustavsen, B., & Engelstad, P. H. (1986). The design of conferences and the evolving role of democratic dialogue in changing working life. *Human Relations*, *39*(2), 101–116.

Hartson, R., & Pyla, P. S. (2018). *The UX book: Agile UX design for a quality user experience*. Morgan Kaufmann.

Helsedirektoratet. (n.d.). Retrieved 12 May 2022, from https://www.helsedirektoratet.no/tema/beredskap-og-krisehandtering/koronavirus/anbefalinger-og-beslutninger/Endring%20i%20rutiner%20for%20bekreftende%20PCR-test%20og%20selvregistrering%20av%20positiv%20selvtest.pdf/_/attachment/inline/e74e39b3-5993-4e8c-8c76-6df834f84aab:5adca5af69754716f27b32ac102b76f3bcdf2749/Endring%20i%20rutiner%20for%20bekreftende%20PCR-test%20og%20selvregistrering%20av%20positiv%20selvtest.pdf

Hirschheim, R. A. (1985). User experience with and assessment of participative systems design. *Mis Quarterly*, 295–304.

HISP. (n.d.). HISP Centre. Retrieved 12 May 2022, from https://www.mn.uio.no/hisp/english/index.html

Hochwarter, S., & A. Farshchian, B. (2020). Scaling Participation-What Does the Concept of Managed Communities Offer for Participatory Design? *Proceedings of the 16th Participatory Design Conference 2020-Participation (s) Otherwise-Volume 2*, 50–54.

Howcroft, D., & Wilson, M. (2003). Participation:'Bounded freedom'or hidden constraints on user involvement. *New Technology, Work and Employment*, *18*(1), 2–19.

Indseth, T., Elgersma, I. H., Strand, B. H., Telle, K. E., Labberton, A. S., Arnesen, T. M., Nygård, K. M., & Godøy, A. A. (2021). *Covid-19 blant personer født utenfor Norge, justert for yrke, trangboddhet, medisinsk risikogruppe, utdanning og inntekt*.

Kaplan, R. M., & Maxwell III, J. T. (1994). Grammar writer's workbench. *Xerox Corporation, Version, 2*.

Karlsson, F., Holgersson, J., Söderström, E., & Hedström, K. (2012). Exploring user participation approaches in public e-service development. *Government Information Quarterly*, *29*(2), 158–168.

Kensing, F. (1983). The trade unions influence on technological change. *Systems Design For, With and By the Users. North Holland*.

Kensing, F., & Blomberg, J. (1998). Participatory design: Issues and concerns. *Computer Supported Cooperative Work (CSCW)*, *7*(3), 167–185.

Kimaro, H. C., & Titlestad, O. H. (2008). Challenges of user participation in the design of a computer based system: The possibility of participatory customisation in low income countries. *Journal of Health Informatics in Developing Countries*, *2*(1).

KS. (n.d.-a). Om KS. Retrieved 12 May 2022, from https://www.ks.no/om-ks/

KS. (2020). KommIT-rådet. https://www.ks.no/kommit

KS. (2021). [Om Fiks Folkeregister]. KS. https://www.ks.no/fagomrader/digitalisering/felleslosninger/fiks-plattformen/om-fiks-plattformen/

KS. (2022). Smittesporing Ved Bruk Av DHIS2 :: KS Fiks. https://ks-no.github.io/fiks-plattform/tjenester/dhis2/

KS. (2022b). Testmiljø. https://ks-no.github.io/fiks-plattform/testmiljo/

KS. (2020b). Digitalt verktøy for smittesporing. https://www.ks.no/fagomrader/digitalisering/felleslosninger/fiks-smittesporing/elektronisk-losning-for-smittesporing/

KS. (2022d). Sparer verdifull tid på selvregistrering av smitte. https://www.ks.no/fagomrader/digitalisering/felleslosninger/fiks-smittesporing/sparer-verdifull-tid-pa-selvregistrering-av-smitte/

Kuhn, T. S. (1962). *The Structure of Scientific Revolutions. Chicago (University of Chicago Press) 1962.*

Lee, K. J., Roldan, W., Zhu, T. Q., Kaur Saluja, H., Na, S., Chin, B., Zeng, Y., Lee, J. H., & Yip, J. (2021). The Show Must Go On: A conceptual model of conducting synchronous participatory design with children online. *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*, 1–16.

Lippeveld, T., Sauerborn, R., Bodart, C., & Organization, W. H. (2000). *Design and implementation of health information systems*. World Health Organization.

Madsen, E. (2022). Effektivt reproduksjonstall. In *Store medisinske leksikon*. http://sml.snl.no/effektivt_reproduksjonstall

McNally, B., Mauriello, M. L., Guha, M. L., & Druin, A. (2017). Gains from participatory design team membership as perceived by child alumni and their parents. *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems*, 5730–5741.

Mickos, E. (2012). *IANI-future gateway for interlending communication.*

Msiska, B., & Nielsen, P. (2018). Innovation in the fringes of software ecosystems: The role of socio-technical generativity. *Information Technology for Development*, *24*(2), 398–421.

Mumford, E. (1981). Participative Systems Design: Structure and Method. *SYS. OBJECTIVES, SOLUTIONS.*, *1*(1), 5–19.

Mumford, E. (2006). The story of socio-technical design: Reflections on its successes, failures and potential. *Information Systems Journal*, *16*(4), 317–342. https://doi.org/10.1111/j.1365-2575.2006.00221.x

Myers, M. D. (n.d.). Qualitative Research in Information Systems. *Information Systems Journal*.

Myers, M. D. (1997). Critical ethnography in information systems. In *Information systems and qualitative research* (pp. 276–300). Springer.

Nyamtema, A. S. (2010). Bridging the gaps in the Health Management Information System in the context of a changing health sector. *BMC Medical Informatics and Decision Making*, *10*(1), 1–6.

Obendorf, H., Janneck, M., & Finck, M. (2009). Inter-contextual distributed participatory design. *Scandinavian Journal of Information Systems*, *21*(1), 2.

Ormston, R., Spencer, L., Barnard, M., & Snape, D. (2014). The foundations of qualitative research. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, *2*(7), 52–55.

Poppe, O., Sæbø, J. I., & Braa, J. (2021). WHO digital health packages for disseminating data standards and data use practices. *International Journal of Medical Informatics*, *149*, 104422. https://doi.org/10.1016/j.ijmedinf.2021.104422

Poppe, O., Saugene, Z., Kossi, E., Sæbø, J. I., & Braa, J. (2020). Rapid Systems Response to COVID-19: Standards Disseminated as Digital Health Packages. *IFIP Joint Working Conference on the Future of Digital Work: The Challenge of Inequality*, 237–250.

Rabiee, F. (2004). Focus-group interview and data analysis. *Proceedings of the Nutrition Society*, *63*(4), 655–660.

Rainer, R. K., & Prince, B. (2021). *Introduction to Information Systems*. John Wiley & Sons.

Rawnsley, M. M. (1998). Ontology, epistemology, and methodology: A clarification. *Nursing Science Quarterly*, *11*(1), 2–4.

Regjeringen. (2022). [Nyhet]. Changes to the TISK Strategy; regjeringen.no. https://www.regjeringen.no/en/aktuelt/changes-to-the-tisk-strategy/id2895499/

RHINO. (2002). http://www.cpc.unc.edu/projects/measure/rhino/rhino.html

Ries, E. (2011). *The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Currency.

Roland, L. K., Sanner, T. A., Sæbø, J. I., & Monteiro, E. (2017). P for Platform. Architectures of large-scale participatory design. *3-34*. https://ntnuopen.ntnu.no/ntnu-xmlui/handle/11250/2478234

Runes, D. D. (1983). *Dictionary of philosophy: Revised and enlarged*.

Russell, B. (1945). A History of Western. *Philosophy*, *672*.

Sanders, E. B.-N. (2002). From user-centered to participatory design approaches. In *Design and the social sciences* (pp. 18–25). CRC Press.

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *Co-Design*, *4*(1), 5–18.

Sapsford, R., & Jupp, V. (1996). *Data collection and analysis*. Sage.

Schuler, D., & Namioka, A. (1993). *Participatory design: Principles and practices*. CRC Press.

Stake, R. E. (1995). *The art of case study research*. sage.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research techniques*.

Titlestad, O. H., Staring, K., & Braa, J. (2009). Distributed development to enable user participation: Multilevel design in the HISP network. *Scandinavian Journal of Information Systems*, *21*(1), 3.

Tiwana, A. (2009). Governance-knowledge fit in systems development projects. *Information Systems Research*, *20*(2), 180–197.

Urmson, J. O., & Rée, J. (1991). *The concise encyclopedia of western philosophy and philosophers*. Psychology Press.

VG. (2022). https://www.vg.no/spesial/corona/

Visser, F. S., Stappers, P. J., van der Lugt, R., & Sanders, E. B.-N. (2005). Contextmapping: Experiences from practice. *CoDesign*, *1*(2), 119–149. https://doi.org/10.1080/15710880500135987

von Hippel, E., & Euchner, J. (2013). User innovation. *Research-Technology Management*, *56*(3), 15–20.

Walsham, G. (1993). *Interpreting information systems in organizations* (Vol. 19). Wiley Chichester.

Walsham, G. (2006). Doing interpretive research. *European Journal of Information Systems*, *15*(3), 320–330. https://doi.org/10.1057/palgrave.ejis.3000589

Yin, R. K. (1999). Enhancing the quality of case studies in health services research. *Health Services Research*, *34*(5 Pt 2), 1209.