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An Institutional Analysis of Digital Transformation of Covid-19 Contact Tracing During a Pandemic

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AN INSTITUTIONAL ANALYSIS OF DIGITAL TRANSFORMATION OF COVID-19 CONTACT TRACING DURING A PANDEMIC

Research paper

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Abstract

With rising numbers of COVID-19 positive patients in March 2020, Norwegian municipalities, who are responsible for contact tracing, struggled to register all the infected and their close contacts. This was partly due to the scale of the pandemic and partly because the only tools they had were pen and paper and in some cases spreadsheets. To address this situation, some municipalities started exploring how digital health information systems could support them in handling the rapidly changing and unforeseen complexity of the COVID-19 contact tracing work. Drawing on an ongoing case study of disease surveillance in Norway, we first explain how contact-tracing work has undergone a rapid digital transformation. Then we offer an institutional analysis by using a perspective of institutional work forms to illuminate how the digital transformation has brought about long term institutional changes. We then argue that we have seen an institutionalization of digital contact tracing while manual contact tracing is still ongoing. Thus, both the new and the old institution stay alive and are central for different purposes. With this paper, we are contributing to research on digital transformation by theorizing how technology and more particularly digital transformations are intertwined with institutional change. We further contribute to research on institutional work by illustrating how this is a relevant lens to understand digital transformations.

Keywords: Digital transformation, Institutional work, Digital contact tracing, COVID-19.

1 Introduction

The COVID-19 pandemic has had shock-like effects in Norway as well as in the rest of the world. On 12th of March 2020 the Norwegian prime minister announced that "*Today, the government comes up with the strongest and most intrusive measures we have had in Norway in peacetime.*" (Røed-Johansen and Torgersen, 2020, p.). Reducing people's movement slowed down the spread of the virus but one of the most important tools health authorities use to control a fast spreading virus is contact tracing (FHI, 2021).

According to the Norwegian Institute of Public Health (NIPH), COVID-19 contact tracing consists of two main tasks (NDH, 2021). First, a contact tracer interviews the infected (hereafter the index) and identifies the index' close contacts. Second, close contacts are informed and followed up by a contact tracer. In addition, the index is placed in isolation and close contacts are quarantined.

The first law regulating manual contact tracing in Norway was implemented in 1860 and the infection control act (ICA) that regulates today's contact tracing was implemented in 1995. The rules and norms regulating manual contact tracing are thus well established, having been institutionalized over a period of almost 200 years (Aavitsland, 2020).

Before the COVID-19 outbreak, many municipalities conducted contact tracing with pen and paper- or spreadsheet systems. For many diseases, such as tuberculosis, this is an adequate form of contact tracing because of the relatively slow transmission rate. Unlike tuberculosis, COVID-19 transmits easily and fast, and many develop symptoms within a few days. When Norway closed down in March the number of infected was already fast rising and it became clear that the existing contact tracing systems did not suffice.

Our empirical case is and ongoing case study of the digital transformation of contact tracing work in Norway, where the authors have analysed and interpreted the data in plenum during regularly meetings once a week. We study the process of how contact tracing changed from being based on pen-and-paper-/spreadsheet systems to becoming centred on the use of a digital health information system (HIS). More specifically, we investigate the development, deployment and the use of the health management information system District Health Information Software 2 (DHIS2) for digital contact tracing of COVID-19 in the Norwegian health care sector (DHIS2, 2021).

DHIS2 is an open source platform that is primarily used in developing countries to collect and analyse routine health data. The platform is developed by the Health Information Systems Programme (HISP) at the University of Oslo based on World Health Organization (WHO) recommendations. In Norway there are currently two providers of contact tracing software systems based on DHIS2, namely "Fiks contact tracing" and "ReMin". 307 Norwegian municipalities, out of 356, currently use a DHIS2-based contact tracing software solution.

In this paper, we argue that we have seen an institutionalization of digital contact tracing while manual contact tracing is still ongoing. The new and the old institution stay alive and are central for different purposes. Hence, we use institutional theory when discussing the digital transformation of contact tracing. Institutional theory has useful tools to describe how technology and society interact and influence each other (Lawrence et al., 2009). There is also an increasing body of literature of how technology change drives change in institutions (Gawer and Phillips, 2013; Sahay et al., 2019). We use the institutional work forms *mimicry*, *educating* and *theorizing* presented in Lawrence and Suddaby (2006) as a theoretical frame when we discuss how digital transformation of contact tracing has affected the contact tracing institution in the Norwegian health care sector. We use these institutional work forms to illuminate and argue whether or not institutions have been changed or been influenced by the transformation. Our research question is thus: *how have institutions and new technologies interacted in the Norwegian health care sector, in relation to COVID-19 contact tracing?*

2 Related research on digital transformation and institutional work

In this chapter, we first look at various types of technological change, namely digitizing, digitalization, and digital transformation. We exemplify briefly each concept as they relate to infectious disease contact tracing. The qualitative differences between them point to a strong relation to institutions, which we explore by presenting relevant perspectives from institutional theory. Lastly, we look at digital transformation as institutional change.

2.1 Digitizing, digitalization, digital transformation

Introduction of information technology in work practices has been of interest among information systems (IS) researchers for decades. The information system (IS) research field contains much research related to the introduction of information technology in work practices (Sandahl, 1999). A

useful distinction when looking at how digital technologies are used in organizations and fields is that of digitizing, digitalization and digital transformation (Osmundsen et al., 2018) (table 1). The terms have primarily been used when discussing changes in specific markets but are useful terms also for the case of digitalization in organizations and for the healthcare sector more generally.

Digitizing is the process of converting documents and their data of an analogue format to a digital format, enabling documents to be programmable, addressable and communicable (Osmundsen et al., 2018). For example, the scanning of documents and thus converting them into a digital format improves the data accessibility. The intention of digitizing is to change the format of the data and documents, but not to change or improve the work processes. In the municipalities' contact tracing teams, digitizing to address the COVID-19 pandemic entailed moving the contact tracing work from a pen and paper process to register and follow up indexes and their close contacts with the help of spreadsheets.

Digitalization entails a qualitative difference compared to digitization. Digitalization is more than just transforming something physical into something digital, it involves the process of changing work practices and workflows. It involves both technical and social aspects (Dynestøl et al., 2020). Digitalization denotes a change in socio-technical structures, where the social elements include people and their interrelations, rules and norms. The technical elements are routines and work related to the technology as well as the technology itself (Osmundsen et al., 2018). Digitalization of contact tracing has facilitated collaboration between contact tracers as well as between municipalities that use the same contact tracing solutions. For example, compared to paper based systems Fiks contact tracing makes it easier to get an overview of indexes and their close contacts, which makes the contact tracing work more efficient and in particular, when the caseload is high. For municipalities that use the same contact tracing system transfer is enabled of data of indexes or close contacts is done digitally between them.

While digitalization includes both technical and social elements, digital transformation is in the literature often explained as how digital technologies are used to enable significant improvements within a business. Thus significant changes in work routines and value creation (Osmundsen et al., 2018). Mergel et al. (2019, p 12) states that "…digital transformation within the public sector … [also] implies that citizens have a more active part." Citizens are therefore seen as "…actively participating in public service delivery enabled by new technologies". What this means is that digital transformation entails involved stakeholders engaged in changing or developing new practices and processes due to the introduction of new technologies. The introduction of new technologies hence creates new practices that may or may not generate positive effects within the organization. However, for it to be a digital transformation the new practices must also affect society at large. For example, digital contact tracing has impacted contact tracers' work practices and processes, the speed of registering infected, the speed of reporting to health authorities as well as the speed of developing new measures and restrictions to keep the infection rate down. Additionally, involving citizens in the use of the new technology gives them an active role in contact tracing.

Processes	**Definition**
Digitization	Conversion of data and documents into a digital form
Digitalization	Changing work practices and workflows based on IT
Digital transformation	Significant changes in work processes in and among organizations

Table 1. Definition of digitization, digitalization and digital transformation

2.2 Institutional theory, institutional work

Ocasio and Gai (2020) argue that institutions are everywhere but they are not everything. Institutions are "… humanly devised constraints that structure political, economic and social interaction." (North, 1991, p 97). Like North, Sautet (2005) states that institutions contain both informal norms and formal

rules. Informal norms can be such as the norm of sanitizing hands before entering a store. Formal rules are laws and constitutions, like the Norwegian infectious control act (ICA). According to Scott (2013, p 56) institutions "…comprise regulative, normative, and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life."

Institutional theory is concerned with stability and change both on an organizational and an individual level (Hinings et al., 2018). It also emphasizes the influence of institutions on organizations and individuals' behavior, and the adoption and use of technology. We can view digital transformation as constituting changes at the institutional level. According to Hinings et al., (2018, p 53) institutional theory has concepts that are highly relevant to the study of digitalization and especially when the digitalization "… leads to digital transformation".

In digital transformation, technological change is seen as a main driver for institutional change. However, individual and organizational efforts are also relevant. *Institutional work* describes how such actors may enable creation, maintenance and/or disruption of institutions (Lawrence et al., 2009), (Scott, 2013). Work is defined in (OED, 2021) as "...activity involving physical or mental effort and undertaken in order to achieve a result". Thus, work is closely related to effort. There are several kinds of effort associated with institutional work. Effort can be considered a dimension of institutional work and used to understand the motivations and conditions behind the institutional work, as well as the strategies and the work's effects (Lawrence et al., 2009).

A central part of Lawrence et al. (2009)'s definition of institutional work is about the direction between agency and institutions. Most institutional research on organizations highlights how institutions influence actions and actors. Institutional work, on the other hand, is used as a theoretical lens to understand how actors and actions influence institutions, which is our approach.

We find the three institutional work forms *mimicry*, *educating*, and *theorizing* helpful in illuminating the influence of actors' practices on institutions. Mimicry is defined as drawing on "… existing patterns of action in order to articulate and legitimate new practices and structures" (Lawrence et al., 2009, p 228). Educating "provides actors with the knowledge necessary to engage in new practices or interact with new structures" (Lawrence et al., 2009, p 228). Theorizing is the development of "...concepts and beliefs that can support new institutions" (Lawrence et al., 2009, p 228).

The three institutional work forms can be used as a lens to show how active actors use their knowledge and experience to guide and teach others and thus convincingly argue for one institutional practice over another. By inspiring and convincing others to use the new practices, it is possible to create enthusiasm for the new work practices. By spreading the enthusiasm, the goal that new practices become the prevailing ones may be achieved.

2.3 An institutional perspective on digital transformation

The literature describes digital technologies as disruptive (Vial, 2019). Use of digital technologies can cause disruptions that trigger strategic responses. Strategic responses may be changes in the digital business strategy that creates new or different uses of digital technologies. Adoption of new technology or the use of technology in a different way may have an effect on the actors involved, as new automation processes push forward the need to develop new skills. Digital transformation may thus also affect the organization as a whole (Vial, 2019).

New work- and social practices due to new technology as well as new rules and regulations can therefore impose a change in or break the existing institution and impose the creation of a new institution. These processes are called deinstitutionalization and re-institutionalization (Oliver, 1992). Contrastingly, new technology may have a reinforcing effect on practices, rules and norms, and thus help uphold the institution.

Additionally we have the process of institutionalization, where a new institution is developed and further reinforced due to positive feedback (Scott, 2013). For example, when implementation of new

technologies makes it difficult or sometimes even impossible to change path, because an alternative path will be costly and the feedbacks from the implemented technologies are largely positive. "The learning and coordination effects, coupled with the associated growth of formal and informal rules, all reinforce the buy-in of multiple players." (Scott, 2013; North, 1991).

In the next chapter we present our methodology, how we collected our data as well as how the authors have worked together to analyse the data.

3 Methods

This paper is a result of an on-going interpretive case study (Walsham, 2006) that started in May 2020. Some of the authors have had active roles in the development of the system in question, thus this research also has elements of a participative case study (Baskerville, 1997).

3.1 Data collection

The data collection can be divided into three phases. During the first phase, three bachelor students (one who is co-authoring this paper) conducted ten interviews with participants from different Norwegian municipalities, the DHIS2 community, and WHO. These interviews were carried out as part of a bachelor research programme, see table 2.

Phase	Role	Number of interviews	Interviewees
1	DHIS2 manager	2	2
	DHIS2 implementer	2	2
	DHIS2 developer	1	1
	Municipality contact tracer	1	1
	Municipality chief physician	2	2
	Municipality manager	1	1
	WHO manager	1	1
2	KS enterprise architect	2	2
	NIPH senior advisor	4	3
	Municipality contact tracer	4	3
	Municipality physician	1	1
3	Municipality physician	3	4
	Municipality contact tracer	1	1
	KS e-health	1	2

Table 2. Number of interviews, intervieweer, their respective roles and coded identities.

In the second phase, two of the authors and a DHIS2 implementer conducted field trips to two municipalities where they did group interviews. Three interviews with stakeholders from The Norwegian Association of Local and Regional Authorities (KS) and the Norwegian Institute of Public Health (NIPH) were also carried out.

The third phase was an interview study organized by an international research project hosted by the Department of Informatics at the University of Oslo. During this phase, the authors (sometimes jointly, sometimes separately) conducted four interviews with general practitioners and contact tracers from different municipalities. During all three phases, the authors observed and engaged in user forum meetings and development meetings related to Fiks, collected notes and

published news articles - all of which played a role for understanding and interpreting the context of contact tracing work and impacts of the contact tracing system.

Some of the authors were involved in interviews without any direct involvement with the development project and field, while two of the authors have had active roles in the project. The fact that authors with different levels of involvement in the project have worked together have some advantages. Authors with a relatively neutral role, i.e. outside observers (Walsham, 2002), have asked critical questions about situations they have not been part of. Situations that authors with active involvement in the project, i.e. involved researchers (Walsham, 2002), may have been blind to. While an involved researcher may experience guarded answers from interviewees, the interviewees may give more frank answers to an outside observer, as they may not perceive the outside observer as one having a personal stake in the project (Walsham, 2002). Lastly, the involved researcher has an inside view of the project that an outside observer lacks.

The authors have been involved at various times with the case, approaching it from different angles and looking at different themes. While the University of Oslo and the DHIS2-team currently have a contractual agreement for supporting the configuring and continuous management of Fiks contact tracing, two of the authors were engaged in the project prior to this formalization in May 2020, e.g. with risk and vulnerability analysis of DHIS2 and helping the first interested municipalities to test the system. One of the authors has later worked daily with the design and implementation of the system since early May 2020. She has among other tasks, contributed to prioritization of functionality, gathered requirements, conducted functional design work and advised KS on architectural decisions. Through this engagement, the team has worked closely with several municipalities as well as relevant national stakeholders such as the NIPH and the KS.

Six municipalities have been interviewed online. With the interviewees' informed consent, interviews have been digitally recorded (only sound recording, not video). In two municipalities we did contextual inquiry and interviewed contact tracers. Interviews have lasted for one hour. Several user forum meetings have been observed where multiple municipalities have been present and discussed requirements for the new system. Our data material is based on notes and transcriptions from interviews, notes from meetings, emails, chat channels, development discussions, and risk analysis exercises as part of the design process. Text and pictures from a series of published news articles in Norwegian media have also been important data for triangulation purposes and interpretation of the context.

The triangulation of data, methods and investigators provide substantial internal validity for our case study, and a good basis for analysis. Since the data for this paper was collected at different times by different people and in different formats, it became important to share and align the facts, understandings and interpretations. During the work of this article, the authors regularly met once a week, sometimes more often, to analyse and interpret the data in plenum. Some of the meetings have been conducted in person. However, when Oslo closed down in November all meetings had to be moved online.

3.2 Data analysis

The data was analysed pragmatically and iteratively by all authors throughout the making of this article. Weekly meetings were held to share thoughts, ideas and patterns from the data. From the initial meetings, we found that the actions of the involved actors have had an invaluable impact on the digital transformation of contact tracing. Their involvement in creating new work routines- and processes, teaching newcomers, testing and improving Fiks contact tracing was interesting to explore further by using institutional theory. Thus, it was natural to use institutional work forms as a lens when describing and explaining the digital transformation of contact tracing.

The theme of institutions, institutional work forms and institutional change became the basis of future discussions of the data. During our analyses, we found that *mimicry*, *theorizing*, and *educating* were

both useful and powerful in describing how contact tracing has been affected by new technologies. This form of analysis was meaningful because all authors had collected and focused on different data, which enabled rich discussions. At a later stage in the research process, we will consider analysis such as coding and thematic analysis.

A retrospective approach can be challenging as data has been collected at different times with varied compositions of members of our research group with at times somewhat different themes in mind. Our experience is, however, that this has made our data collection richer and broader, which was important for this paper.

4 Findings

During the 20th century, Norway has not experienced communicable diseases with anything near the characteristics of COVID-19. Up until the COVID-19 pandemic, Norwegian municipalities used manual systems for contact tracing, usually involving pen-and-paper- or spreadsheet. When it comes to digitalization, even if the Norwegian health care sector is well developed, it is said to lag behind other sectors by at least 15 years. As a representative from a contact tracing team in a municipality said, "*There is something about the fact that things are cumbersome with ICT in the Norwegian health care sector*" (CT2). When a sked if the COVID-19 digitalization process had been more efficient than usual digitalization within the health care sector, a digital strategist in a municipality pointed answered that, "*It is challenging when the ones with prioritization authority are situated on a different government level than the ones with the responsibility for implementing the system. What makes it even more complicated is that the user group and the ones financially responsible for the system is situated on a third government level*" (IT1).

A number of different actors are involved in contact tracing of COVID-19, both humans and technologies. We have study the work of actors from the municipalities with their district medical officers, municipal chief physicians, contact-tracing teams and other health personnel, NIPH as well as actors representing the contact tracing software systems providers. In addition to digital contact tracing systems other information systems have also been subject to change as part of the digital transformation. NIPH's *MSIS laboratory database* (MSIS labDB) (MSIS, 2020) for emergency preparedness work was deployed in May 2020. Integrations between NIPH and laboratories reporting positive cases of notifiable diseases (now also including all test results from COVID-19) increased from 75% to close to 100%. A digitalization of "*Clinician report*", which facilitates reporting of infectious diseases with in-depth and supplementary epidemiological information for each individual case, was deployed in May 2020 (Klinikermelding, 2020). In April 2020, "*The disease pulse for the municipal health service*" was implemented (Sykdomspulsen, 2020).

4.1 Contact tracing in Norway

The first positive case of COVID-19 in Norway was detected on February 26 2020. A standard procedure for contact tracing was initiated, and a contact tracing team was established to handle and control the suspected and confirmed cases of COVID-19. There were not yet any national guidelines regarding digital contact tracing systems. Municipalities worked through March with a paper or spreadsheet based system, but as the virus quickly spread and the number of infected increased, this approach did not scale.

At the onset of the pandemic, laboratories notified municipalities of positive COVID-19 results via phone. Contact tracers then registered information about each index including close contacts by pen and paper and/or spreadsheets. This information was then used to contact the index, inform about isolation and additionally notify close contacts about quarantining. These work processes posed some challenges, which made collaborative work more difficult: the inability to upload data in real time, duplicates of data, coordination of work between the contact tracers, reporting of data to NIPH, data analyses, and privacy and encryption.

In normal times, investments in new technologies in the Norwegian health care sector are restricted, as noted by a senior advisor in NIPH: "*... digitalization of the health care sector is usually not at the top of the prioritization list*" (N3). This has resulted in relatively old, partly paper-based and non-integrated systems. As another NIPH senior advisor said, "*as long as it works we just let it*" (N1). The systems are functional, but not flexible and scalable enough for a pandemic. In addition, when a "*storm hits*" (N3), priorities may change, as was the case in January 2020.

With increasing infection rates, contact tracers in many municipalities worked longer hours trying to register indexes and their close contacts. An extensive overlapping of data was required in order to report to different departments and actors both internal and external to the municipalities. There was a vast need for data and information among several instances such as the crisis team, emergency team, management and NIPH. Hence, early in the COVID-19 pandemic it became clear that there was a need for a digital tool to help handle the complex collaborative work routines related to contact tracing.

On March 23, a search and selection process for an open source HIS was set in motion by an epidemiologist in a Norwegian municipality. The choice fell on DHIS2. This decision was made because DHIS2 had recently developed a COVID-19 surveillance module based on WHO's guidelines, and because with limited resources, the system could be customized to fit local requirements.

A quick development process was initiated where the municipalities specified their instant needs. As one of the contact tracers explained, *"... we needed a system for contact tracing and we knew that this is a new situation where we have a continuous development process with new functionality being developed over time."* (CT2).

The digitalization process was initiated and coordinated by a team of actors and organizations that were given the responsibility to coordinate the different COVID-19 measures being put in place. Intensive work was done to explain the need for and advantages of the digital contact tracing system DHIS2. There was a need for swift decision-making. The sense of urgency made positive contributions to the process. During a period of lower infection rates – May 2020 - DHIS2 was implemented and a pilot run was conducted. One of the reasons why the implementation of DHIS2 got started so quickly was that a long bureaucratically process could be skipped because of the digital first approach of one of the municipalities. DHIS2 was implemented on KS' digital platform "Fiks" and named "Fiks contact tracing".

Then training of contact tracing teams was conducted. The teams consisted of health care workers reallocated from other positions in the health service who did not have an epidemiological background. Health care workers therefore had to be trained in both epidemiology and the use of a new digital contact tracing system. This allocation system is vulnerable in many ways. When the infection rates dropped, the health care workers would return to their original work locations. As soon as the infection rates increased again, the need for health care workers increased but the previous health care workers who had already received some training would not necessarily be available for contact tracing work. Hence, new health care workers would step in and the training had to start from scratch again. As more health care workers have gained experience with and knowledge of contact tracing municipalities have put in place processes so that they are able to handle an increase in the infection rate. Contact tracers can now also work from home.

Moving forward the importance of maintaining the communication between municipalities was pointed out as important. A *user forum* was established, where representatives from the most active municipalities participated. Here members share their experiences with the system and discuss potential new functionalities and needed improvements.

Fiks contact tracing has since deployment been expanded with an integration towards NIPH's *MSIS laboratory database* (MSIS labDB) called "Fiks Lab results". "Fiks Lab results" enables access to the laboratory results of citizens that then is registered in Fiks contact tracing. Additionally indexes

receive a link that grants them access to register their close contacts in the system. Self-registration is only an option and not mandatory. The index can still inform a contact tracer of all close contacts via phone. The contact tracer will then register them in the system.

At the same time as the municipalities were searching for digital tools to help with the contact-tracing process, another route to contact tracing was also explored. Like in many other countries, a contact-tracing app for smartphones was launched in Norway, on April 16 2020, after only 5 weeks of development. NIPH together with a technology partner were behind the app "*Smittestopp"*. However, NIPH received criticism of the app's architecture and way of sharing and storing sensitive data and the data protection authorities found a lack of proportionality between the intrusiveness of the app and the number of infected in the population at that point in time. On June 16 2020, NIPH had to close the service and delete all data. On December 21 2020, NIPH launched a new app, with the same name, developed together with a different technology partner, addressing the challenges with the previous app. On June 7 2021, 1,026,700 had downloaded the new app (Smittestopp, 2021). If a user tests positive, the user can register it in the app and choose to let the app notify individuals whom the person has been in close contact with. The contacts receive a message saying they have been in contact with a COVID-19 positive, but not who and where. They are then advised to test themselves. *Smittestopp* is integrated with MSIS but not with the municipalities' contact tracing systems.

4.2 An increased information need

Compared to other countries, Norway has so far been spared high numbers of infected, hospitalized and fatalities caused by COVID-19. However, Norway experiences a massive disruption of the economy and people's lives have changed. The COVID-19 pandemic also created a sudden and substantial need for more information. The demand for information and being informed included the society at large, public officials and policy makers, and public health departments across all levels of the health system. It soon became clear that new processes, systems and tools were needed for contact tracing in Norway (Dynestøl et al., 2020).

While contact tracing has a long history as established systems and practices in the Norwegian municipalities as well as among other medical physicians, contact tracing of COVID-19 was on a different level. The information need also affected organizations such as NIPH, who publishes analyses, statistics and aggregated numbers based on the numbers of COVID-19 laboratory tests. When asked if contact tracing has changed during COVID-19 an NIPH senior advisor answered, that*"It is a completely different form of contact tracing than what is done now. Where you map all contacts. There was no current issue on that scale then. You have done it with measles, for example, so you do it by contacting the close contacts. However, it will be different, because most close contacts have been vaccinated. … There are very few cases around each infected who are not vaccinated so the scale of the work becomes much smaller. So there we have not seen the same need for tools as we see now. It has been used more abroad. For example linked to ebola, where the same contact tracing is relevant. But it has not been an issue in most western countries"* (N3).

The same NIPH senior advisor also pointed out the impact the digitalization process has had on Norway's preparedness, and in that regard pointed out the positive consequences of the digitalization process: *"One of the big challenges in 2009, the pandemic then, was that you could not connect the data you needed to handle the pandemic. It took a very long time to connect relevant data and get updated information. We have done that now for the first time really. Made connections so that we have daily updated data on admissions, seriously ill and also connect everyone who is tested."* (N3)

5 Analysis

In this chapter, we analyse the findings through the lens of the institutional work forms *mimicry, theorizing* and *educating.*

5.1 Digitalization and digital transformation of the health care sector

As shown above, a number of new digital solutions were developed and implemented in the Norwegian health care sector due to the COVID-19 pandemic. Norwegian municipalities implemented new contact tracing solutions that facilitated a more efficient contact tracing and cross-municipal sharing of data about indexes and close contacts. Involved actors have drawn on their knowledge about contact tracing when they have contributed to the implementation, roll out and further active use of digital contact tracing solutions.

Additionally indexes have been given the opportunity to self-register their close contacts. As well as improve the efficiency of contact tracing, implementation of Fiks contact tracing has enabled citizens to participate in the contact tracing process and the important work to keep the number of infected down. The digital first approach of one of the municipalities' also showed that less bureaucracy made for speedier processes.

Actors have demonstrated and shared with others new discoveries and smart functions that can influence contact tracing and processes around it to become more efficient. Hence, we argue that actors have educated each other in efficient use of Fiks contact tracing and the practices and processes that follow with it. An example is how a contact tracer uses the system's dashboard functionality to create an overview of important messages and work for the next shift to handle.

The development of municipality COVID-19 test centres, online booking systems for COVID-19 testing, health authorities' websites explaining and describing contact tracing as well as the media's publications about digital contact tracing, have all contributed to a development of concepts and a common understanding of what contact tracing and digital contact tracing entails. We therefore argue that a *theorizing* of digital contact tracing has taken place in Norway.

Due to the rapid development of new technologies during 2020, actors in the municipalities have started a process to change the implementation and development processes within the health care sector. However, for this project to succeed it is vital that actors from different organizations and different organizational levels come together and agree upon new strategies, processes and concepts for the digitalization of the health care sector.

One important reason for integrations is patient safety, that data about the registered (i.e. the index and the close contact) is shared with relevant actors. The fact that *Smittestopp* is a standalone HIS and not integrated with municipalities' contact tracing systems poses the question if the missing integration could be due to two different organizations on different organizational levels not communicating. There is also uncertainty related to whether there exist a common understanding of what rapid development within the health care sector actually entails. Hence, we would argue that *theorizing* in this context is still ongoing.

6 Discussion

Institutionalization is "… the process by which an institution attains a stable and durable state or property" (Currie, 2011). For this to happen an organized vision must be developed at an early stage and stay present throughout the institutionalization process (Mignerat and Rivard, 2009). Institutionalization is dependent on a shared history and a common understanding of the rules, norms and culture. In this chapter, we discuss how the digital transformation of contact tracing has affected institutions in the Norwegian health care sector. More specifically, we discuss how the change in the COVID-19 pandemic has influenced development of knowledge about COVID-19, which again has influenced development of new technologies. Then we discuss how the digital contact-tracing tool has played a central role in the institutionalization of contact tracing by facilitating common understanding and practices.

6.1 Digital transformed contact tracing

When the COVID-19 pandemic hit, the institutionalised approach to contact tracing tried but failed to keep control over the spread of the virus. The existing taken-for-granted practices, norms and rules did not suffice to get the control as needed. The situation required changes. (Holm, 1995) asks how actors can "… change institutions if their actions, intentions, and rationality are all conditioned by the very institution they wish to change?" This is where our discussion is centred, on active actors' effort to create a change, more specific to initiate a digital transformation of contact tracing. The effort of the actors was, however, not concentrated on creating a change in the institutionalized manual contact tracing institution; it was an effort to create something new in order to handle a crisis.

Manual contact tracing was and is still ongoing for other infectious diseases, regardless of the COVID-19 pandemic. We argue that the COVID-19 pandemic necessitated a digital transformation of contact tracing of COVID-19 (and of future pandemics). The digital transformation laid the foundation for the new institution, namely the digital contact tracing institution.

As described above, digital transformation implies significant changes in work processes in and among organizations, as well as creating disruptions (Osmundsen et al, 2018; Vial, 2019). The digital transformation necessitated pro-active actors who were digital literate and had knowledge of epidemiology, and who could see the potential in digital tools to counter the informational challenges.

According to Lawrence and Suddaby (2006, p 227) "…educating of actors in skills and knowledge necessary to support the new institution" is "…an important form of cognitive work". When developing a new institution there is a need for new and old practices to merge. Actors in the municipalities who had worked with manual contact tracing of other infectious agents, became central in the work to both implement DHIS2 and to develop and educate teams of contact tracers, both in the use of the system and in the skill of contact tracing. Existing contact tracing practices, norms and rules were used to associate the digital contact tracing with the manual contact tracing. This made the adoption of the new idea easier (Lawrence et al., 2009). In addition to the work done in municipalities, the health authorities, KS and NIPH pointed out the necessity of digital tools for contact tracing. Through media, the general public learned that manual contact tracing did not suffice in controlling the spread of SARS-CoV-2 and while Norwegian contact tracers used pen and paper, contact tracers in Sri Lanka and Uganda could express their success with digital contact tracing (Johansen, 2020), using DHIS2. Thus early in the Spring of 2020 digital contact tracing had become a known and accepted way forward for Norwegian contact tracers.

The municipalities' contact-tracing teams constitute a new way of performing contact tracing. New personnel have been educated first in contact tracing and then in using the new contact tracing system. Contact tracers have learned the rules and the norms concerning handling sensitive information. Shifts and rotations have been put in place in order to handle situations of increasing cases of COVID-19 positives. Medical representatives from some municipalities have been involved in the development of the digital contact tracing system through a user council/board. Thus, important actors in the municipalities have been involved in the shaping of digital contact tracing.

With daily published data about COVID-19, about the number of positives, deaths and hospitalized the media has played a role in educating the general public about contact tracing and the fact that digital tools work to streamline the contact tracing work. Digital contact tracing and its practices, rules and norms is therefore supported by other individuals and groups in the society that are not usually involved in contact tracing. The general public has for example been invited to aid in contact tracing by the possibility to "self-register" their close contacts.

According to Vial (2019, p 26)'s research of digital transformation literature, inertia and resistance can hinder digital transformation. Further, they write that the culture, identity and legitimacy of an organization is so strong that it prevents development of new technologies. As for resistance, Vial (2019, p 27) explains that it may have to do with "innovation fatigue". Resistance, they argue, is also a product of inertia. Thus, one cannot just expect that people will alter their work routines and processes

just because a new technology is being introduced. However, the literature shows that involving organizational actors who will be affected by the digital transformation may help prevent resistance.

Our research can be seen as a proof of Vial (2019)'s argument that involved actors need to be active in the process of transforming manual work processes into digital ones. In the Norwegian municipalities, intense initial work of contact tracers, lobbying for their need for a digital tool to aid them in contact tracing COVID-19, educating new teams of contact tracers, has shaped a new institutional environment.

Even though the work of manual contact tracing has remained unaltered, a new way of contact tracing work has been developed, where digital transformation of systems and practices has led to an institutionalization process characterized by new forms of work and collaboration, data sharing and possibilities for analysis.

The digital contact tracing is now being used and supported by 307 municipalities, their contact tracers as well as citizens, who are aware of the rules as well as the positive effects related to digital contact tracing. Thus, we argue that digital contact tracing has been legitimised.

6.2 An institutional view on the digital transformation of the health care sector

In our research, we have studied how quickly new technologies have been developed since the COVID-19 pandemic hit Norway. In contrast to past development processes that usually have taken years.

In OED 2) (2021) *agile* is defined as "able to move quickly and easily". Organizational agility is defined as "… a firm's ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise" (Vial 2019, p 21). Agility is dependent on cross-functional collaborations as an important element of digital transformation, where the collaboration consists of involved actors.

In the sections above, we have described a digitalization process in the Norwegian health care sector with a higher speed than before. Actors involved in contact tracing and digitalization of municipalities have taken charge of development. They have moved quickly to acquire and distribute new knowledge about COVID-19 and to implement new functionalities due to this new knowledge. Then they have used *mimicry* - their skills and knowledge about contact tracing in general and their new knowledge and skills related to COVID-19 and new technologies, to market the new contact tracing system of activities, processes and technologies, as the favoured one. Actors have also *educated* each other in the use of new functionalities and following processes og practices. However, the cross-functional collaboration does also entail involvement from other sections and other levels of government.

Digitalization in the health care sector involves multiple actors on different government levels. Coupled with limited funding the priorities of what to build is a constant weighing of needs for adapting to new regulations, integrations toward external systems for efficiency gains (e.g. the national population registry, laboratories etc.) and improvements of already existing functionality. Vial (2019) argues that, "agility … is necessary … to compete in a digital world".

However, implementing agile work processes necessitates a common understanding of the term agility; which actors and organizations are involved, how will their work processes be affected and affect each other. The development and specification of abstract categories is a part of *theorizing* (Lawrence and Suddaby, 2006). According to Lawrence and Suddaby (2006, p 239) institutional work involves "…practices of speaking and writing that are aimed at affecting institutional context within which those practises occur". *Theorizing* is one of the important institutional work forms used to create new institutions. In that lies "the naming of new concepts and practices so that they might become a part of the cognitive field." (Lawrence et al., 2006, p 226).

Our case shows that the implementation and development of new technologies, new work processes and practices, new and better ways of collaboration and quicker reporting procedures between different government levels have contributed to the digital transformation of contact tracing. However, the health care sector is a complex sector with numerous different actors and organizations with their own needs and agendas (Currie and Guah, 2007).

7 Conclusion

In this paper, we have told the story of how new technologies emerged as a response to the COVID-19 pandemic and then digitally transformed the way in which contact tracing is performed. We answer our research question, by arguing that the digital transformation of contact tracing work during the COVID-19 pandemic has brought about institutional changes to the Norwegian health care sector by institutionalizing digital contact tracing.

This institutional change was enabled by the use of the three institutional work forms including *mimicry*, *educating* and *theorizing*. By building upon existing contact tracing procedures as well as knowledge about contact tracing, namely *mimicry*, actors, represented by contact tracers, municipal chief physicians, KS and NIPH, have collaborated in implementing and further developing and improving new contact tracing systems. Further actors involved with contact tracing used their new knowledge and experience about the implemented contact tracing systems to teach other contact tracers. Hence, they *educated* colleagues within their own municipality as well as contact tracers in other municipalities in the use of new functionalities that had a positive impact on collaboration and efficiency related to contact tracing. Finally yet importantly, actors involved with contact tracing in one way or another, have developed concepts and a common understanding of, *theorized* what digital contact tracing is and why it is important in the work to reduce the number of infected. Hence, the institution of contact tracing and digital contact tracing now function side by side.

A question that comes to mind is whether contact tracing and digital contact tracing will continue to function side by side when the COVID-19 pandemic is over, if it will hibernate until the next pandemic arrives or simply fade.

Additionally, we observe forces among several actors within the municipal health care sector and other organizations that want to change the institution of health care sector digitalization. Active actors work from the bottom and up to try to instil change, in the way digitalization is conducted within the sector. Further research into these processes might show if digital transformations during the COVID-19 pandemic have had an impact on larger institutions within the Norwegian health care sector.

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