



Digital Contact Tracing in Switzerland: A Computer-Assisted Qualitative Analysis

RESEARCH

VIKTOR SUTER 

 ubiquity press

ABSTRACT

Public administrations often face significant challenges when adopting new digital technologies. The introduction of contact tracing during the pandemic provided an opportunity to assess the challenges encountered by public authorities when implementing digital technologies. We conducted semi-structured qualitative expert interviews with representatives of federal and cantonal agencies, as well as the Swiss National COVID-19 Science Task Force, to explore their opinions and viewpoints on the implementation of SwissCovid, a contact tracing application deployed by the Swiss government. The interview data were analyzed using a combination of topic modeling algorithms and manual thematic coding. The results of this analysis show that government agencies face gaps in technological literacy, unsatisfactory institutional structures, and legal barriers that impede interagency collaboration. We frame these insights from a theoretical perspective on the implementation of digital technology in public administration and provide empirically grounded insights into how these challenges play out in practice. We conclude with a discussion of potential reforms that may be useful to policy and decision-makers in public institutions.

ZUSAMMENFASSUNG

Öffentliche Verwaltungen stehen beim Einsatz neuer digitaler Technologien oft vor grossen Herausforderungen. Die Einführung des digitalen Contact Tracings während der Pandemie bot die Gelegenheit, den Stand der Digitalisierung in der Schweizer Verwaltung zu beurteilen und die Herausforderungen, denen sich öffentliche Stellen gegenübersehen, besser zu verstehen. Wir führten semi-strukturierte qualitative Interviews mit Vertretern von eidgenössischen und kantonalen Behörden sowie der nationalen wissenschaftlichen COVID-19-Taskforce durch, um ihre Meinungen und Standpunkte zur Einführung von SwissCovid, einer App zur Ermittlung von Kontaktpersonen, die von der Schweizer Regierung eingesetzt wird, zu untersuchen. Die Interviewdaten wurden mit Hilfe eines Topic Modeling Algorithmus und manueller thematischer Kodierung analysiert. Die Ergebnisse dieser Analyse zeigen, dass die Behörden mit Lücken in der technologischen Kompetenz, unbefriedigenden institutionellen Strukturen und rechtlichen Hindernissen konfrontiert sind, die die Überbehördliche Zusammenarbeit erschweren. Wir geben einen detaillierten qualitativen Überblick darüber, wie sich diese Probleme in der Praxis darstellen, und schliessen mit einer Diskussion über mögliche Reformen, die für Politiker und Entscheidungsträger in öffentlichen Institutionen von Nutzen sein können.

CORRESPONDING AUTHOR:

Viktor Suter

University of St. Gallen,
Switzerland

viktor.suter@unisg.ch

KEYWORDS:

Digital Transformation; Contact Tracing Implementation; Swiss Public Administration; Pandemic Response Technology

TO CITE THIS ARTICLE:

Suter, V. (2023). Digital Contact Tracing in Switzerland: A Computer-Assisted Qualitative Analysis. *Swiss Yearbook of Administrative Sciences*, 14(1), pp. 130–146. DOI: <https://doi.org/10.5334/ssas.177>

Les administrations publiques sont souvent confrontées à des défis importants lorsqu'elles adoptent de nouvelles technologies numériques. L'introduction du traçage des contacts numérique pendant la pandémie a offert l'opportunité d'évaluer l'état de la numérisation dans l'administration suisse et de mieux comprendre les défis rencontrés par les autorités publiques. Nous avons mené des entretiens qualitatifs semi-structurés avec des représentants des agences fédérales et cantonales, ainsi qu'avec la Swiss National COVID-19 Science Task Force, pour explorer leurs points de vue sur la mise en œuvre de SwissCovid, une application de traçage des contacts déployée par le gouvernement suisse. Les données d'entretiens ont été analysées en utilisant une combinaison d'un algorithme de topic modeling et de codage thématique manuel. Les résultats de cette analyse montrent que les agences gouvernementales sont confrontées à des lacunes en matière de culture technologique, de structures institutionnelles insatisfaisantes et de barrières juridiques qui entravent la collaboration inter-agences. Nous proposons une vue d'ensemble qualitative détaillée de la façon dont ces problèmes se manifestent dans la pratique et concluons par une discussion des réformes potentielles qui pourraient être utiles aux décideurs politiques des institutions publiques.

INTRODUCTION

Digital technology is a major driving force behind political change. It affects how citizens form political opinions, participate in politics, and interact with the state. The ambivalent effects of social media on democracy and the innovative tools, such as e-voting, e-collecting, and voting advice applications, that digital technologies enable have been prominently debated (Gilardi, 2022; Linder, 2022). In comparison to these topics, e-government – the digitization of administrative processes to improve service delivery and information exchange between governments and their stakeholders (Pleger & Mertes, 2022) – often receives less attention despite its potential to realize immediate benefits for citizens.

The COVID-19 pandemic brought the importance of digital technology in public administration into sharp focus as it prompted the widespread use of digital contact tracing (e.g., Mello & Wang, 2020; Servick, 2020). The development of technological standards through scientific (Troncoso et al., 2020) and industry (Apple & Google, n.d.) collaboration enabled the rapid deployment of digital contact tracing apps. Implementing this technology presented substantial challenges for public authorities as they had to integrate it into their existing structures and processes under tight deadlines. Government agencies often lacked a comprehensive digital infrastructure for disease surveillance and did not possess the necessary expertise to effectively operate such technology (Troncoso et al., 2022). In this article, we explore the challenges of implementing digital contact tracing in Switzerland as one instance of a large-scale government digitization effort. By examining this specific example, we aim to generate insights into common challenges and suggest potential reforms for the implementation of digital technologies within public administration.

While recent research on digital contact tracing in Switzerland has shed light on its effectiveness and user acceptance (Danio et al., 2022; Salathé et al., 2020), as well as its portrayal in the media (Amann et al., 2021; von Wyl, 2021), there remains a gap in our understanding of the qualitative dimensions that underpin its implementation. The perspectives and opinions of those directly involved in implementing this technology are crucial to understanding the practical challenges and organizational dynamics at play. This study seeks to directly address this gap by engaging with federal and cantonal government staff, as well as scientific advisors to the Federal Council, to capture their experiential understanding of the implementation process. Given Switzerland's pioneering role in establishing technological standards for digital contact tracing (Troncoso et al., 2020) and being among the first in Europe to launch a digital contact tracing app (Amann et al., 2021), the Swiss context presents a rich backdrop for exploring such perspectives. Respondents' first-hand experiences provide an inside perspective from which to assess how organizational context and capabilities within government have influenced the adoption of this novel technology and to identify potential areas for improvement. This approach is also particularly relevant because it captures the often-underreported subtleties and on-the-ground operational realities that shape the implementation of digital technologies.

The remainder of this paper provides a brief overview of the academic literature on digital contact tracing, including both international and Swiss-specific sources. It then outlines relevant aspects of the theory of technology implementation in the public sector in order to derive research questions. The following sections detail the study design, including sampling, participant recruitment, and data analysis technique. Finally, we report the findings and conclude with suggestions for reform.

BACKGROUND INFORMATION

Contact tracing involves identifying individuals who may have been exposed to infectious diseases and advising them to self-isolate, thereby limiting the spread of infections. The digital approach to contact tracing, which uses smartphone apps that employ Bluetooth, QR codes, or GPS data, offers speed, scalability, and the ability to track random contacts (Servick, 2020). This makes it potentially superior to analogue contact tracing, which relies on telephone interviews with infected individuals to identify close contacts from people's recollections of past events (Kendall et al., 2020). SwissCovid, a voluntary-to-use digital contact tracing app, was launched by Swiss health authorities in June 2020 and featured a privacy-preserving data collection system (Troncoso et al., 2022). The app was in use until March 2022, when the Swiss government decommissioned it because it was no longer deemed necessary for coronavirus containment efforts (Federal Office of Public Health, 2022). In its last month of operation, it had 1.45 million daily users (Federal Statistical Office, 2022), equivalent to 16.6% of the Swiss population (8.7 million). According to media reports (Hollenstein, 2020; Schurter, 2022), the government spent between 10 and 11 million Swiss francs to develop SwissCovid.

The effectiveness of digital contact tracing has been the subject of intense debate (Pandit et al., 2022). Early studies suggest that the SwissCovid app was comparable in effectiveness to analogue methods and helped identify hundreds of positive cases per month (Daniore et al., 2022; Salathé et al., 2020). Studies based on British data indicate that a 1% increase in app adoption can reduce infections by 0.8–2.3% (Wymant et al., 2021). Even with low app adoption rates of 15–20% of a population, digital contact tracing has been shown to reduce infections, especially when combined with other non-pharmaceutical interventions such as analogue contact tracing, mask use, and social distancing (Abueg et al., 2021; Moreno López et al., 2021; Rodríguez et al., 2021). Importantly, the effectiveness of these applications depends on variables such as viral reproduction rates, the effectiveness of the health care system, and the socioeconomic circumstances of the population (Cencetti et al., 2021).

Several studies have examined the public perception and media coverage of digital contact tracing applications. Public opinion surveys indicate that 60–70% of people in different European countries and the US support digital contact tracing (Altmann et al., 2020; Lewandowsky et al., 2021). The actual adoption rate, however, was often much lower. A study by von Wyl et al. (2021) found that while 46.5% of Swiss participants reported either using or planning to use a contact tracing app, the proportion of active users in the Swiss population was recorded at 24.2%. Concerns about privacy and trust in government, as well as a lack of digital literacy and health-conscious behaviors, were identified as key reasons for low adoption rates (Guillon & Kergall, 2020; Jansen-Kosterink et al., 2021; Lewandowsky et al., 2021). Media coverage was generally favorable, with news articles in Austrian, German, and Swiss newspapers focusing on data governance issues (e.g., centralized vs. decentralized data processing), participation options (e.g., mandatory vs. voluntary use), and explanations of the app's technical features (Amann et al., 2021). The same study (Amann et al., 2021) found that while media coverage was generally supportive, it also reflected anti-establishment sentiment and skepticism toward governments and technology companies that provided the infrastructure on which digital contact tracing applications ran.

THEORY – DIGITAL TRANSFORMATION IN PUBLIC ADMINISTRATION

The idea that digital technologies can improve the decision-making capabilities and policy implementation efforts of government organizations received a substantial boost after the decline of New Public Management (Margetts & Dunleavy, 2013). New Public Management, a market-centric approach to running public organizations, stressed disaggregation and

competition, and assigned digital technologies a peripheral role. This approach has been replaced by what is sometimes called Digital Era Government (Evans et al., 2019), which emphasizes the integration of departments and levels of government through digitization and focuses on creating user-centric digital services. From this perspective, digital technologies are key drivers of transformative change that enable new ways of working, the introduction of new services, or recognizable improvements in performance levels (Bannister & Connolly, 2014). This view also regularly links the use of digital technologies to the promotion of public sector values such as responsiveness, fairness, transparency, and efficiency (e.g., Ingrams, 2019; Margetts & Dorobantu, 2019).

In the literature, the implementation of digital technologies is often understood to affect two main components (Hanelt et al., 2021). First, it consists of changes in procedures, organizational structures, routines, and norms within public organizations. Second, it comprises changes in the interaction between a public organization and its external environment. This interaction takes place through political participation and the provision of public products or services. Haug et al. (2023) detail the internal and external determinants that influence such technology-driven change. Important endogenous variables include the existence of a coherent digital strategy, an administrative leadership committed to change processes, and sustained stakeholder engagement. Exogenous variables include technological advances, citizen demand for digitized public services, support for digitization from political elites, and the regulatory environment in which public organizations operate.

The adoption of digital technologies can disrupt entire ecosystems of state governance and the labor relations within them. For instance, Giest and Klievink (2022) argue that the potential for disruption is often underestimated at both the political and administrative levels. Rather than understanding digitization efforts from a holistic perspective that takes into account personnel, organizational, and procedural questions, digital technology adoption is frequently relegated to a technical activity focused on digitizing discrete tasks. Such a narrow focus can create a situation where public administrators are faced with unanticipated changes in their roles, a lack of well-defined rules, a shortage of training, and ambiguity about the rationale for change. This kind of poor organizational alignment can easily create barriers to the effective implementation of digital public services.

Theory on the topic also consistently emphasizes the relevance of organizational and bureaucratic culture in public administrations. The general tendency of public administrations to avoid risk reduces the likelihood of experimenting with new technologies that have uncertain outcomes (Mergel et al., 2020). Key challenges include capability barriers, related to the ability of governments to cultivate and maintain internal knowledge that enhances their ability to govern with data, and regulatory barriers, related to the political willingness to change regulatory and administrative frameworks in the face of technological advances (Evans et al., 2019). Institutional contexts that favor established procedures and hierarchies, combined with challenges in achieving broad digital literacy, often result in cost overruns, delays, or failure to deliver digitization projects.

In light of these issues, we outline the following research questions to explore the implementation of SwissCovid. Our focus includes specific aspects identified above: organizational culture, digital leadership, and strategy (RQ 1), stakeholder engagement (RQ 2), and relevant laws and regulations (RQ 3). Additionally, we aim to capture respondents' opinions on potential recommendations for reform (RQ 4).

RQ1: What role did the organizational culture, leadership, and strategy within public administration play for the implementation digital contact tracing?

RQ2: What role did stakeholder engagement play for the implementation of digital contact tracing?

RQ3: How did laws, regulations, and the stance of political decision-makers influence the implementation of digital contact tracing?

RQ4: What changes do interviewees suggest to improve future digitization initiatives?

The selection of SwissCovid as a case study was guided by a number of factors that highlight its particular position and relevance in the context of our research questions. The Swiss government’s early initiative in deploying a contact tracing application established SwissCovid as a pioneering example in Europe, providing a unique perspective on the nuances of early adoption and the challenges associated with it. In addition, the country’s federal and decentralized political structure makes it a highly relevant case from which to draw actionable lessons for other governments with similar governance structures outside of Switzerland. Finally, the transparency and accessibility of SwissCovid’s documentation made it an ideal case for a detailed examination of how digital technology is implemented within public administration on a national scale.

In order to study this case, we employed semi-structured interviews as our main data collection tool. Interviews were chosen for their capacity to capture the personal experiences of those central to the implementation of SwissCovid – insights not captured by prior studies that used other methods, such as media content analyses (Amann et al., 2021; von Wyl, 2021) or public opinion surveys (von Wyl et al., 2021). This method also provides insights into the congruence of theoretical perspectives on digital transformation in the public sector with the practical realities of implementation. Given the relatively early stage of broad digital transformations in public administrations and the distinctive context of SwissCovid, a qualitative approach that allows for exploratory components seemed most appropriate. As Yin (2009) points out, case studies using semi-structured interviews are particularly well-suited for in-depth exploration of phenomena within contexts that are not exhaustively delineated.

SAMPLING AND RECRUITMENT

We identified key actors directly involved in the development and implementation of the SwissCovid app through desk research. To narrow the scope of recruitment and increase the specificity and relevance of the research, we explicitly focused on a small group of primary project owners and experts with high-level insight into digital contract tracing. Eventually, we approached selected members of the Federal Office of Public Health, cantonal health authorities, and the Swiss National Covid-19 Science Task Force. To recruit participants, invitations were sent out via email. Invitations included an overview of the study and its objectives, a guarantee of confidentiality for the participants, an interview guide, and the researcher’s contact information. Out of 15 invitations sent out to different individuals and organizations, a total of 10 individuals eventually participated in an interview, resulting in a conversion rate of 66%.

INTERVIEWS

Between June and September 2022, we conducted semi-structured interviews via video conferencing software. Before each session, participants gave verbal consent to be recorded. They had the option of conducting the interview in English or German, with each session lasting between 25 and 50 minutes. Table 1 provides a demographic breakdown of the participants

Gender	Male	7
	Female	3
Position	Cantonal govt. staff	5
	Scientific advisor	3
	Federal govt. staff	2
Area of Expertise*	Medicine	4
	Computer Science	4
	Public Health	2
	Public Admin. / Management	2
	Epidemiology	2
	Law	1
Number of interviewees		10

Table 1 Sample demographics.

*Interviewees can have expertise in multiple areas.

in terms of gender distribution, professional position, and disciplinary background. We do not present this table to claim representativeness of the sample. Rather, its purpose is to increase transparency and aid in understanding the research context. Given the qualitative exploratory nature of this study, the focus is on depth and discovery rather than sample representativeness.

The design of the interview guide was informed by the aforementioned theoretical considerations and aimed to discover participants' perspectives on the topics articulated in the research questions. The specific questions addressed in the interviews are itemized in the interview guide, which is included in the Appendix.

ANALYSIS

The recordings from the interviews were transcribed verbatim in their original language, using the Sonix transcription software. Six interviews were conducted in German and four in English. To mitigate potential biases that may arise from analyzing data in different languages, the German-language transcripts were translated to English. We employed the DeepL Pro software to translate the interviews, followed by human review to ensure accuracy.

The data analysis was conducted using a two-step iterative process. Rather than relying solely on human coders, we integrated both computational and traditional methods for theme detection. In the first step, we used the Latent Dirichlet Allocation (LDA) topic modeling algorithm to identify latent thematic patterns within the collection of interview transcripts. A thorough description of the LDA technique can be found in the works of Blei (2012) and Blei et al. (2003). Recent findings, as documented by Miner et al. (2023), indicate that topic modeling algorithms frequently align with topics identified by human coders, enhance the replicability of qualitative methods, and are a powerful way to augment manual coding. Standard LDA approaches require the selection of the number of topics k for a given text corpus. Initial qualitative evaluations of the coherence of the topics generated by the algorithm showed that topic models with between four and fifteen individual topics classified the topics in the texts most sensibly.

In the next step, we used manual thematic coding to validate the computer-generated topics. We coded the data using Atlas.ti 23 software, applying a mix of inductive and deductive reasoning (Fereday & Muir-Cochrane, 2006). The inductive analysis focused on the themes identified through topic modeling as well as emergent themes that developed during the manual coding process, while the deductive analysis followed the themes specified in the interview guide. By going through multiple iterations of both computationally and manually generated themes, we converged on six topics. We then manually labeled each topic based on an examination of the associated top terms (as shown in Figure 1) and our close reading of the interview transcripts. The results of this analysis are reported in the next section.

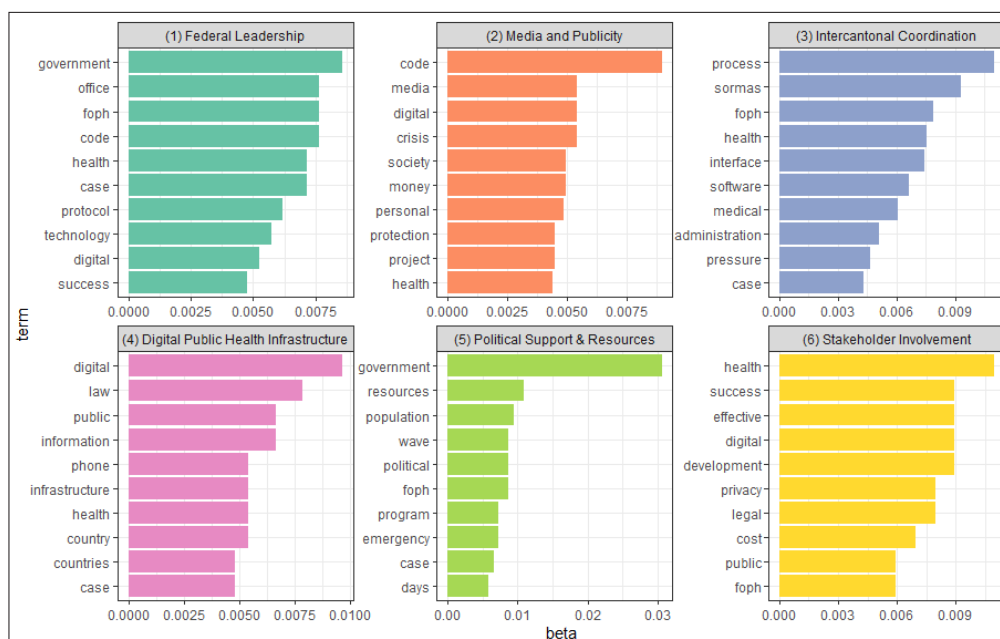


Figure 1 Overview of topics identified by the topic modeling algorithm. The y-axis of the graph shows the top 10 terms identified as part of each topic. Beta on the x-axis measures the relevance of each term to a topic.

The analysis resulted in six topics, as illustrated in Figure 1. These topics encompass the following: (1) federal leadership, (2) media and publicity, (3) intercantonal coordination, (4) digital public health infrastructure, (5) political support and resources, (6) stakeholder involvement. The following sections provide a detailed examination and contextualization of each of these topics.

FEDERAL LEADERSHIP

The Federal Office of Public Health (abbreviated as “foph” in Figure 1) was identified as a key factor in the understanding of digital contact tracing by interviewees. This is consistent with FOPH’s role as the federal authority responsible for health policy and the management of the healthcare system in Switzerland. It was also the primary entity overseeing the implementation of the SwissCovid app. The observations of the interviewees regarding the FOPH covered a range of topics, but a recurring issue that emerged was that of a lack of clear ownership and leadership at the federal level.

“...there was a lack of leadership on digital transformation. Nobody was willing to coordinate the tools.” (Interviewee 4)

This issue was commonly raised by interviewees. They acknowledged a limited willingness or ability to improve and iterate on the app and that there were no meaningful updates to the app since its initial roll-out. For example, Interviewee 3 expressed concerns about the lack of active management and updates to the underlying protocol and parameters of the app.

“...the delta peak of wave three should have led to new parameters, but they were never implemented [...] Information systems are constantly managed and must be constantly adapted, and in this case, there was no one to own the evolution of SwissCovid within the FOPH that was really driving it.” (Interviewee 3)

Interviewees also expressed concern about the allocation of personnel to digitization efforts. The team responsible for digital transformation at the FOPH was small and tasked with overseeing the introduction and maintenance of the SwissCovid app. Despite working in collaboration with other federal offices and private companies, the limited capacity of this team led to the perception among some interviewees that digitalization was not given sufficient priority at the FOPH:

“The team that was responsible for digital transformation at the time was [...] an absolutely minuscule sized team of roughly three people, you know, in an organization of 800. Meaning it’s not even half of a percent of the staff that’s responsible for digital transformation, which just goes to show that this has not been taken seriously.”

(Interviewee 1)

While other interviewees raised similar concerns, they also understood the challenges faced by FOPH in this regard. They recognized that the FOPH was, like most public agencies, overwhelmed during the pandemic and that it is crucial to consider the wider organizational, political, and legal constraints that limited the agency’s scope for action.

“The circumstances and the situation of the FOPH was such that it was really hard to get things moving, but for many reasons. Political and time reasons, resource reasons, etc.” (Interviewee 2)

Some interviewees agreed that improvements could have been made in the handling of the app but they had a more favorable perception of the FOPH’s role. Interviewee 10 highlighted that given the circumstances of the pandemic and the limited experience of the agency with digital projects, the collaboration within the larger group coordinated by the FOPH was effective.

“I think the whole thing with the app was a success because it showed various things are feasible and can be done [...] It was the case that you had to build a rather complex network of organizations and people in a short time. And in my opinion, that worked very well.” (Interviewee 10)

The consensus among interviewees was that the media coverage of the SwissCovid app was of mixed quality. A major concern was that the app received media attention that may have contributed to a lack of adoption and confidence in the app. For instance, interviewees referred to media reports (e.g., SRF, 2021) focused on the fact that some codes entered into the app did not trigger exposure notifications (“...the whole disaster with the codes...” (Interviewee 1)). Interview participants also observed that media reporting captured opinions that misrepresented issues around data protection and anonymization features of the app, which wasn’t addressed by official communication.

“...the initial communication about what the SwissCovid app does do and what it doesn’t do, how the data protection works, that it is really anonymized, that was insufficient. From my point of view more than insufficient and accordingly the attitude of the population towards this technology was rather negative from the ground up.”

(Interviewee 3)

Furthermore, several interviewees mentioned that official communication took a passive approach to promoting the app and that there was no attempt to systematically initiate contact with target groups.

“There was no active management to canvass the population [...] reactive, little marketing and no sales as opposed to any notion of targeted marketing and proactive outreach.” **(Interviewee 4)**

Furthermore, the interviews largely indicate that the absence of public support from politicians for the app (“...no politician wanted to speak out in the media...” (Interviewee 10)), combined with the significant financial resources needed for public relations and marketing campaigns, contributed to the limited visibility of the app.

“...at the end of the day, public relations campaigns are really, really expensive. The federal government has spent millions on these communications efforts, and it never really launched a pure app-only communications campaign like that. [...] So, the app was always there. But it wasn’t any real major action that was explicitly just about the app because it was simply too expensive.” **(Interviewee 10)**

Some of the shortcomings in the media’s portrayal of SwissCovid result from the gaps in federal leadership discussed above. A cohesive approach by the FOPH, which was responsible for leading official communication on the app, could have ensured a consistent public relations strategy. Firm federal leadership would not only oversee the technical improvements of the app, but also shape its public image, clear up doubts, and encourage positive media coverage. The close link between these two topics suggests that improved federal leadership could have led to more proactive outreach and fostered a supportive media environment.

INTERCANTONAL COORDINATION

Cantonal authorities play a crucial role in the organization of the Swiss healthcare system. While the federal government sets national standards, regulations, and guidelines and provides financial support to the cantons, certain key components are regulated at the cantonal level. In particular, the cantons are responsible for the financing and provision of health services within their territories. They were also in charge of the implementation of contact tracing measures. Interviewees often highlighted issues related to the federal-cantonal interface and to how the cantons themselves co-operated. The following quote illustrates the difficulty of coordinating and harmonizing efforts between the cantons:

“...it boils down to, you know, things happening at the cantons. And things happen if cantons take matters into their own hands. I’m not trying to put all the blame on the cantons. But it makes things very complicated. And, you know, we saw it not just with SwissCovid. We also saw it in harmonizing data collection for manual contact tracing.”

(Interviewee 2)

Cantonal sovereignty over public health resulted in the implementation of multiple, incompatible contact tracing systems in the cantons, which reduced data flow between authorities and the overall effectiveness of the tracing process.

“...you have to have systems that work across the cantonal borders [...] It’s a big problem for me and it reduces the efficiency of contact tracing tremendously because the systems are not compatible.” (Interviewee 3)

The different solutions in the cantons also created problems with the flow of information between the testing laboratories and the cantons, resulting in problems with notifying citizens of possible infections.

“...the testing is done by labs, and the information flow between the labs and the cantons and dedication with the cantons down to the people turned out to be problematic.” (Interviewee 4)

A group of cantons sought to establish a joint system by using SORMAS, an open-source software for contact tracing, data collection, and case management developed in Germany. However, several interviewees thought this system was difficult to customize and, due to the German origin of the software, impractical.

“I need a program that can not only store data, but also send data from within the program. That means I have to be able to send a text message or an email from within the program, and SORMAS, for example, can’t do that.” (Interviewee 3)

“If, for example, SORMAS suddenly sends data to Germany, it gets very inefficient because there are an insane number of checks and clearances that have to be... For that alone, they hired two lawyers for a while, who did nothing but check whether it was legal.” (Interviewee 7)

Most importantly, the use of SORMAS did not address challenges related to data flow and communication capabilities. As Interviewee 4 mentioned, the system was not optimized to facilitate data sharing and interoperability between different cantons.

“...they [the cantons that used SORMAS] concluded that the right deployment model would be to have independent instances of SORMAS deployed next to each other in a data center. Add the data without any programmatic coupling in-between and without any sharing of data between them.” (Interviewee 4)

Overall, the lack of standardized and interoperable IT tools and systems at the cantonal level resulted in a piecemeal arrangement of systems that created data silos and hindered the efficient exchange of information. Interviewee 5 noted that this problem has been recognized by policymakers, but that there is no solution in sight.

“So this keyword, patchwork of measures in the various cantons. That at the political level, too, people realize that crisis management of this kind does not end at the borders of municipalities and cantons, but that a joint national approach is needed and that no one will lose any sleep over it if everybody does the same thing. That is a mental aspect that remains unresolved.” (Interviewee 5)

The strength (or weakness) of intercantonal coordination is closely linked to the leadership dynamics at the federal level. Specifically, the limited capacity of the FOPH’s digital transformation team corresponds to the fragmented IT systems found in individual cantons. While a fully unified national approach may be aspirational given Switzerland’s confederated institutional structure, a better-resourced federal team could potentially have cultivated a more harmonized strategy between cantons. Moreover, the federal government’s role in setting standards is directly linked to the cantons’ responsibility for implementing them. Any perceived shortcomings at the federal level could therefore amplify challenges to coordination and consistency at the cantonal level.

Overall, most interviewees felt that the problems with contact tracing in general and the implementation of the app in particular reflected the government's lack of technological expertise. They mentioned that the country's IT systems lag behind those of other countries. Respondents also highlighted the need for a comprehensive infrastructure approach to digital communications within the Swiss administration and pointed out that the law can play an enabling role. Regarding the federal government's digital skill and competencies, Interviewee 1 suggested that there are cultural barriers to the adoption of digital technologies:

"...our government is technologically not very savvy. I mean, at least not on average, and certainly not in the public health field. There are sections that are quite savvy, but the Federal Office for Public Health isn't, and the Federal Council isn't either. And so there wasn't that culture, right?" (Interviewee 1)

Interviewees also noted a lack of technological preparedness in the cantons. As Interviewee 7 pointed out, contact tracing routines were at best rudimentary before the outbreak of the pandemic.

"...you had to realize that we don't really have an infrastructure, but that contact tracing was something that a person at the cantonal medical service did as a side activity when an infectious notifiable disease appeared somewhere. And that was somehow limited to a maximum of 5 to 10 cases per disease or virus. [...] that was still quite far away from a real administrative process. It was an Excel list." (Interviewee 7)

Many cantons demonstrated the ability to rapidly digitize their operations and processes during the pandemic. However, a large part of the interviewees observed that the IT infrastructure was not as capable as that in other countries, with participants often citing Scandinavia as a benchmark.

"...the IT systems in Switzerland, [it] must be said quite clearly... We are simply ten years behind countries like Sweden or Norway." (Interviewee 3)

Furthermore, several interviewees acknowledged that the public administration lacks a comprehensive digital infrastructure and that there is no plan for how the digital transformation of public services in Switzerland should be approached.

"We don't think of it as an infrastructure of its own right the way the post office is a national infrastructure, the way the highways are national infrastructure, the way the tunnels are our national infrastructure. We don't think about the way various parts of the Swiss administration communicate with each other [...] We don't have any infrastructure equivalent for our digital lives in Switzerland as citizens, as patients, as professionals, as members of the administrations." (Interviewee 4)

"...what I'm saying is [that in terms of] digital transformation, the gaps have been pointed out to me now. But there's no real plan yet, no real idea of how you can and will close those gaps." (Interviewee 10)

The interviews also illustrated that the law plays an important role in shaping the digital public infrastructure. Interviewees mentioned that the legal basis for the SwissCovid app included important core principles that are generally beneficial for the provision of digital services by the public administration.

"The law is very good. If you actually look at the revision of the Epidemics Act that provides the legal basis for the Swiss government, it's quite principled. It talks about the fact that it's free, it's voluntary, it's open source. All these things, I think, were very important principles." (Interviewee 2)

However, other respondents disagreed and noted that certain provisions within the legal framework hampered the flexibility needed to run a digital public service. For instance, the ordinance governing SwissCovid presented challenges in terms of updating and modifying the application as the circumstances during the pandemic evolved.

“The ordinance is way overly detailed in my opinion, in a non-constructive way because it tries to codify how the program works.” (Interviewee 4)

“...we had to develop a legal basis for the app, both in the Epidemics Act, but then also an ordinance. And that, of course, pretty much restricted our options. That is, we could change little simply like that.” (Interviewee 9)

The overarching sentiment that Switzerland lags behind other nations in its digital public infrastructure is directly related to the need for political support and resources. The willingness (or lack thereof) to invest in IT and adapt regulatory frameworks determines the development and maintenance of this infrastructure. Similarly, the government’s lack of technological expertise can be linked to the need for long-term investment and political support to push digital transformation forward. These issues of political support and resources are discussed next.

POLITICAL SUPPORT & RESOURCES

Most interviewees agreed that politicians effectively facilitated the provision of the necessary support and resources for the deployment of SwissCovid. They cited the federal government’s rapid initial policy responses and the acceleration of the legislative process, specifically the consultations associated with it, in reaction to the pandemic.

“...the fact that this went through parliament extremely quickly and we were able to launch this app in June with a legal mandate. You know, if you know anything about Swiss politics, which I didn’t at the time, this is just historically fast.” (Interviewee 1)

“Normally such a consultation takes at least three weeks. In our case it sometimes took a few days.” (Interviewee 9)

Several interviewees reported that although some politicians stressed the importance of data protection, there was no opposition to SwissCovid. In fact, policymakers were largely supportive of the app and digital contact tracing in general.

“There was definitely goodwill there in some parliamentary discussions. There were a few more critical voices regarding data protection who always said it’s important, don’t forget data protection. That too. But I have not noticed any real opposition.” (Interviewee 10)

Some interviewees, however, noted that as the severity of the Covid-19 waves decreased and the number of cases dropped, it became more difficult to communicate to politicians the need for sustained resource allocation.

“...we will be busy with this pandemic in the coming months and possibly years. And to do that, we need new resources. And that is expensive. And the politicians, of course, are less than enthusiastic about investing in this.” (Interviewee 5)

Furthermore, several respondents spoke about the need for long-term investment in IT infrastructure as a critical aspect of the digital transformation of the public administration, but that there are challenges in securing political support and thus the necessary funding.

“...we would have to invest in IT millions, Switzerland-wide, of francs, not only to be prepared for a next pandemic or epidemic, but simply to make our normal situation much more efficient.” (Interviewee 3)

“What the crisis has certainly shown is the topic of digital transformation. You have the weak points, the vulnerabilities pointed out. And these will not be solved in such a short time. Unless you are willing to put a lot of money into it. [...] I don’t know which politician is going out on a limb to do that.” (Interviewee 10)

Political support and resource allocation are linked to aspects of federal leadership. Leadership with a focus on digital technologies can be challenging when politicians are reluctant to make long-term commitments and invest in digital transformation. While the legislative processes

for SwissCovid moved quickly, increased stakeholder engagement led by the federal level would have provided additional leverage. The combination of rapid passage of legislation and strong stakeholder collaboration could ensure more efficient implementation on the ground. Such aspects of stakeholder engagement are discussed in the following section.

STAKEHOLDER INVOLVEMENT

In addition to the topics raised in previous paragraphs, interviewees identified factors related stakeholder participation that could have improved the implementation of the app. They noted that there were challenges in evaluating the effectiveness of the app due to strict data protection and privacy standards. This led to issues in the communication with interested parties and eventually to negative perceptions of the app by some in the healthcare sector. Interviewees stated that because of the strict legal limits on data collection it was extremely challenging to calculate any measure of the app's impact:

"...when asked: Yeah, what's the point? We could never say, the app has prevented this many infections, because we just don't know. Sure, you can calculate it with some methods, but in the end, you don't have any hard facts." (Interviewee 9)

Difficulties in accurately and meaningfully measuring the app's performance made it challenging to communicate its usefulness to the cantonal health authorities, whose support was crucial to the app's successful implementation. Some interviewees working for cantonal health authorities reported that they did not understand the app's value proposition and questioned its effectiveness.

"I didn't understand until today what the point of the app is, I have to be honest." (Interviewee 3)

"I think a key point for the acceptance of the SwissCovid app in the expert community would be if it could or can show that people who would not have gotten tested and are really positive go and get tested because of a warning. With the SwissCovid app, we wanted to catch people ahead of time who otherwise wouldn't have gotten tested and would have infected others. And I have never seen this proof." (Interviewee 6)

While the limitations of data collection created barriers to securing the commitment of key stakeholders, interviewees also suggested that insufficient attention had been paid to involving affected parties. Accordingly, most interviewees noted that the communication between government organizations and healthcare professionals was not well coordinated.

"And this whole commitment part that was also something that was totally underdeveloped and not really on the radar. [...] what we underestimated was the need for partnerships, you know, people in manual contact tracing and at the testing centers who need to support the app." (Interviewee 2)

Interviewees held differing opinions about who should be responsible for engaging healthcare professionals. Some felt that the federal government had failed to provide clear direction and guidance. They expressed criticism regarding the communication coming from the federal level.

"As far as contact tracing in particular is concerned, there was no exchange for a long time. It was a mystery to us. Why not?" (Interviewee 5)

In contrast, other interview participants observed that the federal authorities lacked the necessary authority to issue direct orders because contact tracing fell within the jurisdiction of the cantons.

"...in the health sector, the greatest competence is actually with the cantons, not with the federal government. And especially, contact tracing is and always has been the responsibility of the cantons." (Interviewee 9)

Overall, however, respondents agreed that there was room for improvement in the integration of the app into the healthcare system and that better stakeholder involvement is a necessary condition for this to happen.

The analysis points to three primary areas of concern, each of which corresponds to research questions 1 through 3 as outlined above. First, the findings indicate that a lack of technological expertise and leadership hampers the development of a robust digital infrastructure. Second, existing institutional structures and procedural norms act as barriers to effective coordination and collaboration. Third, there is a need for legal and regulatory frameworks that facilitate digitization. The following sections briefly summarize each of these findings in turn. Finally, the conclusion outlines recommendations for improvement in accordance with research question 4.

(1) Limited Technological Expertise & Leadership: The importance of digital leadership and strategy, as well as technological expertise, is well established in the literature (e.g., [Evans et al., 2019](#); [Giest & Klievink, 2022](#)). This idea relates to RQ1, which explores how these aspects have factored into the implementation of digital contact tracing. Interviewees across agencies and cantons highlighted a general shortfall in digital leadership and commitment to digital solutions, which contributed to a disjointed approach to contact tracing. Each canton adopted different technological resources, resulting in duplication of effort and obstacles to sharing knowledge. The federal government's lack of focus on digitization appears to reflect past attitudes toward digital technology as peripheral, highlighting the need for a culture of strong leadership and organizational support for digital initiatives ([Mergel et al., 2018](#)). Without this, as the implementation of digital contact tracing has shown, outcomes are compromised.

(2) Lack of Coordination & Collaboration: Highlighting the second research question, RQ2, stakeholder engagement is essential for the successful implementation of digital initiatives, as emphasized by [Hanelt et al. \(2021\)](#) and [Haug et al. \(2023\)](#). The interview data underscored a lack of coordination and collaboration, pointing to entrenched institutional structures and routine agency functioning as barriers. A lack of collaboration not only made it difficult to secure the support and commitment of key health stakeholders, but also hindered the harmonization of IT systems across administrative units. As a result, effective information sharing across organizational boundaries was hampered. This demonstrates the importance of stakeholder engagement in the adoption of digital innovations. In the absence of such engagement, the goal of a digital government that delivers efficient, user-centered services will continue to be challenging.

(3) Regulatory Framework: The legal and regulatory context, which is relevant to RQ3, has a significant impact on the adoption of digital public services such as contact tracing apps. The regulatory environment in Switzerland was praised for its alignment with public values such as transparency and social inclusion ([Ingrams, 2019](#)). Nevertheless, the regulatory framework also posed challenges, particularly in collecting data to assess the effectiveness of SwissCovid, echoing concerns about regulatory barriers identified in previous work ([Evans et al., 2019](#); [Mergel et al., 2018](#)). The perceived inflexibility of legal guidelines underlines the importance of creating a legal environment that balances protective measures with the need for innovation and adaptability – a balance that is essential for the iterative improvement of digital public services and a key consideration in understanding the role of laws and regulations in the adoption of digital technologies.

CONCLUSION

In response to research question 4, which asks about recommended changes to improve future digital initiatives, participants offered several schemes for improvement. They called for a heightened focus on developing digital and data expertise. This could be realized through comprehensive training initiatives and fostering skill exchange across administrative branches. A standout recommendation was the creation of specialized competence centers. These would be strategically grouped by specific policy areas, such as health or education. The main objective behind these centers would be to spur collaboration, facilitate the exchange of best practices, and ensure that all departments are on the same digital page. Aside from adapting laws and regulations to the requirements of digital technology development, as touched upon above, one of the more ambitious proposals was the idea of legally mandating the digitization of public agencies. This would not only concern the introduction of digital-first public services, but also encompass refining internal digital communication channels, instituting standard data formats, and implementing interoperable IT systems. This call also included the establishment of clear and actionable data sharing guidelines. The underlying sentiment among most of the interviewees was clear: there is a palpable desire for a more defined roadmap for the implementation of digital

technologies and the digital transformation of the public administration. Such suggestions for reforms are supported by the literature's emphasis on understanding digitization holistically, rather than as a piecemeal effort to digitize individual tasks. Future policy discussions or initiatives could benefit from taking such observations into account.

APPENDIX: INTERVIEW GUIDE

Before the interview, the researcher informed the respondents of the study's aims and reminded them of the confidentiality and anonymity safeguards in place. The researcher also asked for permission to record the conversation prior to the interview.

INTRODUCTION: Respondent's position and role in the project.

- What is your role in the project and what is your disciplinary background?
- In what phases of the project were you involved in and for how long have you been working on the project?

TOPIC 1: Respondent's opinion on the challenges and benefits of SwissCovid, including participation.

- In your opinion, was SwissCovid a major, minor, or not a success?
- What were the good things about SwissCovid? What worked well?
- What is your opinion of the preliminary end of SwissCovid?
- Did the use of SwissCovid present any new challenges? If so, what were they? If not, did existing challenges change?
- Do you see any particular impact on citizen participation? Do you think the project could have benefited from more public input?
- Did you feel that you were able to strike a balance between acting quickly and accommodating the needs of citizens with SwissCovid? If so, how did you achieve this balance? If not, do you think the process should be more open to citizen input? How could this be done?
- How does the process of public consultation during the SwissCovid project compare to similar projects you have participated in?

TOPIC 2: Assessing respondent's opinion on working practices and collaboration.

- What management techniques did you use to organize project activities and tasks?
- Did you consider using agile development methods?
- What was your experience with collaborating across organizational boundaries? Were you able to share and collaborate effectively with individuals outside your organization?
- Did you establish any structures or processes for collecting user feedback and facilitating outside collaboration?
- Did policy makers encourage an open implementation of the project? Did you encounter resistance on any specific issues?
- Did the project's external requirements or demands change during its course? If so, what changed and were you able to respond adequately to these changes? If not, what prevented you from adjusting?

TOPIC 3: Respondent's views on regulations and policies adopted for the project.

- Did you follow any specific guidelines, regulations, or policies during the project? If so, which ones?
- How did these specifications impact the project?
- Did the rules and regulations adequately equip the project team for its task?
- If not, do you think different regulations are needed? If so, what aspects should be changed?

- What new skills and resources did the project provide?
- Do you believe that the use of large-scale citizen data has potential for use in other areas of public administration? If so, in what domains?
- If you could work on similar projects in the future, what recommendations would you have? What aspects need improvement?
- What aspects would be paramount?

COMPETING INTERESTS

The author has no competing interests to declare.

AUTHOR AFFILIATIONS

Viktor Suter  orcid.org/0000-0002-2682-5073

University of St. Gallen, Switzerland

REFERENCES

- Abueg, M., Hinch, R., Wu, N., Liu, L., Probert, W., Wu, A., Eastham, P., Shafi, Y., Rosencrantz, M., Dikovsky, M., Cheng, Z., Nurtay, A., Abeler-Dörner, L., Bonsall, D., McConnell, M. V., O'Banion, S., & Fraser, C. (2021). Modeling the effect of exposure notification and non-pharmaceutical interventions on COVID-19 transmission in Washington state. *Npj Digital Medicine*, 4(1), 49. DOI: <https://doi.org/10.1038/s41746-021-00422-7>
- Altmann, S., Milsom, L., Zillesen, H., Blasone, R., Gerdon, F., Bach, R., Kreuter, F., Nosenzo, D., Toussaert, S., & Abeler, J. (2020). Acceptability of App-Based Contact Tracing for COVID-19: Cross-Country Survey Study. *JMIR mHealth and uHealth*, 8(8), e19857. DOI: <https://doi.org/10.2196/19857>
- Amann, J., Sleight, J., & Vayena, E. (2021). Digital contact-tracing during the Covid-19 pandemic: An analysis of newspaper coverage in Germany, Austria, and Switzerland. *PLOS ONE*, 16(2), e0246524. DOI: <https://doi.org/10.1371/journal.pone.0246524>
- Apple & Google. (n.d.). *Exposure Notifications: Help slow the spread of COVID-19, with one step on your phone*. Covid-19 Information & Resources. https://www.google.com/intl/en_us/covid19/exposurenotifications/
- Bannister, F., & Connolly, R. (2014). ICT, public values and transformative government: A framework and programme for research. *Government Information Quarterly*, 31(1), 119–128. DOI: <https://doi.org/10.1016/j.giq.2013.06.002>
- Blei, D. M. (2012). Probabilistic topic models. *Communications of the ACM*, 55(4), 77–84. DOI: <https://doi.org/10.1145/2133806.2133826>
- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent dirichlet allocation. *Journal of Machine Learning Research*, 3(Jan), 993–1022.
- Cencetti, G., Santin, G., Longa, A., Pigani, E., Barrat, A., Cattuto, C., Lehmann, S., Salathé, M., & Lepri, B. (2021). Digital proximity tracing on empirical contact networks for pandemic control. *Nature Communications*, 12(1), 1655. DOI: <https://doi.org/10.1038/s41467-021-21809-w>
- Daniore, P., Nittas, V., Ballouz, T., Menges, D., Moser, A., Höglinger, M., Villiger, P., Schmitz-Grosz, K., & Von Wyl, V. (2022). Performance of the Swiss Digital Contact-Tracing App Over Various SARS-CoV-2 Pandemic Waves: Repeated Cross-sectional Analyses. *JMIR Public Health and Surveillance*, 8(11), e41004. DOI: <https://doi.org/10.2196/41004>
- Evans, M., Dunleavy, P., McGregor, C., & Halupka, M. (2019). Towards digital era governance: Lessons from the Australian experience. In A. Massey (Ed.), *A Research Agenda for Public Administration*. Edward Elgar Publishing. DOI: <https://doi.org/10.4337/9781788117258.00015>
- Federal Office of Public Health. (2022). *SwissCovid app—Temporary suspension*. <https://www.bag.admin.ch/bag/en/home/krankheiten/ausbrueche-epidemien-pandemien/aktuelle-ausbrueche-epidemien/novel-cov/swisscovid-app-und-contact-tracing.html>
- Federal Statistical Office. (2022). *SwissCovid App Monitoring*. <https://www.experimantal.bfs.admin.ch/expstat/en/home/innovative-methods/swisscovid-app-monitoring.html>
- Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating Rigor Using Thematic Analysis: A Hybrid Approach of Inductive and Deductive Coding and Theme Development. *International Journal of Qualitative Methods*, 5(1), 80–92. DOI: <https://doi.org/10.1177/160940690600500107>

- Giest, S. N., & Klievink, B.** (2022). More than a digital system: How AI is changing the role of bureaucrats in different organizational contexts. *Public Management Review*, 1–20. DOI: <https://doi.org/10.1080/14719037.2022.2095001>
- Gilardi, F.** (2022). *Digital Technology, Politics, and Policy-Making (Elements in Public Policy)*. Cambridge University Press. DOI: <https://doi.org/10.1017/9781108887304>
- Guillon, M., & Kergall, P.** (2020). Attitudes and opinions on quarantine and support for a contact-tracing application in France during the COVID-19 outbreak. *Public Health*, 188, 21–31. DOI: <https://doi.org/10.1016/j.puhe.2020.08.026>
- Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C.** (2021). A Systematic Review of the Literature on Digital Transformation: Insights and Implications for Strategy and Organizational Change. *Journal of Management Studies*, 58(5), 1159–1197. DOI: <https://doi.org/10.1111/joms.12639>
- Haug, N., Dan, S., & Mergel, I.** (2023). Digitally-induced change in the public sector: A systematic review and research agenda. *Public Management Review*, 1–25. DOI: <https://doi.org/10.1080/14719037.2023.2234917>
- Hollenstein, E.** (2020, July 26). *Die Covid-App kostet 11 Millionen Franken*. *Persoelich.Com*. <https://www.persoelich.com/kategorie-werbung/die-covid-app-kostet-11-millionen-franken>
- Ingrams, A.** (2019). Public Values in the Age of Big Data: A Public Information Perspective: Public Values in the Age of Big Data. *Policy & Internet*, 11(2), 128–148. DOI: <https://doi.org/10.1002/poi3.193>
- Jansen-Kosterink, S., Hurmuz, M., den Ouden, M., & van Velsen, L.** (2021). Predictors to Use Mobile Apps for Monitoring COVID-19 Symptoms and Contact Tracing: Survey Among Dutch Citizens. *JMIR Formative Research*, 5(12), e28416. DOI: <https://doi.org/10.2196/28416>
- Kendall, M., Milsom, L., Abeler-Dörner, L., Wymant, C., Ferretti, L., Briers, M., Holmes, C., Bonsall, D., Abeler, J., & Fraser, C.** (2020). Epidemiological changes on the Isle of Wight after the launch of the NHS Test and Trace programme: A preliminary analysis. *The Lancet Digital Health*, 2(12), e658–e666. DOI: [https://doi.org/10.1016/S2589-7500\(20\)30241-7](https://doi.org/10.1016/S2589-7500(20)30241-7)
- Lewandowsky, S., Dennis, S., Perfors, A., Kashima, Y., White, J. P., Garrett, P., Little, D. R., & Yesilada, M.** (2021). Public acceptance of privacy-encroaching policies to address the COVID-19 pandemic in the United Kingdom. *PLOS ONE*, 16(1), e0245740. DOI: <https://doi.org/10.1371/journal.pone.0245740>
- Linder, W.** (2022). Zur Ambivalenz der Digitalisierung direkter Demokratie. In M. Bühlmann & H.-P. Schaub (Eds.), *Direkte Demokratie in der Schweiz*. Seismo Verlag AG. DOI: <https://doi.org/10.33058/seismo.30822>
- Margetts, H., & Dorobantu, C.** (2019). Rethink government with AI. *Nature*, 568(7751), 163–165. DOI: <https://doi.org/10.1038/d41586-019-01099-5>
- Margetts, H., & Dunleavy, P.** (2013). The second wave of digital-era governance: A quasi-paradigm for government on the Web. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 371(1987), 20120382. DOI: <https://doi.org/10.1098/rsta.2012.0382>
- Mello, M. M., & Wang, C. J.** (2020). Ethics and governance for digital disease surveillance. *Science*, 368(6494), 951–954. DOI: <https://doi.org/10.1126/science.abb9045>
- Mergel, I., Ganapati, S., & Whitford, A. B.** (2020). Agile: A New Way of Governing. *Public Administration Review*, 81(1), 161–165. DOI: <https://doi.org/10.1111/puar.13202>
- Mergel, I., Gong, Y., & Bertot, J.** (2018). Agile government: Systematic literature review and future research. *Government Information Quarterly*, 35(2), 291–298. DOI: <https://doi.org/10.1016/j.giq.2018.04.003>
- Miner, A. S., Stewart, S. A., Halley, M. C., Nelson, L. K., & Linos, E.** (2023). Formally comparing topic models and human-generated qualitative coding of physician mothers' experiences of workplace discrimination. *Big Data & Society*, 10(1), 205395172211491. DOI: <https://doi.org/10.1177/20539517221149106>
- Moreno López, J. A., Arregui García, B., Bentkowski, P., Bioglio, L., Pinotti, F., Boëlle, P.-Y., Barrat, A., Colizza, V., & Poletto, C.** (2021). Anatomy of digital contact tracing: Role of age, transmission setting, adoption, and case detection. *Science Advances*, 7(15), eabd8750. DOI: <https://doi.org/10.1126/sciadv.abd8750>
- Pandit, J. A., Radin, J. M., Quer, G., & Topol, E. J.** (2022). Smartphone apps in the COVID-19 pandemic. *Nature Biotechnology*, 40(7), 1013–1022. DOI: <https://doi.org/10.1038/s41587-022-01350-x>
- Pleger, L. E., & Mertes, A.** (2022). Einführung: Digitale Transformation der öffentlichen Verwaltung in der Schweiz: Stand, Entwicklungslinien und Praxisbeispiele. In L. E. Pleger & A. Mertes (Eds.), *Digitale Transformation der öffentlichen Verwaltung in der Schweiz: Stand, Entwicklungslinien und Praxisbeispiele*. Springer Fachmedien Wiesbaden. DOI: <https://doi.org/10.1007/978-3-658-36591-2>
- Rodríguez, P., Graña, S., Alvarez-León, E. E., Battaglini, M., Darias, F. J., Hernán, M. A., López, R., Llana, P., Martín, M. C., RadarCovidPilot Group, Ramirez-Rubio, O., Romaní, A., Suárez-Rodríguez, B., Sánchez-Monedero, J., Arenas, A., & Lacasa, L.** (2021). A population-based controlled experiment assessing the epidemiological impact of digital contact tracing. *Nature Communications*, 12(1), 587. DOI: <https://doi.org/10.1038/s41467-020-20817-6>

- Salathé, M., Althaus, C. L., Anderegg, N., Antonioli, D., Ballouz, T., Bugnion, E., Čapkun, S., Jackson, D., Kim, S.-I., Larus, J. R., Low, N., Lueks, W., Menges, D., Moullet, C., Payer, M., Riou, J., Stadler, T., Troncoso, C., Vayena, E., & Von Wyl, V.** (2020). Early evidence of effectiveness of digital contact tracing for SARS-CoV-2 in Switzerland. *Swiss Medical Weekly*, 150(5153), w20457. DOI: <https://doi.org/10.4414/smw.2020.20457>
- Schurter, D.** (2022, March 23). *Der Bund schaltet SwissCovid ab – das musst du jetzt wissen*. Watson. https://www.watson.ch/digital/schweiz/329637086-der-bund-schaltet-swisscovid-ab-das-musst-du-wissen#h4_5
- Servick, K.** (2020). Can phone apps slow the spread of the coronavirus? *Science*, 368(6497), 1296–1297. DOI: <https://doi.org/10.1126/science.368.6497.1296>
- SRF.** (2021, January 18). *Covid-Codes als Flaschenhals – doch die Warn-App funktioniert*. Schweizer Radio Und Fernsehen. <https://www.srf.ch/news/schweiz/swisscovid-app-covid-codes-als-flaschenhals-doch-die-warn-app-funktioniert>
- Troncoso, C., Bogdanov, D., Bugnion, E., Chatel, S., Cremers, C., Gürses, S., Hubaux, J.-P., Jackson, D., Larus, J. R., Lueks, W., Oliveira, R., Payer, M., Preneel, B., Pyrgelis, A., Salathé, M., Stadler, T., & Veale, M.** (2022). Deploying decentralized, privacy-preserving proximity tracing. *Communications of the ACM*, 65(9), 48–57. DOI: <https://doi.org/10.1145/3524107>
- Troncoso, C., Payer, M., Hubaux, J.-P., Salathé, M., Larus, J., Bugnion, E., Lueks, W., Stadler, T., Pyrgelis, A., Antonioli, D., Barman, L., Chatel, S., Paterson, K., Čapkun, S., Basin, D., Beutel, J., Jackson, D., Roeschlin, M., Leu, P., ... Pereira, J.** (2020). *Decentralized Privacy-Preserving Proximity Tracing*. <https://doi.org/10.48550/ARXIV.2005.12273>
- von Wyl, V.** (2021). Challenges for Nontechnical Implementation of Digital Proximity Tracing During the COVID-19 Pandemic: Media Analysis of the SwissCovid App. *JMIR mHealth and uHealth*, 9(2), e25345. DOI: <https://doi.org/10.2196/25345>
- von Wyl, V., Höglinger, M., Sieber, C., Kaufmann, M., Moser, A., Serra-Burriel, M., Ballouz, T., Menges, D., Frei, A., & Puhan, M. A.** (2021). Drivers of Acceptance of COVID-19 Proximity Tracing Apps in Switzerland: Panel Survey Analysis. *JMIR Public Health and Surveillance*, 7(1), e25701. DOI: <https://doi.org/10.2196/25701>
- Wymant, C., Ferretti, L., Tsallis, D., Charalambides, M., Abeler-Dörner, L., Bonsall, D., Hinch, R., Kendall, M., Milsom, L., Ayres, M., Holmes, C., Briers, M., & Fraser, C.** (2021). The epidemiological impact of the NHS COVID-19 app. *Nature*, 594(7863), 408–412. <https://doi.org/10.1038/s41586-021-03606-z>
- Yin, R. K.** (2009). *Case study research: Design and methods* (4. ed.). Sage. DOI: <https://doi.org/10.1038/s41586-021-03606-z>

TO CITE THIS ARTICLE:

Suter, V. (2023). Digital Contact Tracing in Switzerland: A Computer-Assisted Qualitative Analysis. *Swiss Yearbook of Administrative Sciences*, 14(1), pp. 130–146. DOI: <https://doi.org/10.5334/ssas.177>

Submitted: 18 April 2023

Accepted: 07 November 2023

Published: 21 December 2023

COPYRIGHT:

© 2023 The Author(s). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited. See <http://creativecommons.org/licenses/by/4.0/>.

Swiss Yearbook of Administrative Sciences is a peer-reviewed open access journal published by Ubiquity Press.