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Final Thesis

Why E-government projects fail: main antecedents of the non-adoption of Electronic Health Records in Germany according to stakeholder perceptions

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Authorship Declaration

I have prepared this thesis independently. All the views of other authors, as well as data from literary sources and elsewhere, have been cited.

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Abstract

The Electronic Health Record in Germany was introduced in January 2021 and offers the integrated use of the application across sectors and institutions. However, two years after this introduction, less than 1% of the German population has applied for such a record with their health insurance provider. This is despite evident support of medical professionals as well as the society at large. To explain this non-adoption in particular and e-government non-adoption in general, the main goal of this thesis is the synthesis of the main antecedents of e-government non-adoption by investigating the perceptions of its main stakeholders: political stakeholders, medical professionals and citizens.

Building on the assumption that non-adoption is not simply the opposite of adoption, and that perceptions of stakeholders play a crucial role in the engagement with e-government, this study is set in an interpretive, single case study. Moreover, the research conducted in this thesis employs Q-methodology, a mixed-methods approach that allows for the study of subjective experiences, and therefore perceptions. Analyzing the data from 29 participants (4 political stakeholders, 9 medical professionals and 16 citizens), this study found four main antecedents of non-adoption: communication, trust, design and attitude. These can be considered a starting point for more research focused explicitly on non-adoption and give valuable insights for practitioners.

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List of abbreviations

EHR	*Electronic Health Record*
gematik	*governmental body responsible for the EHR*
ICT	*Information and Communication Technology*
IS	*Information System*
IT	*Information Technology*
TI	*Telematics Infrastructure*

1. Introduction

 "Without acceptance, the [Electronic Health Record] will end up exactly where the digital ID card has rested since its introduction: in the graveyard of well-intentioned but poorly executed digital technology projects" (Debatin & Dirks, 2020).

These are the words of two experts at the health innovation hub at the German Ministry of Health, shortly before its introduction. Nevertheless, two years after the introduction of the Electronic Health Record (EHR) in Germany, this is exactly what the project is struggling with. As of February 9, 2023 only 599,374 of around 73 million insured citizens use the EHR, a ratio of less than 1% (*TI-Dashboard*, 2023). There can be no doubt about the good intention with which this project was introduced – high hopes were and are placed on the role of the EHR for the quality of medical care as well as the efficiency of the institutions involved. Moreover, the government has been planning the introduction of the EHR as a core public service for decades (Stachwitz & Debatin, 2023).

In fact, the EHR was introduced as one effort to combat the extensive challenges facing the German healthcare system. With an aging population and a shortage of skilled labor regarding medical professionals, Germany's healthcare system is already under pressure and expected to be even more so in the future. For example, only 30% of doctors as well as nurses say that they can imagine working until their retirement age, 72% lament the intense physicality of their jobs and it is estimated that 1,8 million positions in the healthcare sector will not be filled in 2023 alone (PwC, 2022). Moreover, the costs for medical technologies and drugs are rising as well. The healthcare system is thus under continuous pressure to keep improving the quality of care, even though it is also under pressure to keep costs under control (Debatin & Dirks, 2020; Drews & Schirmer, 2015; Stachwitz & Debatin, 2023).

Digital health solutions offer one new perspective on this challenge, seeing as, when executed properly, they can help alleviate administrative burden and increase efficiency as well as effectiveness for all parties involved (Cucciniello et al., 2015; Debatin & Dirks, 2020; Kohli & Tan, 2016). This is true for medical professionals as much as patients or the German government as the main healthcare provider. At the same time, these solutions also offer the possibility of increasing the quality of treatment and patient-doctor relations (Kohli & Tan, 2016; SVR, 2021). Ideally, for example, patients would only come to the doctor when truly necessary because patients could renew their prescriptions online or share their routine data, e.g., pain

journals for cancer patients, directly in the EHR (KBV, 2022a; SVR, 2021). More importantly however, doctors would have a complete overview over a patient's medication plan, a fact that could save an estimated 70,000 lives a year in Germany ("Digitalisierung rettet Leben," 2023). For this reason, Germany has decidedly embraced the idea of EHRs.

It is curious then, that even though the EHR promises extensive benefits for all parties involved and its inception has been supported by a majority of citizens (Paulsen & Schenk, 2021), these same citizens still do not choose to adopt it after its introduction. However, the German EHR is not the only project that has faced this dilemma or has ended in the 'graveyard' of large-scale IT projects in the public sector. In fact, it is estimated that, while definitions of failure vary, the failure rates of projects involving Information Systems (IS) are high globally (Dwivedi et al., 2015), with some estimates stating that only one in two hundred projects manages to stay on time, not exceed the budget and reach the intended benefits (Balka et al., 2022).

There therefore seems to be a continued mismatch between the design of a given e-government service and what the citizens need or want (Ebbers et al., 2008). In other words, the IS and related services provided by the government often do not afford what citizens would need from the service. This mismatch and the concurrent failure of the projects have severe consequences in terms of measurable quantities such as financial resources but also when it comes to less definable concepts such as opportunities, benefits and trust (Heeks, 2006; SVR, 2021; Toots, 2019; Wissenschaftsrat, 2022). The latter is especially important for the government, since the decrease of trust between citizens and the government resulting from failed projects also significantly impacts the possible acceptance of later projects or services (Carter & Bélanger, 2005; Muller et al., 2021).

It is therefore necessary to understand why the introduction of the German EHR was not successful in order to learn from the experience and to make informed choices in the necessary reform of the project. However, the insights gained from this thesis are also directly relevant for the study of non-adoption or failure of e-government initiatives in general. A majority of research concerned with e-government non-adoption simply assumes that non-adoption is the opposite of adoption and relies on well-known models from technology adoption literature (Distel, 2018; Distel & Ogonek, 2016; Hofmann et al., 2012; Titah & Barki, 2006). However, as Distel and Ogonek (2016) point out, even though these models are not unsuitable to study non-adoption per se, "prior to … information gathering or initial testing of the service, there may be many inhibiting factors, which are not included in these models" (p. 3).

Knowing this, and in order to address both issues, i.e., explaining the specific non-adoption of the German EHR as well as studying non-adoption as a phenomenon in its own right, the research question posed in this thesis is as follows:

> What are the main antecedents for non-adoption of the German EHR, according to political stakeholders, medical professionals and citizens?

To be able to answer this research question, it is necessary to acknowledge that the introduction of a public digital service or public e-service comes with its own, very specific set of challenges. These include, among others, access to digital resources, digital literacy or privacy concerns (Distel & Ogonek, 2016; Rana et al., 2013a; Titah & Barki, 2006). At the same time, introducing an EHR necessarily includes a multitude of actors – those developing it, multiple users in the medical institutions (family doctors, specialists, physical therapists, etc) as well as patients themselves. This already presupposes that any analysis of the situation will be complex and multi-layered. For example, it is highly unlikely that the majority of stakeholders listed above will share the same perceptions about what the problem underlying non-adoption is and how to solve it. In other words, the imbalance between supply and demand, i.e., the introduction of the EHR and its non-adoption, are therefore highly context-dependent and what Klijn and Koppenjan (2015) call a 'wicked problem'.

Every 'wicked problem' faces difficult issues, is highly complex, and involves a multitude of actors (Rittel & Webber, 1973). Moreover, these wicked problems are characterized by the crucial role of differing perceptions among stakeholders about the problem at hand, i.e., its nature, causes and consequences. There is clearly no easy solution which is the reason why Klijn and Koppenjan (2015) have further suggested to begin any analysis of such a problem with an analysis of the involved actors and their perceptions. In order to relaunch the EHR in Germany and foster its wide acceptance among citizens, as well as to better understand the phenomenon of e-government non-adoption, it is therefore necessary to find out exactly what the predominant perspectives among the different stakeholders are (Cuppen, 2013; Heeks, 2006; Lehtonen & Aalto, 2016). This helps in structuring the problem of non-adoption for both researchers and practitioners and represents a basis for any future work or research. By providing new insights into a potentially deadlocked situation (Cuppen, 2013), such research can also help to establish dialogue among relevant stakeholders by finding common ground.

To be able to discern the different perspectives on adoption among the main stakeholders, this thesis is set in a qualitative, interpretive single-case study, using Q-methodology to synthesize

the major antecedents for non-adoption based on the perceptions of these stakeholders. These include the political stakeholders, medical professionals, and citizens. Previous research recognizes that any public service must correspond to the context into which it is being introduced – not only the general, macro-context of it being a public service, but also the individual context of end-users (Heeks, 2005; Johns, 2006; Toots, 2019). However, it is also widely recognized that government often bases its design and implementation decisions for these services on assumptions about the context of its end-users as well as specific assumptions about the end-user as an individual (Heeks, 2005). In other words, the design context of the political stakeholders overshadows the context of the person it is being designed for, which leads to a collision of these contexts and subsequent failure of the project.

A single-case study allows for the in-depth exploration of such situations since it rests on the assumption that a phenomenon and its context are hardly, if ever, truly separable in real-world conditions (Yin, 2018). In comparison to experiments or other methods of research such as surveys, single-case studies thus offer insights into a phenomenon *within* its context instead of trying to single out the phenomenon and separate it from its context. Q-methodology complements this as its main concern is the study of individual subjectivity (Watts & Stenner, 2012). As Newman and Ramlo (2010) point out, it therefore allows for the extensive consideration of the context in which specific experiences take place. Moreover, the methodology combines both qualitative and quantitative elements. First, qualitative data is collected by forming a Q-set of statements that are broadly representative of the topic at hand. After asking participants to sort these items, the sorted statements are subjected to quantitative factor analysis to find interconnected patterns, or larger viewpoints, among the data (Newman & Ramlo, 2010).

The combination of both, i.e., a qualitative, interpretive single-case study using Q-methodology thus allows for the in-depth consideration of the context as well as the differing perspectives of the multitude of actors. With this, it clearly contributes to an understanding and possible solution of the wicked problem that the individual non-adoption of the German EHR constitutes. By including the perceptions of the main stakeholders about the antecedents of non-adoption, i.e., assumptions about barriers to adoption, this thesis will be able to provide a comprehensive picture of the overarching antecedents that are shared by all three actors. In doing so, it offers an explanation of the low adoption of the EHR while at the same time offering insights into what should inform the reform of the EHR as a public e-service in the future. Moreover, it represents an important starting point for further research that is explicitly focused on the non-adoption of e-government projects as a phenomenon in its own right.

Beginning with an in-depth explanation of research goals and considerations in Section 2 of the study, the theoretical framework underlying this thesis will then be outlined in Section 3. This will elaborate on major characteristics of e-government adoption, the EHR as a public e-service and a short overview over wicked problems and their possible solution. Preceded by the elaboration on the methodology used to study and explain the non-adoption of the German EHR in Section 4, the results of the study will then be presented in Section 5. After highlighting how data was collected for this thesis, including a detailed case description, the results will then be analyzed and set in context. Lastly the implications of the results for current and future research as well as for practitioners are discussed.

2. Research puzzle

There are two fundamental issues that this thesis addresses, or rather builds upon. Firstly, there is a continuous mismatch between the supply and demand side of public services, where designers of the services fail to develop services that are either wanted or, when wanted, still do not fulfill the needs of end-users and are thus not being used. This mismatch is crucially dependent on context, i.e., e-government projects such as the EHR are connected to the social context in which they are deployed. However, "the context of invention is not the same as the context of design, and that is not the same as the context of deployment. These differences are fundamental to the outcome of e-government projects" (Heeks, 2005, p. 54). In other words, technology influences context but context at the same time forms part of the technology. Technologies therefore contain certain perceptions and predictions about the world (Homburg, 2008; Klijn & Koppenjan, 2015; Orlikowski, 1992).

Specifically, every public e-service will have certain inscriptions of "how processes will be undertaken; of the values that people will have; of the structures in which they are to be placed; etc" (Heeks, 2005, p. 54). Therefore, it is important to view e-Government and its non-adoption holistically as a collection of related dimensions. These are drawn from the context in which it is designed rather than seen in a one-dimensional, reductionist way. In other words, it is necessary to see the development and non-adoption of a given technology such as the German EHR as epistemological in nature – different institutional, social political or economic contexts will have different assumptions, expectations and perceptions that inform their understanding.

This leads to the second fundamental issue: the governance of the EHR in Germany. Via its integrated nature, i.e., the goal of providing an EHR that is interoperable across sectors and institutions, the development and deployment of the EHR is necessarily set within a network of different actors. These include, inter alia, the government and public health insurance providers as a provider of the EHR application, medical professionals from primary healthcare such as doctors or nurses as well as secondary care providers such as physical therapists (SVR, 2021). Moreover, pharmacists are included as they dispense e-prescriptions that are stored in the EHR, medical institutions such as hospitals, medical experts working in research, as well as data security experts and interest groups (*E-Patientenakte*, 2023). However, the EHR is not being governed like a network. In fact, the federal ministry of health holds 51% of all votes in the stakeholder assembly in the governmental body ('gematik') that is responsible for the development and deployment of the EHR – a circumstance that is harshly criticized by, inter alia, the National

Association of Statutory Health Insurance Physicians: "For us, the political question is, do we still participate in gematik if we're always outvoted?" (Koch, 2022).

Research Gap

Together these two issues point to a research gap that has been briefly touched upon before: the necessity for a more holistic understanding of e-government adoption, including non-adoption. In other words, current research tends to engage in deterministic understandings of stakeholders which leads to a studying the phenomenon in separate stakeholder groups such as citizens, professionals, or civil servants. In addition, e-government is often still understood from a managerial perspective, i.e., focusing on project management (Hofmann et al., 2012; Lindgren & Jansson, 2013). However, as has been established above, e-government projects, such as the German EHR, and their subsequent success or failure is dependent on the different prescriptions, assumptions and expectations held by the different stakeholders and which, if not considered carefully, lead to what Heeks (2005) terms "collisions of context", which then lead to failure.

Based on the evident difficulties with designing and implementing successful digital public services, scholars have already identified the need for a more systematic analysis of the e-government specific factors that affect (non-)adoption (Dwivedi et al., 2013, 2015; Rana et al., 2013b) as well as more systematic analyses concerning the various actors affected by these services (Carter & Bélanger, 2005; Ebbers et al., 2008; Janssen et al., 2013; Toots, 2019). This thesis will do so by reframing the non-adoption of the German EHR as a 'wicked problem', i.e., a public policy problem that is characterized by high level of complexity and a multitude of connected actors. As such, any attempt at solving such a problem necessarily begins with an analysis of the actors connected to this problem and their perceptions of it (Klijn & Koppenjan, 2015). Understanding the non-adoption of the German EHR as a 'wicked problem' therefore allows both simultaneously: to consider the main relevant stakeholders or connected actors of the project, as well as yielding the specific factors or antecedents that affect non-adoption via the synthesis of the perceptions of the affected actors.

This also addresses a general lack of knowledge regarding large-scale IT project failure in the public sector in Germany (Bannister et al., 2014; e.g., Drews & Schirmer, 2015; Räckers et al., 2013). This knowledge would be crucial, however, seeing as this would give valuable insights for future projects. Specifically, it is important to understand the unique e-government issues and the variables influencing them at the national level. Governments will thus be able to create solutions that are uniquely suited to the country's circumstances by looking into, i.e.,

antecedents for non-adoption. To realize the goals of e-government in Germany, for example, it would be essential that such a strategy be adopted at several levels of government. This way, the 'right' strategy for developing and implementing effective e-government policies at the national level could be found.

Research aim and question

The argument put forth in this thesis is that in order to (re-)develop public e-services that can put the goals of e-government into practice, it is necessary to understand what all affected stakeholders think, and especially which assumptions or perceptions they share. This constitutes crucial knowledge, as not being aware of these divergent understandings of the problem among the affected stakeholders will lead to a continued mismatch between the EHR's intended or envisioned usage and actual adoption. In order to improve the success rate of e-government projects., especially those involving the sharing of sensitive data with the government, it is necessary to map out the diverging perceptions to then find common points for resolving the problem. In this way, it becomes possible to understand the link between perceptions and how they shape reality.

Specifically, if the German government aims to innovate the current form of the EHR in order to foster wider acceptance, it is important to first find out what stakeholders currently think are the main reasons for non-adoption. Any kind of innovation in the future must necessarily be based on current perceptions of these antecedents. To truly understand why the EHR is not being adopted, the affected stakeholders must reflect on their own understanding of the barriers to adoption since this directly informs and has informed the engagement with it. Therefore, the research question of this thesis is as follows:

> What are the main antecedents for non-adoption of the German EHR, according to political stakeholders, medical professionals and citizens?

In asking this question, the work presented in this thesis aims at laying the foundation for a structured and deliberate engagement with the perceptions underlying public e-services that goes beyond producing a list of factors that can be checked off when developing or innovating a project. Instead, it aims to go to the root of the problem that is the apparent mismatch between design and reality by asking the main stakeholders for their perception of antecedents. With this knowledge, the motivation for their specific choices can be understood, be it design and implementation choices, strategic choices in governance networks or the decision to not adopt the given system.

How will the research question be addressed?

As shortly explained above, the research question is set within a qualitative, interpretive single-case study and will be answered by using Q-methodology, a mixed-methods approach originating in psychology.

By conducting a single-case study, this thesis is able to specifically take the German context in which this public e-service is set into account. As Yin (2018) elaborates, it is seldom possible to isolate a phenomenon from its context and this is certainly true for the German EHR. There are a multitude of policy as well as real-world developments in the last decades that inform the understanding stakeholders have of barriers to adoption as well as shape what is possible in the design, e.g., from a legal perspective. For example, the introduction of the EHR faces the challenge of highly sensitive data in combination with strong patient data protection laws and concerns of legal liability (Stachwitz & Debatin, 2023). Moreover, there are still competitive forces in the marketplace that encourage continued use of proprietary systems such as the Hospital Information Systems still in place (SVR, 2021). The increasing data volume, rapid speed, and complexity due to various types of data further complicate integration efforts – medical institutions have to be able to share x-ray images, clinical reports as well as lab results.

At the same time, as Mergel (2019, 2021) points out, the implementation context in Germany bears its own challenges. Federalization, i.e., the organization into federal, state, and municipal levels makes decision and especially implementation processes frequently complicated and time-consuming. Much as every other democracy, Germany also faces decades of administrative legacies and path dependencies within its considerably large bureaucracy. Moreover, these also include extensive IT legacies, i.e., systems that have been used since the beginning of digitalization in the public administration. To overcome these, many activities related to digital governance are outsourced to external service providers, which are often not familiar with public service characteristics. In addition, Germany also faces the particular challenge of historical legacies – given the history of the Nazi Regime, citizens as well as the government are hesitant when it comes to data sharing or storing data in central, (easily) accessible databases (Mergel, 2019, 2021). The influence of all these factors can be taken into account when conducting a qualitative, interpretive single-case study.

The research question itself will be addressed using Q-methodology. This methodology is uniquely suited to address highly complex and often contested issues (Ramlo, 2015, 2023; Watts & Stenner, 2005), such as the non-adoption of the German EHR. It pursues "participant-

led *subjective expressions* and *viewpoints*" (Watts & Stenner, 2005, p. 69, emphasis in original), and, in contrast to strictly quantitative, objective measurements, it thus highlights *interconnected* patterns among groups of participants. Instead of concepts or hypothesized phenomena, the study's participants become the variables of interest, effectively shifting the focus away from attempts at generalization known from quantitative methods and instead offering a glimpse at the representativeness of a given phenomenon (Watts & Stenner, 2005). In this case, this relates to locating the most representative, i.e., main, antecedents of non-adoption according to the main stakeholders affected by this public e-service.

Therefore, Q-methodology offers the distinct advantage of finding perspectives that overlap, regardless of the participants' contexts. Even though one might think that participant's perspectives might differ based mostly on their different background contexts, this is not necessarily true. The implicit assumption that diverse participants and their backgrounds reflect diverse perspectives may very well be incorrect (Cuppen, 2013), a nuance which Q-methodology is able to pick up on. With using Q-methodology, this thesis aims to find the shared viewpoints that exist despite the range of different backgrounds among the main stakeholders. This will at the same time offer an explanation of the non-adoption of the German EHR as well as a way forward, for example via stakeholder dialogues that build on these shared viewpoints.

Knowledge contribution

There are a number of contributions of this thesis, both to research but also for practitioners in general and for the specific stakeholders in particular.

Research and Literature

First and foremost, it contributes to the literature on e-government, specifically (digital) public services and their non-adoption. E-government is prevalent in most countries in the world as the effort to provide better government to citizens via the Internet (OECD, 2003) but as such, it comes with a number of challenges. Using the Internet, for example, requires certain knowledge and resources and is fraught with the possibility of privacy violations and insecurity in terms of data protection (Lancelot Miltgen et al., 2013). Moreover, the services a government provides can be decidedly complex and it might prove impossible to translate some personal interactions into websites or other internet-based services (Ebbers et al., 2008). Therefore, every public e-service, in order to reach the end-goals for its introduction, e.g., to be equally as or more efficient and effective as the existing version, must be widely adopted among citizens.

It is thus necessary to gain a better understanding of the antecedents for the non-adoption of these projects in order to prevent their failure. However, as Distel (2018) points out, when studying non-adoption as the opposite of adoption, e.g., by applying adoption models to study non-adoption, "research reproduces already obtained knowledge rather than producing new insights" (p. 98). By putting the focus explicitly on non-adoption, this thesis therefore contributes to the study of non-adoption as phenomenon in its own right. Moreover, by using Q-methodology, this thesis is also able to address another important issue. Distel further argues that the quantitative analyses employed by these adoption models do not help to mitigate this issue and rather contribute to it as they "impede the rise of new views and topics" (p. 98). In other words, this approach is unable to address the fact that non-adoption may be fundamentally different with regard to its antecedents (Distel, 2018). By synthesizing antecedents for non-adoption from the case of the German EHR and using a mixed-methods approach; this thesis thus helps to establish possible new viewpoints which could then be studied further.

This study will therefore contribute to both the understanding of e-government non-adoption as well as the role of stakeholder perceptions in public e-services. Moreover, by focusing on the stakeholder's individual perception, it not only adds detail to understanding adoption but also allows for understanding the role of subjective realities in the development, implementation and usage of public e-services. This also includes the larger context of large-scale IT projects in the public sector in general and in Germany in particular. By engaging with the stakeholders' perspectives and specifically their subjective perceptions, it offers an understanding of the constraints and limitations concerning large-scale IT projects that are neither legal, regulatory or technological in nature. Instead, it allows to see the (constraining) influence that, e.g., having specific assumptions about what influences non-adoption, has on the outcome of a public e-service. By visualizing the common points that all stakeholders share, this study also offers indicators of potential measures that need to be taken to solve an issue such as non-adoption.

Moreover, there are wide variety of studies concerning the introduction of Electronic Health Records in hospitals, among medical professionals or in terms of their contribution to values such as productivity or efficiency of medical treatments (e.g. Ben-Zion et al., 2014; Kaye et al., 2010; Kruse et al., 2014; Ludwick & Doucette, 2009; Standing & Cripps, 2015). To the best of our knowledge, there are only a handful of studies concerned with the introduction of an Electronic Health Record at the state or federal level, i.e., the introduction of the same Information System or infrastructure for all medical institutions (Fragidis & Chatzoglou, 2018; Klecun et al., 2019; Kohli & Tan, 2016). This thesis will thus contribute to the literature in the sense that

it is among a small number of studies concerned with such large scale, government-sponsored Electronic Health Records.

Practitioners

For practitioners related to e-government and specifically the stakeholders of the German EHR, this study also offers new insights and opportunities. For example, sorting statements as part of Q-methodology has been reported as helping stakeholders to structure their own opinions on a given topic, especially if it is such a high-stake, complex problem as the German EHR (Cuppen, 2013; Lehtonen & Aalto, 2016). This at the same time creates ownership of the problem, i.e., a feeling of responsibility for the solution of the issue at hand and clear allocations of such responsibility. It can also add accountability. In his study on dialogues on sustainable bioenergy in the Netherlands, Cuppen (2013) also argues that Q-methodology is specifically suitable for establishing stakeholder dialogues that could help to solve wicked problems.

In addition, Q-methodological analysis can reveal unexpected areas for agreement or compromise that could be helpful in developing responsible and stable policies to either re-approach the existing project or approach future projects with more sensitivity towards the influence of different stakeholder perceptions (Lehtonen & Aalto, 2016). Moreover, projects in the public sector are usually compromises that are sought over a long period of time, e.g., in Germany for over 15 years. Q-methodology can then help to elucidate the likelihood of such a compromise as it helps to comprehend the landscape of political debate and preferred solutions as well as the underlying assumptions that inform the stakeholders' decisions (Cuppen, 2013; Lehtonen & Aalto, 2016). All in all then, the methodology offers two distinct contributions for practitioners: By finding consensus statements it shows stakeholders the common points on which they can build, while, at the same time and by synthesizing the main viewpoints, it also highlights the prevalent assumptions among stakeholders that influence their decisions regarding design, implementation or non-adoption.

Limitations

As every scientific work, this thesis also faces several limitations. Firstly, this is only a final thesis and as such lacks the resources to cover all aspects of the topic. For example, this thesis omits the perspectives of specific groups of citizens that are especially vulnerable to the risks of EHRs regarding privacy and security and whose perceptions would be important to consider. These include, inter alia, (former) addicts or HIV-positive citizens where any kind of data leak exposing their diagnosis could have significant impacts because of the stigma surrounding it

(Schock, 2021). With more time, this study would benefit from these insights as well, in order to create a more holistic and comprehensive picture of the situation in Germany. This should specifically include more in-depth interviews to elaborate on subjective assessments of the situation but could also include semi-structured interviews to generate ideas for potential solutions.

Secondly, there are specific limitations when it comes to the choice of method and methodology. Single-case studies offer no possibility of generalization or even comparison, as they focus on one specific setting, location or phenomenon. Q-methodology faces a similar limitation in the sense that it focuses on studying subjectivity and therefore is not replicable or generalizable as such. However, these limitations are not limitations per se when one chooses them consciously. The topic at hand, i.e., the non-adoption of the German EHR and all the factors that influence it (and make it incredibly complex), can be best addressed by doing so in a single case study, which allows for the consideration of context as well as Q-methodology, which allows a new perspective on how individual perceptions shape public e-services. What is certainly a limitation, however, is the fact that both the single case study as well as Q-methodology only allow for a snapshot at the point in time at which the study takes place. For a deeper understanding, one would need to conduct more longitudinal studies to see how perceptions might change with policy changes or adjustments.

While these choices therefore limit the kind of study that can be conducted, i.e., to which they can be applied, they must not be understood as limitations for the content of the study since these issues. i.e., generalizability or a comparison were never the goals of this specific study in the first place.

3. Theoretical Framework

As was elaborated in detail in the Research puzzle section, this thesis is aiming to explain the non-adoption of the German EHR by finding the main antecedents for this non-adoption among the three main stakeholders: political stakeholders, medical professionals and citizens. For this reason, Q-methodology was employed to synthesize the individual perceptions and group them according to major, identifiable viewpoints. However, before explaining how exactly the study was conducted, it is necessary to elaborate on the assumptions underlying this thesis as well as theoretical foundations and the main concepts employed in this work.

Epistemological and ontological assumptions

The selection of a research area is inevitably dependent on philosophical assumptions about the nature of social and physical reality, i.e., ontology, as well as assumptions about the nature of knowledge and how it may be acquired, i.e., epistemology. It is crucial to define the ontological and epistemological presumptions underlying every scientific endeavor because they dictate not only what is in focus but also what knowledge may be achieved in the first place. To be able to address these presumptions, it is first necessary to highlight the two ontological assumptions on which this thesis is built: 1) digital, public services (public e-services) are an essential part in realizing the goals of e-government, and 2) they affect a wide range of different stakeholders.

When it comes to epistemology, Information System literature, a field from which e-government borrows heavily, knows three epistemological foundations, i.e., *positivist*, *interpretive*, and *critical* (Goldkuhl, 2012). Interpretive research is the dominant form of qualitative research and investigates phenomena on the understanding that they are determined by the meanings that are assigned to them (Goldkuhl, 2012). Reality is constructed via a number of social phenomena such as language, consciousness or shared meanings (Myers, 2009). In other words, reality is constructed by the participants and their specific perspectives. As this thesis adheres to this understanding, it consequently assumes that there are multiple realities with multiple meanings which makes the findings of the study dependent on the observers, i.e., the participants' perspective.

The just mentioned approaches have been further extended into the area of IS system success and failure, which is one of the areas in which this thesis falls as it considers the non-adoption of the German EHR as a failure of the latter. This extension can be divided into three branches that are broadly based on the distinctions above: rationalistic (positivist), interpretive/social-

constructivist/relativist and socio-technical/process views (Fincham, 2002). These have direct consequences for what results will be possible within this study. The rationalistic approach proposes a factor-based and deterministic understanding of failure, i.e., that there are 'failure factors' that can be causally linked to failure, an approach which has often been criticized for the inability to provide comprehensive and coherent explanations of failure and 'black-boxing' different categories of explanation (Dwivedi et al., 2015; Nograšek & Vintar, 2014).

The other two approaches acknowledge failure as a subjective, social construct, i.e., making the understanding of failure dependent on the observer (Fincham, 2002). In other words, any question of success and failure is dependent on which stakeholder one asks, e.g., the Project Management or the End-User. The socio-technical approach goes even further and understands failure as a process, "an outcome of complex socio-technical interactions" (Toots, 2019, p. 548). As can be seen from the elaborations above, it is the assumption of this author and consequently of this thesis, that success or failure are subjective and constructed within the project one chooses to investigate which also takes into account the socio-technical interactions mentioned above. There can therefore be no definitive factors that can always be causally linked to either success or failure.

What does it mean though when failure is subjective? Let us assume that a given IS project, e.g., a new software for supply chain management is introduced in a company and is delivered only a few weeks after the deadline and within the estimated budget. The project management would therefore call this project a success. However, this new software requires the workers along the supply chain to change their flow of work and increases the amount of time they spend on their individual tasks. They, as end-users, would not call this project a success and neither would the company leadership which sees the productivity of their workers decline.

Clearly, success and failure are not two sides of the same coin – as we can see from the example above, success and failure are inherently contextual and constructed. While one involved party deems the project a success, the other one would argue the exact opposite. However, there are also many nuances in between: simply because a project has not been successful it is not automatically a failure. It can also just work to a lesser extent than desired. This obviously complicates the study of success and failure in the sense that before beginning any investigation, one must first establish what the different stakeholders understand as success and, consequently, failure, for the given project.

Knowing this, failure in this thesis is understood as the lack of adoption of the German EHR by individual citizens. This understanding draws on statements made by two of the most significant stakeholders in the project: the German Minister for Health, Karl Lauterbach, as well as the president of the National Association of Statutory Health Insurance Physicians, Andreas Gassen. Citing the low numbers of adoption, they declared the project to be a failure (*Gassen fordert Neustart*, 2022) and an "illusion" (Koch & Borchers, 2023).

E-government, public e-services and their adoption

This understanding of failure is clearly set in the wider context of e-government projects in general and public e-services in particular. It is therefore also necessary to elaborate on the understanding of e-government and public e-services employed in this thesis. As mentioned above, e-government as a relatively recent phenomenon has borrowed heavily from IS literature. However, albeit relying on Information Systems, it still differs crucially from IS contexts. Whereas IS literature is mostly concerned with the introduction of information systems in businesses or organizations, e-government uses information systems in the public sector, a context very much unlike a business.

E-government in this thesis is understood as the effort by a government to offer their services digitally. This usually does not only mean that forms are available digitally but rather "the use of information and communication technologies, and particularly the Internet, as a tool to achieve better government" (OECD, 2003, p. 13). This 'betterment' of the government includes, inter alia, increased efficiency, effectiveness (decreasing the administrative burden), or trust in government (Twizeyimana & Andersson, 2019). While having a simple mission, i.e., providing citizens with a better government by using Information and Communication Technologies (ICTs), e-government necessarily encompasses several areas of impact – it must span, as well as connect, social, technical, economic, political, and administrative spheres. In other words, e-government is much more complex than the introduction of an IS into a single organization. The government must reach and connect citizens irrespective of their age, gender, socio-economic status and respective access to ICT infrastructure, experience with the internet or cultural background, to name a few, rather obvious determinants of difference.

Implicit in this definition is therefore the assumption that when using ICTs as a tool, government must transform its processes as well. Even though this might be very radical change it is at the same time unavoidable (Jaeger, 2003) – "e-government is a complex phenomenon involving both technical and process change" (Beynon-Davies, 2007, p. 7). For example, the use

of ICTs does not only impact citizens but also the workflow in public administration and the way it interacts with other organizations within the bureaucracy, e.g., while sharing information. E-government therefore also entails significant challenges for public management in the sense that newly introduced Information Systems need not only be adopted and used by citizens but by professionals as well (Grönlund, 2005; Savoldelli et al., 2014). The implementation of ICTs in government can therefore not just be "patched onto existing government structures" (Beynon-Davies, 2007, p. 14). In this sense, e-government refers to both political strategies for transforming government, as well as to a field of research devoted to the study of this transformation.

Formal background: E-government in Germany

Much of government is characterized, until today, by what Klijn and Koppenjan call the "Traditional Public Administration Model" which relies on a large bureaucratic apparatus where "problems, policies, and services are assigned to specialized governmental units" (2015, p. 5). Tasks and procedures are differentiated and their integration and coordination relies on the understanding of government as a profession in which the aim is to produce effective policies and services that have the goal of equality, legitimacy and legality at the core of each (inter-)action. As part of such a 'professional' approach to government, complexities are met by deconstructing them and delegating them to specialized units, i.e., they are turned into intellectual design challenges which need to be resolved by engaging with other, more specialized professionals, such as analysts or scientists (Klijn & Koppenjan, 2015).

To an extent, Germany exemplifies this traditional model – the German government is characterized by an ever-increasing number of tasks, and, accordingly, the personnel to carry them out, the organizational units in which they are organized and the budgets to pay for them (Mergel, 2019, 2021). This results in problems of controlling this budget, motivating the civil servants, coordinating the abundance of different units while at the same time delivering comprehensive policies that meet the needs of all citizens (Klijn & Koppenjan, 2015). Researchers Drews and Schirmer, who investigated the failure of the German e-prescription project, further argue that this results in weak governance as one obstacle for e-government projects: "The distributed power structure and its large size hinders the German system from quickly implementing new technologies" (Drews & Schirmer, 2015, p. 12).

This sentiment is echoed by scholar Ines Mergel who makes out further peculiarities of the German system in relation to a possible digital transformation. Above all, she identifies the

independence between administrative levels which also leads to independent progress across these levels (2019, 2021). Furthermore, this independence leads to little or no connection in terms of possible information exchange – which then leads to the parallel work processes. Unfortunately, this also results in little to no interoperability between the levels and their different systems. This form of governmental organization has moreover led to the outsourcing to external service providers which means that there is no sustainable expertise in governmental bodies themselves. Rather than digital skills, legal knowledge and skills have built up instead. Lastly, resources are handled very strictly with no specific budget for digital (transformation) projects, whether in terms of infrastructure or personnel that has experience with digitalization or cybersecurity (Mergel, 2019, 2021).

When it comes to citizens sentiments on e-government, Germany also faces unique challenges. Given the history of the Nazi Regime, citizens as well as the government are hesitant when it comes to data sharing or storing data in central, (easily) accessible databases (Mergel, 2019, 2021). Specifically, citizens are very hesitant when it comes to sharing their data with ever more institutions in fear of becoming "transparent citizens" (Mergel, 2021, p. 333). This then adds to existing concerns about data protection, security and privacy (Drews & Schirmer, 2015; Räckers et al., 2013; SVR, 2021; Wissenschaftsrat, 2022). Additionally, it increases the power distance felt between these instances and is not helped by the fact that many citizens perceive the administration as "slow, overly bureaucratic, and that access to public services is bogged down by excessive administrative burden"(Mergel, 2021, p. 333).

These problems are clearly visible in the German EHR. The federal level, i.e., the Federal Ministry for health is one of the political stakeholders and is therefore responsible for the (legal) decision-making regarding the introduction and form of the EHR. At the same time, however, the German public healthcare system is organized in "Selbstverwaltung", i.e., self-administration. Insured citizens as well as those providing healthcare organize themselves in representative bodies, so-called 'Vereinigungen' or associations and provide healthcare in their own responsibility (Bundesministerium für Gesundheit, n.d.). Including the factors mentioned above, i.e., the lack of connection between levels or apprehension about sharing data, any problem, policy or service related to healthcare thus becomes incredibly complex. It involves all levels of government while at the same time having to serve a heterogenous group of 83 million citizens with different needs and expectations – and, as the German EHR project shows, it does not do so very successfully when it comes to innovating these services.

Studies relating to e-government and its adoption in Germany have therefore often focused on the adoption of specific projects like e-prescription (Drews & Schirmer, 2015), the German eID (Räckers et al., 2013) or e-government adoption of administrative services (Distel, 2018). This thesis will contribute to this stream of research with its focus on the introduction of the German EHR. In more general terms, research has investigated channel choice and preference (Plattfaut et al., 2013; Thiel, 2016), as well as the impact of culture (Akkaya et al., 2012) and the impact of context on form and level of data protection in e-government (Wu, 2014). It is important to notice that all of the highlighted papers have either focused on the adoption of e-government in Germany or non-adoption as the direct opposite of adoption.

However, as Distel (2018) points out, when studying non-adoption as the opposite of adoption, e.g., by applying adoption models to study non-adoption, "research reproduces already obtained knowledge rather than producing new insights" (p. 98). She further argues that the quantitative analyses employed by these adoption models do not help to mitigate this issue and rather contribute to it as they "impede the rise of new views and topics" (p. 98). In other words, this approach is unable to address the fact that non-adoption may be fundamentally different with regard to its antecedents (Distel, 2018). This reinforces the relevance of research question posed by this thesis, i.e., *What are the main antecedents for non-adoption of the German EHR, according to political stakeholders, medical professionals and citizens?*

By employing a mixed method approach (Q-methodology) in this thesis, i.e., an approach that is inherently based on qualitative data (the perceptions of participants), these viewpoints can develop their own trajectory and help in synthesizing antecedents specific to non-adoption. Since there has been little previous research with the main focus explicitly on non-adoption (e.g., Carter & Weerakkody, 2008; Van De Walle et al., 2018), and there is still a significant overlap between the two phenomena (Distel, 2018), it is worth to explore the literature on e-government adoption as a starting point for this analysis.

E-government adoption

Before continuing to discuss the most common concepts, it is necessary to establish the understanding of adoption used in this thesis. Since the EHR in Germany was only introduced in January 2021, adoption in this thesis is therefore understood as the initial decision by an individual citizen to apply for an EHR with their respective healthcare provider, a number that is tracked daily by the society for telematics infrastructure, 'gematik' (*TI-Dashboard*, 2023). This

is in line with the findings of Hofmann et al (2012), who highlight that "adoption or acceptance research generally focuses on the initial usage of services" (p.8).

However, the study of e-government adoption and its antecedents remains fragmented to this day. Dwivedi et al. (2012) point out that out of the 178 unique variables they have found in studies on e-government adoption, only 24 have been examined five or more times in combination with specific dependent variables. Hofmann et al. (2012) have found 110 constructs of which only seven were tested and subsequently found to be significant by more than one author. In other words, there is no consensus within the discipline as to which variables seem to explain e-government adoption best. This has been echoed by several authors who describe the literature on adoption as "at best, fragmented"(Kumar et al., 2007, p. 64) and criticize the lack of effort that has been put into developing integrative frameworks (Grönlund, 2005; Hofmann et al., 2012; Jacob et al., 2019; Kumar et al., 2007; Rana et al., 2015, 2017; Titah & Barki, 2006). There is thus a pronounced problem with establishing conceptual clarity when it comes to adoption in e-Government contexts.

Nevertheless, the major aim of e-government research regarding adoption remains identifying its antecedents (Hofmann et al., 2012). In other words, what influences citizen to adopt a large-scale IT project or not? Information System and Public Administration are the major research branches which investigate e-government adoption (Grönlund, 2005; Hofmann et al., 2012; Titah & Barki, 2006). However, these authors also conclude that this is not necessarily an equal influence. In fact, research on e-government adoption "often builds on 'quasi standard' models of IT acceptance" (Hofmann et al., 2012, p. 4). While these are often complimented by concepts from political or social science, such as trust, Dwivedi et al. still conclude that

"there is a need for e-government specific theories and methodologies that address the idiosyncratic nature of e-government as the well known information systems concepts … are not equipped to encapsulate the complexities surrounding e-government. Aspects like accountability, digital divide, legislation, public governance, institutional complexity and citizens' needs are challenging issues that have to be taken into account in e-government theory and practices" (Dwivedi et al., 2012, p. 11)

Several researchers have therefore endeavored to find the most common concepts used in studying e-government adoption (Distel, 2018; Ghareeb et al., 2019; Hofmann et al., 2012; Jacob et al., 2019; Rana et al., 2015; Titah & Barki, 2006) as well as the study of barriers to e-government adoption (Distel & Ogonek, 2016; Dwivedi et al., 2013; Rana et al., 2013a). These can be grouped into environmental characteristics, individual characteristics and technology characteristics. However, what connects all these identified concepts is the fact that they refer to the

end-user's *perception* of them. After all, how can one measure usefulness or trust in absolute terms?

Environmental characteristics

Environmental characteristics refer to a number of external influences that might affect adoption. Among these are concepts such as political support and communication, i.e., the positive influence of support of and communication about the project by those managing it (Titah & Barki, 2006) as well as important institutions such as interest groups (Fernandez & Rainey, 2006). This assessment is echoed by other authors, who emphasize 'knowledge of the service' (Jacob et al., 2019) or 'targeted communication' (Räckers et al., 2013). As Jacobs points out: "the knowledge of the supply of e-government services is important to the intention to use and the actual use of these services by citizens" (Jacob et al., 2019, p. 809). Räckers et al emphasize this point especially since previous studies have found that the lack of specifically targeted communication and channels is one reason for the lack of e-government in Germany (Heierhoff & Hofmann, 2012; Räckers et al., 2013). This is furthermore in line with communication as a barrier to e-government adoption that Distel and Ogonek (2016) identified.

Myers (2015) further identifies context as one the major external influences. As he points out, "many of the key issues in IT implementation are … related to politics, culture and people … . No set of injunctions will apply every time" (Myers in Dwivedi et al., 2015, p. 149). These contextual differences appear, e.g., as a 'digital divide', i.e., as socioeconomic barriers (Distel & Ogonek, 2016). Venkatesh et al. conceptualize such influences as 'facilitating conditions' (Venkatesh et al., 2003). These describe the extent to which a person believes that organizational and technical infrastructures exist that would support using the new system (Dwivedi et al., 2017; Venkatesh et al., 2003). This is irrespective of whether this infrastructure is provided by the government or whether individuals perceive themselves to have the necessary resources to use the service. As such, the construct allows for the consideration of the context into which the system is introduced. The authors further find that context has influence on the technology characteristics, such as perceived ease of use (Dwivedi et al., 2017; Venkatesh et al., 2003).

Individual characteristics

Individual characteristics shape user experiences and refer to the individual experiences and perceptions of a e-government project and its technology by the citizens. Perceptions and attitudes of potential adopters' towards the e-government service are critical in the success of these projects, as has long been recognized (Davis, 1989; Davis & Venkatesh, 1996; Fishbein &

Ajzen, 1975). An individual's attitude is directly influenced by trust in the provider (Belanche et al., 2012; Carter & Bélanger, 2005; Warkentin et al., 2002), the social context around them (Dwivedi et al., 2017; Räckers et al., 2013; Venkatesh et al., 2003) as well as well as the perception of how useful, consistent with performance objectives, and user-friendly the given system is, i.e., whether it gives them an advantage (Carter & Weerakkody, 2008; Rogers, 2014).

Regarding the social context, the concept 'social influence' (Venkatesh et al., 2003) captures the extent to which a potential user believes that persons important to them in turn believe that they should use the new (e-government) system. It therefore also describes the concept that an individual's behavior is influenced by how they believe others will see them after using the new technology. This individual perception is a direct expression of context and specifically on the individual context of potential users. However, it is not only important whether those close to the individual use the system but also whether those in more formal roles, such as supervisors or even the organization in which the system is introduced actually support the use of the system (Venkatesh et al., 2003).

It is important to note that e-government projects cause unique security concerns which have immediate implications for the trust in e-government (Belanche et al., 2012; Lancelot Miltgen et al., 2013; Warkentin et al., 2002). For example, Rana, Dwivedi and Williams (2015) have found that 80% of Internet users are concerned about making their personal identities known on the internet. Therefore, there seem to be two important manifestations of trust at play in e-government contexts: Trust in the government, as well as trust in the Internet. Both forms are necessary to overcome the uncertainties and concerns about the reliability of the Internet as well as the government (Carter & Bélanger, 2005; Rana et al., 2013a; Warkentin et al., 2002). In other words, trust mitigates the perception of risk, whether in terms of the Internet in general or internet-based technology in particular.

As Dwivedi et al. (2017) state, this perceived risk consists of behavioral as well as environmental insecurity. While the former refers to insecurity about the nature of the internet, the latter refers to the unpredictability of internet-based technology in general. In other words, "perceived risk is an individual subjective expectation of suffering loss in pursuit of a desired outcome" (p. 220). Specifically then, trust in government can mitigate the perceived risk related to the internet-based technology whereas trust in the Internet will mitigate the risk associated with the nature of the Internet (Dwivedi et al., 2017).

Together, all these factors will lead to the formation of a specific attitude within the individual, such as that s/he think that using the new system is a wise idea (Dwivedi et al., 2017). Individual characteristics such as attitude, the social influence of an individual's context as well as trust and perceived risk are therefore important to consider as they directly influence the intention to use a new system, and this intention has been hailed as "the single best predictor of actual usage" (Davis & Venkatesh, 1996, p. 20).

Technology characteristics

Furthermore, the perception of the used technology plays an important role in adoption. Specifically, perceived risk as in security, privacy or confidentiality (Distel & Ogonek, 2016; Titah & Barki, 2006) as well as perceived ease of use and perceived usefulness (Davis, 1989; Dwivedi et al., 2017; Rana et al., 2015; Venkatesh et al., 2003) have been found to influence the decision to adopt or not adopt a service. However, perceived risk in this thesis has been deemed to have a larger impact as an individual characteristic – while it is still related to the technology in question, it is a perceived risk, i.e., it is based on individual ideas about what constitutes a risk, and how this risk is evaluated.

Perceived ease of use or (Davis, 1989) or effort expectancy (Venkatesh et al., 2003) refers to "the level of simplicity associated with the use of a system" (Dwivedi et al., 2017, p. 218), i.e., the service's usability (Titah & Barki, 2006). It is one of the most well-known concepts adopted from IS literature for e-government adoption (Hofmann et al., 2012). This perceived ease of use is rather self-explanatory and assumes a cost-benefit relationship between the design of the technology and the amount of effort this means for tasks. In other words, ease of use refers to whether a given technology's performance benefits outweigh the effort of using it and the extent to which this is true (e.g., Carter & Bélanger, 2005; Hofmann et al., 2012; Titah & Barki, 2006). As such, it has been included in many studies alongside another measure of usability, namely perceived usefulness.

Perceived usefulness (Davis, 1989) or performance expectancy (Venkatesh et al., 2003) refers to "the degree to which a person believes that using the system will assist him or her in accomplishing improvements in job performance" (Dwivedi et al., 2017, p. 218). It is, among perceived ease of use, another major concept borrowed from IS research for studying e-government adoption (Hofmann et al., 2012). Carter and Bélanger (2005) further argue that compatibility plays a role for adoption, i.e., "the degree to which an innovation is seen to be compatible with existing values, beliefs, experiences and needs of adopters" (Rogers, 2014, p. 225). This

compatibility also refers to the compatibility of the technology with already existing services, i.e., whether interfaces of integrated e-government services are compatible with each other (Carter & Bélanger, 2005; Hofmann et al., 2012).

As can be seen from these elaborations, (non-)adoption is a complex process influenced by different factors. However, one crucial criticism within e-government has not been addressed yet- It has become somewhat become good practice within e-government adoption research to point out how most of the constructs have been borrowed from IS literature and that there is a definite need for more research focused on concepts that capture the idiosyncratic nature of e-government (Dwivedi et al., 2017; Hofmann et al., 2012; Jacob et al., 2019; Rana et al., 2015; Titah & Barki, 2006). What does this mean specifically though? As highlighted above, e-government is unlike the business context in which IS research usually takes place. By transferring the knowledge from these contexts "the specificities of the relation between administrations and governments with their citizens are overshadowed" (Distel, 2018, p. 104). It is therefore necessary to elaborate on what this specific relationship entails.

Public e-services

As established above, this thesis rests on the ontological assumption that digital, public services, i.e., public e-services, are an essential part in realizing the goals of e-government. However, as Lindgren and Jansson point out, "the meaning of e-service seems to be taken for granted" (Lindgren & Jansson, 2013, p. 163). For the sake of clarity, this thesis thus leans on the authors' three-dimensional conceptualization of public e-service as being: "(1) a *service*, (2) *electronic*, and (3) *public* (as contrasted to being private)" (p.170, emphasis in original). All three dimensions are considered equally important and relate to each other, although not all dimensions need to be put at the center of attention – as long as they are all acknowledged to some extent (Lindgren & Jansson, 2013).

Service characteristics

The concept of services is built on three characteristics that are based on the understanding of services as activities: intangibility, inseparability, and heterogeneity (Parasuraman et al., 1985). These refer to the fact that services are performances, which makes them intangible and difficult to assess in any way before their use. At the same time, "the quality of a service emerges as the service is delivered, typically in interaction between the customer/client and the service provider" (Lindgren & Jansson, 2013, p. 165), i.e., production and consumption become inseparable from each other. Lastly, services often vary across producers, consumers, and, naturally,

over time – they thus cannot be stored. This refers to another crucial aspect: demand is critical to services. In other words, "services must be available to the right customers at the right time and place, and to the right price" (Lindgren & Jansson, 2013, p. 165).

The quality of a service, while inherently tied to these three characteristics, is further dependent on the delivery of the service. This is exactly where the mismatch identified as the research motivation for this thesis is located: there is a gap, or divergence, between expectations and the delivered service. This is due to an asymmetrical relationship between the government as a service provider and citizen as 'customer', where the latter ultimately decides the quality of the service (Lindgren & Jansson, 2013). Nevertheless, Grönroos argues that this should still be seen a dynamic process – the value is created through the interaction of both provider and customer within the service. Crucially, this understanding is able to highlight the role of resources in the interaction, meaning that "if the consumer does not have the skills … or … the additional resources required for this, value will be non-existent or lower than otherwise" (Lindgren & Jansson, 2013, p. 166). This is in line with the argumentation that public value is not only created by program or service delivery but also crucially by "doing other things … that enable program delivery" (Barzelay, 2019, p. 3).

These service characteristics have significant implications for comprehending public e-services and their adoption. There is an asymmetrical relationship between user and supplier, since the user's experiences are of highest importance, i.e., service quality can only be determined by the user, not the supplier. This means in turn, that when assuming that increased service quality increases the likelihood of adoption, it is crucial to consider the subjective experiences of the user. As such, this gives additional insight as well as legitimacy to the category of individual characteristics of e-government adoption identified above.

Electronically mediated services

Delivering such a service through electronic means in this thesis refers to the use ICTs such as websites or applications to provide the service via the Internet. As such, it is understood to be integrated with related, existing services or service providers and the respective organizational support processes. Implicit in this understanding is the notion that such a service must be understood in direct relation to "its intended use and users, meaning that issues such as accessibility and usability are important aspects" (Lindgren & Jansson, 2013, p. 167). In other words, for an assessment of service quality and eventually adoption, the technical interaction with the system providing the service, i.e., the respective Information System, must be understood as

well, which has already been touched upon in the technological characteristics of e-government adoption above.

Public e-services

There are a number of connotations that come with the use of the prefix 'public' – it can refer to a service that is available for public use, but it might also refer to a service that is provided by a public organization. This thesis understands the prefix as referring to both: the German EHR is available for public use and it is provided by the government, a public organization. A public organization in this thesis is understood as a formal entity deciding on and organizing public administration at a variety of levels, such as state, federal or municipal level (Lindgren & Jansson, 2013). These entities provide public services either to citizens as a collective or as individuals and either provide them directly or delegate this task to private providers (Fernandez & Rainey, 2006). As such, the term 'public' then denotes certain characteristics that need to be taken into account when studying these services.

Firstly, and probably most obvious, the relationship between citizens and government is never voluntary – citizens instead are crucially dependent on the government for its services. The government has the 'monopoly', i.e., there is no possibility to change to another service provider as would be possible in the private sector (Beynon-Davies, 2007; Lindgren & Jansson, 2013). For example, for many social or welfare services, the government is the only viable solution since private offers are usually too expensive for most citizens. Moreover, the government and its institutions have a number of compulsory claims such as taxation which it can enforce as it usually also holds the monopoly for the legitimate use of force (Lindgren & Jansson, 2013). This also means that the asymmetrical relationship described above is asymmetrical in two ways: users have the upper hand in determining the quality of the service, however, they are also crucially reliant on the service. Trust therefore plays a crucial part in their relationship (Carter & Bélanger, 2005; Warkentin et al., 2002).

Second, Lindgren and Jansson argue that, since the main users are citizens, the public organizations are also guided by a different logic, i.e., what they call 'public ethos' (Lindgren & Jansson, 2013). The organizations' work must necessarily combine both democratic values as well as economic values to ensure that serving the public simultaneously ensures its collective interest. In other words, they must combine "a shared sense of responsibility for serving social justice and the common good" (Lindgren & Jansson, 2013, p. 167). In practice, this means that while the budget must be balanced according to economic targets, it must also serve to ensure

that the constitutional goals of citizens are realized. In the context of e-government as public e-services, this also means that services must be easily accessible and available to all citizens, regardless of their, e.g., socio-economic background or education level.

The third aspect is intimately related to the main users of public e-services being citizens with unique constitutional rights. These should be ensured via the rule of law and aim to fairly distribute social resources (Lindgren & Jansson, 2013). However, these constitutional rights might conflict with each other – the right to healthcare for example is certainly in conflict with the right to data protection when wanting to implement EHRs that can be shared across sectors. This then touches upon the point made above, namely the importance of trust. If citizens do not trust their government, how would they trust that is has their best interested at heart? Therefore, as Warkentin points out, e-government should be removed from the political arena since it is paramount for adoption that citizens trust e-Government regardless of who is in power (Warkentin et al., 2002).

In sum, these considerations clearly complement the characteristics identified in the literature, i.e., environmental, individual and technological characteristics. E-government adoption is evidently influenced not only by political support or (targeted) communication, but also by individual-level characteristics such as attitude or trust, as well as the influence of the social context around the individual. Moreover, the usability, accessibility and availability of the technology and the risk associated with it play a major role and are influenced by their provision through public organizations. Important to note is, once again, that all these considerations are based on individual perceptions of these concepts, i.e., individual assessments of trust, risk, the extent of communication or the existence of supportive structures. This crucial foundation of adoption on perceptions, however, makes designing e-government, and therefore public e-services, incredibly complex.

"wicked problems"

Researchers Rittel and Webber have characterized such issues, of which both the German EHR and its subsequent non-adoption are an example, to possess a high degree of wickedness (Rittel & Webber, 1973). In other words, these instances all involve complex problems that call for in-depth understanding of their causes and potential solutions. Furthermore, they also involve numerous actors, which can lead to a chaotic process with undesirable (and unexpected) results or a process that ultimately breaks down in prolonged and intense controversies or even

conflicts that are immensely difficult to resolve (Klijn & Koppenjan, 2015). It is important to realize, however, that

"the wicked nature of these problems is not only caused by the lack of information or knowledge or the technologically advanced nature of the issue; but probably even more by the presence of various actors, with diverging or even conflicting interests and perceptions" (Klijn & Koppenjan, 2015, p. 2).

Consequently, it is not only the citizen's individual perception of the e-government service that could be an antecedent of non-adoption but also the perceptions of the various other actors and what they think makes citizens adopt a service or not. These perceptions immediately influence the design of the service and therefore influence the interaction between citizens and the service. This interaction has been shown to be crucial in the creation of value for citizens (Grönroos, 2008) and does so by shaping the citizens perception of, inter alia, the trustworthiness of the system, its usability, accessibility or the risk associated with it. In other words, these perceptions are interdependent and constantly influence each other. Titah and Barki therefore conclude that any approach to e-government adoption must capture its "continuous and contextual character" (2006, p. 30).

This continuous character is also evident in the fact that these various actors are often connected across the traditional jurisdictions of the public organizations (Klijn & Koppenjan, 2015). Moreover, the issues cut across the established divisions of responsibility between the governmental entities, i.e., federal, state, regional and municipal level. In the German case, this includes the supranational level as well, since the EHR is supposed to become interoperable with other health records in the EU. As such, they also blur the boundaries between public, private and societal realms (Klijn & Koppenjan, 2015). For example, the German government relies on the health insurance providers to create the application for the EHR, which in turn outsource this to private sector companies (SVR, 2021).

As can be seen from this short elaboration, there is substantial complexity to be found in the processes to design, offer and maintain the EHR in Germany. Klijn and Koppenjan poin out that this complexity is inherent to all governance networks that are "confronted with societal problems and that try to develop policies and services to deal with these" (p.11). As such, however, it also needs to be contrasted from 'complicatedness', i.e., a social or technical phenomenon where the interaction of the many parts may be complicated but can be resolved "by decomposition and information gathering, making an inventory, and analyzing the components of the system" (p. 12) This is not at all possible when it comes to complexity. "*Complexity* goes

beyond complicatedness because it refers to *dynamics* within systems" (Klijn & Koppenjan, 2015, p. 12, emphasis in original).

As such, it is also inherently tied to the reflective nature of the network's agents, i.e., the fact that actors are not static but may behave unpredictably, have preferences and make conscious decisions about them – they may even choose to actively act counter to expectations (Klijn & Koppenjan, 2015). The wickedness of every problem therefore refers to the degree of complexity, tied to the problem as well as the actors, that is found in it (Rittel & Webber, 1973). In the context of the German EHR this results in the following: how to ensure the acceptance of an Electronic Health record that comes with significant challenges for patient autonomy, privacy and the security of data, while at the same time integrating it into existing workflow and across sectors?

For this problem, there seems to be a substantial impasse. After all, the problem persists – the current version of the EHR is not being adopted by a significant number of citizens. While Klijn and Koppenjan classify three forms of complexity that contribute to this, i.e., substantive, strategic and institutional complexity, only the first, substantive complexity is especially relevant for this thesis.

Substantive complexity

Substantive complexity is caused by "by the uncertainty and lack of consensus over the nature of problems, their causes and solutions" (Klijn & Koppenjan, 2015, p. 12). As the authors point out, this can also extend to "uncertainty or disagreement on the status of information, expertise, and evidence" (p. 40), and which in turn results in conflicts about the knowledge available and how to interpret it. These also includes or leads to 'report wars' and what has been called 'dialogues of the deaf'. There are thus two sources of this substantive complexity: first, uncertainty or conflict about the nature of the problem, including different perceptions of the problem based on different objectives and values. These in turn lead to different ideas about what kind of solution is needed and who should be involved in it. Second, this uncertainty and conflict extends to the available information and knowledge about the problem, i.e., its causes, consequences and its solution. It is therefore not the lack of information per se that increases complexity but rather "the unclear and contested status of data and expertise" (Klijn & Koppenjan, 2015, p. 42).

Both of these major causes of substantive complexity are inherently tied to the epistemological assumptions underlying this thesis: these problems are not "objective circumstances or artefacts

… rather, they are social constructions; perceptions of actors on what makes a situation problematic" (Klijn & Koppenjan, 2015, p. 45). Importantly, these can be views expressed by individuals, but they can also be shared by groups of individuals or communities, such as medical professionals in the case of the German EHR. A problem is therefore not an objective condition but an individual perception of the existing situation, its causes and consequences and how to best address them. This is clearly informed by the fact that an individual's knowledge is "limited and subjective by definition: our perception of the world around us is selective" (Klijn & Koppenjan, 2015, p. 45). As a consequence, a situation such as the non-adoption of the German EHR is only a problem if it is perceived as such.

Perceptions

What are perceptions though? In this thesis they are understood to be a "more or less coherent set of beliefs, ideas, and opinions that actors have about the policy problem and the situation in which they find themselves" (Klijn & Koppenjan, 2015, p. 46). These refer, inter alia, to the situation at hand and core determinants of the problem, the consequences that arise from them and their underlying causes, the values by which a desired solution or outcome will be measured, what this solution might look like as well as perceptions about the other actors in terms of their strategies and characteristics (Klijn & Koppenjan, 2015). These in turn have real-life consequences – after all, actors base their behaviors on them, from problem framing to identifying solutions and implementing them.

However, this is not always a conscious effort – perceptions act like a filter through which the world is experienced. As Klijn and Koppenjan state (2015), they help to "organize, select, and attribute meaning to the vast amount of disorganized information we receive" (p. 54) and are therefore a significant determinant of our identity. This means at the same time that, owing to their life-long internalization via education, socialization and previous experience, they are very hard to change. This is not made easier by the fact that these perceptions are usually also shared with other societal groups and, eventually, organizations or larger networks. Since any different perception automatically challenges the 'correctness' of the original perception, the individual will usually be very averse to accepting a new perception. After all, their own perceptions are inherently tied to their deeper beliefs and identity. There therefore exists a certain 'immunity' to alternative views of the problem (Klijn & Koppenjan, 2015)

Approaching wicked problems

This is emblematic of two options that are often employed in the dealing with such complex problems: gathering information and involving experts as well as offering counter-expertise to the one already offered by other actors (Klijn & Koppenjan, 2015). Referring back to the distinction made earlier between complicated and complex, the first approach is exactly that: a problem is seen as technical and complicated instead of complex. The standard response, and one often employed in the German context, is to equal complexity with a lack of knowledge and therefore, in order to resolve this complexity, data is collected, and experts or research commissions are employed (e.g. SVR, 2021; Wissenschaftsrat, 2022). This is characteristic of a positivist understanding (not the interpretive understanding of this thesis) that applied or empirical research will provide objective statements about the nature of the problem that are separable from political choices or argumentation. In other words, they will provide 'objective' knowledge that is understood to be an "authoritative starting point for problem analysis and government intervention" (Klijn & Koppenjan, 2015, p. 59).

In turn, this knowledge is contested by the other parties involved in the problem, who then commission research to reinforce their perceptions of the problem. While this can be an expression of democratic debate about a given topic, this is a rather idealistic view on what is happening. Instead, it can be argued that the produced knowledge and counter-knowledge is rather used to 'win' an argument rather than to align perceptions, i.e., find consensus (Klijn & Koppenjan, 2015). Moreover, these responses exclude a wide variety of actors who cannot follow the debate because of lack of resources, knowledge or simply because of the overload of information. This "struggle for knowledge and truth" (Klijn & Koppenjan, 2015, p. 60), has direct consequences on whether and how it can be resolved. In practice, it results on an overload of information in the form of reports, expert opinions and studies while at the same time not engaging with each other about the problem at hand.

Any solution therefore needs "clarification, reflection, and communication on the various problem perception of relevant parties and on the assumptions and values that underlie these" (Klijn & Koppenjan, 2015, p. 64). Klijn and Koppenjan (2015) emphasize that this does not mean that an absolute consensus is required – joint actions can still result from different perceptions as long as there is some shared understanding and the awareness that there are indeed different ways to understand, or perceive, the problem. In other words, joint meaning should be produced that builds on a comprehensive mapping of the relevant actors in the governance network. This

requires a different approach than the dominant understanding of complex issues as an intellectual design question that can be solved with (enough) expertise and research. Instead, "they require a shift from a more traditional top-down way of problem-solving to a more horizontal cooperative approach" (Klijn & Koppenjan, 2015, p. 4).

Consequently, the focus should lie on the relations between government and with other actors and aim at improving the coordination of these entities and therefore the quality of policy-making and service delivery. The focal point of such an approach is therefore decidedly inter-organizational and rests on the assumption that resolving complexity requires deliberate interaction. This interaction is necessary, or rather, unavoidable in order to reach effective outcomes that are supported by all those they affect (Klijn & Koppenjan, 2015). While this is hard to implement, this point is especially important as it acknowledges the fact that not doing so eventually results in the collision of contexts described by Heeks, i.e., the continued mismatch between the design of a service, the affordances it allows and whether these actually reflect what citizens as end-users need or want (Heeks, 2005).

The fact, however, remains that each of these actors will have their own perception of the problem, its solution(s) and the strategies that are necessary to get there. What does this mean in practice? It is clear that the wicked problems occurring in networks require collective action in order to be resolved and that there will be significant interdependencies as the resources that are required are usually owned by different actors. Specifically, and crucially for this thesis, this means that any starting point for an analysis as well as subsequent management of the issue must be the "multi-actor nature of interaction settings and the presence of diverging and sometimes conflicting perceptions, objectives, and institutions" (Klijn & Koppenjan, 2015, p. 14). In other words, the beginning of the solution of a wicked problem must always be an analysis of the actors, their perceptions of the problem and the context in which this happens.

Knowing all this, Q-methodology was chosen as an appropriate way to study the differing perceptions of actors in the specific context of the German EHR. Invented by psychologist and physicist William Stephenson in 1935 and later refined (Stephenson, 1953, 1968), this methodology focuses on subjectivity, i.e. it pursues "participant-led *subjective expressions* and *viewpoints*" (Watts & Stenner, 2005, p. 69). In contrast to strictly quantitative, objective measurements, it highlights *interconnected* patterns among groups of participants, thus making possible an exploration of highly complex and often contested issues (Ramlo, 2015, 2023; Watts & Stenner, 2005). By understanding participants as the variables of interest, this allows a glimpse at

the representativeness of a given phenomenon instead of a population (Watts & Stenner, 2005). At the same time, this representativeness can be evaluated using quantitative methods.

As such, Q-methodology allows for the comprehensive consideration of context, whether of individual context or the larger implementation context. Its concern with the subjective experience of individuals automatically considers the context in which these experiences take place, seeing as these are hardly, if ever, separable from each other (Yin, 2018). In other words, the context is captured by the fact that every participant will infuse the statements with his or her own meaning (Newman & Ramlo, 2010; Watts & Stenner, 2005, 2012). For this reason, Klijn and Koppenjan (2015) recommend the use of Q-methodology for this crucial step of mapping actor perceptions that ultimately help in resolving wicked problems. Using Q-methodology will provide an overview over the main antecedents for non-adoption, according to the different, affected stakeholders, which simultaneously will map the commonalities among the different perceptions of the problem, its causes and consequences.

4. Methodology

After having elaborated on the theoretical framework on which this thesis builds and towards which it aims to contribute, this section will offer insights into the underlying methodology and the justifications for its use.

4.1. Case Studies

Case studies have a long tradition in social and political science research, even though their explanatory power has been contested almost as long. However, what a case study can contribute and how it does so is not dependent on the methodology of the case study as a formal research method per se but rather on the individual execution of a given case study. If done properly, Yin (2018) argues that case studies offer an in-depth investigation of a "contemporary phenomenon (the 'case') … within its real-world context" (p.45). This is done with the belief that concluding such an investigation will improve not only the understanding of the case but very likely include "important contextual conditions" (p. 46). In other words, in comparison to experiments or other methods of research such as surveys, case studies offer insights into a phenomenon *within* its context instead of trying to single out the phenomenon and separate it from its context. This also takes into account that a phenomenon and its context are hardly, if ever, truly separable in real-world conditions (Yin, 2018).

As mentioned above, since they cater to a wide variety of fields, there is no one strict way of 'doing' case studies. However, as Yin (2018) states, they are invariably based on the assumption that "there will always be many more variables of interest than data points" (p.46). This then necessitates the development of theoretical propositions to guide the process as well as multiple sources of evidence which should be triangulated to achieve validity and reliability. There is thus always an element of interpretation of the observations within a given study. This includes a variety of different epistemological assumptions, such as the interpretivist/relativist approach chosen in this thesis, i.e., the assumption that reality is constructed by the participants and their specific perspectives (Yin, 2018).

Yin (2018) has laid out a number of characteristics for different kinds of case studies. This thesis, concerned with the introduction of the Electronic Health Record in Germany and explaining its subsequent low adoption by citizens, is a holistic, critical, explanatory single case study. It is holistic in the sense that it only looks at a single unit of analysis, the introduction of the Electronic Health Record in Germany. As should be clear by now, this is also an explanatory case study, i.e., it aims to explain the low adoption of the EHR by individual citizens in

Germany. It does so by looking at the perceptions of the main stakeholders to single out the main antecedents of the non-adoption. Furthermore, the case is critical in the sense that it might offer new or more specific insights into the phenomenon of non-adoption specifically, theory on public e-services and e-government in general and the phenomenon of wicked problems. It could also lead to a rejection of theoretical concepts, although this is not considered overly plausible in the context of this thesis.

There are a number of traditional concerns when it comes to case studies, such as whether case studies are rigorous enough or whether one can even draw general conclusions from them, a clear goal within inferential statistics (Yin, 2018). While these are legitimate concerns, they can also immediately be answered by going back a step and realizing that, on the one hand, generalizations in other disciplines are rarely ever made from a single experiment. On the other hand, the goal of a case study is not to make probability-related statements but rather what Yin calls 'analytical generalizations', i.e., "to expand and generalize theories" (2018, p. 53). It is thus explicitly *not* the goal of single case studies to make generalizations and to be a basis of comparison but rather to add depth and detail to existing theories, by offering insights from the rich context in which the case is situated. In other words, single case studies are concerned with the representativeness of a given, subjective experience or phenomenon as opposed to the representativeness of its participants and therefore the case's replicability for entire populations.

To address the issue of non-adoption of the German EHR, this thesis thus engages in a qualitative, interpretive case study research. Since the adoption of the German EHR is inherently subjective, i.e., a decision with a reasoning behind it that is entirely determined by the citizen him- or herself, it is only fitting to engage in such qualitative, interpretive research since it allows for the depiction and study of this subjectivity. The case study will thus help "to *explain* the presumed causal links in real-word interventions that are too complex for survey or experimental methods" (Yin, 2018, p. 50, emphasis in original). The presumed causal links in this thesis refers to the fact that while there are causal links that lead every individual to either decide for or against the adoption of the EHR, these links are at the same specific to every individual. While these decisions are subjective, they are at the same time logical and therefore causal for the individual. This is due to the assumption of a multiplicity of realities mentioned above. In the context of a case study, however, it is possible to explain these links since researchers can pay more attention to the circumstances, i.e., the context influencing these subjective reasoning processes.

In comparison with the induction or deduction that is associated with theory building or testing, this thesis instead engages in abductive reasoning. In other words, within the subjective context of the case study, or the information 'at hand', this thesis aims to find the most likely explanation for this context (Toshkov, 2016). By finding this most likely explanation, the case study adds valuable insight and "feeds back into the pool of theoretical knowledge by either suggesting a completely new theory, adjusting the scope conditions, or offering unconditional support for existing ones" (Toshkov, 2016, p. 82). However, as mentioned above, it is more likely that this thesis will either contribute new insights or specifications to the existing theory or support its already existing findings.

4.2. Q-methodology

To be able to analyze the research question laid out above and link data to the theoretical propositions, this thesis will use a mixed methods approach called 'Q-Methodology'. Invented by psychologist and physicist William Stephenson in 1935 and later refined (Stephenson, 1953, 1968), this methodology focuses on subjectivity, i.e. it pursues "participant-led *subjective expressions* and *viewpoints*" (Watts & Stenner, 2005, p. 69). In contrast to strictly quantitative, objective measurements, it highlights interconnected patterns among groups of participants, thus making possible an exploration of highly complex and often contested issues (Ramlo, 2015, 2023; Watts & Stenner, 2005). Instead of concepts or hypothesized phenomena, the study's participants become the variables of interest, effectively shifting the focus away from attempts at generalization known from quantitative methods and instead offering a glimpse at the representativeness of a given phenomenon (Watts & Stenner, 2005). In other words, it shifts the "focus of attention from the columns of the data matrix to the rows" (Dieteren et al., 2023, p. 1).

The methodology thus correlates individuals instead of items or statements, thereby making visible consensus or disagreements between participants (Yang, 2016). In doing so, it adopts the aforementioned "abductive approach to find the most plausible explanation" (Lee, 2017). Since it focuses on participants instead of phenomena, it is able to provide a snapshot not only of the substance of a given conflict (or consensus) but also its strength, and most importantly, its structure (O'Leary et al., 2013). In short, Q-methodology "operates with an ontology in which ultimate realities are neither subjects nor objects but actual occasions of experience" (Stenner, 2011). Moreover, Ramlo claims that Q-methodology requires "a substantial epistemological shift before acceptance" (Ramlo, 2015, p. 30). While epistemology usually refers to

the relationship between the observer and the observed, i.e., what we *can* know as researchers, Q-methodology believes that only those that are being observed can truly "capture and reveal their [own] subjectivity", i.e., they determine the knowable themselves (Ramlo, 2015, p. 30).

This has several implications for important constructs in statistical analysis, namely reliability, validity and generalizability as well as representativeness and robustness. However, before addressing these, it is necessary to elaborate on the possible research questions within Q-methodology and subsequent methods and techniques.

Research Questions in Q-methodology

There are a number of ways in which to address potential topics of research with Q-methodology and in general it can be said that the methodology is used to answer 'what' or 'how' questions (Duncan Millar et al., 2022). However, there is much more nuance to research questions in Q-methodology. Watts and Stenner propose a triadic scheme to identify different types of research questions namely i) causes or reasons, ii) definitions and iii) reactions, responses or policies (2012, p. 9). As the authors point out, these also clearly include a temporal aspect as they can be read as i) before, ii) during and iii) after. An example in this case could be to look at i) the causes for adoption or non-adoption, ii) how adoption is currently defined and iii) how low adoption should be addressed (Watts & Stenner, 2012). This thesis is concerned with the first type of research question, namely causes/reasons and will use the three main stakeholder groups involved in the project as participants (political stakeholders, medical professionals and patients). As such, the research question guiding the process was "what are the main antecedents of non-adoption, according to your personal assessment?". By asking this specific question about the potential, underlying reasons and being able to map them, Q-methodology will help to understand *why* the adoption of the EHR is so low and therefore contribute to the explanation of the current situation.

Q-set

Every study using Q-methodology consists of several distinctive steps. First, researchers will construct a so-called 'Q-set' or concourse': a list of statements that should each capture a distinct aspect about the topic at hand (Stephenson, 1953). The sample size in the context of a Q-methodology study refers to these statements. The assertions in them must further be recognizable, i.e., they must be broadly representative, or what Watts and Stenner (2005) term a "representative *condensation of information* (p. 75, emphasis in original). By demanding this precondition for statements in the Q-set, it becomes apparent that the methodology is not

concerned with the set or the items themselves but rather the attitudes, interpretations and overall worldview that inform the engagement with them (Newman & Ramlo, 2010). The specific meaning of the respective statements thus only becomes apparent once the participants engage with it, a fundamental benefit of Q-methodology as it offers a general overview of relevant views or attitudes towards the subject in question.

These statements can come from a variety of sources and there is no restriction to specific bodies of knowledge. It is specifically not necessary for the statements to be driven by theory (Watts & Stenner, 2005). They can be selected empirically, for example by conducting several expert interviews that yield insights or by interacting with future participants (Nurhas et al., 2019; Watts & Stenner, 2005; Yang, 2016). Researchers can also collect statements from academic literature reviews but are not restricted to journal articles or conference papers – they can also consider digital sources like websites or even videos or images and even artworks (O'Leary et al., 2013; Watts & Stenner, 2005). This flexibility is another benefit of the methodology. However, to be able to ensure that personal significance is elicited, statements should not be factual as this prohibits any kind of subjective judgement (Watts & Stenner, 2005). This is especially important, seeing as not adhering to this criterion would prevent the ranking of statements, a crucial step on which the methodology depends.

There is no rule on how many statements must be used for a Q-study to yield significant outcomes. However, in a review of studies using Q-methodology, Dieteren et al. have found that most studies (67,4%) used between 30 and 50 statements (Dieteren et al., 2023, p. 4). There are also no specific criteria that must be fulfilled when selecting these statements, i.e., a word count or an arbitrary limit of five statements per possible aspect of the topic (Watts & Stenner, 2005). Rather all statements should aim at a broad representativeness and the avoidance of factual statements mentioned above. Researchers should balance their set, when possible, i.e., try to cover all possible aspects of a topic equally. In general, the number of statements and their exact content, e.g., the specificity of a given statement, crucially depends on the research question and the general aim of the study (Watts & Stenner, 2005).

The Q-set used in this thesis was synthesized by looking at well-researched concepts from e-government (non-)adoption literature and research and applying them to the German context, i.e., assessing their relevance by consulting expert assessments, scientific reports, media interviews with stakeholders and media articles about the EHR. These concepts include environmental characteristics such as political support or communication, individual characteristics

such as attitudes or trust as well as technology characteristics which include perceived ease of use or usefulness. As Ramlo has demonstrated in several studies, it is possible to 're-use' survey questions as statements for a Q-set (Newman & Ramlo, 2010). A similar approach has been used for this study since most articles concerned with e-government adoption employ quantitative methods (Distel & Ogonek, 2016; Hofmann et al., 2012). This is also due to the fact that most of these articles re-use the well-known models of technology adoption which are quantitative in nature (Hofmann et al., 2012; Rana et al., 2015; Titah & Barki, 2006).

For this reason, statements were first collected by considering the previous research done in the context of e-government adoption. However, many of these statements were not applicable to the German EHR context. For example, they specifically referred to public e-services that were used in a very different way than an EHR, e.g., tax declarations or government websites to retrieve information and interact with the government (e.g., Carter & Bélanger, 2005; Dwivedi et al., 2017). For this reason, the statements were rather taken as inspiration of how to operationalize concepts that have been shown to influence the decision to adopt a given public e-service. Their specific content, however, was tailored to the main discourse around the German EHR, i.e.,

1) the goals voiced by stakeholders, such as increased efficiency or effectiveness
2) concerns about privacy, data protection and continued patient confidentiality
3) criticism voiced about the design of the EHR
4) the implementation itself, e.g., a lack of communication and public information about the EHR
5) the implementation context: a lack of digital readiness among society as well as in medical institutions; attitudes among the end-users

This yielded 38 statements which can be grouped into the categories mentioned above: 12 statements concerning environmental characteristics, 13 concerning individual characteristics and 13 statements concerning technological characteristics. For the first, statements touched upon, inter alia, the support by the Minister of Health and the government in general or whether there was sufficient information regarding the introduction of the EHR. For the second, the attitude of individuals was considered as well as the trustworthiness of the government and the Internet among others. For the third category, statements were concerned with, e.g., the ease of use of the EHR as well as its perceived usefulness and its compatibility. The complete list can be found in Appendix 1.

P-set

When it comes to possible participants of a study, there is once again no fixed number of participants that must be included to guarantee significant outcomes. The number of participants should rather depend on the research question and the aims of the study. Dieteren et al. have found that studies using Q-methodology usually have between 20 and 50 participants (Dieteren et al., 2023, p. 4), which is also in line with other recommendations (Ramlo, 2015; Watts & Stenner, 2005). The exact constitution of the participants group thus depends on the topic that is being studied and the context of the topic.

As was established above, this study (now) aims to map the perceptions of the three main stakeholder groups that are affected by the introduction of the German EHR: the political stakeholders, medical professionals and citizens. In the beginning, the focus lay solely on the 'gematik' as the governmental society responsible for the development and implementation of the German EHR. By defining and enforcing binding standards for services, components and applications in the telematics infrastructure (TI), the gematik ensures that this central infrastructure is and remains secure, efficient and user-friendly. For this reason, this thesis aimed to map these stakeholders' perceptions of the main antecedents of non-adoption to understand their influence on the design process and whether there truly is a mismatch between the perceptions of stakeholders and end-users, i.e., citizens. Using the data from the gematik's website, all members of the relevant bodies were contacted to participate in this study.

These include its highest body, i.e., the stakeholder assembly, whose decisions determine the specific configuration of the HER. This assembly consists of nine stakeholders, including, inter alia, the Federal Ministry of Health and the various associations of healthcare and health insurance providers. These stakeholders are advised by a committee consisting of representatives from the federal states, patients, industry, science as well as occupational groups such as nurses (*Über Uns*, 2023). Both these bodies set the guidelines to which the EHR must adhere. If the person's specific e-mail address was found, they were contact directly, if not, their organization was contacted with the request to forward the study to the relevant person. However, out of 45 contacted persons on this list, only four persons agreed to participate – clearly this was too little data to go forward.

For this reason, it was deemed feasible to extend the research to include the other two major stakeholder groups: medical professionals as well as citizens in their role as patients. After all, the mismatch at the basis of this research connects all groups: the political stakeholders at the

gematik who made specific design and implementation choices, the medical professionals who need to integrate the EHR into their usual way of interacting with patients and are thus a crucial part in the usage of the EHR and lastly, the citizens themselves. After contacting several friends and acquaintances that were either citizens or medical professionals, a snowballing technique was used to further distribute the study which resulted in 29 final participants (4 political stakeholders, 9 medical professionals, 16 citizens). This was only possible because the methodology focuses on subjectivity and the representativeness of *phenomena*, not the participants themselves (Watts & Stenner, 2005).

Q-sort

After contacting the participants and providing them with access to the study, they were asked to sort the Q-set created specifically for the German EHR and its context. As mentioned above, this Q-sort is a fundamental part of the methodology. With this technique, the subjectivity of the observed is captured or rather, represented. Participants are asked to sort the statements of the Q-set according to their preference which is along the lines of a simple question to elicit, inter alia, judgements of agreement or importance (Watts & Stenner, 2005). In other words, the sorted data are "expressions of qualitative intensity related to feeling or value" (Ramlo, 2015, p. 29). A previously heterogeneous set of items is thus rendered homogenous in relation to the individual who sorts the Q-set (Watts & Stenner, 2005). The sorting of statements takes place in a quasi-normal distribution (Figure below).

This means that participants do not need to rank each statement in descending order, i.e. 1 to *n*, but rather that they assign positions to statements in relation to the other statements in the set. In other words, the "Q-sort is self-reference" (Ramlo, 2015, p. 33) – the participant's view is determined by themselves, independent of the researcher's view. Viewpoints are thus explored in a systematic way, which is a necessary precondition for a meaningful factor analysis in the next step (Yang, 2016).

Figure 1: Q-sort used in this thesis (38 Statements)

-4	-3	-2	-1	0	1	2	3	4

← Most disagree   Most agree →
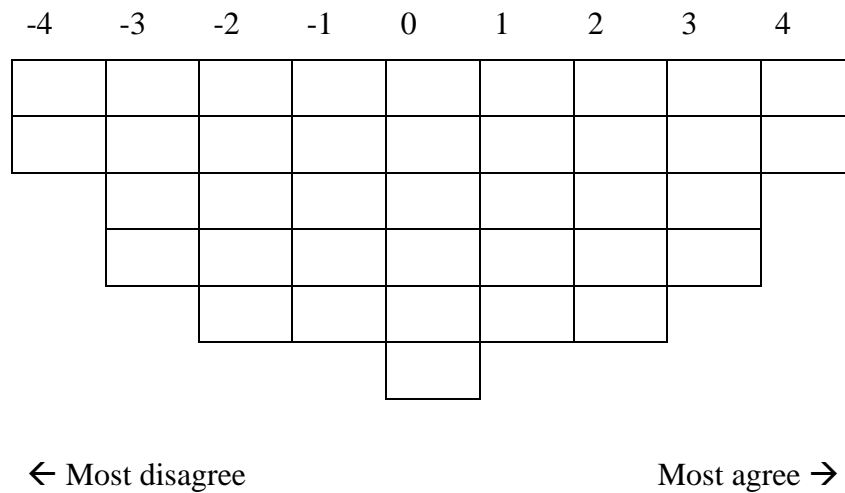
When the respondents have filled out their Q-sorts, researchers can ask for them to elaborate on their placements, either via written comments or interviews (Watts & Stenner, 2005, 2012). Given the time restraints of this thesis, participants were asked to provide a short, written comment (3-4 sentences) on the four most extreme statements, i.e., the two they most agreed and disagreed with. These comments were provided by almost all participants. Moreover, respondents were asked if they were missing statements that they deem crucial to the topic of the study. Such comments on the choices made in the Q-sorting process are vital to the methodology as they are an important aid in interpreting possible factor configurations later on (Watts & Stenner, 2005, 2012).

(inverted) Factor analysis

After receiving the Q-sorts, each Q-sort is correlated with the other configurations. However, it still represents a by-person correlation due to the respondents being the variables of interest (Brown, 1980; Stephenson, 1953; Watts & Stenner, 2005). In the following, last step, the correlation matrix is then used for an inverted factor analysis, i.e., the respondent's Q-sorts are now used as variables for this procedure. The inversion in this method refers to investigating persons instead of tests or other quantitative concepts (Thomas & Watson, 2002). In doing so, it groups respondents into 'factors' that represent similar views. When considering this, O'Leary et al. have suggested to use the analogy of a prism: just like a prism, "factor analysis of Q-sorts reveals the underlying spectrum of perspectives that are held by a group of stakeholders" (O'Leary et al., 2013, p. 1945). In this, Q-methodology still retains the respondent's

self-reference while simultaneously allowing to discover patterns from the responses without any *a priori* assumptions (Stephenson, 1953). Moreover, by analyzing Q-sorts and thus implicitly people as variables, factor analysis helps to maintain the "relationship among themes within the data as it minimizes, … the impact of the researcher's frame of reference" (Ramlo, 2015, p. 36).

Specifically factor analysis produces a set of factors onto which participants 'load' based on their respective Q-sorts. 'Loading' in this method refers to a group of participants sharing the same or similar highly ranked statements in their Q-sorts (Watts & Stenner, 2005). In other words, two participants that create very similar Q-sorts will load on the same factor – their choices indicate their level of agreement or disagreements with the statements. Each factor thus captures a different configuration of statements from the Q-set which is simultaneously shared by all participants who load onto this factor. Dieteren et al. (2023) have found in their comparison of studies, that these studies usually result three to four factors per study, with 90% of studies showing between two and five factors (p. 7). In other words, Q-methodology "uses subjective data to objectively group people" (Ramlo, 2015, p. 33).

However, factor analysis as the method in Q-methodology does not yield the most meaningful result at first glance. In order to find those combinations that yield the most explanatory power for the study, the factors should be rotated to maximize the amount of variance that can be explained by them (Brown, 1980; Stephenson, 1953, 1968). This is a point of contest between different factions within the Q-methodology community. While some contend that only statistical means of rotation analysis should be used, others argue for choices of factors informed by subjective interests such as theoretical considerations or a researcher's own, particular ideas (Yang, 2016). However, there is little statistical difference between using methods (Brown, 1980). This thesis will thus use a more mathematical approach using varimax rotation. As Watts and Stenner (2005) argue, "it makes theoretical sense for us to pursue a rotated solution which maximizes the amount of variance explained by the extracted factors" (p.81) which is exactly what the varimax procedure offers.

Limitations of Q-methodology and the quality of the research design

As mentioned above, there are a number of concepts that are often criticized when it comes to Q-methodology and that relate to the quality of the research design namely the validity, reliability, representativeness and robustness of the methods used. Validity refers to how accurately a method measures the concepts it is supposed to measure. Validity, however, is of no concern

in Q-methodology since the Q-sort is entirely self-referent (Ramlo, 2015). There is no accurate measurement necessary since respondents make their choices based in comparison to all other alternative statements within the closed Q-set of statements. Their choices are thus neither exclusive nor absolute (Thomas & Watson, 2002; Yang, 2016). Moreover, Q-methodology is explicitly focused on subjective experiences and viewpoints and does not have an epistemological claim to external observation of human behavior (Ramlo, 2015). On the contrary, it rather aspires to an examination of the world from the internal viewpoint of the individual (Watts & Stenner, 2005, 2012).

Even though the focus is on the subjectivity of specific persons at a specific point in time, Q-methodology is not concerned with the replicability of results over time or observers (Thomas & Watson, 2002; Watts & Stenner, 2005; Yang, 2016). Nevertheless, the methodology is still concerned with the reliability of its results, albeit within itself. It is assumed that because the factors and the Q-sorts they are based on are grounded in concrete behaviors, they will consequently be reliable and easily replicated (Brown, 1980). In other words, the same participant, faced with the same context of the study will very likely reproduce a similar or the same Q-sort.

As mentioned above, Q-methodology does not aim to produce results that are representative for entire populations. Therefore, representativeness within the P-set of participants is of no concern (Brown, 1980). The sampling of the participants rather relies on their relationship to the topic at hand and a concern for representativeness is only articulated for the phenomena within their subjective experiences, i.e., the factors that emerge from the participants' Q-sorts. Moreover, Q-methodology is explicitly not concerned with generalizability of its results. Instead, it focuses on subjectivity of participants within a specific context which is diametrically opposite to any kind of general statement. By focusing on the participants as variables of interests, the methodology forfeits any claim to generalizability since participants have inherently different, *subjective* experiences that define them and their view of specific subject matters. The method of Factor analysis makes this obvious as it "clarifies and reveals the subjective structure of the 'universe' from which the statements were drawn, not the proportion of a population that adheres to a particular view" (O'Leary et al., 2013, p. 1944).

Q-sorting, then, is fundamental for the robustness of the methodology. By actively engaging participants via the Q-sorting process, the methodology takes advantage of a well-studied human trait – the desire to ascribe and find meaning in all things encountered (Watts & Stenner, 2005). As Watts and Stenner (2005) conclude: "it is these very desires which ensure the

robustness of Q methodology, as a group of participants will ultimately make vigorous attempts to impose their viewpoints onto *any set of statements they are given*" (p. 76, emphasis in original). This further addresses a final, perceived limitation of the methodology, namely the assumed objectivity of the researcher. It is hardly possible to assume objectivity, when the statements in the Q-sort are chosen by the researchers themselves (Robbins & Krueger, 2000). However, the methodology addresses this by asking respondents to elaborate on their choices as well as to mention what they think might be missing from the set of statements after sorting. The necessary narrowing-down of the 'universe' as statements by the researcher is thus mediated by the participant's additional, clarifying input (Ramlo, 2015).

Q-Methodology and the digitalization of healthcare

In light of these explanations, it is also worth highlighting another reason why this methodology was chosen for this thesis. While Klijn and Koppenjan (2015) have highlighted a number of different methods to map actor perceptions of the problem at hand, Q-methodology was chosen because it is also uniquely applicable to the healthcare context. Churruca et al. (2021) have written a review of the use of Q-methodology in healthcare and have identified a list of reasons for its use. For example, Q-methodology was described as the ideal approach to explore complex or controversial topics which usually elicit strong divisions in opinion or perspectives. This was deemed especially valid for healthcare, a field in which different approaches are often very contested (Churruca et al., 2021).

Moreover, the ability to provide a more holistic approach that is centered on individuals is a clear advantage. By forcing a choice within the set of statements, realistic conditions of healthcare are mirrored "in which decision-making is constrained and must consider multiple factors" (Churruca et al., 2021, p. 7). This also extends to the context of this thesis. The Electronic Health Record in Germany is a project that connects a multitude of stakeholders with differing priorities and interests while at the same time being a crucial E-government project. Moreover, it is crucial for the future delivery of high-quality healthcare. However, no one stakeholder is responsible for all details, nor can all stakeholders make decisions to the same extent. It is therefore worthwhile to employ Q-methodology to identify opposing opinions, attitudes or evaluations within the project of introducing an EHR in Germany.

Lastly, Churruca et al. (2021) have found that another common perceived advantage, regardless of the topic being studied, was the rigor of Q-methodology. This is something this thesis will benefit from as well. Via the integration of qualitative techniques and the rich data it yields

from the Q-sorting, as well as the rigor of statistical analysis during factor analysis, Q-methodology allows for participants to create their own meaning (Ramlo, 2015; Watts & Stenner, 2005, 2012). At the same time, and most importantly, it reduces the impact of the researcher, whether this refers to prior assumptions or even potential biases. In addition, and in reference to the statistical concepts mentioned above, Q-methodology does not suffer problems of 'missing' data and therefore of validity or representativeness. Instead, Q-sorts are only analyzed as wholes. (Churruca et al., 2021)

All in all then, it is clear that Q-methodology offers several advantages to the project at hand, i.e. studying the non-adoption of the Electronic Health Record in Germany as a 'wicked problem'. As a mix of qualitative and quantitative techniques and methods, i.e., Q-sorts and factor analysis, it offers unique insights into complex problems by focusing on the persons involved in the context of the study at hand. More specifically, it simplifies the complexity of the issue by focusing and therefore reducing participants viewpoints to a smaller number of shared perspectives through quantitative, inverted factor analysis (Churruca et al., 2021). At the same time, the collection of data via Q-sorts and asking participants for elaboration of their sorting choices, as well as the fact that the statements and elaborations continue to inform the factor analysis, allow for retaining nuances in the different perspectives (Watts & Stenner, 2005). This makes Q-methodology an ideal method to study the complexity that comes with different stakeholders, their different priorities, motives and interests as well as the ethical implications that come with the sharing of sensitive, medical data in a digital space.

5. Analysis

The next section will elaborate on the study conducted as part of this thesis by highlighting the data collection, analyzing results and discussing them and by offering subsequent recommendations for research and practice.

5.1. Data Collection

To create a Q-sorting grid to share with the P-set, the free software EQ WebSort as developed by Shawn Banasick was used.[1] There are a number of different free programs available on Github that are mainly written in HTML, i.e., that can be displayed in a web browser to share with participants instead of asking them to sort paper cards. Another widely used software for this is HTMLQ. However, this program has not been updated for more than a decade which is why EQ WebSort was chosen instead. Another convincing feature is that EQ WebSort comes with a configurator which makes the process more intuitive and clearer and was the final argument for EQ WebSort – code-wise there is little to no difference between the two programs.

In order to use EQ WebSort in the German EHR context, the application was re-configured in German, adding the statements as well as creating a "landing site", i.e., an introduction where the survey and its goals were explained and the procedure to follow outlined. After asking participants to perform a preliminary sorting into "agree", "neutral" and "disagree" piles, they were then asked to perform the final sorting within the sorting grid. After completing this step, participants were asked to comment on the four most extremely ranked statements, i.e., those they agreed/disagreed with the most. At the end of the Q-sort, the participants were asked to provide some general information about themselves: their age (YYYY format), their gender, their professional background, in what capacity they were filling out the survey (as stakeholder or member of the advisory committee of the gematik, as a medical professional or citizen). Moreover, they were asked, if applicable, if there was an aspect they were missing within the statements.

These surveys were sent out via e-mail first to the political stakeholders, i.e., the stakeholders of the gematik as well as the members of its advisory committee – however, as mentioned above, only four of the 45 contacted persons agreed to participate. In order to still provide an analysis for this thesis, the survey was thus distributed to friends and acquaintances from

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[1] After setting up the sorting grid as well the general set-up of the survey, I encountered severe difficulties in connecting the application to the database and, since I did not know who else to contact, I reached out to Mr. Banasick himself. My sincere gratitude goes to him for trying to help me solve this issue even from afar and across several time zones.

specific backgrounds (citizens and medical professionals) who were asked to share the survey with other people in their environment. This yielded 29 participants in total, of whom 26 filled out the survey correctly and whose Q-sorts were thus used in the analysis. The table below shows a summary of their characteristics.

Table 1: Participants' characteristics

Participants	26
Average age	38,37
Gender	14 women, 12 men
Political Stakeholders	3
Medical Professionals	9
Citizens	14
Backgrounds	Political Stakeholders
	IT, research, administration
	Medical professionals
	nursing, physical therapy, doctors
	Citizens
	students (political and social science, industrial design, psychology), biotechnology, biology, veterinary medicine, engineering, administration, law

Before coming to the interpretation of the results, however, it is wort to elaborate on the specific context in which the study is set.

5.2. Case Description

Knowing the details of Germany's multi-level administration mentioned above, the provision of healthcare in Germany is another reflection of this principle. It is organized in what is called "Selbstverwaltung", i.e., self-administration. While the federal government provides the legal framework and defines the tasks for health care, the insured citizens as well as those providing healthcare organize themselves in representative bodies, so-called "Vereinigungen" or

associations (Bundesministerium für Gesundheit, n.d.). These include the association of all registered doctors in Germany, as well as an association of health insurance providers, dentists and pharmacists (Bundesministerium für Gesundheit, n.d.). The institutions of the healthcare system in Germany thus organize themselves and provide healthcare in their own responsibility. The federal agency mainly responsible for regulations in the healthcare sector is the Federal Ministry of Health (BMG, 2022).

Specifically, the health system is set up in three interacting levels. First, the frame is set through governmental regulation. This can be done by either the federal government, the state governments or the municipalities. For example, during the COVID-19 pandemic, the federal government recommended social distancing but the respective states decided whether and when they would close public institutions such as schools, restaurants or museums (BMG, 2022). Second, the actual configuration of the system is organized by the self-government with its healthcare institutions and associations mentioned above. Third, local and concrete healthcare is provided by the institutions of the healthcare system, i.e., health insurance providers, hospitals and pharmacies as well as the medical professionals, i.e., physicians, nurses and other personnel, with all of them represented on the second level via their associations (BMG, 2022)

The German health system thus serves around 83 million citizens in more than 1900 hospitals and around 101.000 doctor's offices, supported by more than 18.000 pharmacies (BMG, 2022; KBV, 2023). This costs more than 440 billion Euros per year (BMG, 2022) and results in over a billion patient-doctor contacts per year (KBV, 2023). Since 2007 it is mandatory to have health insurance when one lives or has their usual place of residence in Germany (BMG, 2022). Most citizens are insured via their employers, who pay half of the subscription, as long as they earn less than a specific amount (5.362,50 € per month in 2022; (BMG, 2022)). How much a citizen pays for the insurance depends on their income but does not determine the availability of services. All publicly insured citizens have access to the same services.

When it comes to the digitalization of the health system in Germany, this happens first and foremost on the first level mentioned above, i.e., on the federal level via the Federal Ministry of Health which passes the necessary legislation. This cannot be done by the states themselves because it touches upon a service that must be available to all citizens anywhere in Germany – not depending on whether one lives in Berlin or in the Black Forest. Providing the legal framework for the digitalization of healthcare therefore lies within the responsibility of the federal government. Moreover, a digital healthcare system relies on Telecommunication, another area

where the federal government holds exclusive regulatory responsibility (Art. 73 GG). The legislature thus created the society for telematics infrastructure, 'gematik', a company with limited liability which includes all partners of the self-administration as shareholders, and, as of 2019 the Federal Ministry of Health as the main shareholder (51%) (SVR, 2021).

This society is responsible for the telematics infrastructure (TI), the central platform for digital applications in the German healthcare system. As part of its mission, it defines and enforces binding standards for services, components and applications in the TI, so the infrastructure remains efficient and secure (*Über Uns*, 2023). The Electronic Health Record in Germany is located within this infrastructure. How well the infrastructure connects all those working with an EHR, its efficiency and accessibility as well as how comprehensive the information in it are, are some of the core determinants of the eventual usability and adoption of this application.

The Electronic Health Record in Germany

Since January 1, 2021, after more than 16 years of preparation, German citizens who are ensured via the public mandatory health insurance can now request an Electronic Health Record with their health insurance provider. This EHR is implemented in increments. The 'ePA 1.1', for example, included a medical summary for emergencies, an electronic medication plan and electronic medical reports, i.e., physician letters as the first documents to be managed (*E-Patientenakte*, 2023). Within this version it was further possible to easily grant access to data and for patients to protocol certain types of information, specifically by uploading data to provide their doctors with additional information (*E-Patientenakte*, 2023).

Starting in 2023, the 'ePA 2.5' will be introduced which allows for the inclusion of discharge letters from hospitals, lab reports, and radiology images (*E-Patientenakte*, 2023). It will also allow for the monitoring of the patient via telemedical procedures. Data from digital health applications can be saved in the EHR as well and all this data can be shared pseudonymously with scientific institutions to improve the provision of healthcare in the future (*E-Patientenakte*, 2023). In order to use the EHR, medical institutions need to update their existing connectors to the TI (software), install a secure communication program (software), have a digital medical license in form of a chipcard (hardware), update the specific information system used in their medical institution (software) and usually purchase additional card readers for the treatment rooms so the information on insurance card can be read in privacy and not at the reception desk (hardware) (KBV, 2022c).

However, the Electronic Health Record in Germany today is on a voluntary basis, i.e., citizens opt-in to using the system in opposition to a provision of the EHR where citizens would only opt-out if they do not want to use an EHR (*E-Patientenakte*, 2023). This means that patients in Germany choose to give healthcare providers access to their medical data in the application that their health insurance provider offers. Specifically, the EHR is understood to be a 'patient-led' health record, i.e., patients decide what data to include or upload and who they give permission to access and populate their EHR when they are in treatment (SVR, 2021). The EHR is therefore maintained and controlled by the patients themselves. Starting in 2022, patients can even give document-specific permission to these institutions and can delete documents from the EHR on their own at any time (*E-Patientenakte*, 2023). Consequently, healthcare providers cannot assume that they will receive a complete version of the patient's medical history in the EHR. Insured persons also have the right to revoke their consent to data processing vis-à-vis their health insurance provider at any time (*E-Patientenakte*, 2023). The entire record will then be deleted.

As mentioned above, the EHR can be populated both by the patient and those (s)he has given permission to access and populate the EHR. Who exactly uploads documents in a doctor's office or hospital is not specified. The permission a patient has given is not tied to the doctors themselves but rather to their electronic medical ID, i.e., a chipcard issued by the medical association which allows for verified digital signatures (*FAQ*, 2023). When such an institution uploads a document to the EHR, this is only a copy of the original document which remains within the institution's respective information system (KBV, 2022a).

Given the sensitivity of any information related to health, medical information is often subject to a special confidentiality obligation, i.e., such personal information must remain confidential between doctors and patients. To protect sensitive health data, health insurance providers thus do not have access to documents uploaded into the EHR and cannot read them, even though they provide the EHR application (*FAQ*, 2023). However, insured persons can request the upload of billing data to their EHR via their insurance provider. In this case, the health insurance provider is granted exclusive writing access (*FAQ*, 2023). The company providing the specific EHR application never has access to the data but is merely responsible for its technological maintenance (*FAQ*, 2023).

To ensure that only authorized personnel has access to the EHR and remains within the permissions (s)he has obtained, a detailed log of every access to the EHR is kept in the application

(SVR, 2021). This log includes not only the date and time of access but also the activity performed, the name of the person accessing the EHR and information on what data object was accessed (*FAQ*, 2023). Patients can thus track changes and access dates and report any suspicious activity for three years. For a doctor's office this simply means that as soon as the office's respective information system accesses a patient's EHR, this activity is logged. To explain an activity that was not ill-intended e.g., a doctor looking for specific information on prior treatments but not being able to find such a document, notes can be added to the patient's file informing them of the purpose of the access and the fact that it yielded no relevant results (*FAQ*, 2023).

In conclusion, as of today, the use of an EHR is optional for every patient in Germany. The health insurance providers are legally obliged to inform their subscribers about the functioning of the EHR as well as the advantages and benefits (KBV, 2022a). This information should be found on the provider's websites. The gematik estimates that more intense communication and advertisement of the EHR will commence once all doctors in Germany are connected to the TI and can therefore use the EHR when treating patients (*FAQ*, 2023). However, even though the Digital Care Provision Law of 2019 required all doctors to connect to the TI until June 30, 2021, in fact only 74% were fully ready to use the TI in 2022 (*TI-Atlas*, 2023).

This is also due to the fact that there are 126 different Information Systems used in doctor's offices all over Germany, which need to connect to the TI which often requires specific updates (KBV, 2022b). Moreover, there are 96 different public health insurance providers and 42 private insurance providers (*Mitglieder*, n.d.). This is a significant problem, as political stakeholders have also pointed out in their comments on this study (participant 4, 19, 25) . Moreover, they pointed to the role of health insurance providers in the non-adoption. However, even though it is their responsibility to inform their insured members, i.e., to properly advertise the EHR, this is unlikely. For this to be able to happen, a significant number of doctor's offices still needs to be connected to the TI so that all citizens can truly use the advertised services.

5.3. Results

For conducting the factor analysis of the gathered Q-sorts, KADE software was chosen which complements the EQ WebSort application as they are designed by the same developer. This software allows for the uploading of data directly from the database instead of adding Q-sort by hand and is frequently updated. The application is very similar to PQMethod, the prevalent software in the field for the last decades (e.g., O'Leary et al., 2013; Ramlo, 2015; Watts & Stenner, 2005; Yang, 2016). However, this software has not been updated since 2014. KADE software on the other hand is very intuitive, allows for different methods of rotation and is overall very easy to handle. After uploading the Q-sort data and statements to the application, the program calculates a correlation table among all participants which is then used as a basis for the following factor analysis.

Analysis of results

The factor analysis employed in Q-methodology is done in several steps. First is the calculation of an unrotated factor matrix, on the basis of which factors are then extracted. Regardless of extraction method, i.e., Principal Component Analysis (PCA) or Centroid Factors, this is limited to eight possible extracted factors from the available data. PCA was chosen for this thesis, in line with Watts and Stenner's (2005) argumentation for maximizing the amount of variance by relying on a mathematical rather than a theoretical approach. This initial extraction already gives a good overview over the distribution of the Q-sorts and their possible groupings. However, eight factors are quite clearly too many to be extracted from the data and still fulfill the goal of data reduction.

Which factors were chosen and on what basis?

As the main purpose of factor analysis is to reduce data and condense it in order to explain the data, it is necessary to establish a threshold. Not every factor that emerges should also be interpreted. A standard that has emerged in Q-methodology is to only choose those factors that have an Eigenvalue above 1.00 (Brown, 1980; Stephenson, 1968; Watts & Stenner, 2005, 2012). The term 'Eigenvalue' refers to the sum of squared factor loadings for a given factor. If one divides the Eigenvalue by *n,* i.e., the number of participants in the study and multiplies this result with 100, one will have the variance accounted for by this factor. The equation is thus as follows:

$$Variance = 100 \times (Eigenvalue \div n)$$

This ensures that this factor should explain more than a single variable, i.e., than a single Q-sort. However, it is still possible that this is not the case. First, depending on the size of the participant group or the Q-set, the Eigenvalue could be above 1.00 even though the factor is not statistically meaningful (Yang, 2016). Moreover, and apart from statistical significance, even a factor that does not reach above 1.00 could give unique insights (Watts & Stenner, 2012). It is therefore necessary to not only interpret factors according to their statistical significance but also consider whether they would make a unique contribution to understanding the main objective of any Q-study – the subjective experiences of participants.

For this reason, it is necessary to consider other important values. One of these is determining the number of significant loadings for a given factor (Watts & Stenner, 2012). This is calculated as follows:

$$2.58 \times (1 \div \sqrt{nr.\,of\,items\,in\,Q-set})$$

This yielded, after rounding, a significant loading at $\pm0,42$. Watts and Stenner (2012) agree with Brown (1980) that any factor with two or more such significant loadings should be accepted, regardless of the Eigenvalue. This was also adopted in this thesis and reduced the factors to four, which together explain 62% of the variance in the dataset.

Table 2: Factor characteristics (unrotated)

	Factor 1	Factor 2	Factor 3	Factor 4
Eigenvalues	8.481	3.6265	2.1715	1.8052
% explained variance	33	14	8	7
Cumulative % explained variance	33	47	55	62

How are factors interpreted?

These four factors were then subjected to rotation analysis, in order to find those combinations that yield the most explanatory power for the study (Brown, 1980; Stephenson, 1953; Watts & Stenner, 2012). This is a point of contest between different factions within the Q-methodology community. While some contend that only statistical means of rotation analysis should be used, others argue for choices of factors informed by subjective interests such as theoretical considerations or a researcher's own, particular ideas (Yang, 2016). However, there is little statistical difference between using methods (Brown, 1980). This thesis used a more mathematical

approach using varimax rotation. As Watts and Stenner argue, "it makes theoretical sense for us to pursue a rotated solution which maximizes the amount of variance explained by the extracted factors" (Watts & Stenner, 2005, p. 81), which is exactly what the varimax procedure offers.

After rotating the four extracted factors, this yielded the following distribution:

Table 3: Participants after rotation

	Factor 1	Factor 2	Factor 3	Factor 4
Participants	9	5	7	5

For every factor configuration there are "defining respondents" (Yang, 2016, p. 47). These respondents load strongly on the given factor, and they are especially important to understanding the specific factor. In fact, only the responses of the defining respondents are used to further calculate the factors and are considered to explain its specific characteristics (Yang, 2016). Identifying these statements is called 'flagging' and is usually done by marking those individual's that represented by a factor with an X next to their factor scores (Newman & Ramlo, 2010). For this study, statements were flagged at p<0.01 and requiring a majority of common variance which ultimately resulted in the following distribution:

Table 4: Participants after flagging (p<0.01)

	Factor 1	Factor 2	Factor 3	Factor 4
Participants	9	4	6	3

The loading values of the flagged respondents were then further considered individually. These values range from -1 to +1 as this is the correlation coefficient indicating the extent to which a given Q-sort is associated with the underlying factor. In other words, this loading represents the "sharing or rejection of the concepts underlying the factor" (Yang, 2016, p. 47). As was calculated above, a significant loading equals $\pm$ 0,42. However, it can be argued that is not particularly close to the factor, i.e., not close enough to $\pm$ 1. Since this thesis aims to synthesize the *main* antecedents for non-adoption from the given data by interpreting these factors, it was thus decided to only consider those loadings of $\pm$ 0,6 or higher/lower. This yielded the following, final distribution:

Table 5: Participants after threshold of ± 0,6 for significant loadings

	Factor 1	Factor 2	Factor 3	Factor 4
Participants	8	2	4	3

A complete overview of including individual participants and their loadings can be found in Appendix 2.

However, when looking closely at the individual factor loadings after this decision, Factor 4 has both positive and negative loadings. In other words, there are both respondents who agree with the concepts underlying this factor and who disagree. In fact, the strongest loading was at -0,85. This thus represents a so-called 'bi-polar factor' and for this reason, the factor was split.

Table 6: Factor characteristics after rotation, flagging (p< 0.01, threshold of significance at 0,6) and splitting the bipolar factor

	Factor 1	Factor 2	Factor 3	Factor 4a	Factor 4b
Participants	8	2	4	2	1
Eigenvalue	4,337	1,095	2,115	1,593	
% explained variance	22	13	16	11	
Cumulative % explained variance	22	35	51	62	

Since 4a and 4b are still the same factor, it is not problematic that only one person significantly loaded onto 4b. On the contrary, it is particularly interesting that there is such a difference in opinion about the same concepts underlying the factor.

Factor interpretation

To get a first overview, researchers should analyze the factor score for each statement within each factor. Factor analysis generates a z-score for each item within each factor, i.e., the average score of an item by all defining respondents of this factor (Yang, 2016). This yields three different kinds of statements: extreme, distinguishing and consent statements.

Extreme statements are rather intuitive – they denote those statements with the highest or lowest z-score within the factor (Yang, 2016). They strongly define the factor and can therefore be understood as a comprehensive, first overview. Distinguishing statements are those statements

where the z-scores differ the most from those of other factors (Watts & Stenner, 2012). The software for the analysis further calculates the significance of these statements at p<0.05 and p<0.01. These statements thus show what is most unique about any given factor. Consensus statements on the other hand are those statements that are scored similarly by all respondents, i.e., they have minimal z-score difference and indicate the viewpoints that are most common among all respondents (Watts & Stenner, 2012; Yang, 2016).

Furthermore, Watts and Stenner (2012) recommend the creation of a first overview sheet which identifies, in addition, those statements that are ranked more positive and those ranked more negative than in all other factor arrays. KADE software does this automatically and creates such 'relative ranks' for each factor (Appendix 3). These sheets can then be complemented with the exemplary Q-sorts for each factor and the individual Z-scores for each statement in each factor. Moreover, all these statements can and should be complemented by the data and insights gained, for example, from the comments provided by the respondents (Watts & Stenner, 2012). By doing this, a comprehensive and holistic picture of the factor can be drawn that utilizes the existing data to gain the maximum of information possible. The details of the participants loading on the factors can be found in Appendix 4 and their comments on their extreme statements in Appendix 5 (translated to English).

Factor summaries

> Factor 1: Left alone, but hopeful
>
> Factor 1 has an eigenvalue of 4,337 and explains 22% of the study variance. Eight participants are significantly associated with this factor, specifically, there are four females and four males with an average age of 28,75 years. There are six citizens (three social/political science students, one industrial design student, one engineer and one psychologist), one political stakeholder with a background in medical IT and research, and one medical professional (nurse) who loaded onto this factor.

Respondents clearly see the benefits of an EHR and the EHR itself as a valuable service. They are especially hopeful that the EHR will help citizens get specific document such as prescriptions faster and easier than before, thereby increasing the efficiency and effectiveness as well as the quality of medical interactions. They trust the government as a provider of the EHR and this trust extends to the Internet as a medium for the interaction with medical professionals. As one respondent points out, "*I think that in a state where the rule of law is respected, the government is much more trustworthy than commercial/private actors*" (Participant 16).

At the same time, respondents feel left alone with this service. There was not enough information about the introduction of the EHR and there are no specific guidelines to help citizens in using the EHR. Citizens are thus missing exemplary leaders or implementers of this EHR. In the respondents' opinion, too few influential persons or institutions such as doctors, their offices or hospitals are using the EHR to subsequently convince citizens of its use as well. They are not aware that there is any kind of network and therefore feel isolated. As one respondent succinctly sums it up: *"When nobody points out new possibilities to you, you do not even know what you are missing"* (Participant 7). Therefore, even though they see the benefits, they would also need clear information and support structures.

Factor 2: wary, but cautiously positive

Factor 2 has an eigenvalue of 1,095 and explains 13% of the study variance. Two participants are significantly associated with this factor, specifically, they are two females with an average age of 60 years. They are both citizens, one is a lawyer, and one is a biologist.

The respondents are very wary about the prospect of the EHR. They do see the benefits of the EHR and do not consider it too time-intensive to use. As one of the respondents points out, *"I don't think the problem with your own health care is the time it takes. Neither that which results from the manual collection of data from doctor's visits nor that which results from feeding this data into an app."* (Participant 6). They also believe that doctor's offices and other medical institutions are well-enough informed to inform citizens about the use in return. Moreover, they deem the government to be very trustworthy and agree that the Minister of Health as well as the government in general have shown enough support for the project.

All in all, however, they do not think that the EHR currently offers a valuable service. Specifically, the risk loss of data via hacking and the risk of unauthorized access to data seem too high for the current EHR – *"Disclosing personal data on the Internet is always a risk. Data concerning the state of health even more so. There is no 100% security that sensitive data cannot be hacked and passed on"* (Participant 6). This shows significant lack of trust in the Internet, which does not seem like a safe environment in which to interact with medical professionals. Specifically, it is not clear enough for citizens, who can access their data and they are not sure that the legal and technical structures sufficiently protect them from problems on the Internet that might affect the EHR as well. While this is somewhat paradoxical, seeing as respondents clearly agreed that the government is trustworthy, the concerns about privacy and the perceived risk of

the Internet outweigh this trust and consequently, it seems unsafe to citizens to use the current EHR.

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Factor 3: Insecure, but hopeful

Factor 3 has an eigenvalue of 2.115 and explains 16% of the study variance. Four participants are significantly associated with this factor; there are two females and two males with an average age of 35,5 years. They are all citizens – while two are students from political science backgrounds, the other respondents are working within the state administration.

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Respondents have divided, but strong feelings about the EHR – they are both aware of and hopeful for its benefits, i.e., usefulness, but are also very insecure about its details and its security. Specifically, they believe in an EHR in principle, for example that it will significantly increase the efficiency, effectiveness and quality of medical transactions. Furthermore, that it will give citizens greater control over their interactions with doctors and therefore that any time spent learning how to use it is well worth the effort. Knowing this, it is not important to them whether there are specific guidelines or (groups of) people to help them with using the EHR.

However, they are very insecure about the details of the current EHR. For example, they are not sure about the ease of use of the system nor about the usefulness of it. Crucially, this results from an absolute lack of communication from the government. In their opinion, citizens did not receive enough information about the introduction of the EHR, nor do they believe that doctors and other medical institutions did. They cannot remember the Minster of Health or the government in general showing support and they believe that there are too few influential persons or institutions such as doctors, their offices or hospitals that use the EHR to subsequently convince citizens of its use as well. This translates into significant concerns and insecurities about data protection, the technical and legal structures surrounding the EHR and who has access to what data. Therefore, while citizens are in favor of an EHR in principle, the lack of communication directly translates into confusion regarding the current EHR and it is thus found to be intimidating.

Factor 4a and 4b: A question of trust

Factor 4 has an eigenvalue of 1.593 and explains 11% of the study variance. Three participants are significantly associated with this factor. However, this is a bipolar factor, i.e., respondents load, albeit significantly, both negatively and positively on this factor. Two women significantly loaded on Factor 4a (positive) with an average age of 41 years, who are both medical professionals (nursing). One man significantly loaded on Factor 4b (negative), who is 59 and a political stakeholder. He has a background in IT security regarding health systems.

Respondents to Factor 4a clearly appreciate a well-kept EHR in principle: "*It is definitely a valuable service because it is easier to use, clearer, cheaper and better for the environment*" (Participant 22). They disagree with the notion that an EHR does not give citizens more control over their interactions with doctors – "*On the contrary! With the know-how it is much easier to look up everything in the EHR than to torture oneself through masses of diagnoses and folders*" (Participant 22). In fact, they strongly believe that an EHR would help citizens to improve their overall medical condition, especially since it would help to get things done more quickly, e.g., prescriptions or sharing documents. They therefore also believe that the time spent on managing such an EHR is well worth the effort.

At the same time, they have strong feelings about the security of the German EHR. They believe that perceptions of the government as not at all trustworthy are a huge contribution to its non-acceptance. "*Unfortunately, Germany is not future-oriented and the government only has to make one "mistake" and people will rise up against it. In the eyes of many, it has gambled away trust and the proposals that come from it "can't be good at all"*" (Participant 22). At the same time, they agree that the risk of unauthorized access seems much too high, furthermore believing that it is not clear for citizens who can access their data in the first place and whether there are any negative consequences to using the EHR. The risk of a loss of data due to, e.g., hacking seems too high as well and it therefore seems unsafe to citizens to use the EHR. Moreover, they clearly recognize the lack of communication about the introduction of the EHR, whether for citizens or in the medical community and a lack of support by the government. Given the above-mentioned concerns, one of the respondents perfectly summarized: "*The idea is good, but I don't trust the German IT to do this well and securely*" (Participant 5).

The political stakeholder (Participant 25) on the other hand is the polar opposite. He deems the government very much trustworthy and therefore also does not think that the risk of data loss through hacking seems too high. He believes that "*In Germany, the citizens tend to see the*

government as trustworthy. Each user decides for him- or herself what information to enter into the EHR. In this respect, basic trust in the government is sufficient to use it". Moreover, "*The trust of the users in the attending medical professionals is categorically rather high. Although the medical and technical parts would have to be separated, trust in the doctors includes the technical part and the protection of information*". They therefore believe it to be clear that there are no negative consequences to using the EHR and that legal and technical structure would sufficiently protect citizens from problems on the Internet that might affect the EHR.

However, they are deeply disappointed in the current EHR. In general, citizens were not sufficiently informed about the introduction of the EHR, and it is too much effort to use it. It does not help with getting documents easier getting things done more quickly. In fact, they believe that the EHR does not help to improve the overall medical condition: "*It only serves to document the patient's history and has no dimension of its own which, for example, as a 'red thread' with additional and interdisciplinary consultation, establishes its own value*". In other words, it is not a particularly valuable service. Moreover, citizens do not have the necessary resources to use it. "*In order to use the EHR, it is necessary to apply for a current electronic health card, with its own a PIN code and an online access at one's health insurance provider. Insured persons must have exactly the health insurance prover's EHR app and an NFC-enabled smartphone and go through two identification processes. Measured against the rather limited utility of the current EHR, obtaining the resources is likely to be too burdensome for most citizens*".

These short summaries of the factors found within the data already point to a variety of different, very nuanced assumptions about what influenced the non-adoption of the German EHR and how. While this is valuable information, the goal of this thesis is the synthesis of the *main* antecedents for the non-adoption of the German EHR. For this reason, the statements highlighted above, i.e., distinguishing and consensus statements will be considered. Interestingly enough, the only statistically significant ($p<0,05$) consensus statement across all factors is (25): EHR use is not compatible with health systems (e.g., health insurance app) that citizens already use. This already points to a significant lack of communication since, as one of the political stakeholders with a background in IT points out, "*The EHR app comes from the health insurance providers, so a fit is inherent to the system*" (Participant 4).

What are other statements that respondents place similarly, i.e., that seem to have some consensus? For this it is worth considering the weighted average score these items have received

across all factors, i.e., the z-score variance across all factors. The table below shows the Top 5 of consensus across the factors.

Table 7: Top 5 consensus statements

Nr	Statement	Z-score variance
27	There are no specific (groups of) persons available to citizens for support and/or advice in case of difficulties with the EHR.	0,16
25	EHR use is not compatible with health systems (e.g., health insurance app) that citizens already use.	0,197
9	Interaction with the EHR is not clear and understandable for citizens.	0,261
38	It is not clear enough for citizens who exactly has access to their data.	0,298
28	Citizens were not sufficiently informed about the introduction of the EHR	0,308

As one can see in the first table, the respondents seem to agree that there are indeed no specific (groups of) people that could support or advise them in case of difficulties with the EHR. Moreover, interaction with the EHR is neither clear nor understandable and therefore it is also not clear who has access to their data. Overall, respondents agree that citizens were not sufficiently informed about the introduction of the EHR. Clearly, some of the main antecedents relate to the design, i.e., technological characteristics, but the most important issue seems to be the (targeted) communication, i.e., environmental characteristics. This is also echoed in the fact that the respective statement (28) was the highest ranked statement in two of the Factors (1,3) and is one of the two highest ranked statements across all factors.

As mentioned above, there is only one statistically significant consensus statement across factors – there are, however, 11 distinguishing statements ($p < 0.01$) between the factors. These therefore give further insight into the perceptions of the main antecedents for non-adoption.

Table 8: Distinguishing statements at p< 0.01

Nr	Statement	Factor	Rank
26	Citizens are not provided with specific guidelines on how to use the EHR.	1	3
7	The operation of the EHR is not easy to learn for citizens.	1	2
34	The Internet in general does not seem like a stable and safe environment to interact with medical professionals.	1	-2
16	The EHR does not make it easier for citizens to obtain certain documents (e.g., discharge letters, lab results).	1, 4b	-3, +3
5	The Minister of Health shows too little support for EHRs.	3	3
3	Citizens do not like the idea of using an EHR.	3	-4
35	The government as the developer of the EHR does not seem trustworthy.	4a	4
17	The EHR does not help citizens improve their overall medical condition.	4b	4
20	EHR use does not make interactions with medical professionals significantly easier.	4b	3
33	It is unclear whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR.	4b	-3
37	The risk of data loss (e.g., through hacking) seems too high.	4b	-4

While an article using Q-methodology would usually go into detail about these factors and how these statements distinguish them from one another, this thesis will use these statements as indicators for the importance respondents associated with specific concepts related to non-adoption, such as communication or trust in general. Clearly visible in the table above is the fact that communication plays a major role in the non-adoption of the German EHR. Specifically, there are no specific guidelines available (26), i.e., there is a lack of *targeted* communication (Räckers et al., 2013). This also includes political support such as the Minister for Health's support (5).

Moreover, communication is tied to the perception of whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR (33). It also affects whether the risk of data loss seems too high or acceptable (37) and whether the government seems trustworthy or not (35).

Another antecedent that can be gleaned from the distinguishing statements is the design of the EHR, i.e., technological characteristics. This concerns the ease of use associated with learning how to operate it (7) but also its usefulness, e.g., whether it makes it easier for citizens to obtain certain documents (e.g., discharge letters, lab results) (16) or whether it makes interactions with medical professionals significantly easier (20). Moreover, trust seems to be a clear issue as the trustworthiness of the government has both been confirmed as well as denied (35 in Factor 4). This trust is also influenced by the perception of whether legal and technical structures can sufficiently protect citizens (33), which are also significant for trust in the Internet as the medium for EHR delivery (34) and the potential risk that comes with it, e.g. hacking (37). The abovementioned antecedents, i.e., communication, design and trust are then complemented by attitude whether in rather abstract terms, i.e., not liking the idea of using an EHR (3) or by the feeling that an EHR does not help improve one's overall medical condition (17).

This cross-factor comparison of distinguishing statements therefore helps to further synthesize the main antecedents of non-adoption. The brief look at consensus statements had already identified design and (targeted) communication as two of these. By further complimenting these with the distinguishing statements across the different factors, this results in two further, visible antecedents: trust, and attitude.

6. Discussion

It is striking that the results from the factor analysis above show a very low level of awareness of the introduction of the EHR in general and its functionality in particular, but at the same time show significant positive attitude or 'hope' towards the anticipated benefits of an EHR in general. This observation ties in directly with the further analysis which showed that there are four main antecedents for the non-adoption of the German EHR: communication, trust, design, and attitude.

Communication

The one consensus statement across factors, i.e., the assessment of the compatibility between health data applications, is exemplary for the formation of this antecedent. The redundancy of this compatibility, given the provision of the EHR by the health insurance providers, clearly highlights how important communication is. This importance is only reinforced by the fact that with targeted communication, citizens would also know that these health insurance providers are also the specific people to ask in cases of difficulty with the EHR (27). Moreover, the German EHR is built on the premise that citizens give specific access to specific doctors as well as to specific files. It should therefore be clear who has access to which data (38). As a pre-caution for unauthorized use, the EHR also includes an access log where citizens can trace who tried to access their data within a period of three years (36,38). This has clearly also not been communicated.

Communication as an antecedent has also been recognized in literature on e-government adoption (Hofmann et al., 2012; Titah & Barki, 2006), and especially in the German context (Distel, 2018; Heierhoff & Hofmann, 2012; Räckers et al., 2013). Hofmann et al. (2012) point out in their literature review that nearly every article asserted the importance of communication in its section on, e.g., 'practical implications'. This included both advertisement or marketing as well as educational training and has been deemed essential for the successful adoption of e-government by both citizens and government personnel (Hofmann et al., 2012). Surprisingly, but to the best of our knowledge, there is no research model that incorporates communication in any way. Clearly, however, communication affects non-adoption as shown in this study. Future research should therefore incorporate communication into possible research models on non-adoption in order to empirically explore the impact of communication, regardless of which form it takes.

Trust

The trustworthiness of the government (35) is, together with the lack of sufficient communication (28), the highest ranked statement among the exemplary Q-sorts (-3, -4, 0, +4, -4). This trust is affected by several other points, e.g., the perception of whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR (33). Moreover, it is affected by the perceived risk that was expressed in terms of the risk of unauthorized access (36) or the loss of data, e.g., via hacking (37). This trust therefore also extends to the Internet and whether it is a safe space for communication with medical professionals (34). As a result of this, citizens attitude changes and they might deem the EHR unsafe (30) or intimidating (32). Trust is therefore crucial for the non-adoption of the German EHR.

As a concept relevant for e-government adoption, it has been recognized for decades (Carter & Bélanger, 2005; Gefen & Straub, 2000; Warkentin et al., 2002). As such, it "is a significant antecedent of … online interactions and transactions because it serves as a central mechanism to reduce perception of uncertainty and risk" (Teo et al., 2008, p. 102). Several authors have therefore investigated the concept of trust in e-government adoption by adding it to the prevalent technology adoption models (Belanche et al., 2012; Carter & Bélanger, 2005; Lancelot Miltgen et al., 2013; Warkentin et al., 2002). However, as this study shows, it is also highly relevant for the non-adoption of e-government and should be conceptualized as such. It should then be used in specific research models concerning explicitly the non-adoption of e-government.

Design

The main antecedent 'design' as found in this thesis refers to the perceived ease of use of a given system as well as its perceived usefulness. In other words, it concerns the ease of use associated with learning how to operate it (7), how clear and understandable the interaction with the system is (9) or how easy it is to use in general (10). Perceived usefulness refers to, e.g., whether it makes it easier for citizens to obtain certain documents (e.g., discharge letters, lab results) (16) or quicker to get things done (e.g., filling prescriptions or submitting paperwork) (14) or whether it makes interactions with medical professionals significantly easier (20). It is therefore critical to the realization of the goals associated with the EHR, i.e., increased efficiency, effectiveness, or increased quality of care.

With perceived ease of use and perceived usefulness, this concept incorporates two of the major constructs within technology adoption literature that were transferred to e-government research.

However, these models, that characterize much of e-government research (Hofmann et al., 2012; Rana et al., 2015; Titah & Barki, 2006), assume that the individual already knows the service or has interacted with it and has made his or her decision to adopt or not adopt after this (Distel & Ogonek, 2016). As an antecedent for non-adoption in this thesis, design is rather abstract though. It does not so much refer to the actual design of the EHR as to the respondent's *assumptions* about it. These are necessarily founded on previous experience with e-government services and interactions with the government, as there has been no actual encounter. The concept of design in this context therefore rather refers to how the service *should* be designed, i.e., it highlights what respondents seem to value most in terms of design. In other words, and opposed to the e-government adoption literature mentioned above, it is not so much a reaction to the existing design but rather an indication of preferences for a design and should therefore influence the design *process*.

Attitude

Attitude has been identified as the last of the four main antecedents and has been found to incorporate attitude in rather abstract terms, i.e., not liking the idea of using an EHR (1) as well more specific attitudes, i.e., not thinking that an EHR helps to improve one's overall medical condition (17). This attitude is influenced by the abovementioned three antecedents (communication, trust and design) and influences them in return. For example, attitude determines how trustworthy the EHR might seem or how useful it is estimated to be and is influenced by the (non-)existence of communication or by how much one trusts the Internet in general.

As such it is also known in previous literature and research on e-government adoption (Dwivedi et al., 2017; Hung et al., 2013; Verkijika & De Wet, 2018), but originally stems from IS literature, specifically the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Theory of Planned Behavior (Ajzen, 1991), which, in turn, the widely known Technology Acceptance Model (Davis, 1989) is based upon. Within these, attitude is "the level to which an individual has a positive or negative evaluation or appraisal of the behavior in question" (Dwivedi et al., 2017, p. 220). Attitude therefore directly influences the intention to use a new system. This is true for attitude as an antecedent of non-adoption as well. In line with the interpretive understanding adopted in this thesis, it acknowledges that diffuse feelings about how 'good' or 'bad' a service is very much influence one's interaction with it. Moreover, this also acknowledges that one's socialization, previous experiences, and education, among others, influence one's perceptions and eventually one's actual behavior.

Implications for research

This analysis clearly shows that there are several antecedents for the non-adoption of the German EHR which rely on the premise that the respondents, apart from the political stakeholders, engaged with the EHR on a hypothetical level. As far as their comments on the study show, none of them had actively decided against the EHR, they had simply not known it already existed. However, the antecedents identified in this thesis are only the first indicators for further avenues of research on non-adoption. Building on the assumption that non-adoption is not simply the opposite of adoption, future research should further study communication, trust, design and attitude in a variety of contexts regarding the non-adoption of e-government services. This is especially necessary as the results above have shown that these antecedents are either new or different from similar concepts used in previous e-government adoption research. These new insights should then be used to construct models that could be tested and modified to also reflect the relationship between the antecedents and thereby help to guide future research.

Moreover, the political stakeholders have pointed out that "*the role of health insurance providers is crucial for the diffusion of the EHR*" (Participant 25) and that "*the effect of primary systems (in medical institutions) on the introduction of the EHR should be considered in more detail*" (Participant 4). These statements show that much further research is needed to truly understand non-adoption in general and of the German EHR in particular. In addition, the political stakeholder loading on Factor 4b decidedly disagrees with all the statements that citizen have identified as benefits, e.g., an improvement of the efficiency, effectiveness, or quality of medical interactions. The mismatch identified as one of the motivations for this research therefore seems to extend rather to the political stakeholders than the citizens themselves. However, if not even political stakeholders are convinced of the current EHR, why would and should citizens adopt it? The political stakeholders' perceptions should therefore also be studied in more detail.

Implications for practitioners

From the analysis above, it is clearly visible that citizens see the benefits of an EHR in principle and have concrete expectations for it, i.e., obtaining specific documents easier or increasing the quality of their medical interactions. However, the analysis and the synthesized antecedents also show what is missing. This includes, above all the communication, i.e., informing the public about the EHR. How necessary this communication is, has been exemplified by the one

consensus statement found across factors (compatibility of EHR with existing health data applications) which is, in fact, redundant, seeing as health insurance providers offer both. Moreover, many respondents agreed that they had not even heard about the introduction of an EHR before being sent this study's survey. Given the further antecedents, and their interdependence, there are several specific recommendations for practitioners.

Firstly, communication and especially targeted communication should be increased. This could include posters in public spaces, ads on television or social media, as well as pamphlets that could also be distributed to medical institutions. For those not comfortable or at ease with the use of computers or smartphones, educational trainings could be offered. Such educational training would also be crucial for medical professionals. Furthermore, trust in the government and trust in the Internet could be increased if the Federal Data Protection Officer and those at state level could be won to support these communication efforts and reassure the population that the EHR operates under the highest standards for data privacy and security. This should be honest communication – it should be mentioned that there can never be a guarantee of absolute security. However, this can clearly only happen if this in fact the case. Should it not be, the government must urgently rectify these circumstances.

Second, intense user testing should be carried out with the variety of end-users that this EHR targets: medical professionals that range from nurses, to doctors, to physical therapist or psychiatrists in their wide variety of possible contexts. Moreover, this testing should include citizens from all ages and professions and socio-economic backgrounds. In other words, the stakeholders of this project should be much better connected and involved with the project and its further development. This would also create ownership of the application which in turn could increase feelings of responsibility and accountability for the solution of the problem of non-adoption. In the hopes for increased and established use in the future, the underlying infrastructure should also regularly be tested for scale – if the EHR will be used extensively in the future, can the infrastructure handle these amounts of data being exchanged across all of Germany and eventually Europe? All the abovementioned measures potentially also influence the attitude of citizens which could also be reinforced by sharing results from successful EHR implementation elsewhere (for now). Once EHR adoption and therefore its use would pick up in Germany, these results could be shared as well.

Limitations

Given the lack of data and the rather late changes to this thesis, the results of the analysis were influenced by the fact that the study was originally conceptualized for the political stakeholders only, i.e., those that actively and regularly engage with the EHR anyway. Some respondents therefore broke off the survey because they did not feel like they knew enough to be answering it well. This study should therefore be repeated with the commonalities of all three groups in mind to see if this would significantly alter perceptions and therefore also the antecedents identified in this thesis. Moreover, with more time, follow-up interview should be conducted that can further highlight the specific experiences and assumptions and perceptions that guided the Q-sorting process.

7. Conclusion

The EHR in Germany was introduced as one effort to combat the extensive challenges which are facing the German healthcare system. These include, inter alia, an aging population which in turn results in a shortage of skilled labor seeing as there are fewer doctors or other medical professionals. In answer to this, the EHR offers benefits such as an increase in efficiency, effectiveness and the quality of care and patient-doctor interactions. However, as of February 9, 2023, two years after implementation, only around 1% of Germany's population has applied for such an EHR with their health insurance provider. This is despite the fact of the benefits mentioned above and the fact that its inception has been supported by a majority of citizens.

The German EHR is not the only project that has faced this dilemma or has ended in the 'graveyard' of large-scale IT projects in the public sector. The failure rate of large-scale IT projects in the public sector remains high globally. There clearly seems to be a continued mismatch between the design of public e-services and what the intended end-users need or want. This in turn has severe consequences in terms of measurable quantities such as financial resources. More importantly however, this also affects less definable concepts such as opportunities, benefits and trust, with the latter also being crucial for the functioning of government in general. It is therefore necessary to understand the failure of the German EHR in order to learn from the experience and to make informed choices in the necessary reform of the project. However, seeing as this project is only one among the recurring large-scale public sector project to fail, it is also necessary to study the phenomenon of e-government non-adoption in general and as a phenomenon in its own right-

Knowing this, and in order to address both issues, i.e., explaining the specific non-adoption of the German EHR as well as studying non-adoption as a phenomenon itself, the research question posed in this thesis was the following:

> What are the main antecedents for non-adoption of the German EHR, according to political stakeholders, medical professionals and citizens?

This thesis thereby set out to contribute to a more holistic understanding of e-government non-adoption, which would take into account the different prescriptions, assumptions and expectations held by the different stakeholders affected by the project. In doing so it built on the assumption that technology is inseparable from context, i.e., technologies contain certain perceptions and predictions about the world (Homburg, 2008; Klijn & Koppenjan, 2015; Orlikowski, 1992). Moreover, it acknowledged that these perceptions are not taken into account by the

current governance of the EHR – while including a multitude of stakeholders with differing perceptions, the Ministry of Health still holds 51% of the shares in the governmental body responsible for the EHR.

However, the explicit focus of this thesis on the non-adoption of EHRs raised some issues when it came to the consideration of the relevant literature. This is due to the majority of literature on non-adoption treating this phenomenon as simply the opposite of adoption. This is problematic as in doing so, "research reproduces already obtained knowledge rather than producing new insights" (Distel, 2018, p. 98). In other words, this approach is unable to address the fact that non-adoption of large-scale IT projects, i.e., e-government may be fundamentally different to adoption with regard to its antecedents. For this reason, this thesis focused on non-adoption as a phenomenon in its own right by finding antecedents for non-adoption via an interpretive case study using Q-methodology.

This resulted in four antecedents: communication, trust, design and attitude. Communication refers not only to general communication about the introduction of the project but also to educational training or providing specific guidelines. Trust on the other hand refers to both trust in the government as well as trust in the Internet. Design refers to the perceived ease of use and usefulness associated with the application, which crucially rest on assumptions that are shaped by previous experiences and interaction with government services. This antecedent should therefore be rather understood as an indicator for what 'good' design would be in the eyes of end-users. Lastly, attitude refers to the positive or negative associations with the service that are shaped by previous experiences, socialization, and education, among others.

These results have implications for both research and practitioners. On the one hand, these constitute a first insight into possible antecedents for non-adoption that can be tested in a variety of contexts to then build models for future research. This is especially necessary as the results above have shown that these antecedents are either new or different from similar concepts used in previous e-government adoption research. On the other hand, the results have very specific recommendations for the German context. Communication in general and targeted communication in particular need to be increased in the future as they influenced attitude as well as trust in the government and trust in the Internet. Moreover, end-users, i.e., both citizens and medical professionals should be included in testing the application, which would also strengthen the connection and involvement of these groups with the project and its further development and thereby create ownership.

As every scientific work, however, this study also has several limitations. Chief among them is the time available for writing this thesis. With more time, specific subgroups could also explicitly have been involved, i.e., groups for which the stakes of an EHR are especially high. With more time, this study would benefit from these insights as well, in order to create a more holistic and comprehensive picture of the situation in Germany. This should specifically include more in-depth interviews to elaborate on subjective assessments of the situation but could also include semi-structured interviews to generate ideas for potential solutions. Second, this thesis is only ever a snapshot of perceptions and assumptions at the time of which the study was carried out. For a deeper understanding, one would need to conduct more longitudinal studies to see how perceptions might change with policy changes or adjustments.

Lastly, this thesis was limited by specific circumstances. As much fewer of the political stakeholders agreed to participate than expected, the study conceptualized for them was also distributed to the citizens and medical professionals. The amount of knowledge that was assumed was in turn criticized by those not having this level of knowledge. Some respondents therefore broke off the survey because they did not feel like they knew enough to be answering it well. This study should therefore be repeated with better adjustment to the different knowledge of all three groups to see if this would significantly alter perceptions and therefore also the antecedents identified in this thesis.

Nevertheless, future research should further study communication, trust, design and attitude (or possible other identified antecedents) in a variety of contexts regarding the non-adoption of e-government services. This is especially necessary as the results above have shown that these antecedents are in part different from similar concepts used in previous e-government adoption research. These new insights should then be used to construct models that could be tested and modified to also reflect the relationship between the antecedents and thereby help to guide future research. Moreover, the political stakeholders have pointed out that "*the role of health insurance providers is crucial for the diffusion of the EHR*" (Participant 25) and that "*the effect of primary systems (in medical institutions) on the introduction of the EHR should be considered in more detail*" (Participant 4). These statements show that much further research is needed to truly understand non-adoption in general and of the German EHR in particular.

In conclusion, the non-adoption of the German EHR clearly remains a 'wicked problem' with intense complexity. The research done in this thesis is a first step at identifying the perceptions underlying this non-adoption and points to several antecedents for non-adoption that could help

to establish active usage of the EHR in the future. After all, as one participant summarized: "*I think electronic health records are totally overdue*" (Participant 17).

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Appendices

Appendix 1.1. Q-set of Statements

Environmental characteristics

4. Too few influential people or institutions (e.g., doctors, practices, hospitals) use the EHR to convince citizens to use an EHR as well.

5. The Minister of Health shows too little support for EHRs.

6. The government in general shows too little support for EHRs.

23. Citizens do not have the resources to use the EHR.

24. Citizens do not have the necessary knowledge to use the EHR.

26. Citizens are not provided with specific guidelines on how to use the EHR.

27. There are no specific (groups of) persons available to citizens for support and/or advice in case of difficulties with the EHR.

28. Citizens were not sufficiently informed about the introduction of the EHR

29. Doctors' offices and other medical institutions are not sufficiently informed to educate citizens about EHRs.

31. It is unclear to citizens whether there are negative consequences to using the EHR.

33. It is unclear whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR.

38. It is not clear enough for citizens who exactly has access to their data

Individual characteristics

1. Citizens do not believe that using an EHR is a good idea.

2. Citizens think the use of an EHR is unwise.

3. Citizens do not like the idea of using an EHR.

12. The time required to use the EHR is too much for citizens (e.g., filling it with data).

13. It takes too long to learn how to use the EHR for it to be worth the effort.

22. Using the EHR does not improve the quality of interactions with medical professionals.

30. It seems unsafe to citizens to use the EHR (privacy and security concerns).

32. The EHR is intimidating for citizens.

34. The Internet in general does not seem like a stable and safe environment to interact with medical professionals.

35. The government as the developer of the EHR does not seem trustworthy.

36. The risk of unauthorized access (e.g., health insurance providers trying to access diagnoses) seems too high.

37. The risk of data loss (e.g., through hacking) seems too high.

Technological characteristics

7. The operation of the EHR is not easy to learn for citizens.

8. It is not easy for citizens to achieve the desired benefits with the EHR.

9. Interaction with the EHR is not clear and understandable for citizens.

10. The EHR is not easy to use for citizens.

11. It is a challenge for citizens to use the EHR efficiently.

14. Using the EHR does not help citizens get things done faster (e.g., filling prescriptions or submitting paperwork).

15. The EHR does not make doctor visits more effective for citizens.

16. The EHR does not make it easier for citizens to obtain certain documents (e.g., discharge letters, lab results).

17. The EHR does not help citizens improve their overall medical condition.

18. The EHR does not provide citizens with a service that is valuable to them.

19. Using the EHR does not make interactions with medical professionals significantly more efficient.

20. EHR use does not make interactions with medical professionals significantly easier.

21. The EHR does not give citizens greater control over their interactions with medical professionals.

25. EHR use is not compatible with health systems (e.g., health insurance app) that citizens already use.

Appendix 2.1. Flagged List of Participants (p<0.01) with threshold of 0.6 for inclusion in factor analysis

Num...	Participant	FG	Factor 1	F	Factor 2	F	Factor 3	F	Factor 4a	F	Factor 4b	F
21	7QHVdT1716	F1-1	0.8946	☑	0.0111	☐	0.1507	☐	0.1346	☐	-0.1346	☐
19	rYA75N5xSw	F1-2	0.7838	☑	0.0028	☐	0.0082	☐	0.0896	☐	-0.0896	☐
7	xWUs4CujqC	F1-3	0.745	☑	0.31	☐	0.255	☐	0.0362	☐	-0.0362	☐
26	HSRSMJoTHS	F1-4	0.741	☑	0.1764	☐	-0.0111	☐	0.2539	☐	-0.2539	☐
24	xdLZqxPKO2	F1-5	0.7099	☑	-0.2433	☐	0.3299	☐	-0.2199	☐	0.2199	☐
16	594mxA8vqg	F1-6	0.7048	☑	-0.131	☐	0.2643	☐	0.3197	☐	-0.3197	☐
17	plOnoNdzmw	F1-7	0.6729	☑	-0.4149	☐	0.328	☐	-0.0949	☐	0.0949	☐
8	TZDuGcDm3x	F1-8	0.6045	☑	-0.2134	☐	0.4949	☐	0.2645	☐	-0.2645	☐
4	iAFHHiSaLM	F1-9	0.4584	☐	0.0315	☐	0.1519	☐	-0.0324	☐	0.0324	☐
20	EKj7Np3dGI	F2-1	0.3589	☐	0.7588	☑	0.0464	☐	-0.1147	☐	0.1147	☐
6	Lf6m-xUV2L	F2-2	0.0206	☐	0.7204	☑	0.1696	☐	0.1994	☐	-0.1994	☐
13	dQGqEdKHfP	F2-3	-0.2678	☐	0.5721	☐	0.0208	☐	0.2259	☐	-0.2259	☐
11	3mrPWw58I8	F2-4	0.273	☐	-0.5618	☐	0.2471	☐	0.1901	☐	-0.1901	☐
2	NO-StIVIYn	F2-5	0.5107	☐	-0.5131	☐	0.3357	☐	0.1452	☐	-0.1452	☐
15	ORD7MsvXbG	F3-1	0.1455	☐	-0.0536	☐	0.8061	☑	0.2411	☐	-0.2411	☐
12	5S7PFIlo_y	F3-2	0.294	☐	0.1495	☐	0.7571	☑	-0.0644	☐	0.0644	☐
9	TxrsYy5Okz	F3-3	0.1776	☐	0.1902	☐	0.714	☑	0.1848	☐	-0.1848	☐
14	A0LyFZLMNI	F3-4	0.0174	☐	-0.1133	☐	0.6182	☑	-0.1696	☐	0.1696	☐
23	G0ovYsJi1O	F3-5	0.402	☐	0.2307	☐	0.5845	☐	0.2196	☐	-0.2196	☐
3	EObKaC96Ji	F3-6	0.194	☐	-0.1308	☐	0.4999	☐	0.3122	☐	-0.3122	☐
10	JBeCqQdF5j	F3-7	0.267	☐	0.4671	☐	0.474	☐	0.1694	☐	-0.1694	☐
25	oLU23cU99g	F4-1	-0.1197	☐	0.1799	☐	0.0913	☐	-0.8457	☐	0.8457	☑
5	E2EIN3SHxD	F4-2	-0.013	☐	0.2771	☐	0.132	☐	0.7125	☑	-0.7125	☐
22	zOZdwL5Hug	F4-3	0.0478	☐	0.0922	☐	0.5116	☐	0.6087	☑	-0.6087	☐
1	i5Wx4n4NV4	F4-4	0.3075	☐	0.3746	☐	0.3636	☐	0.4792	☐	-0.4792	☐
18	nVc_4hb160	F4-5	0.3422	☐	0.4658	☐	0.2662	☐	0.475	☐	-0.475	☐

Appendix 3.1. Relative Ranking of Statements in Factor 1

Relative Ranking of Statements in Factor 1

Nr.	Highest Ranked Statements	Fac-tor 1	Consen-sus/Dis-tinguish-ing	Factor 2	Factor 3	Factor 4a	Factor 4b
28	Citizens were not sufficiently informed about the introduction of the EHR	4		2	4	2	3
4	Too few influential people or institutions (e.g., doctors, practices, hospitals) use the EHR to convince citizens to use an EHR as well.	4		2	3	1	-2

	Positive Statements Ranked Higher in Factor 1 Array than in Other Factor Arrays						
24	Citizens do not have the necessary knowledge to use the EHR.	3		0	3	-2	-1
26	Citizens are not provided with specific instructions on how to use the EHR.	3	D*	0	0	-1	0
29	Doctors' offices and other medical institutions are not sufficiently informed to educate citizens about EHRs.	3		-3	2	2	-2
9	Interaction with the EHR is not clear and understandable for citizens.	3		1	1	-1	1
10	The EHR is not easy to use for citizens.	2	D	0	-1	1	0
27	There are no specific (groups of) persons available to citizens for support and/or advice in case of difficulties with the EHR.	2		1	0	0	1
7	The operation of the EHR is not easy to learn for citizens.	2	D*	0	-1	0	-2
8	It is not easy for citizens to achieve the desired benefits with the EHR.	2		0	-1	0	-3
13	It takes too long to learn how to use the EHR for it to be worth the effort.	1		0	-2	-2	0

	Negative Statements Ranked Lower in Factor 1 Array than in Other Factor Arrays						
36	The risk of unauthorized access (e.g., health insurance providers trying to access diagnoses) seems too high.	0		4	2	4	1
34	The Internet in general does not seem like a stable and safe environment to interact with medical professionals.	-2	D*	3	1	2	2

15	The EHR does not make doctor visits more effective for citizens.	-3		-1	-3	1	1
19	Using the EHR does not make interactions with medical professionals significantly more efficient.	-3	D	-1	2	0	2
16	The EHR does not make it easier for citizens to obtain certain documents (e.g., discharge letters, lab results).	-3	D*	-1	-1	-1	3

	Lowest Ranked Statements						
14	Using the EHR does not help citizens get things done faster (e.g., filling prescriptions or submitting paperwork).	-4		-2	0	-3	2
18	The EHR does not provide citizens with a service that is valuable to them.	-4		2	-2	-3	3

D = Significant at p<0.05
D* = Significant at p<0.01
C = Significant at p<0.05

Appendix 3.2. Relative Ranking of Statements in Factor 2

Relative Ranking of Statements in Factor 2

Nr.	Highest Ranked Statements	Factor 2	Consensus/Distinguishing	Factor 1	Factor 3	Factor 4a	Factor 4b
36	The risk of unauthorized access (e.g., health insurance providers trying to access diagnoses) seems too high.	4		0	2	4	1
37	The risk of data loss (e.g., through hacking) seems too high.	4		0	1	3	-4

	Positive Statements Ranked Higher in Factor 2 Array than in Other Factor Arrays						
34	The Internet in general does not seem like a stable and safe environment to interact with medical professionals.	3		-2	1	2	2
38	It is not clear enough for citizens who exactly has access to their data	3		2	2	3	0
33	It is unclear whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR.	3	D	0	1	1	-3
1	Citizens do not believe that using an EHR is a good idea.	2	D	-1	-3	-3	-1
21	The EHR does not give citizens greater control over their interactions with medical professionals.	2		0	-2	-2	1
3	Citizens do not like the idea of using an EHR.	1		-2	-4	0	-1

	Negative Statements Ranked Lower in Factor 2 Array than in Other Factor Arrays						
11	It is a challenge for citizens to use the EHR efficiently.	-2	D	0	1	1	2
29	Doctors' offices and other medical institutions are not sufficiently informed to educate citizens about EHRs.	-3		3	2	2	-2
5	The Minister of Health shows too little support for EHRs.	-3		-1	3	0	-2
6	The government in general shows too little support for EHRs.	-3		-1	3	2	-2

	Lowest Ranked Statements						
12	The time required to use the EHR is too much for citizens (e.g., filling it with data).	-4	D	0	0	-1	3
35	The government as the developer of the EHR does not seem trustworthy.	-4		-3	0	4	-4

D = Significant at p<0.05
D* = Significant at p<0.01
C = Significant at p<0.05

Appendix 3.3. Relative Ranking of Statements in Factor 3

Relative Ranking of Statements in Factor 3

	Highest Ranked Statements	Factor 3	Consensus/Distinguishing	Factor 1	Factor 2	Factor 4a	Factor 4b
28	Citizens were not sufficiently informed about the introduction of the EHR	4		4	2	2	3
30	It seems unsafe to citizens to use the EHR (privacy and security concerns).	4		1	3	3	0

	Positive Statements Ranked Higher in Factor 3 Array than in Other Factor Arrays						
24	Citizens do not have the necessary knowledge to use the EHR.	3		3	0	-2	-1
5	The Minister of Health shows too little support for EHRs.	3	D*	-1	-3	0	-2
6	The government in general shows too little support for EHRs.	3		-1	-3	2	-2
32	The EHR is intimidating for citizens.	2		1	-1	-2	-1
19	Using the EHR does not make interactions with medical professionals significantly more efficient.	2		-3	-1	0	2
25	EHR use is not compatible with health systems (e.g., health insurance app) that citizens already use.	0	C	-1	-2	-1	-3

	Negative Statements Ranked Lower in Factor 3 Array than in Other Factor Arrays						
27	There are no specific (groups of) persons available to citizens for support and/or advice in case of difficulties with the EHR.	0		2	1	0	1
10	The EHR is not easy to use for citizens.	-1		2	0	1	0
13	It takes too long to learn how to use the EHR for it to be worth the effort.	-2		1	0	-2	0
23	Citizens do not have the resources to use the EHR.	-2		1	1	-2	4
21	The EHR does not give citizens greater control over their interactions with medical professionals.	-2		0	2	-2	1
15	The EHR does not make doctor visits more effective for citizens.	-3		-3	-1	1	1
1	Citizens do not believe that using an EHR is a good idea.	-3		-1	2	-3	-1

	Lowest Ranked Statements						
2	Citizens think the use of an EHR is unwise.	-4		-2	-3	2	-1
3	Citizens do not like the idea of using an EHR.	-4	D*	-2	1	0	-1

D = Significant at p<0.05
D* = Significant at p<0.01
C = Significant at p<0.05

Appendix 3.4. Relative Ranking of Statements in Factor 4a

Relative Ranking of Statements in Factor 4a

Nr.	Highest Ranked Statements	Fac-tor 4a	Consensus/Dis-tinguishing	Factor 1	Factor 2	Factor 3	Factor 4b
36	The risk of unauthorized access (e.g., health insurance providers trying to access diagnoses) seems too high.	4		0	4	2	1
35	The government as the developer of the EHR does not seem trustworthy.	4	D*	-3	-4	0	-4
	Positive Statements Ranked Higher in Factor 4a Array than in Other Factor Arrays						
31	It is unclear to citizens whether there are negative consequences to using the EHR.	3		1	-1	-2	-3
38	It is not clear enough for citizens who exactly has access to their data	3		2	3	2	0
2	Citizens think the use of an EHR is unwise.	2		-2	-3	-4	-1
15	The EHR does not make doctor visits more effective for citizens.	1		-3	-1	-3	1
	Negative Statements Ranked Lower in Factor 4a Array than in Other Factor Arrays						
27	There are no specific (groups of) persons available to citizens for support and/or advice in case of difficulties with the EHR.	0		2	1	0	1
9	Interaction with the EHR is not clear and understandable for citizens.	-1		3	1	1	1
26	Citizens are not provided with specific instructions on how to use the EHR.	-1		3	0	0	0
32	The EHR is intimidating for citizens.	-2		1	-1	2	-1
24	Citizens do not have the necessary knowledge to use the EHR.	-2		3	0	3	-1
21	The EHR does not give citizens greater control over their interactions with medical professionals.	-2		0	2	-2	1
13	It takes too long to learn how to use the EHR for it to be worth the effort.	-2		1	0	-2	0
23	Citizens do not have the resources to use the EHR.	-2		1	1	-2	4
1	Citizens do not believe that using an EHR is a good idea.	-3		-1	2	-3	-1
17	The EHR does not help citizens improve their overall medical condition.	-3		-1	1	-1	4

	Lowest Ranked Statements						
20	EHR use does not make interactions with medical professionals significantly easier.	-4		-2	-2	-3	2
22	Using the EHR does not improve the quality of interactions with medical professionals.	-4		-2	-2	-3	0

D = Significant at p<0.05
D* = Significant at p<0.01
C = Significant at p<0.05

Appendix 3.5. Relative Ranking of Statements in Factor 4b

Relative Ranking of Statements in Factor 4b

Nr.	Highest Ranked Statements	Factor 4b	Consensus/Distinguishing	Factor 1	Factor 2	Factor 3	Factor 4a
17	The EHR does not help citizens improve their overall medical condition.	4	D*	-1	1	-1	-3
23	Citizens do not have the resources to use the EHR.	4	D	1	1	-2	-2

	Positive Statements Ranked Higher in Factor 4b Array than in Other Factor Arrays						
12	The time required to use the EHR is too much for citizens (e.g., filling it with data).	3	D	0	-4	0	-1
16	The EHR does not make it easier for citizens to obtain certain documents (e.g., discharge letters, lab results).	3	D*	-3	-1	-1	-1
18	The EHR does not provide citizens with a service that is valuable to them.	3		-4	2	-2	-3
11	It is a challenge for citizens to use the EHR efficiently.	2		0	-2	1	1
14	Using the EHR does not help citizens get things done faster (e.g., filling prescriptions or submitting paperwork).	2		-4	-2	0	-3
19	Using the EHR does not make interactions with medical professionals significantly more efficient.	2		-3	-1	2	0
20	EHR use does not make interactions with medical professionals significantly easier.	2	D*	-2	-2	-3	-4
15	The EHR does not make doctor visits more effective for citizens.	1		-3	-1	-3	1
22	Using the EHR does not improve the quality of interactions with medical professionals.	0		-2	-2	-3	-4

	Negative Statements Ranked Lower in Factor 4b Array than in Other Factor Arrays						
30	It seems unsafe to citizens to use the EHR (privacy and security concerns).	0		1	3	4	3
38	It is not clear enough for citizens who exactly has access to their data	0		2	3	2	3
4	Too few influential people or institutions (e.g., doctors, practices, hospitals) use the EHR to convince citizens to use an EHR as well.	-2	D	4	2	3	1
7	The operation of the EHR is not easy to learn for citizens.	-2		2	0	-1	0

8	It is not easy for citizens to achieve the desired benefits with the EHR.	-3		2	0	-1	0
25	EHR use is not compatible with health systems (e.g., health insurance app) that citizens already use.	-3	C	-1	-2	0	-1
31	It is unclear to citizens whether there are negative consequences to using the EHR.	-3		1	-1	-2	3
33	It is unclear whether the legal and technical structures sufficiently protect citizens from problems on the Internet that could also affect the EHR.	-3	D*	0	3	1	1

	Lowest Ranked Statements						
35	The government as the developer of the EHR does not seem trustworthy.	-4		-3	-4	0	4
37	The risk of data loss (e.g., through hacking) seems too high.	-4	D*	0	4	1	3

D = Significant at p<0.05
D* = Significant at p<0.01
C = Significant at p<0.05

Appendix 4.1. Details of Participants significantly loading on Factors

Participant Number	Year of Birth	Gender 1 = male 2 = female	Role P = political stake-holder M = medical professionals C = Citizen	Professional Background
5	1968	2	M	Nurse
6	1963	2	C	Biologist
7	1997	1	C	Engineer
8	1998	2	C	Political science (PhD student)
9	1998	2	C	Economics (MA student)
12	1999	2	C	Political science (MA student)
14	1960	1	C	Veterinarian (working in administration)
15	1993	1	C	Administration
16	1997	1	C	Social science (MA student)
17	1998	1	C	Industrial design (BA student)

Appendix 4.1. Details of Participants significantly loading on Factors

19	1972	1	P	Medicine, IT, research
20	1963	1	C	Lawyer
21	1997	2	C	International Relations (MA student)
22	1996	2	M	Nurse
24	1997	2	M	Nurse
25	1964	1	P	IT security regarding health systems
26	1998	2	C	Psychologist

Appendix 4.2. Comments on Extreme Statements (most agree/most disagree) by Participants significantly loading on Factors

Partici-pant	+ 4	+ 4	- 4	- 4	Additional Aspects
5	(s37) Examples from the past have already shown this. Data from health insurance providers was hacked	(s36) I have reservations about that.	(s1) The idea is good but I don't trust German IT to do this well and securely.	no response	
6	no response	(s37) Disclosing personal data on the Internet is always a risk. Data concerning the state of health even more so. There is no 100% guarantee that sensitive data cannot be hacked and passed on.	(s12) I don't think the problem with your own health care is the time it takes. Neither that which results from the manual collection of data from doctor's visits nor that which results from feeding this data into an app.	(s32) The use of apps has become part of almost every household. Cell phones and other electronic devices are commonplace. I don't think people are discouraged from using them because they are "intimidated".	
7	(s4) When nobody points out new possibilities to you, you do not even know what you are missing	(s24) If one does not actively deal with the issue, the knowledge about the problem is missing.	(s2) I can imagine that there are many meaningful and useful use-cases for the EHR.	(s5) Recently I have seen more and more reports about the commitment of the Minister of Health regarding the EHR.	
8	no response	no response	(s18) I believe that citizens are well aware of the benefits the EHR could bring, as many are dissatisfied with the current state of affairs.	(s34) I believe that citizens are well aware of the benefits that the EHR can bring to their lives, and that the Internet is becoming an increasingly ubiquitous medium in the digitalized world.	

9	(s30) Here, too, is a connection to the lack of information.	(s29) I have never been made aware of the EHR or received informational materials during various doctor visits.	(s3) I think they would like to use it if there was more information and help.	(s2) In view of increasing digitalization, I don't see it that way.	
12	(s24)	(s28) Although I was aware of the introduction of the EHR, I was not aware of the extent to which it has or has not been introduced. In general, I have the feeling that the broad mass of the population is insufficiently informed about the introduction of the EHR.	(s31)	(s1) I believe that many citizens would like to have an electronic health record as it would make many things easier. In general, there are already countries (e.g. Denmark) that have introduced the EHR. These countries show that an EHR can also bring many advantages.	
14	(s30) With fraud attempts occurring daily on the Internet, the security of the EHR is questionable.	(s28) I do not remember any information about the introduction of the EHR.	(s37) An assessment of the risk of data loss is not yet possible	(s13) So far, there is no information on the EHR, so the effort cannot be estimated.	Information on the EHR is missing
15	(s24) I doubt that the EHR is even widely known among the population.	(s28) The fact that the introduction of the EHR took place during Covid has certainly ensured that too little priority was given to the broad education about it.	(s1) With enough education, a broad majority for efficiency gains in health care could certainly be won.	(s3) The German population is certainly more skeptical about innovations in sensitive areas like healthcare than in other countries. Nevertheless, I do not see any firmly entrenched attitude against the idea of a well-designed EHR that brings tangible benefits to the patient.	

16	(s28) Until the debate about the opt-out introduction to the HER, I did not know that (and how) one could apply for it.	(s4) The EHR unfortunately seems a bit risky when many doctor's offices still use fax machines and cannot be reached by e-mail/online to make appointments..	(s14) In principle, I consider this prospect a strong pro-argument. However, the added value depends on the use by physicians. If patients still have to pick up/print copies of reports, this isn't very helpful.	(s35) I think that in a state where the rule of law is respected, the government is much more trustworthy than commercial/private actors	
17	(s24) Personally, I didn't know what the EHR was and what it meant. I only learned about it in a personal conversation.	(s28) I did not realize the introduction had already happened	(s34) I don't have any major concerns in that area. I think telemedicine and other digital possibilities to interact with doctors are good. If such a system is developed properly, it is also difficult for unauthorized persons to access the data.	(s2) I think electronic patient records are totally overdue.	
19	(s10) An elaborate identification is necessary only to get the PIN of the electronic insurance card. This is 6-digit and will be forgotten in case of infrequent use. Then authentication with the card & PIN in the EHR app is necessary too often. The authorization management requires explicit technical authorization of the accessing physicians and	(s8) Since the EHR is not easy to set up and use, the desired performance cannot be achieved easily. In particular, the explicit technical authorization for access (whether ad hoc or permanent authorization) is a hindrance here.	(s15) If a lot of relevant data is already accessible via the EHR, doctor visits will certainly become more effective.	(s6) So far, 4 laws regarding EHR have been passed and another law is in the pipeline. After the Federal Ministry of Heatlh took over control of gematik, the pace has also become much faster.	A suitable choice architecture, i.e. opt-out, is in my opinion the most important factor for using the EHR. The EHR should simply work automatically, just like the medical documentation within a hospital or a doctor's office.

	institutions, including PIN entry.				
20	(s36) Data protection for sensitive health data must be very high.	(s34) Concern about unauthorized access to health data is high.	(s5) This is not the case, at least in the current development of the public EHR.	(s6) This is no longer correct. Under Minister Spahn, the priority was on the e-prescription	
21	(s26) I don't know exactly who to contact for information.	(s28) I don't remember getting any information.	(s16) The EHR would make it easier.	(s20) The EHR would simplify the interaction.	
22	(s34) Due to the fact that hacking attacks and data leaks occur again and again, the concern of the population about an attack is quite understandable. In addition, the older generation (clearly in the majority) is still skeptical of the Internet due to lack of knowledge and would rather have findings collected in a folder on paper.	(s35) Unfortunately, Germany is not future-oriented and the government only has to make one "mistake" and people will rise up against it. In the eyes of many, it has gambled away trust and the proposals that come from it "can't be good at all"	(s21) On the contrary! With the know-how it is much easier to look up everything in the EHR than to torture oneself through masses of diagnoses and folders	(s18) It is definitely a valuable service because it is easier to use, less expensive and better for the environment.	

24	(s28) Neither in my friends' group nor my family do many actually know about the EHR.	(s24) I myself had to acquire knowledge about the EHR before filling out this survey.	(s3) I would imagine that the opposite is actually the case. Having all the information collected in one place makes things a lot easier for me. Besides, our generation is used to digitalization.	(s37) If that were the case, then you wouldn't be allowed to give your data anywhere on the internet.	I believe that age is a significant contribution. Especially for people >60 everything that takes place digitally seems to be more complicated and strange. In the hospital, however, it would be an enormous advantage to be able to call up all the data and facts about the patient (outpatient care, visits to the family doctor, visits to the specialist, last hospital stay).
25	(s17) The EHR only serves to document the patient's history and has no dimension of its own, for example, as a "red thread" with additional and interdisciplinary consultation that establishes its own value. If both patients and practitioners do not give EHR its own importance, an improvement of the general medical condition is unlikely.	(s23) In order to use the EHR, it is necessary to apply for a current electronic health card, with its own a PIN code and an online access at one's health insurance provider. Insured persons must have exactly the health insurance prover's EHR app and an NFC-enabled smartphone and go through two identification processes. Measured against the rather limited utility of the current EHR, obtaining the resources is likely to be	(s35) In Germany, the citizens tend to see the government as trustworthy. In addition, most users do not see at least large parts of their medical history as particularly in need of protection, so that excessive trust is not necessary. Each user decides for him- or herself what information to enter into the ePA. In this respect, basic trust in the government is sufficient to use the ePA.	(s37) The trust of the users in the attending medical professionals is categorically rather high. Although the medical and technical parts would have to be separated, trust in the doctors includes the technical part and the protection of information	The role of health insurance providers is crucial for the diffusion of the EHR

		too burdensome for most citizens			
26	(s4) If the EHR was discussed during visits to doctors and hospitals, especially the benefits in case of unclear diagnoses and e.g., easier access to the patient history and the benefits for the patient, or the benefits in emergency situations when the patient is unresponsive, I think the trust and use would increase.	(s32) Many things that are stored digitally seem intimidating to people who may not have grown up with digital media because the system and storage locations and networking possibilities are sometimes less comprehensible.	(s35) I think that the government seems to be very trustworthy for the storage of data because it can be assumed that certain security criteria have to be met.	(s16) I think that many people understand that the EHR facilitates various things, but the 'new' and possibly incomprehensible is intimidating and outweighs the factor of simplification of certain processes. I think many people have more trust in a real counterpart that they may have known for many years already.	

Appendix 5.1. Exemplary Q-sort for Factor 1

-4	-3	-2	-1	0	1	2	3	4
14	35	2	25	33	31	* ▶ 10	24	28
18	15	3	6	12	13	27	** ▶ 26	4
	* ◀ 19	22	1	11	23	** ▶ 7	29	
	** ◀ 16	** ◀ 34	5	37	32	38	9	
		20	17	36	30	8		
				21				

Legend

* Distinguishing statement at P< 0.05

** Distinguishing statement at P< 0.01

▶ z-Score for the statement is higher than in all other factors

◀ z-Score for the statement is lower than in all other factors

Appendix 5.2. Exemplary Q-sort for Factor 2

-4	-3	-2	-1	0	1	2	3	4
* ◄ 12	29	* ◄ 11	16	7	9	4	34	36
35	2	14	32	10	27	18	30	37
	5	20	19	24	17	28	38	
	6	25	31	8	3	* ► 1	* ► 33	
		22	15	13	23	21		
				26				

Legend

* Distinguishing statement at P< 0.05

** Distinguishing statement at P< 0.01

► z-Score for the statement is higher than in all other factors

◄ z-Score for the statement is lower than in all other factors

Appendix 5.3. Exemplary Q-sort for Factor 3

-4	-3	-2	-1	0	1	2	3	4
2	20	13	17	12	34	29	24	28
** ◄ 3	15	31	16	27	9	32	4	30
	1	23	10	14	11	38	** ► 5	
	22	18	8	26	33	19	6	
		21	7	** 35	37	36		
				25				

Legend

* Distinguishing statement at P< 0.05

** Distinguishing statement at P< 0.01

► z-Score for the statement is higher than in all other factors

◄ z-Score for the statement is lower than in all other factors

Appendix 5.4. Exemplary Q-sort for Factor 4a

-4	-3	-2	-1	0	1	2	3	4
20	18	32	16	3	11	6	37	36
22	1	24	9	8	10	29	30	** ▶ 35
	17	21	12	27	15	34	31	
	14	13	25	7	4	28	38	
		23	26	19	33	2		
				5				

Legend

* Distinguishing statement at P< 0.05

** Distinguishing statement at P< 0.01

▶ z-Score for the statement is higher than in all other factors

◀ z-Score for the statement is lower than in all other factors

Appendix 5.5. Exemplary Q-sort for Factor 4b

-4	-3	-2	-1	0	1	2	3	4
35	8	* ◄ 4	1	10	15	11	* ► 12	** ► 17
** ◄ 37	25	5	2	13	21	14	** ► 16	* ► 23
	31	6	3	22	36	19	18	
	** ◄ 33	7	24	26	9	** ► 20	28	
		29	32	30	27	34		
				38				

Legend

* Distinguishing statement at P< 0.05

** Distinguishing statement at P< 0.01

► z-Score for the statement is higher than in all other factors

◄ z-Score for the statement is lower than in all other factors