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Oops, I didn't quite get that - AI-based Chatbots in German Citizen Service Offices

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Universiteit
Leiden

**Oops, I didn't quite get that,
AI-based Chatbots in German
Citizen Service Offices**

**MSc Public Administration: Economics and Governance
Leiden University**

Faculty of Governance and Global Affairs

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Abstract

The ever-new emerging technological possibilities provide public authorities with new opportunities to improve service provision and interaction with citizens and optimise their administrative processes. Artificial Intelligence (AI) technologies can support public administrations and especially citizen service offices on this journey. Citizen service offices are the local governments' point of contact for citizens' service provision in Germany. To improve service provision and interaction between the public institutions and citizens, AI-based chatbots have found their ways into citizens service offices. However, this process is certainly not without challenges. Barriers to interoperability refer to challenges that can impact the administrative ability to collaborate across departments and agencies to provide seamless online services to citizens. Regarding the adoption of AI-based chatbots, barriers to interoperability are especially relevant as chatbots need to be able to obtain data from different departments. This study aimed to examine to what extent barriers to interoperability impact the adoption of AI-based chatbots in German citizen service offices. This question has been explored through semi-structured expert interviews conducted with representatives of the German cities Berlin, Hamburg, Heidenheim an der Brenz, and Munich. The results suggest that political and organisational barriers are impacting the adoption of AI-based chatbots greatly. Challenges have been reported but mostly only by one, or a maximum of two, participants and most of these barriers have been overcome in the early stages of the adoption. Legal and regulatory, as well as technological barriers to interoperability, on the other hand, were found to be the most impacting ones regarding the AI-based chatbot adoption in German citizen service offices.

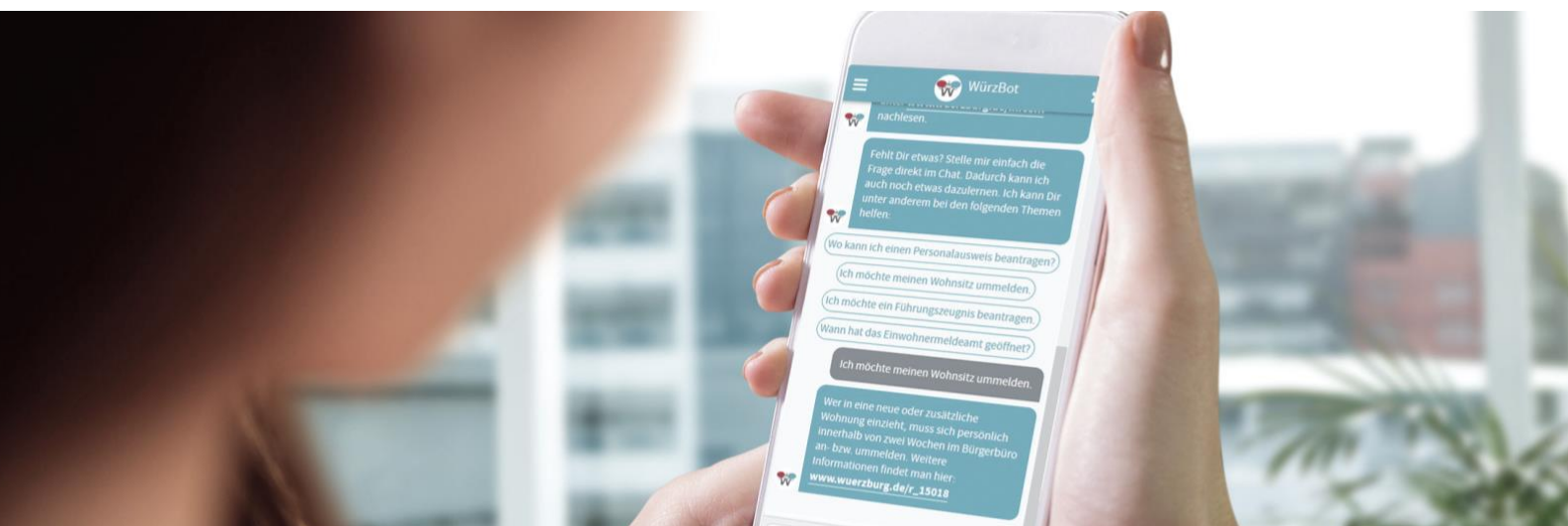


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List of Abbreviations

AI	Artificial Intelligence
LTE	Long Term Evolution
OZG	Online Access Act
EGovG	Electronic Government Act
G2C	Government to Citizen
GDPR	General Data Protection Regulation
VwVfG	Administrative Procedure Act
FIM	Federal Information Management
IT	Information Technology
LeiKa	Service Provision Catalogue (Leistungskatalog der öffentlichen Verwaltung)
ITDZ	Information Technology Service Centre in Berlin
DAI Labor	Distributed Artificial Intelligence Laboratory (Berlin)
ML	Machine Learning
NLP	Natural Language Processing
NLU	Natural Language Understanding

Glossary

Artificial Intelligence	(AI) refers to the simulation of human intelligence in through machines
Chatbot	an online software that is able to hold a chat conversation via text or text-to-speech with humans
Citizen Service Offices	facilities of municipal governments in which services for citizens are combined in one place
e-Government	processing administrative and governance processes with the support of information- and communication technologies via electronic media
Government-to-Citizen	aims to provide one-stop online access to information and services offered by public authorities
Interoperability	the ability of computer systems or software to seamlessly exchange and make use of information
Machine Learning	(ML) a type of artificial intelligence that enables machines self-learning from data which then is applied without human intervention
Natural Language Processing	(NLP) a field that is concerned with the interaction between computers and human language which analyses natural language in text and speech so that the computer can ‘understand’ documents, dialogues, and other exchanges
Natural Language Understanding	(NLU) a key subset of NLP, that leverages AI technologies to recognize
Open Source	computer software code that is designed to be publicly accessible, to use, modify, and distribute
Interface	a shared boundary between two or more separate computer system components

1 Introduction

Technical possibilities have increasingly automated processes and enhanced efficiency in various aspects of our everyday lives. Artificial Intelligence (AI) technologies are on the rise and are becoming more and more a part of people's daily activities and most of us cannot imagine our lives without them anymore. Smartphones, social media, music streaming services that recommend the best songs for you, or online banking that enables you to make transactions from anywhere, have become daily practices for many across the world. Varieties of technological devices and applications are developed every day that aim at making people's lives more convenient in all imaginable ways. However, these enhancing technologies are not only useful in the private sphere. The public sector has also been exploring the application and adoption of innovative digital applications. Public administrations aim to become more efficient and provide improved and more effective services to their citizens through e-Government.

The digitalisation of administrative processes also called, e-Government, is one great challenge governments currently face. Successful e-Government implementations can enhance citizen participation, increase labour efficiency, decrease costs, and optimise public service provision. New technologies can assist administrations in making their bureaucratic processes more flexible, transparent and provide unrestricted access to their services, regardless of time or location (von Lucke & Etscheid, 2020). Naturally, these developments do not come without challenges. Federal and state governments are presented with complex issues limited to not only technological, but also political, legal, and organizational barriers (Santos & Reinhard, 2012; Bekkers, 2005). In order to achieve seamless integration of e-Government processes, these barriers have to be overcome.

The potential for e-Government implementation is very promising. Countries such as Estonia, Spain, Denmark or Finland are exemplary on how to successfully deliver digital public services to their citizens (European Commission, 2020). The degree of successful implementation of Germany on the other hand, is much lower compared to the EU average and industry (European Commission, 2020). Even though the German government has put much effort into their 'Digital Offensive', progress continues to be slow. Germany's overall ranking in the Digital Economy and Society Index (DESI) by the European Commission has only slightly improved over the years (see Table 1). One of the principal reasons for Germany's average performance is their 26th rank in user engagement with e-Government services (European Commission, 2020). Research has shown that governments especially encounter

difficulties when adopting interactive e-Government services (Goldkuhl, 2008; Santos & Reinhard, 2011; Lisboa & Soares, 2014).

Decision-supporting systems have been part of the German administration landscape for quite some time now (Etscheid, 2019). However, fully automated processes have only recently become the centre of attention (Etscheid, 2019, p. 248). The implementation of AI-based applications is not without challenges. Questions regarding ethical integrity, data protection, financial resources, the preparedness of administration employees, communication manners, or legal considerations need to be discussed. Opelia, Kar, Thapa and Weber (2018) pose some of these questions in their research and investigate whether there are areas in which regulation and limitation could be necessary. Opelia et al. (2018) raised concerns about quality assurance, ethics, and transparency that can arise regarding automated decision-making systems and labour organization. The German initiative Stadt. Land. Digital. (2018) conducted research on the current state of digitalisation in German cities and communes. They found that digitalisation strategies often fail due to a lack of expertise and financial resources and that communities would like to get more support from the federal government.

Chatbots are certainly not a new technology, however, they are only slowly finding their way into German public organizations. The development of chatbots began as early as in the 1960s and since then they have been mostly utilized by private companies to answer standard customer questions (Hoffmann, 2018). There are different kinds of chatbots that can fulfil different tasks. Some can guide the person seeking an answer through a decision-tree by providing 'pre-cut' answers. Other chatbots can hold a complete conversation in which they even adapt to the communication style of the human on the other side, becoming indistinguishable from real people. Chatbots are intelligent agents that can process the intent of a question that is posed. This is especially crucial in the context of public authorities. Colloquial language differs greatly from administrative language. AI-based chatbots can, therefore, support administration employees by, for example, answering questions outside of the opening hours. AI applications, such as a chatbot, can increase productivity, save costs, and improve service delivery (Androusoyopoulou, Karacapilidis, Loukis, & Charalabidis, 2018).

The ability to integrate and communicate across traditional organizational boundaries of governmental systems is a key component of e-Government (Pardo, Nam, & Burke, 2012). The conceptual framework for this thesis is based on the barriers to interoperability. Interoperability has initially been used to define the harmonisation of information technology (IT) systems to seamlessly exchange information and execute tasks (Guijarro, 2007). However, this concept is also used in the e-Government context where it refers to the administrative

ability to collaborate across departments and agencies to provide seamless online services to citizens (Santos & Reinhard, 2012). As e-Government aims for improving government services, a high degree of local, regional, and national administration interaction has to be achieved (Guijarro, 2007).

In the context of e-Government, the literature suggests that there are various barriers that can impact or even hinder interoperability. However, interoperability has been shown to be central and crucial to the successful operating of e-Government and contemporary public administration systems (Peristeras, Tarabanis & Goudos, 2008, p. 614). The conceptual framework identifies political, technological, legal and regulatory, and organisational barriers to interoperability and organisational nature and places them in the interactive e-Government context. By exploring the case of German citizen service offices, the author does not intend to value the practices at hand to be exemplary good or bad. Rather, the thesis aims to investigate potential barriers to interoperability established in literature and analyse a real case to move beyond theory.

Regarding the adoption of AI-based chatbots, interoperability is especially relevant as chatbots need to be able to obtain data from different departments such as the tourism department, registration office, vehicle registration authority, or others. The technological systems of the different departments need to be able to communicate with each other. Thus, interoperability between other platforms and data is necessary to answer citizens' questions (Manious & Veglis, 2020). Citizen service offices' telephone agents can access all information sources and thus, can provide inter-departmental information to citizens and support them in fulfilling tasks. This is especially useful as a governmental agency such as citizen service offices usually provide information about an enormous number of services and also provide a variety of them. Therefore, when citizens make use of an AI-based chatbot on a citizen service office website they most likely will expect it to be able to call on all information they would also receive when talking to a person, just faster and regardless of time and location.

Most academic research is focussed on the general digitalisation process of German citizen service offices, the e-Government implementation level (see for example Djefal, 2018; Scheiber et al., 2020; Gottschalk, 2009) or barriers faced by public authorities (see for example Schwab et al., 2019; Wirtz, Weyerer & Geyer, 2019). Furthermore, research on chatbots generally is concerned with their commercial use, the research field on chatbots in public administration is still very limited (see Androutopoulou et al., 2019). Nevertheless, a persisting challenge in the e-Government progress is the lack of interactive digital applications, which leads to a decline in digital communication between authorities and citizens (Opelia,

Kar, Thapa & Weber, 2019). A focus on AI-based applications has only started to emerge in the past years and thus research in the public administration field is still rather limited (Opelia et al., 2019; Androutsopoulou et al., 2018). Furthermore, literature has not paid enough attention to barriers to interoperability in regard to interactive governmental services such as chatbots, especially in the German context. Investigating the adoption of chatbots in German citizen service offices with a focus on barriers to interoperability has, to the best knowledge of the author, not been done before. Therefore, this thesis investigates the question:

To what extent do barriers to interoperability impact the adoption of AI-based chatbots in German citizen service offices?

This question will be explored through semi-structured expert interviews conducted with representatives of the German cities Berlin, Hamburg, Heidenheim an der Brenz, and Munich. All four cities make use of AI-based chatbots to support and provide improved service of their citizen service offices to their citizens (BME, 2020). This research is expected to contribute to the identification of the barriers to interoperability impacting the adoption of AI-based applications, specifically of AI-based chatbots in German citizen service offices

1.1 Thesis Outline

The first chapter to follow is the literature review. This chapter first conceptualizes citizen service offices, AI, and chatbots. This is followed by an outline of the current e-Government structure and services provided in Germany. Afterwards, AI applications in the German public sector will be presented. The next chapter is concerned with the conceptual framework. Since the framework is based on literature on barriers to interoperability, this part has been nested under the literature review chapter. The conceptual framework is based on literature concerned with barriers to interoperability regarding the adoption of interactive e-Government services. The identified barriers this thesis focusses on are of political, technological, legal and regulatory, and organizational nature. This differentiation is based on extensive research conducted in the field of e-Government interoperability (see Scholl & Klischewski, 2007; Layne & Lee, 2001; Pardo, Nam & Burke, 2011; Guijarro, 2007). This particular approach provides the research with the possibility to investigate manifold barriers that public administrations face when implementing e-Government services.

The third chapter is the method section. There the research design, a within-case design, and the case description and selection of the cities are outlined. This is followed by the research strategy, the justification of the selected interview participants, and the research method, semi-

structured expert interviews. Lastly, the shortcomings of the research design are outlined. The results are stated in chapter four and describe the findings from the interviews. This chapter is organised by first providing an outline of the development, the intentions and the process of the each of the chatbots. Afterwards, the findings on political, technological, legal and regulatory and organizational interoperability and its barriers are presented. This is all followed by the analysis in chapter five. This chapter interprets and illustrates the significance of the findings and places them into perspective on what has already been exposed in previous research. This chapter is again divided in political, technological, legal and regulatory, and organisational barriers to interoperability. Finally, the conclusion will summarize the main findings.

2 Literature Review

In order to identify and investigate barriers to interoperability that citizen service offices face when implementing AI-based chatbots, certain concepts and terminology must be identified and conceptualized. First, a conceptualization of citizen service offices and their history will be highlighted. To understand AI-based chatbots and their advantages, a conceptualization and definition of artificial intelligence (AI) and Chatbots is necessary. Afterwards, AI-based chatbots are being conceptualized. This will be followed by a brief outline of the e-Government structure of Germany and research on e-Government service development will be examined. Furthermore, this literature review investigates the use of AI applications in German public administration and specifically the use of AI-based chatbots. The concept of interoperability and barriers to it, will be briefly outlined and followed by the in-depth examination of political, technological, legal and regulatory, and organisational barriers to interoperability.

2.1 Citizen Service Offices

Citizen service offices are public institutions of local governments in Germany. These offices are the point of contact for citizens seeking governmental service provision. Most public services provided in Germany can be handled in a citizen service office. They can be found in almost all German cities with 20.000 inhabitants and above (Schwab et al., 2019). The idea of citizen offices developed in the 1970s in the North Rhine Westphalian city Unna. The concept of a governmental office citizens could visit to handle all their administrative matters, such as

applying for a new passport, registering a new car, or reporting that one moved, has not been adopted in most cities until the beginning of the 1990s (Schwab et al., 2019).

The main motivator for the reorganisation of the public administration offices, that used to be located in different parts of the city, was to make the public service delivery more accessible to German residents (Schwab et al., 2019). Most of the citizen service offices host various departments or governmental organisations under one roof and can thus provide a multitude of public services to citizens. The concentration of administrative tasks had the advantage that citizens did not have to visit different governmental agencies to make use of administrative services and would thus establish a “one-stop-agency” (Kuhlmann & Wollmann, 2014).

The model of “one-stop-agencies” has become a popular way to organize public service delivery but has also received criticism over the past years. Long waiting hours, insufficient or poor service, bad working environments due to having to work overtime, and the closing of offices in remote areas (Schwab et al., 2019, p. 8). This is a result of the high workload citizen service offices are confronted with. The constant overload of requests by citizens visiting the offices in person or calling the service hotlines results in people not being assisted (Djeffal, 2018). Therefore, interaction channels such as e-mail or chatbots, are emerging to improve service delivery and interaction between citizens and government agencies (von Lucke & Etscheid, 2020).

2.2 Artificial Intelligence

When hearing the term Artificial Intelligence (AI) various images and words come to people’s minds. For some, it seems like a future vision of something that will take over the world and reminds us of what we have seen in movies such as *I, Robot*. For others, Google Maps, Siri and Alexa, social media, image recognition, or algorithms, may come to mind. The reality lies somewhere in between. Even though the term AI has been used in science since the 1950s, it is a concept that does not have one clear-cut definition (Etscheid, 2019; von Lucke & Etscheid, 2020; Wirtz, Weyerer, & Geyer, 2019). AI can be understood as an accumulation of different technologies that provide the possibility to solve tasks better, more efficiently, or more effectively, compared to a human (Felfernig, Stettinger, Wundara, & Stanik, 2019). In 1968, Marvin Minsky already defined AI as “*the science of making machines do things that would require intelligence if done by men*” (in Minsky & Matter, 1968, p. 5).

However, due to the considerable technological developments in the past decades, it is near to impossible to define AI from a technological viewpoint only (Etscheid, von Lucke, & Stroh, 2020). Therefore, von Lucke and Etscheid (2020) and Djefal (2018) suggest considering defining the AI based on their capabilities, such as speech or image recognition, translation services, face recognition, or the ability to recognize signals or tone sequences (pp. 63-64). One of the basic abilities of AI, which is the basis for all the aforementioned abilities, is *searching* (Djefal, 2019; von Lucke & Etscheid, 2020; Felfernig et al., 2019). In the end, what most AI's do, is search for answers to the questions it has been presented with and make decisions based on the question and the search results.

Often a distinction is made between a “weak AI” and a “strong AI”. Strong AI aims to unravel human decision-making and problem-solving abilities and create better agents based on these findings (Felfernig et al., 2019, p. 492). However, currently, this type of “superhuman intelligence” AI does not exist yet, and opinions differ greatly on the feasibility of this technology (Felfernig et al., 2019; Sun & Medaglia, 2019). Weak AI, on the other hand, refers to systems that can carry out tasks better or more efficiently than humans (Felfernig et al., 2019; Etscheid, 2019). This form of AI is widely used by companies already. It supports decision-making processes, risk analysis, or communication with customers and is slowly finding its way into public authorities as well.

2.3 Conceptualization of Chatbots

Chatbots seem to have appeared everywhere in the past years, but they are not a newly emerged technology that just came about recently. They have been around as early as the 1960s when scientists started to simulate written and even 'speaking' conversations. The German American computer scientist Joseph Weizenbaum developed the natural language processing program ELIZA in 1966 at MIT (Hoffmann, 2018). ELIZA has been programmed to read through a text to check a value against a pattern and match them to select a certain branch of code (Stucki, D'Onofrio & Portmann, 2018). This code then told ELIZA what to do with the given information. This process is called “pattern matching” and is still used today. Using pattern matching, Eliza was able to simulate a conversation and consequently became one of the first chatbots to pass the Turing test. The Turing test tests the ability of a machine, or a chatbot, to exhibit intelligent behaviour in such a way that the machine is indistinguishable from a human being (Kohne, Kleinmanns, Rolf, & Beck, 2020). ELIZA was able to react to pre-programmed keywords to make the person feel as if they were interacting with another human being (Kohne,

Kleinmanns, Rolf, & Beck, 2020). However, due to the limited technological advancement, the big breakthrough for chatbots still took some time (Hoffmann, 2018).

In the past decades, chatbots have become more popular in various areas where automated communication can improve and accelerate service. The ‘bot’ in chatbot stems from ‘*robot*’ and represents that a chatbot is a digital robot without any physical characteristics (Kohne, Kleinmanns, Rolf & Beck, 2020). However, most chatbot systems have an avatar appearance. These appearances can be abstract or take on animal forms, but most are human-like, with attractive women or girls being a favoured model (Burden, 2020). The avatar supports building a connection between the user and the chatbot. The chatbot system works by a user starting a dialogue and then the system fulfils tasks autonomously based on the commands given (Stucki, D’Onofrio & Portmann, 2018). Most commonly, chatbot systems can be found on websites, on messaging and social media platforms, or on apps where they can answer a simple question such as ‘what will the weather be like today?’ or ‘how can I return my purchase?’.

These rather simple tasks are often fulfilled by ‘*rule-based*’ chatbots. Rule-based chatbots operate with a system similar to a decision tree. This means that if a person asks the chatbot a question, the Chatbot provides the user with pre-selected responses (Efraim, Maraev, & Rodrigues, 2017). The user can then choose whether they would like to receive more information on any of the responses. The user interface, the interaction plane between the user and the bot, usually features buttons, links to websites, or a prompt to rephrase the question when the keywords did not match anything the chatbot ‘knows’ (Efraim, Maraev, & Rodrigues, 2017). These chatbots react to certain keywords which then are linked to actions. Generally, rule-based chatbots work domain-closed which means that they only answer questions relating to the website or organisation (Efraim, Maraev, & Rodrigues, 2017). If one desires a more sophisticated chatbot, they will have to turn to AI-based chatbots.

2.3.1 AI-Based Chatbots

In contrast to a ‘rule-based chatbot’, an AI-based chatbot uses NLP (Natural Language Processing, see Glossary) techniques to understand the intent behind the asked question and answer the question without human assistance (Sadekov, 2020). One of the main differences between the two chatbots is that an AI-based one understands the asked question just as a human agent would (Sadekov, 2020). The chatbot uses algorithms to extract information from unfiltered data and to process the input of the asked question (Etscheid, von Lucke, & Stroh,

2020). The algorithms do not only understand the single words that have been typed into the chat field, but they also can detect connections between the words and the intention behind the asked question (Etscheid, von Lucke, & Stroh, 2020).

Furthermore, AI-based chatbots are capable of learning through machine learning (ML see Glossary). Chatbots learn from the input they are presented with, but also from the databases they are connected to. These databases are the foundation of the chatbot, the place where it retrieves its information from (von Lucke & Etscheid, 2020). With access to databases and learning capabilities, AI-based chatbots can automate many more questions and require less training than rule-based chatbots (Sadekov, 2020). These kinds of chatbots can learn and provide valuable answers to users. Technology has developed greatly in the past decades. While a chatbot like ELIZA tried to convince people that it is human by imitating human-like language, we have moved to an age where chatbots are more focussed on being efficient and profitable (Business Insider, 2019). Their usage has increased significantly in the past years and, according to Business Insider (2019), will continue to do so.

However, are not the only advantages of AI-based chatbots in public administration. The chatbots can take off a burden of the citizen service offices by handling requests for which citizens would have otherwise called, and thus reduce waiting time and improve citizen satisfaction (Materna, n.d). The dialogues between a person and a chatbots can be analysed by investigating the reasons for contact, the provided feedback or the usage of the chatbot generally. Thus, AI-based chatbots can be used for monitoring and analysis. The provided information can be used to adjust and improve future communications and dialogues (Materna, n.d).

With an AI-based automated chatbot, citizen service offices are accessible all around the clock, every day of the week and can thus answer the citizens' questions at any time (Djeffal, 2019). Citizen service offices play a great role in the interaction between citizens and the government. The all-around-the-clock accessibility of a chatbot can improve and enhance the government to citizen (G2C) interaction (Etscheid, von Lucke, & Stroh, 2020). G2C, as a concept, aims to offer one-stop service provision through a centralised online platform. One-stop service stands for the concept that citizens will be able to access information and services offered by different public authorities online easily and quickly, at any time and no matter their location (Scholta, Mertens, Kowalkiewicz & Becker, 2019). Such one-stop agencies require that the IT systems of all governments departments are connected (Scholta et al., 2019, p. 12). Thus, this is a crucial aspect to consider when adopting chatbots in public administration as these chatbots will need to access information from various governmental departments and for

that, the systems will need to be connected. Another advantage is that administrative burdens and labour costs can be reduced and through this, a more efficient resource allocation can be achieved (Wirtz, Weyerer, & Geyer, 2019).

2.4 Current e-Government structure in Germany

Von Lucke and Reinermann (2000) together defined e-government at the University of Applied Sciences for Public Administration in Speyer and since then this definition is also referred to as the '*Speyerer Definition of Electronic Governance*'. The term 'e-Government' refers to the "processing of business processes in the context of governing and administering with the support of information- and communication technologies via electronic media¹" (von Lucke & Reinermann, 2000; p. 12). Expectations on e-Government systems are high on the citizens' but also the politicians' as well as the public administrators' sides (Goldkuhl, 2008). e-Government applications have become a crucial link between public administration (offices) and citizens (Wirtz, Piehler & Daiser, 2015). These applications have the potential to completely transform how citizens communicate with the administration and how they access public services. Moreover, it could enhance the image of the public sector (Wirtz, Piehler & Daiser, 2015). The successful implementation of e-Government applications can enhance citizen participation as citizens will be able to connect with citizen offices, and participate in public initiatives more easily (Wirtz, Piehler & Daiser, 2015).

That Germany is not a frontrunner in digital public management is not a secret. In the Digital Economy and Social Index (DESI) ranking provided by the European Commission (2020), Germany generally performs well in most of the DESI dimensions. However, overall, Germany only ranks 12th due to their poor performance in digital public services, where it only ranks 21st (European Commission, 2020, p. 3). Not even half of the citizens (49%) are actively engaging with e-government services (European Commission, 2020, p.3). This low engagement leads to a 26th rank for the indicator of e-Government users (European Commission, 2020, p. 12).

In the context of this study, e-Government refers to the process of providing public services and information online. The digitalisation of administrative processes increases efficiency and enhances the citizens' experience by offering information and services at any time and day. The utilization of communication and information technologies makes

¹ Free translation by the author of this paper from German to English

governmental operations more efficient (Wirtz, Piehler, & Daiser, 2015). Germany scores especially low on the indicator measuring the interaction between public authorities and the general public (European Commission, 2020). Table 1 provides an overview of Germany’s rankings in the DESI and especially in regard to e-Government services.

Year	Overall Ranking	e-Government users
2018	14	25
2019	12	26
2020	12	26

Table 1: Overview of DESI Ranking

The *Law for the Improvement of Online Access to Administrative Services*, in short, the *Onlinezugangsgesetz (OZG)* entered into force in 2017 and requires the federal government, state government and the local authorities to provide administrative services digitally by 2022 (Gomell, Holler, Hundehege, Kairies-Lamp, & Plazek, 2019). To achieve this, the 575 most important services will need to be made available online, pushing the boundaries of existing digital and technical structures (Gomell et al., 2019). One of the main aims of the OZG is to develop a ‘portal network’ for all federal and state administrative services (§3(1² OZG, 2017). This portal network serves the purpose of providing citizens with the possibility of accessing and receiving public services barrier-free and without media disruption (§3(1) OZG, 2017). In other words, with the successful implementation, citizens would be able to receive and complete the process without hindrance.

The attitudes of cities and municipalities towards the e-Government process has become increasingly positive in the past years. In 2015, only around 40% acknowledged the benefits the reform would bring, in 2018 already 60% of the municipalities were planning or already had a digitalisation strategy (Stadt.Land.Digital, 2018). The *E-Government-Gesetz (EGovG)* is the law that provides the legal basis for the advancement of the electronically offered administrative services. The *EGovG* entered into force in 2013 and regulates the communication between citizens, companies, and the administration (Drechsler, 2013). The regulations in §2 *EGovG*³ ensure the constitutional provisions based on the rule of law to

² §3(1) The portal network assures that users receive barrier and media disruption free access to electronic public services from federal and national administrations [translation by the author]

³ §2(2) Every federal authority shall further be obliged to open up electronic access via a De-Mail address in accordance with the De-Mail Act, save where the federal authority concerned has no access to the central IT

effectively and efficiently provide access to the administration (EGovG, 2013; Drechsler, 2013). By increasing transparency, efficiency, and flexibility but also reducing bureaucracy, the EGovG answers many calls to make administrative services accessible without restrictions to opening hours or the physical location (Herr, 2015).

2.4.1 e-Government Service development and integration

Improving interaction and communication between citizens and public authorities lies at the basis of the EGovG. As in any form of interaction, a differentiation between the sender and the recipient has to be made. In the case of citizen service offices, the communes are the sender of the information, and the citizens are the recipients. Stember and Hasenkamp (2019) also refer to this government to citizen dynamic as G2C, that also aims to provide the one-stop agency. However, this is not the only goal that is desired to be reached. Reinermann and von Lucke (2000) and Stember and Hasenkamp (2019) identify six different areas of e-Government applications. The first one is *e-information*, this application includes information services for citizens, the economy and generally for everyone interested. *e-information* can lay the foundation for more e-Government applications and in most cases can be as simple as an authority website where citizens can look up information (Stember & Hasenkamp, 2019). This area has been completed throughout the German administration on every level (Bundestag, 2020).

The second area that shall be implemented is *e-communication*. E-communication includes applications that enable citizens to participate and come into dialogue with their authorities via online services. This is followed by *e-forms*, which enable citizens to print and then fill out administrative forms to e-mail them to authorities (Stember & Hasenkamp, 2019). Online transactions services can further simplify this process. With *e-transactions*, citizens can handle forms fully online and citizen service office employees can process files, contracts and documents online (Stember & Hasenkamp, 2019). The fifth area in e-Government is *e-services*. E-services describes the process of various administrative services being fulfilled electronically, such as distributing permits, but this can also include law enforcement duties

process provided for the federal administration via which the De-Mail services are provided for Federal authorities.

§2(3) In administrative procedures in which they are required to establish a person's identity under a legal provision or in which they consider identification to be necessary on other grounds, every federal authority shall be obliged to offer electronic proof of identity pursuant to Section 18 of the Passport Act or pursuant to Section 78 (5) of the Residence Act.

(Stember & Hasenkamp, 2019). The last application area is *e-commerce*. E-commerce solutions provide marketplaces for auction systems, exchange systems, or payment systems (Stember & Hasenkamp, 2019).

2.5 Artificial Intelligence Applications in Public Administration

AI has attracted much attention in the past years in economics, society, business but also the public sector. This ‘new discovery’ of the usage of AI in everyday fields has opened up a variety of new opportunities (Wirtz, Weyerer, & Geyer, 2019). Processes that have been performed by humans can be carried out or supported by AI systems to make them more efficient (von Lucke & Etscheid, 2020). AI applications such as “Virtual Agents” or “Predictive Analytics” can be very beneficial for the public sector. These technologies can support public administration employees in undertaking repetitive tasks or by answering questions. With this, AI can reduce the workload of, for example, citizen service office employees, who then can focus on more important aspects of their work, and thus may reduce the waiting times faced by citizens (Egger, Schatzky, & Viechnicki, 2017).

According to Wirtz, Piehler and Daiser (2015), providing public services online increases citizens’ satisfaction concerning e-Government services. Zheng, Han, Cui, Miao, Leung and Yang (2018) also showed in their study that AI-based services increase efficiency and improved the service provision of e-Government implementations. However, society and citizens will need to accept the new technology for it to be of added value. This acceptance is most visible when the applications are easy to use, are useful, interactive, and protect privacy (Wirtz, Piehler, & Daiser, 2015).

2.6 Sub-Conclusion

This literature review defined the concepts that are relevant for the thesis to research the barriers to interoperability citizen service offices face when implementing AI-based chatbots. The concepts, citizen service offices, AI, chatbots, and AI-based chatbots have been examined. Further, this chapter outlined e-Government development research and the use of AI applications in the public sector. Furthermore, the motivation for the research has been stated. The following part will conceptualise the framework, based on research done in e-Government interoperability.

2.7 Barriers to Interoperability: A Conceptual Framework

2.7.1 Introduction

The conceptual framework of this thesis is based on the literature on barriers to interoperability in the application of interactive e-Government services. This chapter will identify the barriers discussed and analysed in the existing literature and thus provide guidance through the thesis and lay the basis for the analysis in Chapter 5. The literature review identified that AI-based chatbots can, if incorporated well, bring great benefits to the public sector. Reducing costs, decreasing employee's workload, improving citizen's satisfaction and also enhancing public service delivery can all be achieved with the support of new technologies (Androutsopoulou, et al., 2018). Various scholars acknowledge in their research that there are different barriers that can hamper the adoption of e-Government applications, such as AI-based chatbots. Adopting and finally successfully implementing AI-based chatbots is and will be an ongoing process. The technologies are evolving continuously and changes in regulation and even society call for flexibility in the process (Scholl, 2005).

The word interoperability stems from the Latin word *opus* 'work' and *inter* 'between'. Initially, the term has been defined for information technology and describes the process of two systems being able to exchange information (Scholl & Klischewski, 2007, p. 901; Guijarro, 2007). Interoperability has also become a crucial component for the implementation of e-Government applications. Governmental agencies need to be able to integrate their information systems to become capable of exchanging data seamlessly (Santos & Reinhard, 2012). Interoperability can, therefore, contribute to improved accessibility to governmental agencies as well as reduce transaction costs (Santos & Reinhard, 2012).

The concept of interoperability has been identified as a prerequisite for well-functioning public administration systems of the 21st century eras by Peristeras, Tarabanis and Goudos (2009, p.614). Interoperability is concerned with the multidimensional, complementary and dynamic capabilities of governmental organisations, to enable seamless sharing and integrating information across organisational boundaries (Pardo, Nam & Burke, 2011). Therefore, this concept is very suitable for the research of citizen service offices as these agencies cooperate with various governmental departments to provide the most encompassing service and information to citizens. Within the literature about barriers to interoperability, there are reoccurring themes. Especially barriers of political, technological, legal and regulatory, and organizational nature have been found to impact the adoption of e-Government services (see for example Scholl & Klischewski, 2007; Layne & Lee, 2001; Pardo, Nam & Burke, 2011;

Guijarro, 2007). This conceptual framework will serve as the basis for interpreting and understanding the gathered data from the expert interviews with German citizen service office employees.

2.7.2 Interoperability in e-Government

To integrate means to unite something into a larger unit (Scholl & Klischewski, 2007). The integration of IT-systems in e-Government contexts is crucial when aiming to make them one coherent system (Goldkuhl, 2008). This process can refer to the “fusion of different administrative functions, services or products” (Scholl & Klischewski, 2007, p. 895). One crucial distinction between integration and interoperability is that interoperable systems remain separate systems but are linked to exchange data (Goldkuhl, 2008), while integration refers to forming a larger unit to merge processes or sharing information (Gottschalk, 2009).

The implementation of the citizen-centric technologies and services enhances the potential to build better G2C relationships by providing easier, smoother and more efficient interaction (Layne & Lee, 2001). However, this development is a multi-step process that presents public administrators with various challenges. One of the first and most prominent research in this area has been presented by Layne and Lee in 2001. Their four-stage model for developing fully functional e-Government services provided the basis for the growing research on interoperability (see for example: Pardo, Nam & Burke, 2011; Goldkuhl, 2008; Scholl, 2005; Stember & Hasenkamp, 2019; Parasie & Veit, 2016).

Their first stage focusses on online presentation of information. The second one, is concerned with allowing citizens to make electronic transactions with the government, by connecting the internal government systems to online interfaces (Layne & Lee, 2001, p. 125). Layne and Lee’s third stage refers to the so-called *vertical integration*. Vertical integration means that local, state, and federal governments are able to connect for different functions or service provision (p. 125). This could mean that a citizen would only have to provide their information once and one department could propagate it to another state system to be more efficient. The last and most mature stage of e-Government is defined as *horizontal integration*. In this stage, public administrations would be able to integrate systems across different functions and services (Layne & Lee, 2001, p. 126) Thus, that public agencies would be able to communicate with each other effortlessly, provide needed information seamlessly, and present citizens with a real one-stop-agency.

Figure 1 shows the dimensions e-Government will have to accent to, to reach the ideal stage of e-Government integration. Citizens then would ideally have access to exhaustive public services with “the functional walls inside government transparent to them” (Layne & Lee, 2001, p. 126). Figure 1 shows Layne and Lee’s (2001) and Hasenkamp and Stember’s (2019) interpretations of e-Government development stages merged. Hasenkamp and Stember (2019) based their research on Layne and Lee (2001) and moved the stages into a contemporary context. Chatbots, if implemented fully and successfully into an interoperable system, could guide citizens through the whole process. From retaining information to filling out forms and submitting them.

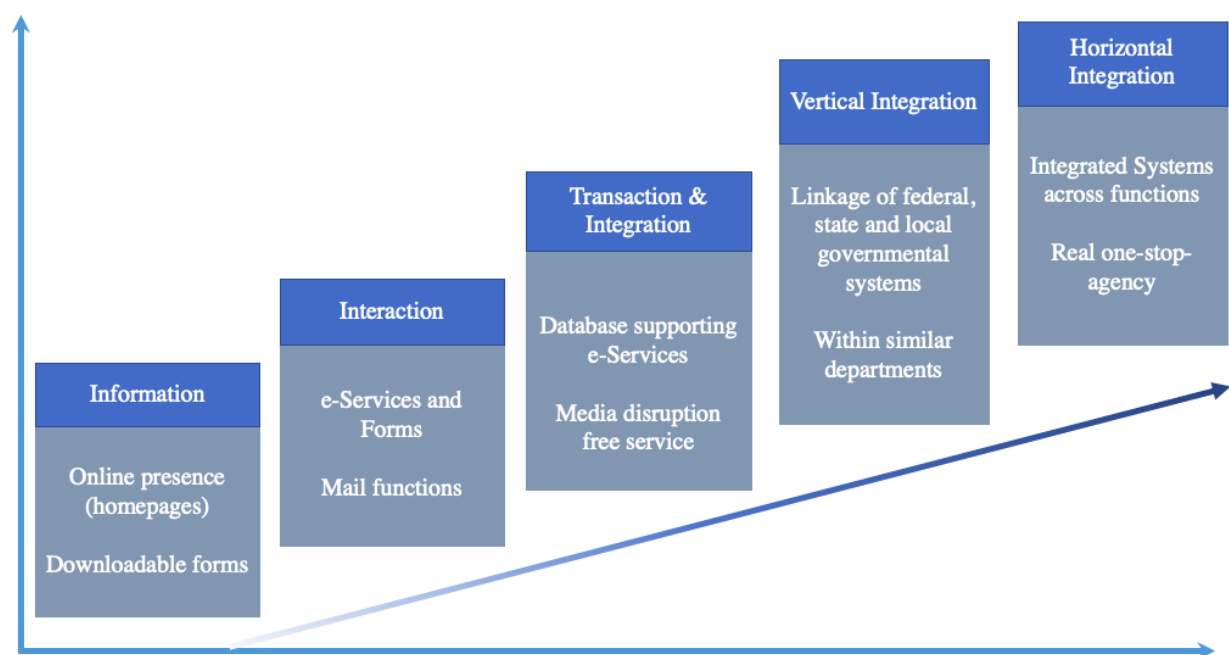


Figure 1 e-Government development stages based on Layne & Lee (2001) and Stember & Hasenkamp (2019)

This ultimate goal, to reach system integration and interoperability through vertical and horizontal integration, poses considerable managerial, organisational, technological and legal challenges (Scholl, 2005). e-Government interoperability of IT-systems has been subject to numerous studies across different disciplines as each address various technical and non-technical issues (Scholl & Klischewski, 2007). Pardo, Nam and Burke (2011) also acknowledge that it is crucial to especially address non-technical factors in the process in order for e-Government applications to reach mature stages. A lack of interoperability has been seen as a major challenge to e-Government maturity (Pardo, Nam & Burke, 2011). Interoperability being a complex concept, research already identified different barriers to interoperability, such as political, technological, legal and regulatory, and organisational.

These challenges are particularly relevant when public administration offices aim to adopt technological systems and applications such as chatbots. These systems need to be integrated and have access to various databases, departments, and information to become impactful and helpful for citizens. As aforementioned, not only technological compatibility is crucial but also other aspects need to be considered to successfully adopt e-Service provision. The reoccurring themes can be divided into political, technological, legal and regulatory, and organisational barriers. These barriers will be addressed in the following sub-sections of this chapter. The last sub-section will further briefly concentrate on additional pitfalls that can impact interoperability.

2.7.3 Political Barriers to Interoperability

The complex governance and administrative landscape in Germany, with the federally organized structure leading to parallel existing regulations, appears to challenge and even hinder the implementation of the EGovG (Parasie & Veit, 2016). Even though Jaeger (2002) discusses the implications of the creation of e-Government policies and services in the US, the federal governance structures, is something that can be found in the German context as well. The challenges he points out are of legal and regulatory nature, stemming from the particular federally organized governmental and public administration structure. The barriers to interoperability here are rooted in the overwhelming number of laws and regulations at the federal, the national, and even the municipal level (Jaeger, 2002). The laws at all levels of government could potentially impact how interoperability can be achieved and poses the challenge to design and implement policies in accordance with the constitutional principles (Jaeger, 2002).

Therefore, a great challenge for Germany is its federally organized structures. Every federal state holds its own competencies concerning the legislative and regulatory framework (BMI, 2020). On the one hand, federalism enhances autonomy and provides the states with the opportunity to apply individual solutions which are customized to the region. On the other hand, however, many state and local authorities often do not have the resources to advance the digitalisation projects on their own as quickly as they would need to (BMI, 2020). Further, the complex legislative landscape of parallel existing regulations, offered services and IT or digital infrastructures (Herr 2019; BMI, 2020) makes the EGovG implementation a highly sophisticated project for many citizen service offices in Germany.

Schwab et al. (2019) conducted extensive research on the status quo of the digitalisation process of citizen service offices in Germany. They have found political management and coordination to potentially be barriers to interoperability in citizen service offices. The coordination between the federal states and their municipalities poses a great barrier to interoperability. As aforementioned, the federal states implement their own EGovG and their municipalities, in which the citizen service offices are integrated, will have to execute these plans. Schwab et al. (2019) highlight that the municipal side greatly criticized the federal approaches. Especially, the implementation of the *service database* that provides information on all public services that citizen service offices provide appears to be more a “compound structure” (p. 35) rather than an interoperable database.

Furthermore, political opposition can be one interoperability barrier to be overcome. Lack of political support has been identified by Pereira, Ginner, Rinnerbauer and Parycek (2017, p.159) to be a great barrier that can stem from a lack of IT- knowledge, technological complexity or public doubts regarding the usefulness of the services (Schwab et al., 2019). This lack of political support can however also stem from low political priority to e-Government interoperability. According to Schwab et al. (2019), municipalities also criticize the missing sense of urgency for system and information integration and a general lack of a clear objective. This highlights again how crucial political management across all levels is to reach interoperability. Scholl and Klischewski, (2007) further identified that compatible political leadership styles have a positive impact on interoperability. Thus, political and administrative fragmentation and a lack of support can be a great barrier to interoperability.

2.7.4 Technological Barriers to Interoperability

When thinking about e-Government barriers to interoperability, the first barriers likely to come to most people’s minds would be technological barriers. e-Government, and also chatbots, are technological developments and systems which could suggest that barriers of technological nature are the most prominent ones. However, Scholl (2005) suggest that these may be the ones that are easiest to address. There are various standards, such as the XML⁴-based inter-agency information sharing, that aim to provide an IT-architecture that optimizes between information searching, storage, and maintenance demands (Scholl, 2005).

⁴ Extensible Markup Language: Technological standardization and regulation of presentation and data formats used in most countries as the basis for e-Government implementation (Parasie & Veit, 2016).

Nevertheless, even though Scholl (2005) suggests that these may be the easiest to solve, that does not mean that there are not any. To the contrary, there are various barriers that need addressing. Schwab et al.'s (2019) research on citizen service offices in the federal state of Baden-Württemberg identified technological barriers to be the second leading challenge to digitalisation with 26 percentage points (p. 33). The same research also identified insufficient IT-infrastructure to be a major technological barrier in adopting e-Government services (Pereira et al., 2017). The digital infrastructure needs to be able to handle the online traffic that is associated with providing AI-based services to citizens and careful considerations are needed about where to store the data (Stember & Hasenkamp, 2020; Pereira et al., 2017). These, however, are barriers that often are beyond the scope of municipalities and thus also beyond citizen service offices' capabilities.

A general issue that often hinders interoperability is the incompatibility across different IT-systems regarding security models, their standards or legacy systems⁵ (Pardo, Nam & Burke, 2011; Bekkers, 2005). Incompatibility of IT-systems often stems from legacy infrastructure, that conflicts with newer IT-systems (Bekkers, 2005). Furthermore, a crucial aspect is IT security. Data transmitted to governmental agencies such as citizen service offices, can often be personally identifiable or sensitive data that must be protected (Kalloniatis, Kavakli, and Gritzalis, 2004). Data protection and privacy is of utmost importance when implementing e-Government services. Furthermore, due to the frequent incompatibility across IT-systems, this can pose a crucial barrier that needs to be overcome.

Germany's federally organized public administration structures can pose an extra challenge to the coordinated and uniform integration of e-Government systems (Parasie & Veit, 2016). Due to the complex and fragmented governance landscape, every federal state holds the responsibility for the technological implementation (Parasie & Veit, 2016; Herr, 2019). Further, the responsibility for organizational questions regarding information and communication technologies is shared between the state, the federal and the municipal level. As a result, a particularly heterogeneous IT and digital landscape has developed (Schwab et al., 2019). Layne and Lee (2001) suggest that the integration of exactly those heterogeneous systems serves as a major barrier for any governmental agency. Layne and Lee (2001) provide the example that health system requirements for data and processes might not be comparable to the ones of transportation systems (p. 133). This can also pose an obstacle in the context of

⁵ Legacy systems are older, outdated systems that are still in use

citizen service offices. Their array of services ranges from issuing identification cards to consultation about tuberculosis.⁶

According to Schwab et al. (2019), in the context of citizen service offices, one key technological barrier is the seamless interface between administration and citizens. However, e-Government services are not at all or only insufficiently integrated into the administrative online-applications (p. 37). However, Schwab et al. (2019) acknowledge that several of these barriers will not be solved on the municipal level alone and the federal state level will need to improve the technical approaches. In the end, successful interoperability is concerned with information and system sharing on all governmental and administrative levels.

2.7.5 Legal and Regulatory Barriers to Interoperability

Due to the rather new developments of AI-based chatbots, and particularly them being used in public administration in Germany, there is no clear legal or regulatory basis. Having an interoperable e-Government system yields many benefits to citizens and administrations. However, when interviewing managers and employees of three communes in Baden-Württemberg, Schwab et al. (2019, p. 31) identified legal barriers with 27 percentage points to be the most challenging to e-Government implementation and interoperability. This is also in line with the findings of Goldkuhl (2008) and Bekkers (2005) that legal interoperability is one of the greatest barriers for the adoption of e-Government applications. Pereira et al. (2017) confirm that this is especially an issue when adopting public service delivery of e-Government services. In their study, they identified that often there is a lack of a legal framework guiding the process, or that the legislation is highly complex which leads to confusion on both the citizens' and the administrative side.

Public administrations that desire to adopt AI applications, have to adhere to the strict data protection regulations and IT security in Germany (Djeffal & Horst, 2021). Therefore, one great concern for both sides, the citizens and the administration, are privacy and data protection (Scholl, 2005; Pereira et al., 2017). Concerns from the citizens' point of view that can pose great barriers is that the complex or even missing legal basis may be a threat to their privacy (Bekkers, 2005). Citizens will very likely be concerned with their privacy (Pereira et al., 2017). Layne and Lee (2001) already mention that there is a possibility for governments to trace online activities such as, time spent on services or which services have been used. This can be very

⁶ see: <https://www.luebeck.de/de/buergerservice/leistungen/index.html?lid=8969552&zufi=1&bereich=7>

useful data for the citizen service offices to improve their services but can also lead to the temptation of selling this data to external third parties (Lanyne & Lee, 2001, p. 127). Thus, a clear legal framework is needed. These concerns can greatly influence citizens' trust in using the applications (Pereira et al., 2017; Bekkers, 2005). As a consequence, if citizens are not using the services, interoperability will be redundant. Therefore, establishing trust in citizens regarding data protection is a prerequisite and a challenge.

On the public service side, there are also barriers to overcome when it comes to data protection (Pereira et al., 2017). Different countries impose different legal standards about data protection and privacy. These regulations are usually concerned with where the servers, on which the data is stored, are located. This can result in an obstacle of inadmissibility of specific interactive e-Government services (Pereira et al., 2017). Different legal regimes or even conflicting obligations and rights regarding privacy can reinforce confusion and lead to uncertainty about responsibilities (Bekkers, 2005).

Germany published its first version of the 'Standards and Architectures for e-Government Applications' (SAGA) in February 2003 (Guijarro, 2007) and updated it to version 5.0 in November 2011. Parasie and Verit (2016) acknowledge that the general application of legal provisions in the public sector in Germany is difficult. Therefore, SAGA is (only) a non-binding guideline for decision-makers in e-Government entities in public administration in Germany (Parasie & Veit, 2016; Guijarro, 2007). This can again potentially lead to confusion on both the public service provision and the citizens' side.

Furthermore, Scholl and Klischewski (2007) point out that at very mature stages of e-Government service provision, governments run the risk of "blending into a functioning whole" (p. 896). This can pose serious threats to the separation of powers and thus, violate basic democratic principles (Klischewski, 2004; Jaeger, 2002). Gottschalk (2009) agrees with these concerns. He also refers to the utmost importance of assuring constitutional checks and balances and warns calls for caution when integrating and interoperating different governmental branches. This development can pose a barrier at a more mature stage of e-Government applications but should be considered when envisioning the progress.

2.7.6 Organisational Barriers to Interoperability

As interoperability refers to the ability to share information across systems and organisations, it should not come as a surprise that organizational hurdles can impact the adoption of e-Government service applications. The European Commission (2004) defines organisational

interoperability as the process of “defining business goals, modelling business processes and bringing about the collaboration of administrations that wish to exchange information and may have different internal structures and processes” (p. 16). In other words, the focus of organisational barriers lies on interaction between humans, the organisational agents in this context, and between the information systems (Goldkuhl, 2008). A great challenge to the interaction and finally interoperation of the systems can be differing organisational processes and resources across departments and organisations (Scholl & Klischewski, 2007). Without proper standardisation across processes, systems, departments, and policies, interoperability might prove to be achieved only with great difficulty (Scholl & Klischewski, 2007; Gottschalk, 2009). Therefore, when public e-service provision advances from the intra-organisational to the interorganisational domain, the organisational barriers will begin to outweigh technical barriers in terms of complexity (Pardo, Nam & Burke, 2011, p. 10).

While Layne and Lee (2001) agree that processes and resources can differ across departments, they also acknowledge that different departments also have different needs. This can result in different resource allocation to e-Government service provision. Making information available online is one thing, but maintenance of the information, or web pages, and services is another organisational barrier that needs to be overcome with allocating resources (Layne & Lee, 2001). Some information or services provided may only be temporary and thus must be kept up to date but also correct. Pereira et al. (2017) identified collaboration and cooperation between departments as a crucial organisational barrier as well. According to them, the “organisational frame” of governmental departments and agencies can impact their willingness regarding shared resources and collaboration (Pereira et al., 2017, p. 158). Therefore, drawing attention to the importance of consistent collaborative governance is necessary to avoid this interoperability barrier.

The concept of enterprise architecture refers to the structure and scope of an organisation or multiple agencies working together and a comprehensive description of the elements that make up the enterprise (Guijarro, 2007; Pardo, Nam & Burke, 2011). In the e-Government context, an enterprise can be a governmental agency, department or institution (Guijarro, 2007). Guijarro (2007) identifies enterprise architecture as being central to e-Government advancing to interoperability as it also facilitates effective procedures to deal with interoperability challenges across agencies and departments. This approach is especially relevant when organisations, such as citizen service offices, have large service portfolios and consequently have to manage a high level of complexity across their applications (Pardo, Nam & Burke, 2011).

The lack of structured processes and suitable modelling tools to execute e-Government projects, can increase organisational barriers to interoperability for e-service provision in the German public administration landscape (Parasie & Veit, 2016). Germany's adoption of SAGA, however, specifies guiding principles for interoperable e-Government services, but they are yet to provide a framework for enterprise architecture (Guijarro, 2007). These kinds of frameworks can provide organisations with guidelines about project management, suitable project sizes, and alignment of goals to avoid conflicts between agencies (Pereira et al., 2017).

Thus, horizontal integration also requires the management level of, for example, citizen service offices to adapt (Layne & Lee, 2001). Policy and managerial considerations are crucial in order for organisations or departments to effectively work together (Pardo, Nam & Burke, 2011; Guijarro, 2007). Layne and Lee (2001) point to a bias many managers have, namely that their department is the most important one and thus disregard others (p. 133). Here, it is crucial to consider that functional specialisation may not prove to be the most accommodating approach to e-Government; but rather focus on efficiency, effectiveness and citizen-centredness to achieve the desired outcome of organisational interoperability (Layne & Lee, 2001; Pareira et al., 2017).

Not only the managerial level is important to overcome organisational interoperability barriers, the employees of public agencies are also crucial for the successful implementation. With the adoption of e-Government service provision, working processes and bureaucratic structures can pose a barrier to interoperability (Pereira et al., 2017). Pereira et al. (2017) identified that the lack of IT-skills, or rather the lack of qualified personnel and also the internal acceptance of the technologies, can hamper interoperability greatly. Schwab et al (2019) confirmed this observation in their research. Recruitment of qualified personnel with sufficient digital competencies appears to be rather difficult. On the other hand, it also appears that a lack of training of the employees and managers impacts this barrier negatively as well (Schwab et al., 2019; Pereira et al., 2017). Lastly, training does not only need to be focused on acquiring IT-skills but can also be beneficial in altering employees' attitudes towards change (Pereira et al., 2017). Resistance to change, both from the employee and the managerial side, pose a great operational interoperability barrier. This can also lead to a lack of internal acceptance. The attitudes towards e-Government applications and changing service provisions can be impacted by a fear of loss of power or even losing one's job (Pereira et al., 2017).

2.7.7 Other Potential Barriers to Interoperability

Naturally, the list of barriers provided is not exhaustive. Nevertheless, due to the scope of this thesis and keeping its feasibility in mind, not all barriers could be researched. However, to gain a small overview over other potential barriers citizen service offices can potentially face when implementing interactive e-Government tools, this section will provide a brief outline. *Financial barriers* can hinder interoperability. Adopting new technologies costs money. Money that not all citizen service offices have at their disposal. Scholl and Klischewski (2007) also identified the importance of the economic side of interoperation, as costs have been found to directly relate to the extent of functionality in interoperation. However, not only adopting new technologies can be costly, also the integration and interoperation of IT-systems will need to be done. Either by hiring external IT-service providers or consultants or by employing someone capable of performing these tasks. Thus, financial means can also pose barriers to interoperability.

On the other hand, *social barriers* can pose a challenge to interoperability. These are concerned with the users, the citizens. Pereira et al. (2017) point out that user-centric service provision will and cannot be exploited when citizens do not make use of them. Therefore, it is crucial for public administrations to understand and anticipate their citizen's needs (Helbig, Gil-Garcia & Ferro, 2009). That this could potentially pose an issue had been highlighted in research that has been conducted by the Initiative D21 under the patronage of the Federal Chief Information Officer (CIO) (Initiative D21, 2020). The CIO is the highest-ranking governmental executive that steers the IT-strategy (Groß & Krellmann, 2019). The D21 research concluded that many citizens still prefer face-to-face interaction with citizen service employees overusing digital public services (Scheiber, Müller, Stein, Krcmar, Hein, Daßler, Paul, Exel, & Pleger, 2020). Further, Schreiber et al. (2020) concluded that interactive digital assistants such as chatbots are still rather unknown in Germany. Only around 18 percent of citizens even know about digital assistants and only 5 percent have tried them (Scheiber et al., 2020, p. 44). On the other hand, however, the study found that 67 percent can envision themselves using digital assistants in the future (Scheiber et al., 2020, p. 44). However, this will not be the focus of this research as this thesis focusses on the interoperability challenges citizen service offices face when adopting chatbots. Nevertheless, it is a crucial burden public authorities must keep in mind when adopting e-Services.

2.7.8 Conclusion

The conceptual framework of barriers to interoperability has many facets. The most prominent ones in literature have been grouped under the themes political, technological, legal and regulatory, and organisational barriers to interoperability. Not all mentioned barriers always seem entirely clear cut. Some challenges, such as data protection, can hold aspects that need addressing from both, the legal and regulatory side but also from the technological side. Nevertheless, these four categories act as a guideline for the analysis. Furthermore, this conceptual framework has been used to identify relevant questions to ask during the expert interviews.

2.8 Theoretical Expectations

Through the Literature Review and the conceptual framework, the main barriers that can impact AI-based chatbot adoption in German citizen service offices have been identified. Furthermore, it has been established that there appears to be consensus in the research community that barriers to interoperability of political, technological, legal and regulatory, and organisational nature are the most frequent ones to pose challenges to interoperability. Therefore, separate expectations for each of the ‘areas’ will be presented. The theoretical expectations for the research regarding barriers to interoperability that potentially impact the adoption of AI-based chatbots in German citizen service offices are as follows:

Expectation 1 - Political barriers to interoperability:

Firstly, political barriers to interoperability appear to be a limiting factor to innovations and thus also the citizen service offices in implementing AI-based chatbots. The federally organised structures and communication between them can pose political barriers. The expectation is that the analysis will find that political processes and politicians, who are responsible for the e-Government implementation on the municipal level, hamper the adoption of AI-based chatbots due to a lack of knowledge.

Expectation 2 - Technological barriers to interoperability:

Furthermore, technological barriers to interoperability have been identified to pose a challenge when implementing e-Government services. Even though technological barriers may not be the most difficult ones to address, they still need addressing. The heterogenous IT-landscape that has developed in the past years is expected to prove challenging for citizen service offices. Furthermore, it is expected that the insufficient digital infrastructure will hinder interoperability by not being able to process data properly.

Expectation 3 - Legal and regulatory barriers to interoperability:

Due to the highly limited legal and regulatory landscape regarding e-service adoption it is expected that citizen service offices will not be provided with an extensive guideline, which can result in issues. However, the greatest expected legal and regulatory barriers are the ones concerned with data protection and privacy. Due to very strict personal data regulations in Germany, integrating chatbots that process, transfer or store data will impact the scope of application and usability of the chatbot.

Expectation 4 - Organisational barriers to interoperability:

Organisational barriers to interoperability have been identified extensively. Cooperation between and harmonisation of goals, procedures and systems between departments is expected to prove a great barrier to chatbot adoption in German citizen service offices. Technological knowledge and the ability of the employees to work effectively with a chatbot cannot be assumed. Furthermore, citizen service employees could fear to be replaced by the chatbot. Thus, a lack of IT-savvy employees as well as a lack of their acceptance of the new technology, is expected to pose a challenge to the citizen service office.

In order to analyse the barriers outlined and identified in the literature review and conceptual framework, this research incorporated the four themes into the qualitative research method of semi-structured expert interviews. The analysis chapter will investigate to what extent the selected German citizen service offices faced or still face the barriers and how they impacted the adoption of AI-based chatbots into their agencies. The following chapter will describe the research methods and design used to answer the research question of this thesis.

3 Methods

3.1 Introduction

After the examination of the conceptual framework that identified the barriers in e-Government implementations, the empirical investigation of this thesis follows. This study investigates the barriers to interoperability German citizen service offices are facing when adopting AI-based chatbots. This thesis has been approached from an empirical-analytical angle (Azevedo et al., 2011). Furthermore, a deductive research approach has been applied to investigate the research question. A deductive research approach uses existing concepts or theories to formulate theoretical expectations which then need to be tested (Azevedo et al., 2011). The research

started with the observation that, according to the DESI 2020, 2019, and 2018, Germany ranks extraordinarily low in e-Government service provision and especially in the indicator measuring interaction between public authorities and the general public (European Commission, 2020; 2019; 2018). From there, the landscape of chatbot adoption in German citizen service offices has been investigated and to the surprise of the author, this landscape is still rather limited, as is the research on them. The concept of interoperability, which is commonly used in e-Government implementation research, serves as a foundation for the expectation formulation.

3.2 Research Design

In order to narrow down the large field of e-Government research, this thesis focusses on the adoption of AI-based chatbot systems in German citizen service offices. One of the key hurdles of successful e-Government integration continues to be interoperability. This research makes use of a within-case study design, since the research topic investigates a very specific case, case studies are advantageous to gain detailed understanding of the issues and barriers at hand. The research design of within-case evidence provides the possibility to examine how the theoretical expectations hold against the information acquired thorough the semi-structured interviews (Toshkov, 2016). Toshkov (2016) refers to these kind of case studies also as single case studies (p. 285). The single case, or within-case studies provide the researcher with the possibility to examine multiple segments of information.

The analysis in this research design focusses on observations within one single case rather than across different cases (Toshkov, 2016, p. 285). The single case at focus of this research is the adoption of AI-based chatbots in German citizen service offices. Toshkov (2016) also states that the case selection for this case study design needs to be performed with attention to the expected theoretical contribution (p. 290). As this thesis aims to investigate the impact of barriers to interoperability in the context of AI-based chatbot adoption in German citizen service offices, and thus contributes to the research on interoperability of interactive e-service provision, this component is fulfilled. Swanborn (2010) defines case studies as a *study of a phenomenon or a process as it develops within one case* (p. 9). In the context of this research the process that is being investigated are the influence of barriers to interoperability on the provision of services through AI based Chatbots in the case of German citizen service offices. Figure 2 provides an overview of the (expected) relationship between the different

independent variables and the dependent variable. This variable model has been based on the conceptual framework that presented the barriers to interoperability.

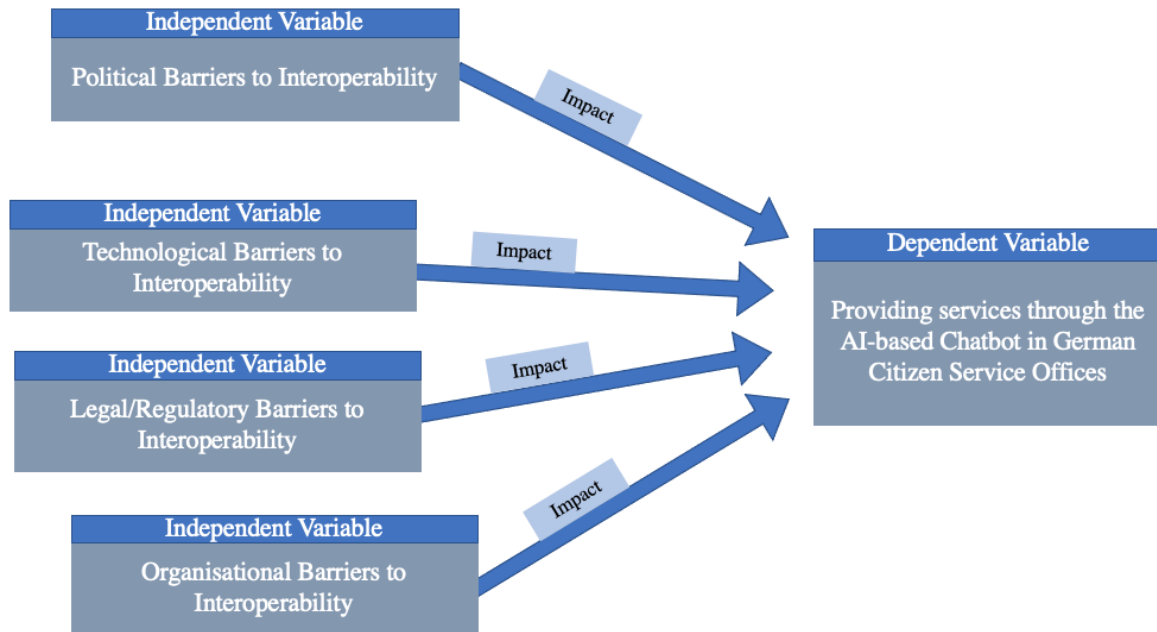


Figure 2: Variable model of independent and dependent variable(s)

The variables derived from the literature review and the conceptual framework have been summarized in table 2, which can be found in the following sub-section. This table provides an operationalisation of each variable shown in figure 2. The dependent variable is the “service provision through AI-based chatbots”. The independent variables are political barriers to interoperability, technological barriers to interoperability, organisational barriers to interoperability, and legal and regulatory barriers to interoperability. These independent variables have been derived from the conceptual framework.

3.2.1 Operationalisation and Indicators of the Variables

The operationalisation of the variables shown in figure 2, is presented in table 2. The ‘indicators’ column mentions the barriers that are measured in the context of chatbot adoption in German citizen service offices. The barriers will be measured based on the presence of these indicators which have been discussed in the previous chapter, the conceptual framework.

Variable	Indicators	Sources
<i>Independent Variables</i>		
Political barriers to interoperability	No cooperation between different departments or authorities and management; lack of political support for the adoption; federal structures	Semi-structured Interviews
Technological barriers to interoperability	Insufficient infrastructure that is not able to handle large data traffic; incompatibility of existing IT-systems;	Semi-structured Interviews
Legal and Regulatory barriers to interoperability	Lacking a guiding legal framework; issues regarding data protection and privacy;	Semi-structured Interviews
Organisational barriers to interoperability	Lacking internal acceptance; qualified personnel; cooperation regarding goals, procedures and systems between agencies and departments; lacking structured processes;	Semi-structured Interviews
<i>Dependent Variable</i>		
Service provision through AI-based chatbot	Citizens being able to receive services through the chatbot offered by the citizen service office without media disruption	Semi-structured Interviews

Table 2: Operationalisation of Variables

Table 2 provides an overview of the concepts and variables that are crucial for this research. Toshkov (2016) describes concepts as “*the building blocks of scientific reasoning*” (p. 84) they support our minds in forming theory and making sense of the relationship between them. Operationalisation on the other hand, helps us to translate these abstract concepts into something more tangible, something that can be classified, measured or detected in the real, empirical world (Toshkov, 2016, p. 100). The indicators specified in table 2, are not measurable

in a 'numerical' way that would provide insight in a more precisely measurable way. Rather, the results will depend on the individual experiences interview participants. Therefore, this research makes use of 'second type indicators' that are not precisely measurable but rather serve the purpose of detecting presence or absence (Toshkov, 2016, p. 101).

Political barriers to interoperability will be measured by the indicators of absence of cooperation with different departments, authorities, and managements. This has been proven to be a barrier that often hinder the adoption of e-Services (BMI, 2020). Furthermore, the lack of political support for the desire to implement AI-based chatbots in citizen service offices will be measured as an indicator for political barriers to interoperability. Without the support from the municipalities or federal structures, service offices will likely lack money and guidance on their course (Scholl & Klischewski, 2007). Lastly, these barriers will be measured by the indication in how far the federal structures have hampered the adoption thus far.

Technological barriers to interoperability will be measured by assessing the digital infrastructure, which has been demonstrated to have hampered digitalisation efforts in the past (Schwab et al., 2019). A sufficient digital infrastructure is needed to handle the data traffic that can be generated by the use of the chatbot. Furthermore, the heterogenous IT and digital landscape that developed in Germany, largely due to the federal structures, often causes existing IT-systems to be incompatible with each other (Parasie & Veit, 2016). This has been indicated to be one of the greatest barriers to successful e-Government implementation (Layne & Lee, 2001).

The third independent variable, legal and regulatory barriers to interoperability will be measured by investigating whether the lack of a guiding legal framework in regard to e-Government interoperability hindered the adoption of AI-based chatbots. Furthermore, as Germany is known for its strict personal data protection and privacy laws, it will be measured whether these have impacted the adoption as well.

Lastly, the organisational barriers to interoperability that possibly influenced the adoption of the chatbot in citizen service offices will be measured by investigating the internal acceptance. As this research investigates the public administrative side of the adoption of the chatbots and not the citizens' perspective, the employees that operate or work with the chatbots need to accept its adoption. Furthermore, it will be measured whether the lack of qualified personnel, but also the lack of structured processes, have become an impacting factor in the chatbot adoption. The last indicator that will be measured is the possible cooperation regarding goals, procedures and systems between departments and agencies regarding the adoption of the AI-based chatbot.

3.3 Case Description

According to Business Insider (2019), the global chatbot market is anticipated to reach \$9.4 billion. The chatbot market is booming and simultaneously research is advancing, and the fields of applications are expanding constantly. This expansion also reached the public sector. The most prominent example for AI in the public sector in Germany is chatbots. Earlier, this paper discussed two types of chatbots, the ones that are based on AI technologies and rule-based, or keyword-based ones. Purely keyword-based chatbots are not necessarily useful for public administration, as the administrative language used differs from colloquial language. This does not pose an issue when a citizen talks to a citizen service office employee as they usually know what the administrative word is for what the citizen is looking for. Thus, it is of utmost importance for a chatbot to work with thesauri, ontologies, and self-learning systems to be of added value in public administration (von Lucke & Etscheid, 2020). AI-based chatbots are used to expand the administrative communication channels between citizens and the authorities. By providing information in a quick and easy-to-understand manner, citizens can retrieve advice or instructions on how to handle their requests.

The digitalisation of citizen service offices in Germany is proceeding, in some aspects better than in others. There are various barriers to successful implementation of digital strategies that can provide e-Government services to citizens. Those can be of legal and regulatory, political, technological, or also of organisational nature. As it has been established in the conceptual framework chapter, these barriers can be grouped under interoperability. Interoperability, having the particular nature of providing the possibility to incorporate different systems without any restrictions, makes it a very suitable concept for this research. The visualisation of the e-Government development stages (see Figure 1) illustrates the need for this incorporation of different systems. The tasks of the and possibilities are becoming more complex with each step and thus, different systems will need to work together. In the beginning a simple homepage will be enough, but as the development progresses, databases will need to be linked, forms from different authorities and departments must be made available at one click, and finally, all authorities, whether on a local or federal level should be linked to truly provide a one-stop-agency (Etscheid, von Lucke & Stroh, 2020). Germany's public administration landscape is not particularly filled with AI-based chatbots. Nevertheless, these applications could guide citizens through the whole process, by first providing them with information and later perhaps even automatically filling-out forms and reminding people when their identity cards expire.

Chatbots have become one of the most prominent examples of AI applications in public administration. In Germany there are first practices of chatbot adoptions that can communicate in natural language with citizens (Etscheid, von Lucke & Stroh, 2020). Etscheid, von Lucke and Stroh (2020, p. 23) acknowledge that AI-based chatbots can expand the existing channels of public agencies and support users without expertise to arrive quickly at their desired information. Furthermore, the reasons why, in the context of German citizen service offices, AI-based chatbots are more beneficial than rule-based ones is the discrepancy in ‘languages’ used. Within the administrative sphere very different words are often used to describe something. For example, the word *abgeparkt* (parking) would be the administrative word and in colloquial German people would often call it *geparkt* (parking). AI-based chatbots are linked to thesauri and ontologies and machine learning capabilities that can counteract confusions that might arise from these issues (Etscheid, von Lucke & Stroh, 2020). Furthermore, Balta, Kuhn, Sellami, Kulus, Lieven and Krcmar (2019) recognize the usefulness of NLP to summarise and extract information to design more successful participatory tools (p. 237).

The general legal basis for e-service provision in administrative procedures in Germany can be found in the Administrative Procedure Act (VwVfG). This law regulates the issuing of administrative acts and documents and opens up the possibility to use electronic signatures or electronic authentication of documents (Djeffal, 2018; Beck, 2019). Furthermore, Djeffal (2018) describes another aspect, the experimentation clause, that can be found in most of the local e-Government laws. This clause opens up the possibility to experiment with AI applications in public administration and even develop them themselves. The combination of these with the e-Government law and the OZG provide the federal states and cities with a rather loose framework that enables them to try to implement AI-based applications, such as chatbots, into their administrative processes.

Nevertheless, there are regulations and legal guidelines that German citizen offices need to consider when implementing AI-based chatbots. The General Data Protection Regulation (GDPR), for example. The Chatbots used on German citizen service offices websites do not ask for personal data. However, due to the nature of the chatbot having an open chat field, people can always enter sensitive and personal data. Therefore, secure data processing and storage must be ensured. The General Data Protection Regulation (GDPR) adopted in May 2018 by the EU, guides the collection and processing of personal data of the users. In order to protect citizens’ personal information and privacy, this data must be stored safely and securely. The general guideline is that if personal data must be stored, then only in such a way that it is not possible to identify a person by it (GDPR, 2018).

Organisational hurdles can be found in the German administrative landscape at various points. The federal information management (FIM) provides all administration levels with information about the administrative services that result from the national level (BMI, 2018). This information serves as the basis for the primary online distribution and e-Government applications. Harmonisation of information and implementation of a common, coordinated approach and standardized and seamless IT systems will be especially helpful when implementing chatbots (BMI, 2018). To achieve this goal, the FIM developed a four steps plan. First, the services or objects need to be classified within the LeiKa (Leistungs Katalog = service provision catalogue).

Second, these classified blocks need to be structured by harmonising form fields that are defined by law (Joinup, 2015). Afterwards, the forms, or blocks, must be standardized by a template that meets all legal requirements and has been created by the federal government. Lastly, the forms have to be processed through a technical standardization based on XÖV/XML (standard for electronic data exchange in public administration) frameworks. After these four steps have been completed, the forms and data can be exchanged across departments and authorities in a standardized way. These processes can likely improve the diffuse organisational structure which developed due to the federal structures and differing willingness for innovation and technology implementation (Parasie & Veit, 2016).

3.4 Research Strategy

The observations in this research have been collected with the qualitative methodological approach of semi-structured expert interviews. The aim of these interviews and the research was to gain a deeper understanding of the processes involved, the considerations that have been made and their challenges they have faced. Furthermore, the main objective has been to investigate the barriers to interoperability citizen services offices were or still are facing. Therefore, approaching this issue with a qualitative approach has supported the efforts in gaining a better understanding and deeper insights. The qualitative method enabled the research to gain a deeper understanding of the actual processes involved and the barriers faced during the process of developing and implementing an AI-based chatbot as well as which of them are still present. This rather under-researched topic of chatbots as communication tools between governmental agencies and their citizens benefitted from the primary qualitative data collection.

The semi-structured interviews have been based on the outcome of the literature review and the conceptual framework grounded in the literature on barriers to interoperability. Information for the literature review has been gathered through Google Scholar and the Leiden University Library Catalogue. The literature had to be published and peer-reviewed in order for it to be selected. The basic set of keywords that have been used to search for articles, government publications, and books included: “AI chatbot”, “chatbot”, “Künstliche Intelligenz (KI) in der öffentlichen Verwaltung”, “KI Verwaltung”, “AI in German public administration”, “Bürgerserviceämter”, “öffentliche Verwaltung”, “e-Government”, “Behörden Bürger Kommunikation” and “Digitalisierung in Bürgerämtern” “interoperability government” “interoperabilität e-Government”. Literature has been selected in German and English. Due to the rather novel application of AI-based chatbot systems in public administration, no specific timeframe for the literature has been chosen.

3.5 Selection of the Cities

According to the for Economic Affairs and Energy and the Competence Centre for Innovative Procurement, four cities especially stand out regarding the use of AI-based chatbots in German citizen service offices (BME, 2020). Therefore, these four cities have been chosen to be investigated: *Berlin*, *Hamburg*, *Heidenheim an der Brenz*, and *Munich*. These cities have been highlighted by the Competence Centre for Innovative Procurement (KOINNO). KOINNO has been established under the authority of the Federal Ministry for Economic Affairs and Energy. Their task is to promote and increase public innovation procurement and to be the point of contact for questions regarding innovative public procurement (BME e.V., 2020). In March 2020, KOINNO published a document highlighting examples of the usage of “Artificial Intelligence in the Public Sector” (BME, 2020). All cities followed distinct approaches to the adoption of their chatbots. Furthermore, all cities are located in different federal states with varying structures and resources and, therefore, provide a very interesting and diverse research body. To the knowledge of the author there is no exhaustive list available that lists all AI-based chatbot applications in German citizen advice offices.

3.6 Research Method: Semi-structured Expert Interviews

Expert interviews are a popular practice in social science research (Meuser & Nagel, 2009). An expert generally is someone with relevant knowledge to the researched topic. Furthermore,

expertise can be a result of external conditions such as positions and being in a position with authority or a particular reputation (Meuser & Nagel, 2009; Harvey, 2011). Interviews with experts serve the purpose of ‘extracting knowledge’ from them that otherwise is not available to the researchers (Meuser & Nagel, 2009, p. 100). “An expert has technical, process and interpretative knowledge that refers to a specific field of action, by virtue of the fact that the expert acts in a relevant way” (Bogner & Menz in Meuser & Nagel, 2009, p. 54). This refers back to the profession or position held by a person that can make them an expert. Furthermore, being part of a particular organisational field, such as working in the IT-department of a citizen service office that is responsible for adopting the chatbot, will make someone an expert.

The interview guide for the semi-structured expert interviews was based on the outcome of the literature review and the operationalisation. Most barriers in adopting AI-based chatbots and digitalising citizen offices have been of a technological, labour and political nature. However, as this thesis is also investigating the communication aspect of AI-based chatbots, this topic has also been integrated into the interview manual ([Appendix](#)). Every interview started with a small introduction of the interviewer and the declaration of consent of recording and transcribing the interviews. Afterwards, the interview began with a rather general part asking about why the citizen service offices decided to implement an AI-based chatbot and how they arrived at the application they are using. Furthermore, questions about the development, maintenance, and data transmission of the chatbot have been discussed.

As the agenda for semi-structured interviews is rather flexible, the interviews have not always been conducted according to the order in the interview guide (Newcomer, Hatry & Wholey, 2015). Each interview started with a small part about informed consent to which all participants agreed. The structure depended on the conversation flow that developed and how many questions the participants already answered in their responses. Thus, the order of the barriers varied. Questions about the technological barriers have been divided into digital infrastructure bottlenecks and regarding the translation of language, data and services into the chatbot. Also, the decisions about which scenarios to incorporate and future visions were discussed under this theme. Another theme discussed in the interviews were organisational barriers regarding the maintenance of the Chatbot and conducting daily business with it. Furthermore, the legal and regulatory challenges when adopting chatbots into the public administration landscape have been discussed. Lastly, questions under the theme of political barriers have been asked.

In total, interviews with eight people have been conducted, five individual interviews and one panel interview with three participants. The interviews have been conducted between

mid-January and mid-April, depending on the different availabilities of the participants. The interviewees have been contacted through the citizen service offices of the corresponding cities. All interviews have been held and transcribed in German. The semi-structured interview guide served as a guiding principle and a checklist to assure that all fields have been discussed.

A drawback of semi-structured interviews is that, due to the labour intensity, that one will be unable to interview a large sample (Newcomer, Hatry & Wholey, 2015). However, AI-based chatbots are not utilized in all German municipalities but are rather part of an upcoming development to integrate e-Government applications into governmental agencies. Therefore, a large number of interviews would not have been necessary. Furthermore, since this research aims to gain a deeper and better understanding of the barriers and challenges faced by citizen service offices, semi-structured interviews are the most suitable method (Newcomer, Hatry & Wholey, 2015).

3.7 Selection of Interview Participants

The interview participants have been chosen based on their level of expertise. They needed to be working on the adoption of the AI-based chatbot from the beginning or have at least extensive knowledge about any barriers that might have hampered the adoption process. Furthermore, only cities that currently deploy a chatbot on their websites have been chosen as this research aims to answer the question in how far barriers to interoperability impact the adoption of AI-based chatbots. Thus, the city will already need to have moved beyond the mere planning and idea gathering stage. Otherwise, the challenges encountered would not be comprehensive enough. This section will further elaborate on the unit and level of analysis and the selected cities.

3.7.1 Unit and Level of Analysis

The interviews have been conducted with experts in the field of AI-based chatbots use in German citizen service offices. Units of analysis have been employees in managerial positions and employees that work with the chatbots in citizen service offices. The participants should have experience with the chatbots and been involved in the set-up, decision-making phase of the adoption of the chatbot, and preferably still be involved in operating the chatbot. Initially the research was also interested in front office employees (agents) and how their work and interaction with citizens might have changed with the adoption of chatbots in their citizen service offices. However, it quickly became apparent that the chatbots are completely

uncoupled from the agents. The level of analysis lies at the managerial and technological level. The managerial level in citizen service office is close to the politicians that take decisions about different applications that should be implemented, such as chatbots. The technological level holds the greatest insights of the barriers faced in this regard and how to overcome them.

3.8 Advantages and Shortcomings of the Research Design

As to every research study there are certain limitations to consider when assessing its outputs. Due to the use of qualitative semi-structured interviews, the research resulted in a small-N study that cannot rely on the law of large numbers. Therefore, the results cannot be generalized to a larger population (Toshkov, 2016). However, the within-case design provides detailed understanding of the case and is supposed to connect the set of variables to make sense of the conceptual framework behind it (Toshkov, 2016). Furthermore, this study may not be representative for the larger problem at hand. However, it can illustrate where barriers to interoperability might have hampered the adoption of chatbots in citizen service offices and from there provide “lessons learned” to other citizen service offices that consider adopting one.

3.9 Conclusion

Figure 4 provides an overview of how the conceptualisation and operationalisation fit in the context of this research. Chapter 2, the literature review, provided the conceptualisation of the The next chapters, 4 and 5 the empirical results and discussion, and analysis, will examine the last part of figure 3, the cases. The four interviewed cities and the results of the interviews will be investigated and analysed based on the conceptualisation, operationalisation and the indicators that are extensively listed in table 2. These indicators, that are nested under the systematised concepts provide the basis for the analysis.

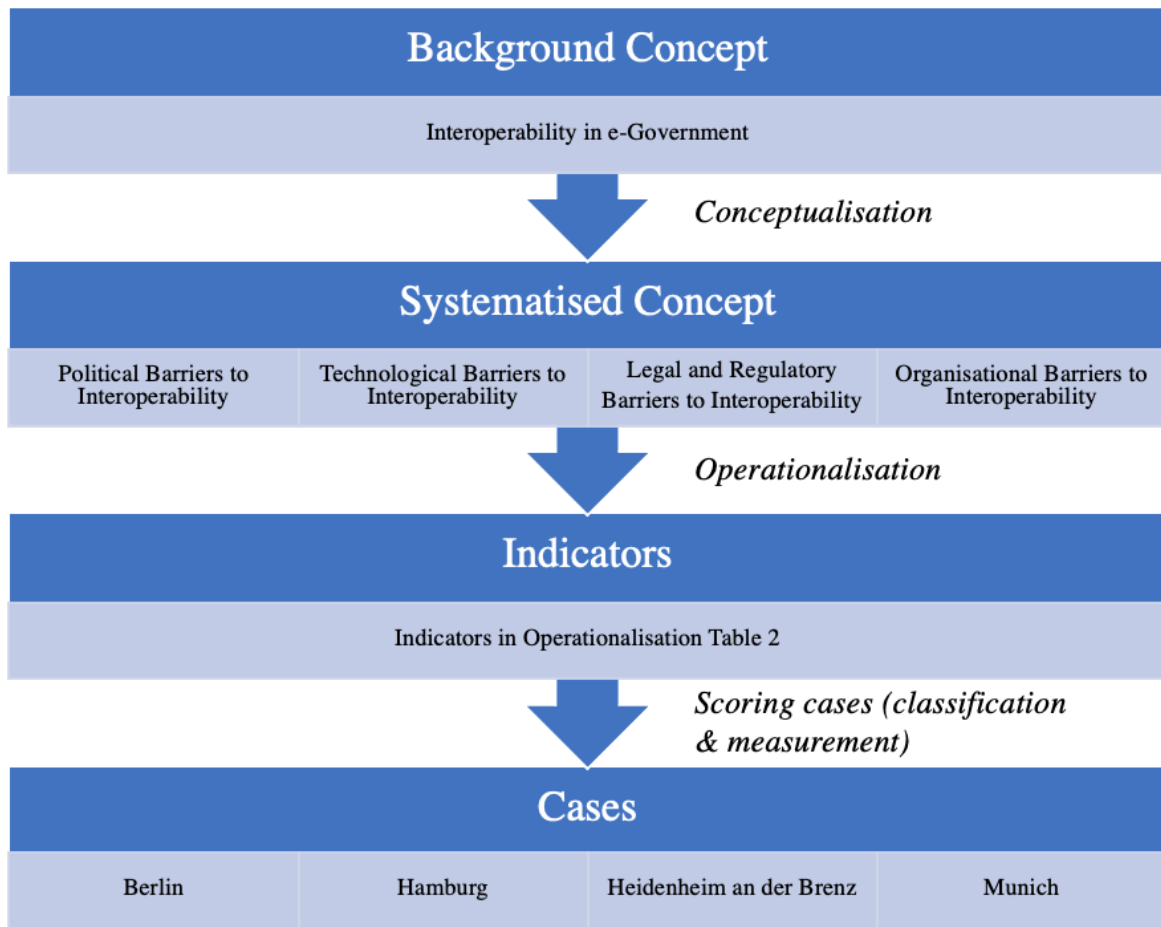


Figure 3: Conceptualisation and Operationalisation in the Context of this Research (Toshkov, 2016, p. 69)

4 Empirical Results

4.1 Introduction

The following chapter will report, outline and synthesise the empirical findings per variable that arose from the semi-structured interviews. To investigate the research question: *to what extent do barriers to interoperability impact the adoption of AI-based chatbots in German citizen service offices?* the conducted semi-structured expert interviews have been transcribed in German and coded with the ATLAS.ti 9.0 program. The coding resulted in 27 codes. The codebook can be found in the [Appendix](#). The codes are linked to the barriers to interoperability, and other reoccurring themes the experts mentioned. The coding process has been done by mixing deductive and inductive approaches. First, the deductive approach stems from the conceptual framework of barriers to interoperability providing the theoretical basis. From there interview segments or quotes have been labelled accordingly. Second, the inductive approach

stemmed from the semi-structured nature of the interviews, which gave room for other subjects to be discussed, and thus aided in the emergence of new codes. In other words, from examining the transcripts, new codes have been detected.

This chapter will start with an outline of the development, the intentions and the process of the each of the chatbots. This is followed by reporting the findings regarding the political, technological, legal and regulatory and organisational interoperability and barriers to it. Furthermore, other challenges that emerged from the interviews will be presented as well. The conclusion will tie the findings together. At the end of each section there will be a table with an overview of the reported results. For each city, an indication will be made whether the interview partner reported a specific barrier, or whether they might have overcome this challenge. For the purpose of readability and understanding, all following citations have been translated from German to English by the author. The transcripts of the interviews in German can be found in the [appendix](#).

4.1.1 Berlin: *Bobbi*⁷

The federal state of Berlin began their cooperation with the DAI Laboratory at the Technical University (TU) Berlin in 2009. The core focus of this cooperation was to derive structures from unstructured data and to link said data to e-Government applications. Within this research cooperation, they started very early to deal with the application of searching technologies through ML and data structures. Since the chatbot market had been thriving in the past years, the research cooperation started to examine what would be possible in their context. The application area had been found within the support context of information provision of the citizen service office.

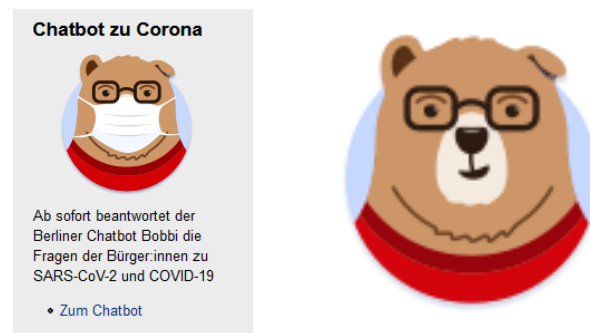
At the beginning of 2015, the citizen-centric approach became the focal point. The ITDZ and TU have been driven by the aim to provide an additional communication channel that could also reach those who are not reached by the existing channels of the citizen service offices. Thus, this chatbot is not to be seen as an individual piece but as part of the access channels to public administration. *Bobbi* is also able to communicate in seven other languages next to German and English.

On June 13, 2017, the chatbot, then still simply called ‘Virtual Citizen Service Assistant’ went live. Since then, the chatbot provides the users with all the information, they

⁷All information from this section has been reported during the Berlin Interview

could also find on the webpage through research. In 2017 the project won second place at the national e-Government competition. Through a naming competition, the name *Bobbi* was finally chosen, and the bear (heraldic animal of the city of Berlin) avatar had been created. At the beginning of 2020, when *Bobbi* was also able to display information about COVID-19 he also received a Mask.

The chatbot usually holds around 3000-4000 dialogues per month, with the additional COVID-19 information provision, this number skyrocketed to over 20.000. Currently, another approach is being discussed. The possibility to also make use of a chatbot regarding internal communication. Especially the IT domain could profit from this as most of the questions they receive are standard questions that could easily be incorporated into a chatbot and thus unburden the IT employees.



Avatar of Berlin's chatbot 'Bobbi' and adjustment with mask

4.1.2 Hamburg: Frag den Michel⁸

Hamburg wanted to provide their citizens with the possibility to access their information provision easily outside opening hours, without having to search for the information for a long time. Through the 115 networks (voluntary network of federal, national and municipal agencies to provide high standard services to citizens) they have already been in close contact with Berlin and knew about their chatbot. Around two and a half years ago, Hamburg also entered a research cooperation with the TU Berlin. This process occurred very smoothly as the chatbot was already developed and the TU already had experience with the incorporation of a chatbot only the data source needed to be changed. The data structure and database are organised slightly differently compared to the one in Berlin, thus, an adjustment had to be made here.

The name '*Frag den Michel*' (ask Michel) stems from the famous St. Michaelis church in Hamburg, which is a well-established term in Hamburg. Other services provided by public

⁸All information from this section has been reported during the Hamburg Interview

agencies also have the name ‘*Michel*’ in their applications. Due to the cooperation with the TU Berlin, the chatbot in Hamburg is also able to hold conversations in eight different languages next to German. *Frag den Michel* holds currently around 2000 dialogues a month. However, the majority, 60%, of these stems from questions to the authority for transport as they placed the chatbot very prominently on their website.



Frag-den-Michel

Branding of Hamburg’s ‘Frag-den-Michel’ Chatbot

4.1.3 Heidenheim an der Brenz: KORA⁹

A great challenge that municipal web pages face is that they are overloaded with information. Heidenheim alone has eight different web pages and around 500 separate pages and content. To support the citizens in not getting lost on these pages and not always having to call the citizen service offices, Heidenheim wanted to provide them with the possibility to use a chatbot. They have aimed to connect different data sources to KORA, such as services but also events. KORA should then provide the answers and to assure legal certainty and up-to-datedness, an interface to the Service Portal Baden-Württemberg has been desired as well.

After a market analysis, the project leader, responsible for the project decided to work together with IBM and the data centre of Baden-Wurttemberg, Komm.One (previously ITEOS). Through a digitalisation funding program, they received a € 42.000 award for the realisation of their project. In June 2018, KORA 1.0 went online. However, in this version, it was not possible to integrate an interface to ServiceBW, the public service portal of Baden-Wurttemberg. Thus, they started to integrate the services via copy-and-paste which has proven to be a very complex undertaking. This led Komm.One to look into possibilities of an in-house solution. KORA now is operated and maintained from Komm.One that also maintains the websites of Heidenheim. This development has also led Komm.One to provide other cities with the chatbot solution and led them to develop Corey, a COVID-19 chatbot. Corey runs on the same basis as KORA but has handled in peak times up to 6000 dialogues per day. Almost all health authorities and the ministry of the interior of Baden-Wurttemberg make use of Corey.

⁹All information from this section has been reported during the Heidenheim 1 and Heidenheim 2 Interview

After a brainstorming session, the name KORA, Kommunale Rathaus Assistentin (Municipal Townhouse Assistant) has been decided upon. Since September 2020, municipal web pages also have to provide videos in sign language. This has been the next step for KORA, together with an Austrian company, [SiMAX](#), that specializes in German sign language they developed an avatar to translate the videos. Since October 2020, KORA can also prominently be found on Heidenheim.de. KORA currently handles around 70 dialogues a day.



Image of the Avatar of 'KORA' used for sign language interpretation

4.1.4 Munich: *Münchner Kindl*¹⁰

The IT department of the city of Munich has been in the process of placing a chatbot on their website for some time now. Around three to four years ago, the topic emerged from a city council request which then should mobilise the needed resources. The chatbot answers questions about general information regarding Munich and the 15 most frequently consulted topics from the citizen service office. This should provide the citizens with faster answers and also release some pressure from the telephone agents.

Through market analysis, they decided to work together with publicplan who developed the GovBot. They already have great expertise regarding the integration of the LeiKa and management solutions and services in the public sector. Through an internal brainstorm session, the name '*Münchner Kindl*' (Munich Child) has been decided upon. The Munich Child is the coat of arms of the city of Munich, this name is also established through various campaigns of the city that work with the same branding. Furthermore, the city of Munich equipped the bot with an avatar that looks similar to their coat of arms but modern. Currently,

¹⁰ All information from this section has been reported during the Munich 1 and Munich 2 Interview

the chatbot is still hidden and serves as a proof-of-concept project. One specific field of application is the Kita-Finder (day-care finder).

At the moment, Munich is on the verge of transitioning to new technology with the same provider. They will switch to the product Botpress, which is open source, through which they will benefit from the approach that the community develops the product further and are not dependent on a single provider. In theory, open source always aims to generate more freedom rights and provide the users with more options. Furthermore, this switch also means that the data centre now will be located in Germany as opposed to the other one which was operated in the United States and thus, presented the IT department with challenges reading data protection regulations.



Avatar of Munich's 'Münchner Kindl' chatbot

4.2 Political Interoperability and its Barriers

Political interoperability can cause challenges for the implementation of a chatbot. Complex governance and administrative structures, party politics, and political opposition can hinder a successful and seamless chatbot integration. This section will present the results from the interviews regarding challenges faced in the political context.

4.2.1 Willingness to Innovate or Lacking Political Support?

Political opposition has been established as one of the main barriers public authorities may face when implementing and adopting e-Government applications. This has also been a challenge mentioned by the expert from Berlin. The ITDZ and the TU Berlin developed *Bobbi* themselves and later received approval from the responsible administration (Berlin Interview). “At the end of 2015, beginning of 2016, we were at a point where we would have liked to go live with [the

chatbot]. But the whole thing didn't start until 2017, because the responsible people from the state of Berlin first had to agree to it. [...] In 2016 there was an election to the Berlin House of Representatives and the new Senate, and the new IT State Secretary in Berlin said '*okay, we can dare to try more beta*', so we referred to that and asked, can we not start with the chatbot as a beta, it took a while." He continues by providing another reason for a shift in the support of the chatbot finally going live. *Bobbi* won second place at "the nationwide e-government competition in 2017, and politicians were then also interested, the state secretary wanted to join us on stage, and shortly afterwards we were allowed to launch". The ITDZ employee also admits having entered the competition to "receive the needed attention so that the state would be courageous enough to go online". *Bobbi* needed to generate users to also generate data, otherwise, the researchers from the TU could not have gained insights from the project (Berlin Interview).

The lack of willingness to innovate has also become apparent with another project that could have provided live waiting times in the citizen advice offices, already at the end of the 2000s (Berlin Interview). However, here, the administrations were also worried and did not want to try it. Another dialogue-based prototype application already has been developed in Berlin. An application through which citizens "can virtually book an appointment; you no longer just find out where you need to go but you can actually complete [the process] by booking the appointment. We have already implemented that, and it can go online at any time." The administration would have to decide on that, "however, there are hardly any free appointments and then we would have another channel telling citizens that there are no appointments at the moment. Therefore, it does not make much sense right now" he also said that they will have to "wait and see" how "brave the state [Berlin] will be" since "the willingness to innovate in politics is sometimes a difficult thing".

Heidenheim did not encounter similar difficulties. After they "received the funding approval [from the digitalisation support program by the ministry of the interior of Baden-Wurttemberg], [the initiator] did not have any problems finding supporters in the municipal council. However, the city of Heidenheim works together very well with the municipal council (Heidenheim 1 Interview). Heidenheim's chatbot expert also gave a couple of presentations to other cities on chatbots and digitalisation in Baden-Wurttemberg. There, he said he also received a lot of appraisals for "going online with an unfinished product, the beta version, and [they knew] very well that [KORA] is buggy and some kind of nonsense can come out of it." He continues by mentioning that "that is not what an administration usually does, usually something is tested 100,000 times and then again and then you have to get x approvals and all

the stakeholders have been consulted on the subject and that is why it all takes so long. Bureaucracy gets in the way. Going online with an unfinished product [...] was no problem at all because no one's head was ripped off, no one complained. To the contrary, there were compliments and it is great that you're trying something like this. [Some pointed to *Kora* making mistakes] and then you say thank you, then you correct the mistake and the next time it's right." (Heidenheim 1 Interview).

There is another example of political support from Munich, where the political side also took the initiative to adopt a chatbot. The city council there said that "it is important to tackle the topic of chatbots and [...] to use new communication channels. [Further,] chatbots are already used in other municipalities" and the digital department has been "receiving corresponding requests from politicians that [they] should do more in this regard" (Munich 2 Interview). The external consultant also gave another perspective on this. He pointed out that "the politicians also want to tick the box on their checklists to say, '*we have a chatbot, we are modern and great*'" (Munich 1 Interview).

4.2.2 Lack of Technical Expertise by Politicians

Not only a lack of political support can hamper technological advancements but also a lack of technical understanding on the political side. This is an observation made by the representatives of the city of Munich. It appears that politicians might have the implementation of a chatbot on their "checklist" but "when talking about the actual hard benefits, there may be two city councillors who really know what they are talking about, and the rest would like to add it to the list of what Munich has to offer." (Munich 1 Interview). He continues by pointing to the issue here. "We have to win clients internally who want to use the bot. [...] the problem is that the politicians come along [...] with the idea that Munich needs a chatbot on its homepage that can answer all questions about the city." However, during the implementation they experienced that one "has to choose a very narrow set of application areas where I know 80% of the enquiries are these 10 enquiries in principle and I can work through them well with the bot. So that the probability of [the chatbot saying] '*I didn't understand you*' or '*I can't help you*' is as low as possible. If the user receives this 3 times, he never tries it again." (Munich 1 Interview) This could especially pose an issue when the chatbot would be placed on the Munich homepage since the chances of the chatbot not being able to answer the questions are very high (Munich 1 Interview).

This is a challenge that has also been raised by the interview participant from Berlin. He said that with the election of oftentimes laymen politicians, “the foresight isn't there, and I've been a civil servant in Berlin for a relatively long time now, politics comes and goes, the apparatus remains, and it's often laypeople who are elected who certainly have enjoyed a good education but whether they then really have the professional suitability to become Secretary of State [...] sometimes is not clear” (Berlin Interview). Thus, politicians often can lack sufficient knowledge of the technologies or the compatibility of the public administration’s needs and capabilities (Berlin Interview; Munich 2 Interview).

4.2.3 Hierarchy and Party Politics

That politics can get in the way of innovation and thus, the adoption of a chatbot, can have various reasons. One is party politics. The expert from Berlin pointed out that sometimes it is difficult to work together with “different political colours” as the approaches of the ITDZ are “interdisciplinary, interdepartmental [...] it was precisely then that it became difficult to really find permanent partners, which is something that we only succeeded in doing for the first time with a certain publicity effect with the chatbot.” Furthermore, “the willingness to innovate in politics is always such a thing, especially since we also experience that rivalling parties begrudge each other.” (Berlin Interview).

The hierarchical and branched organisation of public administrations also proved to be a barrier for Munich’s chatbot. Since the chatbot needs to be provided with every possible dialogue flow, to link possible questions and answers, this package must be delivered to the IT department (Munich 1 Interview). “Coordinating that with the departments is demanding in a city with [...] six-figure employees. It's a relatively hierarchical and branched organisation and therefore it's all very political, which means that before something is submitted, whether we can say something or not, it can go up to a very high level and be very difficult to decide. So that is definitely one of our biggest challenges” (Munich 1 Interview).

		Berlin	Hamburg	Heidenheim	Munich
Political Barriers to Interoperability	Lack of political support due to unwillingness to innovate	(✓)			
	Lack of technical expertise by politicians	✓			✓
	Hierarchy and party politics	✓			✓

✓ = still a barrier

(✓) = overcame this barrier

Table 3: Overview of Political Barriers to Interoperability per City

4.3 Technological Interoperability and its Barriers

Technological barriers to interoperability are according to Scholl (2005) the easiest to solve and multiple standards such as XML-based inter-agency information sharing are implemented already or are on the verge of being implemented. However, there are still various interoperability challenges that need addressing. This section will present the results from the conducted interviews regarding technological (barriers to) interoperability.

4.3.1 Compatibility of the Systems

One technological barrier to interoperability that likely is the most obvious one is the compatibility of different systems, standards or legacy systems. This barrier has also been highlighted in the literature (Pardo, Nam & Burke, 2011; Bekkers, 2005). In the context of the chatbot it has become clear that it is of utmost importance that the system needs to be compatible with the database that hosts the information regarding the services provided by the citizen advice offices (Hamburg Interview, Berlin Interview, Heidenheim 2 Interview, Munich 2 Interview). One of these is the “so-called LeiKa Catalogue, the service catalogue for administration solutions or services” (Munich 2 Interview).

The ‘*Münchner Kindl*’ has been developed by publicplan they have a “special expertise regarding the implementation with LeiKa”. The chatbot is configured in a way that there is an interface between the chatbot and the website München.de (Munich 2 Interview). “That ultimately is a content management system [one can] also enter a question or keyword [on the website] and then the corresponding hits [...] are provided.” said the head of the e-Government division of Munich. The chatbot receives the asked question from the content management system and if it “recognises that [question] could belong to one of these criteria, then [it] finds a corresponding hit and pulls the data from the interface and fetches the corresponding entry from the service finder, prepares it and displays it.”

Kora’s service integration is completely fulfilled, all offered services are fully integrated (Heidenheim 1 Interview). This was, however, not as easy with IBM Watson. There, the responsible employees had to enter all data in a “copy-paste manner” (Heidenheim 1 Interview) as it was not possible to build an interface between the chatbot and Watson. The product manager of *Kora* also mentioned that one of the great advantages of working together with Komm.One is that they can create an interface between Heidenheim’s website, the content management system, and *Kora* to enable the chatbot to fetch data from there as well. The

combability here is much easier since Komm.One is also responsible for the website, thus there is no problem with these systems being interoperable.

The architect and strategic planner from the ITDZ elaborates a bit more on the challenges regarding system compatibility. He points out that information processing for telephone services and the chatbot should differ, not only might the target group be different but more importantly, it should suit the channel through which the information will be distributed. Furthermore, what is still missing as well are certain interfaces that should link the various systems that will emerge “through the implementation of the OZG such as a data cockpit, the register modernisation act, but also the retrieval of registers as part of the application process.” (Berlin Interview). Legally, all these advancements are possible, but the expert from Berlin addresses a bigger challenge: “only with the appropriate technical standards [they] can apply the systems and here, [they] are still far away regarding bot technologies”. Berlin considers the “FIM with its three building blocks: data fields, processes and service descriptions” can be of great support in this process.

The developments, however, are not that advanced yet. “The standardisation of information processing and the building blocks repositories is still rather empty. Not all of the editorial offices [that should provide this information] have been established yet” (Berlin Interview). Nevertheless, it is crucial to standardise and connect the systems and repositories and to model paths for the development across the federal states. Therefore, the municipal, the state and the federal editorial offices need to be established and fill the repositories (Berlin Interview). The ITDZ employee continues by pointing out that “we have a lot of homework to do but are on a good path. But a lot needs to be done in different places so that these channels [chatbots] can be supplemented or expanded” regarding the new abilities provided through the OZG. However, the corresponding XML standards are still in progress and not done yet. “There are these XZUFI¹¹ [formats] that support the competency finder [...] this is also how Hamburg's chatbot accesses its data [...] but this is a low-threshold format [that only provides information regarding] locations and services, we have been doing this for five years and it would be great to reach the next stage.” (Berlin Interview).

Nevertheless, XZUFI is a very complex format and has only been established after Berlin already had a chatbot. Therefore, the first version of *Bobbi* used a simplified JSON¹²

¹¹ Standards for data exchange concerning public services

¹² JavaScript Object Notation, a file format stored and transmits ‘human-readable’ text to objects that consist of attribute-value pairs and arrays to communicate with a server.

format since this provided easier ways to parse (analyse) the data. Currently, XZUFI is only used in the appointment booking tool in *Bobbi*, in a test version (Berlin Interview). Hamburg's *Frag-den-Michel* also fetches its data from a service database in Hamburg (Hamburg Interview) which is based on XZUFI. "There, there are around 4500 services listed and described which also is the basis for the telephone service [...] and an administration finder" (Hamburg Interview). However, since Hamburg's administration also cooperated with the DAI Laboratory at the TU Berlin, it has been very easy to simply change the database to the one relevant for Hamburg (Hamburg Interview). "The database, however, is structured a bit differently than the one in Berlin and thus a few adjustments had to be made but [the chatbot] went online into the test phase relatively quickly, as this is the only way to see where adjustments have to be made" said the manager of the citizens' service office department (Hamburg Interview).

The importance that has been established by the interview partners, here is that the interface between the chatbot and the database is configured and developed reliably. Here, Hamburg enjoyed the benefit of following in Berlin's footsteps and being able to implement and adjust an already existing chatbot into their citizen service office. Thus, generally, none of the cities faced major technological barriers regarding the system compatibility when building these interfaces. Nevertheless, technical standards that would simplify the process are still missing and should be developed soon to also progress and take the next steps in chatbot development (Berlin Interview).

4.3.2 Data Interoperability? Provision and Quality

During the expert interviews challenges concerning the data quality and data provision became apparent. The participants from Hamburg already mentioned that there were no serious issues regarding technological integration in general. However, they commented that the barriers they faced "from the beginning, [were] the data quality and [thus] the comprehension abilities of the bot, the understanding of the dialogue has been the problem". "The greatest challenge really is to assure data quality." Sometimes data is not available at all, mentioned the working student from Hamburg. This is an issue that concerns various public and district agencies, and he will "then have to write to the respective editorial offices [...] and ensure that they will correct the information or even provide it in the first place." When asked the follow-up question on how they are working on solving these issues, one expert said that they work together with a "department which acts like a state editorial office that maintains and supervises service

provision data or asks the individual authorities to improve the description if necessary. Thus, proper data maintenance is one of the greatest barriers mentioned in Hamburg. “The data has to be provided in the correct fields so that the bot can fetch the information” properly (Hamburg Interview).

This observation is also in line with what the experts from Munich reported. “The specific preparation of the dialogue, really delivering the content, is actually the greatest challenge.” (Munich 2 Interview). The external consultant said that “the data basis is there, but it has not been built for a chatbot, meaning the texts are very long and formally phrased”. He continued by mentioning that perhaps in the future this might change, that a ‘bot first’ approach will prevail, just like mobile-first has prevailed (Munich 1 Interview). The challenge of proper data maintenance has not only been faced by Hamburg, but also by Munich. The external consultant explained that future “data paths [could be] added, and that the bot [could also] read [data properly] but for a city like Munich, that means the departments and agencies have to define and maintain the content” (Munich 1 Interview). He also points to the importance of the data structure data. If the data structure is not stable, the bot will have difficulties knowing where to fetch the correct data to the questions posed (Munich 1 Interview). The head of the e-Government department complemented this by also pointing the challenge of avoiding redundancy. “We do not want to maintain two different texts for the same issue”. Currently, there is an interface between the service finder and the webpage of Munich and the “reproduce these texts more or less 1:1” to avoid having another content area just for the chatbot which would mean to double the work (Munich 2 Interview).

The chatbot expert from Komm.One talked about the challenges they faced when first cooperating with IBM Watson. Due to the nature of one public service, they had to type in many different questions and answers into Watson (Heidenheim 2 Interview). “IBM Watsons technology requires an extremely large amount of hits and then I wondered, do I really have to do it like this can we not build an in-house solution that is more elegant and AI-based? That is how we arrived at the current solution” (Heidenheim 2 Interview). She continued by pointing out that “most cities and municipalities provide their offered services on their websites, and this is what is interesting for the citizens” (Heidenheim 2 Interview). Since ServiceBW is structured in a way that makes it easy to add an interface between it and a chatbot, Komm.One was able to quickly develop such a system (Heidenheim 2 Interview). Afterwards, the Komm.One expert continued by mentioning that the integration of the event calendars that “is also an important topic on the municipal homepages [...] another interface has been added”.

Here the issue of data maintenance is noted as well, “where centrally needed” data needs to be updated, but in the end *Kora* “pulls the data via the interfaces and guides the user through keyword allocation to the answer” (Heidenheim 2 Interview). However, she also points to the fact that the services do not change that often, thus data maintenance has not proven to be a major issue for them. “On the municipal websites, you have the interfaces, and services do not change that often, thus one has to make the effort in the beginning once” and only update from time to time (Heidenheim 2 Interview). The chatbot expert from Heidenheim explained why proper data maintenance, provision, quality and training is crucial: “When providing a chatbot on your website, especially on your homepage, it should function properly and know a lot. Because if *Kora* can't answer a question the first time, maybe not the second time and not the third time either, then [...] she has lost the user. [...] that is why we integrated KORA first into *Heidenheim.io* so that we could really separate the two websites, to avoid getting embarrassed, since *Kora* did not know much at that time, [and we did not want to risk] that the chatbot is devalued by the users.” (Heidenheim 1 Interview).

4.3.3 Digital Infrastructure

One barrier that has been highlighted in the literature, and especially by Schwab et al.'s (2019) research was the insufficient digital infrastructure. This, however, has not been an issue for the adoption of a chatbot in the selected cities, according to the interview partners. The participants from Hamburg said that there were not any problems regarding the IT or digital infrastructure. “Regarding problems of technological nature, we did not have any serious issues”. The interview partner from Berlin shared these experiences, he said that they “have various computer centres, also for data with a very high need for protection [...] and we have partners such as Berlin Online who are responsible for the city portal and also the TU has their own computer centre. So, we are very well equipped, so that the infrastructure has never been an issue.” Furthermore, he pointed out that they regard the chatbot as a beta project, and “when we talk about beta, we also have to accept certain possibilities that it sometimes does not work, then we do not provide a 99.9% availability, since no one is paying for it to that extent, but we want to gather experiences” (Berlin Interview).

Kora, the chatbot developed for Heidenheim, has been enjoying a similar comfort. The interview participant said that the first version of *Kora* when they still approached the project with IBM, they “were very lucky that parallel to [the development] IBM built a large computer centre in Frankfurt am Main” (Heidenheim 1 Interview). Thus, no issues occurred here in the

beginning phase and also when later switching to Komm.One, no infrastructure barrier was faced: “I believe they even have four computer centres here in Baden-Wuerttemberg.” (Heidenheim 1 Interview) Lastly, the experiences shared by Munich were very much alike. In the first interview, the participant mentioned that since the chatbot there is “a web snippet, we work with a cloud solution and the [chatbot] fetches public accessible data from München.de and passes them along or refers to it [the information]” (Munich 1 Interview). Thus, the chatbot does not “have a touchpoint with the infrastructure”. However, Munich thought about “making a transition onto their own infrastructure but that would have been a nightmare since one would disconnect [the chatbot] from the stream that develops it [...] then everything has to be transferred” and that would be an expensive undertaking (Munich 1 Interview). The second interview partner from Munich added that since the system is not in such an extensive use (yet) there have not been any issues regarding the “stability or the peak loads”. He also points out that, nowadays, the scaling of chatbots has been constructed in such a manner that it should not pose an issue either (Munich 2 Interview).

4.3.4 Dialogue Comprehension

Heidenheim’s and Berlin’s interview participants both pointed towards another barrier that can hinder the successful adoption of an AI-based chatbot, the variety of services offered, connected to one keyword. For example, when a person types ‘I need a new ID card’ (Personalausweis) into the dialogue field of the chatbot, the chatbot might provide incorrect information due to the user not being specific. There are various services and versions linked to the ID card, one person might need to request a temporary ID card, another one wants to apply for an ID card for 16-year-olds (Berlin Interview). Since Berlin’s *Bobbi*, is equipped with ML capabilities, it will notice soon that “80-90% simply want a regular ID card and *Bobbi* used to ask many questions, do you mean this one? or that one? and with time these questions will we dropped since 80% want the regular one” (Berlin Interview). The question that then arises here, does one want to “shorten the user experience and make it more elegant for around 80% or is one picky and always asks all the questions and most people will be like 'yes of course I mean the regular one’” (Berlin Interview).

Heidenheim also encountered a barrier regarding the high dialogue variety of offered services. Since it was not possible to directly build an interface between *Kora 1.0* and ServiceBW they entered the information in a copy-paste manner (Heidenheim 1 Interview). “There, we started with the ID card and passport, and that are only two topics of around 600, and there alone we already had 255 different response components, different possibilities. [...]

per service multiple topics have to be covered, and questions can also be asked regarding those. That made it highly complex” (Heidenheim 1 Interview). Therefore, he continued by saying that one needs to link the chatbot directly to the database “which has been a lot easier with Komm.One” (Heidenheim 1 Interview).

		Berlin	Hamburg	Heidenheim	Munich
Technological Barriers to Interoperability	Compatibility of the systems			(✓)	
	Data provision and quality (due to lack of cooperation with other departments)	✓	✓	✓	✓
	Digital infrastructure				
	Chatbot’s dialogue comprehension	✓	✓	✓	✓

✓ = still a barrier (✓) = overcame this barrier

Table 4: Overview of Technological Barriers to Interoperability per City

4.4 Legal and Regulatory Interoperability and its Barriers

Since Germany is known for its strict data protection regulations, it could be expected that these will pose some challenges to the chatbot adoption as transferring or storing of data might be impacted by these regulations. Furthermore, the highly limited legal and regulatory landscape regarding e-service adoption does not appear to give guidance on how citizen service offices can best implement AI-based chatbots. This section will present the results obtained through the interviews regarding legal and regulatory barriers to interoperability.

4.4.1 Legal and Regulatory Framework

The legal and regulatory framework concerning the implementation of AI-based chatbots in citizen advice offices is not a clear cut one. However, there are various data protection, tender, and procedural regulations that need to be considered. Naturally, a public agency cannot provide flawed information online. Since there are “a few thousand of them [services], we pull all these services via an interface [between ServiceBW and *Kora*] and integrate them into the homepages of the municipalities to assure legal certainty” (Heidenheim 2 Interview). The interview partner from Komm.One said that due to the development of an interface between *Kora* and the ServiceBW portal, the information is legally certain as well. This is a great advantage as the cities using the chatbot system developed by Komm.One, can rest assured that “every single service has been approved by lawyers and written by editors so that [the

services] are [presented] in more colloquial language and citizens are provided the legal basis and know what they need to do to make use of the services” (Heidenheim 2 Interview). The legal certainty of the information, is, therefore, not changed since the chatbot pulls the data directly and it is not cached anywhere (Heidenheim 2 Interview).

The interview partners from Hamburg responded to the question of whether they rely on any specific regulations or oversight bodies, by saying that they “do not have any kind of approval authority that directly takes a look at it [the chatbot]; we design the chatbot as the IT department within the corresponding legal and regulatory framework that is set for us.” (Hamburg Interview). During the first interview regarding Heidenheim’s *Kora* another topic – the financing of the chatbot development – has been highlighted. The public sector usually has to tender from a certain amount onwards when they are planning on buying a solution from the private sector. Thus, the question arose whether Heidenheim could “just give around €100.000 to a private company [...] or does it need to be tendered and then companies from the private sector can apply for it” (Heidenheim 1 Interview). The accounting control department of Heidenheim, however, assured them since no other city has done this before, Heidenheim was free to decide that IBM would receive the tender (Heidenheim 1 Interview).

The COVID-19 pandemic pointed to another regulatory and legal framework barrier that has not been faced before. Berlin’s chatbot *Bobbi* has been adjusted to also provide information about changing rules and regulations regarding the virus (Berlin Interview). “The senate [the ones responsible for new regulations] hold a meeting every Tuesday and likely discuss amendments regarding the current COVID-19 regulations [...] the press release that the new amendments have been discussed will then be released the next day, maybe even on the same evening and who watches the evening news will be informed already” (Berlin Interview). However, these regulations or amendments are officially not yet adopted as they first will have to be announced in the “Journal of Law and Ordinances of Berlin, and only with this announcement they will become official, and *Bobbi* only provides official information” (Berlin Interview). He illustrated the problem that arises with the example of the senate deciding that stores will have to close next week Tuesday. However, as also pointed out by the Komm.One employee, a public agency cannot publish information that is not yet official or even flawed (Heidenheim 2 Interview).

Essentially everyone will know about these regulatory changes on Tuesday evening, when the news report it, or on Wednesday when the papers print it. The Journal of Law and Ordinances might, however, only be published on Friday and only then the changes will become official (Berlin Interview). Unfortunately, “on Friday’s no editor is working anymore

who could update the FAQs which shops will still be open, and *Bobbi* will, therefore, keep announcing outdated information.” (Berlin Interview). The chatbot can only provide official information as it is part of the official information channels of the citizen advice office. This problem with the procedures causes a delay in updating the information. That in turn, leads to the editors “chasing the updates” since new regulations could be decided upon the next Tuesday (Berlin Interview). The ITDZ professional then raises the question that “if [the editors] already know something, but it is not yet official in terms of jurisdiction or proclamation, [are they] allowed to announce it as if it already were official.” These regulatory procedures place a great burden on the up-to-datedness of information provided by *Bobbi*.

4.4.2 Data Protection and Privacy

As mentioned earlier, Germany holds pride in its strict data protection regulations. Therefore, this has been expected to provide some challenges in the adoption of AI-based chatbots. A reoccurring topic and agreement in this regard has been that it is crucial to store the data in computer centres located in Germany (Interview Berlin; Munich 2 Interview, Heidenheim 1 Interview). None of the chatbots are built in a way that they ask users for or process personal or sensitive data (yet). All of the bots also have a disclaimer that ask users not to disclose personal data. Thus far, these chatbots are merely information-providing chatbots. Users cannot yet fill out forms or ask person-specific questions such as, ‘what is the progress on my parking permit?’. Nevertheless, this does not always keep users from still providing their sensitive personal data which then could turn into a data protection and privacy issue. “That is the problem since it is an open text field, [people] can obviously type in personal data, [their] phone number, blood type, basically everything and the data is then being saved,” said the expert from the first Heidenheim interview.

Therefore, the chatbot expert from Heidenheim also emphasises that it has always been very important to him “that the data will be hosted in Germany”. The second interview participant from Munich mentioned that with their switch to the platform BotPress, which is open source, they would also switch from the computer centre in the United States to one that is located in Germany. The first expert from Heidenheim also mentioned that it has always been very important for them that all data would be hosted in Germany. This has not been an issue for them as in their initial cooperation with IBM since a large computer centre has been built close to Frankfurt am Main, where all data could be stored; and in their later cooperation

with Komm.One, the provider of various computer centres located in Baden-Württemberg, this has not posed any issues either.

The concern of people inserting personal data into the chatbot field is shared by the interview partner from Berlin as well: “we noticed very early on in the use of the chatbot is that we deal with data from people who use the chatbot, but do not even realise that they are not talking to a human being. [...] There are people who, if you look at the dialogue chains, keep asking questions, ‘*Hello, did you understand me?*’ and also share personal data and say ‘*I am Hildegard Meißner and am severely disabled, my husband also has cataracts and I think I need help with care*’ – that is very sensitive data that you really don't want to have stored outside a public data centre.” He continues by saying that it is understandable that people test these kinds of things but that the administration has “to assure that when it is tested out, information does not end up somewhere else”. The ITDZ employee further pointed out that it “is not necessary to use the power of a giant cloud from a US online provider, [...] and [the chatbot] should not be run outside computer centres hosted by the public sector, since sometimes very sensitive data is handled and if someone is volunteering this kind of data, it should be to the public authorities as [they] are not doing anything with it”.

Regarding data security, the expert from Berlin said that they have never experienced an attack on their computer centre that stores the data from the chatbot. “Even if [that were to happen] it is not like someone could get deep into the computer centre and access any data. We never experienced an attack”. He also mentioned that there is a “certain kind of respect to not attack services of public authorities” (Berlin Interview). Heidenheim’s expert explained that they included their data protection officer, in the development process *Kora* and did not experience any regulatory issues (Heidenheim 1 Interview). Komm.One’s representative considered the data protection concerns from another perspective. From her experience in working with online applications, she points to the crucial consideration that data “must be transferred securely through the administrative procedure or to the person in charge. [There they] must ensure data minimisation, meaning that only the strictly necessary data is processed, [...] and the exact path of the data must be described to the citizens as well” (Heidenheim 2 Interview).

Concerning the cloud solution used by Munich, the first interview participant mentions that they “surely have stricter data protection requirements [...] even if [the data is stored] on a German server, but we know that the Americans can get basically anything they want. But generally, the idea is that the chatbot should not process any personal data.” (Munich 1 Interview). The cloud aspect has also been raised by the head of the e-Government department

of Munich. “We have also discussed the data protection issues with them [publicplan] and with our data protection officers, that is to what extent personal information ends up on the cloud platforms. But since this is kept in the sessions and nothing of it is used afterwards, we were given the ‘go-ahead’. There are topics where personal information is involved in the dialogue, but when the dialogue is over, the data is gone. But during the dialogue, it is somewhere, but in case of doubt it is protected on the corresponding cloud platform.” (Munich 2 Interview). However, the IT department of Munich also does not want to include any personal data (Munich 2 Interview). Since Munich’s chatbot will migrate from Synology, a platform hosted in the United States, to a new platform, BotPress, which is hosted in Germany, their data protection concerns and challenges regarding the jurisdiction “will be shelved” (Munich 2 Interview).

On the other hand, Munich’s external consultant raised another challenge he faced during the chatbot adoption. Within public administrations there are always great data protection concerns. The data protection officers “have the greatest concerns, all kinds of concerns, such as entering personal data into the free text field, what happens to it, who sees it, who has access to it, on which servers is the data stored, what mechanisms do they have to prevent that, what mechanisms do they have so that no one sees it, how do we get it to be deleted again as quickly as possible. These are all things that are a bit contradictory, so for it to be deleted quickly, someone has to see it, an AI has a very hard time detecting that something is ‘prohibited’ personal data or that this is other data. So, an address per se is not a problem, but of course, you can combine it in a way that it can become a problem. Data protection has all kinds of concerns, but some of them are simply not technically solvable and yes, on the one hand, no one should look at it and on the other hand, someone should look at it and delete it” (Munich 1 Interview).

4.4.2.1 Future Visions - Future Problems?

Nevertheless, even though the issues regarding data protection and privacy regulations do not appear to hinder the development of chatbots at the moment, it appears that future development and expansion will face challenges. Currently, the chatbots work as straightforward information provider, no personal information is asked of the users. However, most of the cities studied, Hamburg, Berlin, and Heidenheim, have visions of expanding the development and usefulness of the chatbots. The experts from Hamburg stated that “when we go further in the development, we want to offer direct interfaces between the chatbot and online procedures

where personal data will be taken from the dialogue [between the user and the chatbot] and would then be provided to the online process. Then we would need to re-examine the data protection question.” Munich’s expert, on the other hand, stated that something they are disregarding due to complexity, but also data protection concerns, is a transition from the chatbot to a service centre employee. “It would be interesting to be able to forward [the conversation], but then one would need access to the previous conversation, otherwise the question will have to be asked again, and that would be nonsense”.

The future visions for Heidenheim’s chatbot go in a different direction; here the experts talked about the aim to develop a speech-to-text or speech-to-speech ability. This ability should then be “connected to the application processes, so that *Kora* can tell me here is a form [... and] *Kora* can already fill it out [...] via ServiceBW”. This could work in a way where *Kora* asks the user their name, address, etc. and automatically fills out the online form and the user would receive a summary in the end and be asked whether to send it or not. In the end, the user would just receive a confirmation e-mail and could even pay online. The whole process would have been conducted without media disruption (Heidenheim 1 Interview).

Berlin’s *Bobbi* has already been tested regarding a skill integration for Alexa or Google Assistant that would provide the speech-to-speech ability. However, the skill that has been developed during a Bachelor thesis project has not been made public. The expert from Berlin stated that the problem that would arise with such an implementation would be that people would likely provide very personal and sensitive data, which would then “leave the European data protection area, that is just the case with these US American virtual assistants that process natural language [...] we cannot control where the processing takes place and what happens with [the data]. Nevertheless, there are enough people who bring something like this into their home for reasons [such as accessibility]”. Therefore, he continued, the question that arises is that when there are people that willingly accept the unclear data processing and storing, why should Berlin not offer such a skill? “This decision should be taken by a public institution and not through a study project” and thus far no one has taken this decision as “it always comes back to data protection, privacy shields, or dataflows” (Berlin Interview). These discussions with data protection officials, however, appear to often end in deadlock as no perfect solution can be found that will assure 100% data protection and still provide the user will all kinds of functions.

Another project that has been considered by Berlin is to link the chatbot around the OZG regarding the topic of user accounts. “Such a technology may also be included as an assistant in a service app that then proactively reminds you that ‘*your ID card will expire soon,*

I book you an appointment for a new one’, that is relatively trivial to implement.” (Berlin Interview). According to the expert from Berlin, there are various opportunities regarding the developments around the OZG, but he also mentioned that they are not planning on developing these technologies themselves.

		Berlin	Hamburg	Heidenheim	Munich
Legal and Regulatory Barriers to Interoperability	Legal and regulatory framework	✓			
	Data protection and privacy	✓*	✓*	✓*	✓

✓ = still a barrier (✓) = overcame this barrier ✓* = barrier for future development

Table 5: Overview of Legal and Regulatory Barriers to Interoperability per City

4.5 Organisational Interoperability and its Barriers

Organisational barriers to interoperability are as manifold as the other three. There usually is not only one single organisational barrier that hinders the implementation of an AI-based chatbot in the public administration sphere. Internal acceptance, lacking structured processes, and disagreement between departments, to name a few, have been identified in the literature. This section will present the findings concerned with organisational interoperability that have been extracted from the conducted interviews.

4.5.1 Citizen Service Office Employees and the Chatbot

As established in the conceptual framework, research found that a lack of IT-savvy employees and thus their ability to work effectively with the chatbot can pose a great organisational barrier to interoperability when adopting e-Government services (Pareira et al., 2017; Schwab et al., 2019). Technological knowledge has been expected to be needed to exercise maintenance of the chatbot, such as altering answers or adding tasks. However, through the interviews, it quickly has become apparent that none of the citizen advice office employees that currently answer citizens questions and process their requests will have anything to do with the chatbot directly. According to the experts from Hamburg, “the service centre employees are solely on the phone or respond to e-mails the chatbot is completely independent of that”.

The ones currently responsible for Hamburg’s chatbot *Frag-den-Michel* have all been present at the panel interview (Hamburg Interview). Heidenheim’s *Kora* also operates rather

autonomously as the interface between ServiceBW, the other databases, such as the event calendar, and the chatbot are fully implemented (Heidenheim 1 and 2 Interviews). In Munich, there are also only two people tasked with the operation and maintenance of the chatbot (Munich 2 Interview). The IT department of Munich is responsible for the IT platform and the other departments produce and provide the content that should be added to the chatbot's database. However sometimes, the IT department also "has to get the content from somewhere else and here other domain experts are involved" (Munich 2 Interview). Berlin has a similar approach to their *Bobbi*. "The processing of information happens anyway. The so-called performance editors or site editors who are responsible for the administrative services already existed before; they have to do this work anyway and. Therefore, no additional staff is required to process the information [...] we only have two research fellows at the TU who are responsible for the system. Neither of them full-time because we are at a point where *Bobbi* regularly fetches the information from the different sources" (Berlin Interview). This, in combination with the built-in NLP¹³ and NLU¹⁴ engines ensures that the chatbot processes everything autonomously and thus, there are almost no additional tasks that would need to be fulfilled by anyone (Berlin Interview).

However, he acknowledged that not having additional staff to process can also be a disadvantage. The current editors "often do not have a feeling for the different channels where the information is presented". Thus, the information *Bobbi* might catch from the database could be too long for the chatbot window or presented in administrative language which differs from colloquial language (Berlin Interview). An example for this was also presented by Hamburg. The interview partner presented the example of paternity acknowledgement. "If someone wants to recognise that a certain child is theirs, then you might enter "*paternity acknowledgment*" [...] into the chatbot, but the term used in the administration is '*guardianship*'." The colloquial language does not always correspond to the administrative language and that needs to be linked. Munich is also faced with challenges in this regard. Thus, proper data maintenance must be assured. The first interview partner from Munich pointed out that if other departments could update their information on the database themselves, that would, of course, disburden Munich's digital department, but could also cause great trouble. "To create a new flow is thematically limited but requires very extensive [technical] rights [...] then we would also need someone

¹³ Natural Language Processing handles the text in a literal sense

¹⁴ Natural Language Understanding manages the intent and context of the text, thus what the person in this case means by their question.

with sufficient technical affinity in the specialised departments [...]. Thus, the operation of the platform will have to stay with us” (Munich 1 Interview).

4.5.2 Internal Acceptance

One of the organisational interoperability barriers that have been identified in the conceptual framework has been the lack of internal acceptance of the new technology (Pareira et al., 2017). This theme has also come up in the interviews. During the first interview with Heidenheim, the participant mentioned the “fear of digitalisation”. He said that the “greatest problem is that, when you have [...] co-workers that are afraid of something new, along the lines we do it like this since 25 or 30 years and now someone is coming along and wants to change everything.”. The conversation continued with him pointing out that “it always is about taking away these fears [...] and showing the added value of digitalisation, [...] it has always been very important for us to not digitalise for the sake of it but rather only to digitise there where it serves a purpose, [...] also for the employees”. To overcome and combat resentment, Heidenheim justified the adoption of a chatbot to their employees. “We explained that [...] it is much better when a machine, a chatbot can answer standard questions so that [the employees] can concentrate on essentials and do not have to explain 120 times a day that people can pick up yellow sacks [local waste disposal bags] at the citizen office”. After testing the chatbot it has been accepted well even by the sceptical employees (Heidenheim 1 Interview).

Munich reported that these fears “of being replaced” could also arise in the call centre context. However, the interview participant said the “since we did not place the chatbot in this environment [...] these discussions did not really come up and those who engaged with the subject a bit more, they [...] will see the potential that [the chatbot] can disburden [the employees] with standard questions” (Munich 2 Interview). Berlin approached this potential barrier from yet another side. The interview partner explained that they first thought about the different target groups they wanted to reach with the chatbot, such as people who generally do not like to get in touch with public administrations, people who are not fluent in German and prefer asking their questions in different languages, or people who simply prefer self-service options (Berlin Interview). Therefore, they “saw that there is an interest and a market [...] and have also viewed it from the aspect of accessibility and said that we should provide such a channel precisely for the different groups that we do not reach via the telephone channel”. He continued by saying that they “received great understanding from the service centre employees, we never had the situation that they felt we want to replace them or anything alike, but we

rather have always approached it as a complementary channel and have also seen that we have a usage time of around 30% outside the opening hours”.

4.5.3 Lack of Technological and AI Standards

Due to the organisational nature of public administration agencies, they tend to post public tenders for the execution of projects (Berlin Interview). Thus, different companies of research initiatives might take over the chatbot development through the years. The lack of structured standards regarding a transfer of a trained AI can pose difficulties here. “When we train an AI, we are talking about a weak AI or maximal ML, but when I am doing this and throughout the years it will become really good” and then the developer or research team changes due to the call for tender, one needs to “know how to transfer the training results or do I need to start over every time? There are no standards regarding this” (Berlin Interview). None of the other cities have been in such a situation and thus, this issue did not come up during the interviews.

4.5.4 Organisational Structures

Another organisational interoperability challenge that came up during the interviews was one that relates to the data quality and provision barriers already mentioned in the technological interoperability challenges. To gather the correct and compatible data appears to be as much an organisational challenge as a technological one. The expert from Berlin elaborates on the great challenge that comes along with different departments being responsible for providing their information. Often these departments or different policy areas forget to provide context, they always assume that people visit their website, with their branding and everything and when they then mention 'application forms' it should be clear for the user which ones. However, when the information is provided through the chatbot, this context around the website is missing and the user does not know which application form *Bobbi* refers to. This happens because “*Bobbi* indexes the FAQ pages, thus, calling the dialogues from there and when I am interacting with *Bobbi* directly, I am missing context” (Berlin Interview). The ITDZ employee said that “in the beginning, we tried to cure this by phoning after them [the policy areas and departments] *‘please remember there is another channel here, the people are not only on your website’*” (Berlin Interview). The information provided for the chatbots needs to be concise and not everyone is succeeding in achieving this – “this is a great shortcoming” the interview participant from Berlin said. However, they will not change the official information they receive (Berlin Interview).

The development of *Kora* in Heidenheim had not been hampered by this. However, the Komm.One employee is aware of the benefits their structures in this regard bring with them. “We already have something like this [structured content from all services] why should I type in everything again? The structured content is there and then I can just embed it automatically and evenly” (Heidenheim 2 Interview). Komm.One is now also developing chatbots for the cities of Heidelberg and Karlsruhe. “Heidelberg and Karlsruhe love the chatbot, since there is so little maintenance.” ServiceBW is the “portal where the federal state of Baden-Wurttemberg provides all their services” Therefore, the city of Heidenheim has not been dependent on different departments providing the information for the chatbot to them (Heidenheim 1 and 2 Interview).

		Berlin	Hamburg	Heidenheim	Munich
Organisational Barriers to Interoperability	Citizen service office employees technical capabilities				
	Internal acceptance			(✓)	
	Lack of uniform AI standards	✓			
	Organisational structures	✓			

✓ = still a barrier (✓) = overcame this barrier

Table 6: Overview of organisational Barriers to Interoperability per City

4.6 Conclusion

This chapter described the findings that have been reported by the interview participants regarding the challenges and barriers they have faced when adopting an AI-based chatbot in their respective citizen service office environment. Surprisingly, legal and regulatory barriers have been the ones that were named the least affecting ones and technological barriers to interoperability, which have been recognized by Scholl (2005) as the easiest to overcome, have been reported most and by every interview participant. Interestingly, none of the experts reported any barriers regarding the technical abilities of the citizen service employees. Further, only the expert from Heidenheim, noted challenged regarding the internal acceptance and compatibility of the systems in the beginning of their project, though, both have been resolved. During the interview with the expert from Berlin, most barriers have been mentioned, opposite to the interview with Hamburg which reported the least barriers. Table 7 provides an overview of all barriers to interoperability discussed in the interviews and illustrates which city, according to the interview participants, indicated having faced or currently facing any of these barriers. The next chapter, the analysis, will interpret the findings and their implications.

		Berlin	Hamburg	Heidenheim	Munich
Political Barriers to Interoperability	Lack of political support due to unwillingness to innovate	(✓)			
	Lack of technical expertise by politicians	✓			✓
	Hierarchy and party politics	✓			✓
Technological Barriers to Interoperability	Compatibility of the systems			(✓)	
	Data provision and quality (due to lack of cooperation with other departments)	✓	✓	✓	✓
	Digital infrastructure				
	Chatbot's dialogue comprehension	✓	✓	✓	✓
Legal and Regulatory Barriers to Interoperability	Legal and regulatory framework	✓			
	Data protection and privacy	✓*	✓*	✓*	✓
Organisational Barriers to Interoperability	Citizen service office employees technical capabilities				
	Internal acceptance			(✓)	
	Lack of uniform AI standards	✓			
	Organisational structures	✓			

✓ = still a barrier

(✓) = resolved this barrier

✓* = barrier for future development

Table 7: Overview of reported Barriers to Interoperability per City

5 Analysis

5.1 Introduction

The following part will connect the theoretical results, stemming from the conceptual framework derived in the literature review, with the empirical results from the conducted interviews. This thesis aims to investigate to what extent barriers to interoperability impact the adoption of AI-based chatbots in German citizen advice offices. This question has been investigated through semi-structured expert interviews, which provided first-hand experiences regarding the issues faced when implementing chatbots. The concept of interoperability has been used as a foundation for the research. Particularly, barriers that can hamper interoperability and consequently negatively impact the adoption of a chatbot in citizen service offices. As can be seen in table 7, it appears that Berlin encountered the most barriers and Hamburg the least. However, what is important to keep in mind here is that Berlin was the first city to adopt a chatbot and is already at a mature stage with their chatbot. Thus, they likely already encountered challenges that other cities are still having to face. Hamburg on the other

hand, profits from Berlin's experiences. The cooperation between Hamburg and the DAI Laboratory at the TU Berlin benefits from the learnings that have been made with *Bobbi* before. However, the evaluation of the specific challenges and their implications will be discussed in detail in this chapter.

To answer the research question, this chapter will first evaluate the expectation that political processes and/or city council members hamper the adoption of AI-based chatbots. Second, the expectation that the heterogeneous IT-system environment and the insufficient digital infrastructure impact the chatbot implementation will be examined. Third, the expectation that the lacking legal and regulatory landscape, plus the strict data protection regulations, will influence the adoption of AI-based chatbots will be evaluated. Lastly, it will be examined whether lacking reconciliation of goals, procedures and systems between departments and agencies, and a lack of IT-savvy employees, as well as a lacking internal acceptance contributed to organisational interoperability barriers.

5.2 Political Interoperability Barriers

According to the literature, various challenges regarding political barriers to interoperability have been identified. According to research conducted by Parasie and Veit (2016), Jaeger (2002) and the BMI (Federal Ministry of the Interior) (2020), complex administrative structures, due to their federal nature, can pose a barrier to the adoption of a chatbot. However, federal structures have not been mentioned in the interviews to pose a barrier. This might be since the chatbots are generally specific to municipalities. In other words, services and information can differ from municipality to municipality and, therefore, the chatbots need to fetch data specific to the region or department. Naturally, addresses or opening hours might differ, as well as which offices are barrier-free accessible. Thus, the chatbots will need to fetch data specific to the region and citizen service office. Interoperability of federal and municipal systems do not appear to be necessary for this context. Berlin and Hamburg are both also federal states; thus, the federal and municipal structures are not separated. This might be an advantage for political interoperability as well. As reported by the interviewees, chatbot adoption will not necessarily be hindered by complex federal governance structures.

The experts from Hamburg and Heidenheim did not report any political challenges while adopting the chatbot. Hamburg, on the other hand, likely profited from the processes Berlin already went through and thus having a well-functioning example of how a chatbot can work. Politicians will likely be more inclined to adopt a chatbot application when they see a success

story and are even able to cooperate with the same provider, the DAI Laboratory at the TU Berlin. As the interview participant from Heidenheim mentioned that they work very well with their municipal council (Heidenheim 1 Interview). This might also be since Heidenheim with only around 50.000 inhabitants is by far the smallest city. The administrative channels are much shorter, in smaller municipalities and hierarchies might also be flatter. People are very likely to know each other and also know directly who to contact, which might be more difficult in cities with employees in a six-figure range, such as in Munich.

During the first interview with one of Munich's experts, it has become apparent that these hierarchical and branched structures posed a barrier to the adoption of the *Münchner Kindl* chatbot. Munich being the largest municipality in Germany, complex structures are likely to be unavoidable. Public administrations are generally more hierarchical and branched compared to private sector firms and thus often require longer processes to approve projects, especially when these include new technologies. Hierarchical structures can thus, pose a barrier to the political interoperability that is needed for the adoption of a chatbot as regardless of the hierarchy or political party affiliation, seamless information and approval processes are needed. In case of important adjustments, if there is faulty information provided by the chatbot, information will need to be transmitted quickly and hierarchical structures might prove a challenge here.

Another barrier to political interoperability that was discussed during the Berlin interview has been one of party politics. The government can and mostly, changes every four years which can make successful cooperation difficult. Different political parties have different approaches to digitalisation and, according to the interview with the expert from Berlin, this can pose a barrier in cooperation. Furthermore, the ITDZ employee pointed to the "begrudge" of some of the parties. Thus, some departments might not cooperate to the necessary extend or do not see the benefit in cooperating with departments they would otherwise not have any touchpoints with. It can be expected that each party wants to be depicted as the more capable, which also includes the ability to successfully govern the policy departments. Efficiency and effectiveness can be improved through the chatbot, but if party rivalry gets in the way, the adoption of a chatbot will be challenged as the departments also have to cooperate to assure interoperability to, in the end, provide value to the citizens.

As expected, one great barrier to political interoperability is the lack of political support for new technologies (Pereira et al., 2017). Schwab et al. (2019) already established that the lack of support can also stem from a lack of technological knowledge. These are also experiences shared by Berlin and Munich. Especially, during the interviews with Munich, it

has been established that the lack of technological knowledge from the political side can cause challenges. Some politicians want to tick a box on a checklist that might state that the chatbot should be able to answer every question a user might have concerning Munich. During the expert interview with Berlin, it was also mentioned, that politicians also often lack sufficient knowledge on the needs of public administration and their capabilities. Politicians can have very specific ideas about the usefulness of the chatbot, how the chatbot should be presented on the website or how exactly the chatbot should work, without knowing the actual possibilities. A divergence between the technical possibilities and the political expectations can become a challenge as both sides can become frustrated. Politicians, as their expectation, will not be fulfilled and the project delivering side, as they are not provided with the needed flexibility due to hierarchical and branched structures.

On a different note, Scholl and Klischewski (2007) argue the lack of political support can also result in a lack of financial resources that are needed to adopt a chatbot. Heidenheim provided an example of how funding can create political support on the other hand as well. The interview participant stated that after they received the funding from the digitalization support program provided by the Ministry of the Interior of Baden-Wurttemberg, they did not have any issues mobilising supporters. This raises the question of whether that would have been different if the funding had not been provided by a digitalization support program but had instead come from the municipal fund. The reluctance to innovation has also been mentioned by the public official of Heidenheim. This has not posed an issue for them directly, but he has been confronted with a lot of surprise at their lack of difficulty in this regard by other public officials from different municipalities in Baden-Wurttemberg. Generally, public administrations do not launch products of which they know that they will make mistakes at the beginning, such as a beta version of a chatbot. Projects usually need to be tested endless times and all stakeholders have to give their approval before the projects are adopted. None of the other participants mentioned financing as a barrier. Reasons for that might be that both, Berlin and Hamburg are in research cooperation with the TU Berlin. Munich only started to adopt their chatbot now with publicplan, a software company that specialises in providing digitalisation services to public administrations.

How the unwillingness to innovate and taking risks have also hindered the start of an already developed chatbot is exemplified in the case of Berlin. There, the ITDZ and the TU already finished the chatbot prototype around the end of 2015. However, *Bobbi* did not go live until 2017 due to a lack of political support. Only after *Bobbi* won a national e-Government competition, they received the needed political attention and support to finally launch the

chatbot. The hesitation can stem from the general reservedness from the public sector to take risks with new technologies or politicians not understanding the usefulness of a chatbot. The bureaucracy and reservedness, however, hinders innovation and especially with newer technologies, a trial-and-error attitude can be very beneficial. One will only detect the flaws the chatbot still has when it is in use. Nevertheless, it is understandable that politicians are a bit more reserved when it comes to trial and error. In the end, they are spending tax money and in case of a failure, the politicians are the ones that have to answer to the citizens and might not get re-elected in the next elections. Therefore, the lack of political support and unwillingness to innovate appears to be the greatest challenge in the context of political interoperability barriers in the interviewed cities. The empirical data presented shows that this has even led to the delay of the release of one chatbot (Berlin).

5.3 Technological Interoperability Barriers

The systems used to maintain and operate the chatbot have to be compatible. The chatbot needs to be able to fetch properly structured and correct data from somewhere and the digital infrastructure has to be able to handle the data traffic. This challenge to technological interoperability, an insufficient digital infrastructure, has been identified in the literature. Schwab et al. (2016) identified this challenge in their research on citizen service offices. Pereira et al. (2017) have also identified an insufficient digital infrastructure to be a major barrier to successful technological interoperability. However, interestingly enough, the digital infrastructure has not been identified as a barrier in any of the conducted interviews and thus, this expectation has not been met. All participants said that the digital infrastructure has never caused any problems neither regarding the data traffic nor the functionality. The expert from Munich also pointed to the fact that firstly, chatbots nowadays are scaled in a way that should not cause any issue to a 'normal' digital infrastructure and secondly, their chatbot is not in such extensive use (yet) so there have not been any stability issues so far.

However, this result could also be due to a selection bias in the cities examined in this thesis. Citizen service offices that already struggle with an insufficient or unstable digital infrastructure would most likely not take the step to adopt an AI-based chatbot. Such technologies require a digital infrastructure that firstly, can handle large data streams and secondly, can handle the connection between different systems or databases. Thus, municipalities that already face challenges with their data traffic and online services will most likely first aim to solve those issues before turning to the adoption of an AI-based chatbot. An

interesting point made by the expert from Berlin was that, even if the digital infrastructure was not able to handle the traffic at a certain moment, this would not be a major issue. This would not be an issue as the chatbot is never the only channel via which information can be accessed. The agents working at the citizen service offices can be reached via telephone and e-mail, people can go to the physical citizen service offices and lastly, all the information the chatbots provide is publicly accessible online. Thus, if there would be digital infrastructure issues, it could cause an inconvenience for some citizens but will not jeopardise the whole chatbot. Nevertheless, to assess whether there are still municipalities struggling with such bad infrastructure that they are hindered to adopt a chatbot, would have to be the topic of additional research.

Another barrier that has been discussed during the interviews with the experts from Heidenheim and Berlin is that the dialogue comprehension of the chatbot can cause problems to seamless integration of all services. Multiple services can be linked to one keyword and the chatbot will then have to decide which service is the most likely one that is suitable for the user. This can confuse the users as they might not be provided with the correct answer but something slightly different. Heidenheim's chatbot expert and the external consultant from Munich highlighted the importance of the chatbots being able to answer the questions of the users as well. In case the chatbot is unable to make the correct assumptions about the users' question, users might try again by typing in the same or a similar sentence but if they will still not receive the correct answer, they are very likely to give up and might call the service centre. Thus, defeating the purposes of the chatbot, easily accessible information and disburdening of the telephone agents. It is very likely that the citizens are left with a bad impression of the chatbot and might not try again. Thus, posing a technological barrier to interoperability. The issue might be overcome with more training data, which usually is generated through chatbot usage, which in turn is not easy to generate when people are unsatisfied with the results.

However, an even more fundamental issue that can occur due to the great variety of services is the one of proper database linkage. According to Schwab et al. (2019), in the context of citizen service offices, one of the key technological barriers is precisely this seamless interface between administration and citizens. As aforementioned, one of the greatest pitfalls of the cooperation between Heidenheim and IBM was the incompatibility of the systems. It was not possible to directly link IBM Watson to the ServiceBW portal that provides all services. The incompatibility of the systems led Heidenheim to manually add all responses to two topics, which already resulted in around 255 different response components. Thereby, the case of Heidenheim demonstrated the importance of the interoperability of the systems is and

the vital possibility to build an interface between the chatbot and the database. Again, this exemplifying the importance of system compatibility.

The interoperability of data(bases) has been one of the greatest topics of discussion during all interviews. The experts from Hamburg disclosed that they did not face any technological challenges per se. However, they revealed that the quality of the data and the comprehension abilities of the bot have proven to be barriers. In case the systems are not compatible, all services, questions and answers would have to be added manually which would provide an enormous administrative burden on the citizen service offices. Thus, also blurring the line between a technological and organisational barrier to interoperability. The issue stems from a technological place, the incompatibility of systems, but a remedy would be to create another organisational barrier: additional personnel. Data needs to be maintained and adjusted, and the correct interfaces between different departments need to be developed so that the chatbot can access all the information needed. However, once the systems are compatible, new interfaces can be linked easily to include additional data sources.

The federally organised public administration structures prompt each federal state, to some extent, to develop its own set of regulations. However, one overarching system is the LeiKa which catalogues services in a semantic and structurally organised manner. Some chatbot providers, such as publicplan, are experienced in integrating it into a chatbot interface. The implementation of the OZG paves the way for the emergence of different systems. However, there are still various interfaces missing that facilitate linkage between the systems to the chatbot (Berlin Interview). Appropriate technical standards are necessary to apply them to existing systems. However, as established in the interview with the expert from Berlin, the public administration landscape is far from having standards applied to bot technologies. Lee and Layne (2001) already suggested the importance of the integration of heterogeneous systems and that exactly those can be a major interoperability barrier. As established through the literature review, the XML standards for information sharing provide an IT architecture to enhance information searching, storage, and maintenance demands (Scholl, 2005). However, according to the interview partner from Berlin, these developments are not as advanced yet as they could be.

The standardisation of information processing and the building blocks repositories is still fairly empty. Not all of the editorial offices [that should provide this information] have been established yet. The building blocks consisting of data fields, processes and service description, however, are needed to provide structured information to the citizen service chatbot. In case these blocks are not filled, new chatbot interfaces cannot be supplemented or expanded. Thus,

this lack of standardised information hinders seamless integration. Additionally, the competency finder supporting XZUFI formats are not that sophisticated yet. In other words, they mostly only provide information regarding locations and services. The integration of information and systems is still lacking here, a lot needs to be done to remove these technological barriers to interoperability. Otherwise, it will be difficult to advance to the next stage with the chatbots: the provision of a one-stop agency, the aim of G2C. The standards are also needed to provide citizens with the possibility to perform entire administrative processes online.

5.4 Legal and Regulatory Interoperability Barriers

As expected, legal and regulatory challenges to interoperability appear to mostly be of a data privacy nature. Scholl (2005), Pereira et al. (2017) and Bekkers (2005) have been researching the barriers to interoperability in e-Government regarding privacy and data protection regulations and concluded that a clear framework is necessary. However, as the literature also established, a clear legal or regulatory basis guiding the adoption of AI-based chatbots in public administration in Germany is missing. Schwab et al. (2019) reported that legal barriers would be the most challenging ones. Surprisingly, none of the participating experts reported the lacking legal or regulatory framework as an issue. All declared that the chatbots have been developed within the legal boundaries that already exist, such as the GDPR. Nevertheless, the most pressing challenges and concerns discussed during the interviews, revolve around personal data protection and privacy. This has also been one of the main expectations. The data users provide the chatbot with information by typing into the chatbox, and this information has to be stored somewhere. As established in the results chapter, some people do not notice right away that they are not messaging with a person but with a bot and still provide highly sensitive data. Thus, data must be stored safely and securely.

Differing jurisdictions and conflicting obligations and rights regarding privacy can increase confusion among both, citizen and administrations, and thus, lead to uncertainty about responsibilities (Bekkers, 2005). Therefore, all interview participants recognized that it is crucial to store the data on servers located in Germany, since then the stricter German jurisdiction, regarding data protection, holds. The data will not leave the European data protection area, which would be the case if it was stored on US servers, for example. In this case, US data protection regulations would be applicable. As the point of focus of the United States' data protection regulations lie more on the commercial aspect rather than the protection

of individual rights, this could jeopardise the safety of personal data. However, none of the participating experts noted any issues with finding an appropriate data centre to store the data in Germany. It can therefore be assumed, that storing data in Germany to assure compliance with the GDPR, is not a barrier to the adoption of AI-based chatbots.

However, an example of how the legal and regulatory structure can pose a barrier has been given by the expert from Berlin. The COVID-19 pandemic highlighted challenges regarding the up-to-datedness of the information. Since regulations change quickly and Berlin's chatbot *Bobbi* also informs on the COVID-19 FAQ's. One of the issues that emerge from this finding, is again, a blurred barrier, one of the organisational, technological, and legal implications. So far there is no interface between the chatbot and the Journal of Law and Ordinances that publishes and officialises the new regulation. Thus, information would need to be updated manually, which would pose an organisational burden on citizen service offices and their employees. This implies, that the rigid legal and regulatory framework, can pose a barrier to interoperability in terms of the up-to-datedness of information provided. Which in turn, has implications for the usefulness of the chatbot for the citizens and can hamper functionality and successful seamless information integration.

A challenge mentioned by Scholl and Klischewski (2007), that there could be a risk of mature e-Government services to blend into a functioning whole, has not been found applicable to the interviewed participants. The adoption and integration of the chatbots are not in such a mature state, for now, the chatbots provide information that could also be found on the website of the citizen service offices. Therefore, it is likely that it will still take quite some time before such a mature stage, which would blend into one, will be reached.

Another interesting aspect that has been the topic of discussion in every interview was the future visions for the chatbot. Some of these visions have not been realized yet, due to data protection barriers, or political hesitation. Hamburg plans on developing an interface that links the chatbot to an online application system that will need to process, sometimes sensitive, personal data. Then, the data protection strategy will need to be revised again. Something similar holds for an idea raised by the e-Government expert from Munich. The possibility of switching from the chatbot directly to a telephone agent. However, the data provided to the chatbot would then need to be provided to the agent as well which might pose data protection challenges. Berlin's *Bobbi* has been developed further to be able to be used as a 'skill' by virtual assistants such as Alexa or Goggle. Here, the pressing issue of the data being stored in the US would be faced. Since this is something most data protection officers will rebel against

and there are no equivalent NLP assistants that store data in the European area on the market yet, this project has been set on hold.

These findings may help understand why the chatbot development and the interactive service provision in Germany are proceeding as slowly as it is. The strict data protection regulations serve the purpose to protect individuals' rights to privacy and protect them against any harm that could be done with their data. On the other side, these strict regulations also appear to hamper innovation and more integrated service provision. However, other European countries such as the Netherlands (DigiD) or Estonia (e-Estonia), have managed to implement well-functioning systems that offer a variety of e-Government services, such as healthcare, pensions, or even voting. Estonia managed to move 99% of its state services online (e-Estonia, 2021). Therefore, the legal and regulatory barrier to interoperability appears to be something that can be overcome. Clear guidelines could support German public administrations in this journey.

5.5 Organisational Interoperability Barriers

According to the literature review and the thereout established conceptual framework, organisational barriers to interoperability can have different causes. On the one side, there are a lack of structured processes and suitable modelling tools. On the other side, Guijarro (2007) and Pereira et al. (2017) illustrated the concept of enterprise architecture, which can provide organisations with guidelines about project management, suitable project sizes, and alignment of goals to avoid conflicts between agencies. A challenge that has been discussed during the interviews, which relates to this, has been the lack of technological and AI standards. The chatbot of the ITDZ and TU Berlin is already more advanced in their development than some other cities. This might be one reason why they are already considering the transfer of trained AI and others have not mentioned this bottleneck. Since public authorities generally have to tender projects, depending on their size, different companies or research initiatives might take over the maintenance or development of *Bobbi*. As there are no standards regarding the proper transfer of the learnings of an AI, this can greatly hamper the progress of the chatbot. The more integrated the (public) systems are and the clearer the organisational structures, the easier it will be to transfer progress and knowledge rather than having to start over every time a new developer or researcher team comes along. On the other hand, the lack of structured processes could also be seen as freedom to design said processes in an individually suiting manner.

Another organisational challenge that can pose a barrier to interoperability identified in the literature was one of unqualified personnel and their lack of acceptance of the new technology. According to Schwab et al. (2019) and Pereira et al. (2017), most public administrations lack qualified IT personnel that can operate the new technologies emerging with e-Government applications. However, during the interviews, it became evident that this was not confirmed by the empirical experience gathered for this thesis. In none of the cases, the citizen service agents work with the chatbot directly. The chatbot can and should, in all four cases, be considered as a separate, independent channel. Only a very limited number of personnel needed who is responsible for the chatbot. Therefore, technological know-how does not seem to be needed as the chatbot is developed and usually updated by specialized personnel once the interface is integrated correctly. The information that is provided for the chatbot would be provided by the department-specific editors, thus no additional staff is needed.

Nevertheless, even if lacking technology-savvy employees was not a barrier to interoperability, another crucial set of skills is needed. The ITZD expert pointed to the challenge that the editors, that provide the information that is also used by *Bobbi*, do not always have an understanding of the chatbot channel. In other words, information that is provided through a chatbot must be provided differently than when provided on the website. The text field is much smaller; thus, the provided text snippets cannot be lengthy. Furthermore, there is the issue of the colloquial and administrative language. When a citizen is communicating with a person, be it on the phone, via mail, or physically, the service agent will know what is meant when the person uses colloquial words. This is something a chatbot will have to learn, it needs to be provided with synonyms or linked to a thesaurus. Therefore, it is not necessarily IT-savvy personnel that is needed, but rather editors that understand how information must be presented to the users and what language they use.

Issues regarding the internal acceptance of the chatbot can arise. Internal acceptance and support are needed as this can negatively affect the employees' attitudes. Pereira et al. (2017) suggest that training the public personnel can aid in creating acceptance. This is a finding that has been largely confirmed by the empirical experiences of the experts. Generally, they have mentioned that some employees have expressed fears of being replaced by chatbots (Heidenheim 1 Interview; Munich 2 Interview). Therefore, it is important to combat these feelings by providing thorough information on the usefulness of the chatbot and be transparent about the goals. Furthermore, on the current level, chatbots also do not pose a threat to any jobs. Most of them are not yet used that much, which can also stem from them still being rather new technologies. Thus, there is no reason for the agents to fear for their jobs, rather, it can

disburden them especially regarding the answering of standard questions. Thus, if the administrations are clear about the use and benefits of the chatbot, there should not be any internal hesitation against the chatbot.

The experts from Hamburg and Berlin have both mentioned that with the integration of the Corona FAQ's usage has increased greatly. Reasons for this could, on the one hand, be that citizen service offices have been closed during parts of the pandemic, or that people generally became more comfortable with the use of chatbots as most of life moved online. Another reason why service employees will not have to be worried about their jobs is that, according to an expert from Berlin, they report around 30% of the use outside their opening hours. The chatbot should thus, be seen as an additional channel to the telephone agents that can support them. Lastly, another organisational barrier that can impact the progress and process of interoperability is the cooperation, or rather the lack thereof, between different departments. Scholl and Klischewski (2007) highlight that without proper standardisation across processes, systems, departments, and policies, interoperability might prove to be achieved only with great difficulty.

Currently, the citizen service offices face issues of intra-organisational and inter-organisational nature. The chatbot has to provide data from various departments and agencies. Thus, we revisit the data provision barrier mentioned in the technological challenges section. The experts from Berlin and Munich discussed that a lack of proper information provision has become a great organisational challenge. The information has to be edited concisely and properly, however, when different departments do not understand this or do not want to allocate resources to edit the information, the IT departments are faced with a challenge. Either they could decide to adjust the information, which, however, would be very time consuming and could potentially, cause problems regarding the legal certainty of the information. Alternatively, they would have to leave it as it is and risk the chatbot not being as beneficial as it could be. To reach seamless integration of information and systems, cooperation is crucial. Cooperation between the departments and other agencies. Otherwise, chatbot adoption will potentially cost more time and money than it will save.

6 Conclusion

This research set out to investigate to what extent barriers to interoperability impact the adoption of AI-based chatbots in German citizen service offices. The digitalisation of the public sector is high on the political agenda in Germany. The ever-new emerging technological

possibilities provide the public sector with new opportunities to provide improved services to citizens and more efficiency to their administrative processes. However, Germany's efforts regarding the adoption of interactive technologies that provide the opportunity to improve G2C communications and making service access more convenient, have not yet paid off. Within the DESI ranking, Germany continues to score on the very last ranks concerning e-Government services. This observation prompted the research question of what might prove to be barriers to the adoption of more interactive applications such as chatbots. The conceptual framework of the barriers to interoperability served as the basis for the semi-structured interviews conducted with experts involved in developing chatbots for German public service offices and the research as a whole. The framework holistically considers the e-Government application adoption and does not only focus on the technological challenges faced.

6.1 Findings

Based on the empirical evidence gathered, this research demonstrated that all participating cities faced challenges to interoperability that impacted the adoption of AI-based chatbots. Each participant disclosed various challenges they faced when adopting a chatbot into their citizen service offices. Furthermore, the interviews established that the examined chatbots are currently still focused on providing structured information, rather than providing media disruption-free transactions and services. The aim of G2C to provide a one-stop agency is not yet fulfilled. However, taking the step to adopt a chatbot can be the first one in the right direction. The first experiences and learnings are necessary to see where adjustments are needed. Only when the first experiences have been made, the next stage can be approached, namely the service provision through AI-based chatbots, and provide added value to citizens and administrations.

The expectation that political barriers to interoperability could hinder chatbot adoption has been partially confirmed by the empirical evidence. The experts from both, Berlin and Munich provided evidence that they are still facing barriers regarding the lack of technical expertise by politicians as well as hierarchy and party politics challenges. In the case of Berlin, hesitation for innovation has even delayed the launch of the chatbot. Thus, political openness to innovation is a crucial aspect of chatbot adoption. Other political barriers to interoperability have not been found relevant to impact the chatbot adoption extensively.

Another major reported finding, contrary to the theoretical expectation, is concerned with technological barriers to interoperability. This has been the only section in which all four

cities are currently facing barriers. The chatbot's dialogue comprehension is one of the greatest barriers. The chatbot must be able to understand the questions it is being asked and respond to them correctly. Contrary to the theoretical expectations, digital infrastructure has not posed any barriers and neither does the compatibility of the systems. Heidenheim was the only city that encountered system compatibility barriers in the beginning but have resolved this barrier since.

Legal and regulatory barriers have mostly, as expected, been concerned with data protection and privacy. However, the challenges that impact the adoption of a chatbot are mostly concerned with future visions for the chatbot that would then require personal and sensitive data processing. Interestingly, none of the participants encountered any barriers regarding IT-savvy personnel, contrary to previous academic research. Other organisational barriers to interoperability also appear to not be as impactful as the literature suggested.

Furthermore, data provision and the quality of the provided data for the chatbots, has been established to be a barrier in between technological and organisational barriers to interoperability. Another challenge that has been the one of up-to-datedness, which conjuncts technological, legal and regulatory, and organisational barriers. These findings also provide another insight; the lines of responsibility and solutions can be blurred and thus, complicate the successful adoption further. Therefore, inter- and intra-organisational cooperation is crucial to seamlessly adopt a chatbot that is of value for citizens and public agencies. Political and organisational barriers did not appear to impact the adoption of AI-based chatbots greatly. Challenges have been reported but mostly only by one, or a maximum of two, participants and most of these barriers have been overcome in the early stages of the adoption. Additionally, the barriers that impact the adoption of an AI-based chatbot in German citizen service offices most are, according to the conducted interviews, of technological as well as legal and regulatory nature. Finally, simply because some cities such as Hamburg or Munich, have not reported having faced certain challenges yet, this does not mean they will not do so in the future. Both cities are still at the beginning phases of their chatbot adoption and thus, might not have been presented with deeper rooting barriers.

6.2 Academic Contribution

This thesis contributes to the still limited field of AI applications in the German public administration landscape. Most academic research on e-Government implementations focused on digitalisation processes, barriers faced by public authorities, or citizen acceptance and use. Furthermore, research on chatbots generally is concerned with their commercial use, the

research field on chatbots in public administration is still very limited. However, AI-based chatbots can support public authorities in the process to improve G2C interaction and to provide citizens with a one-stop-agency. Therefore, research on what might prove to be a barrier to the adoption of such chatbots can support public authorities in overcoming or even preventing them. Research on interoperability in the e-Government context has gained more attention from the academic community in the past years. However, using political, legal and regulatory, and organisational interoperability, next to the more common technological interoperability, as a conceptual framework for chatbot adoption has, to the knowledge of the author, not been done in a German context.

Thus, this research provides a first insight into the challenges citizen service offices might face when they aim to adopt an AI-based chatbot. The research focused on the three largest cities of Germany, Berlin, Hamburg, and Munich, and one smaller one, Heidenheim an der Brenz, which was one of the pioneer cities in chatbot adoption. The empirical data collection through interviews with experts contributes to a deeper understanding of the challenges faced by citizen service offices when adopting AI applications, and chatbots in particular. e-Government implementation is not a purely technological process; various factors can impact the success of the applications. Therefore, one of the key academic contributions of this research is the investigation of AI chatbot adoption through the lens of political, regulatory and legal, as well as organisational interoperability, as this research acknowledges the importance of these components as well. This approach is especially beneficial when considering the complex structures and stakeholders that are involved in public authorities.

This research can contribute to the improved management of the barriers faced by citizen service offices in Germany that desire to adopt AI-based chatbots. In this regard, this study can serve as a starting point for further research, but also as a small overview of challenges that public administrations could face when adopting AI-based chatbots.

6.3 Limitations of the Research

One limitation to this study is that only cities that already adopted a chatbot have been selected. This can cause a selection bias in the evaluation of the actual barriers to interoperability, since there might be cities that tried to adopt an AI-based chatbot but have been hampered in their efforts to such an extent that they had to let go of their plans. Thus, there might be barriers to interoperability that impact the adoption even more and these have not been mentioned by the interview partners as they did not encounter these. Furthermore, the adoption of an AI-based

chatbot costs money. Thus, only municipalities that have this money to spare will be able to afford to take this innovative step. This, in turn, can also imply that the municipalities have already been able to eradicate certain barriers to interoperability before starting to adopt a chatbot and are generally more advanced in the field of system interoperability.

Another limitation of this research is the small number of cities included and participants interviewed. Due to this, making generalisations about the wider German context is not possible. This thesis can only state which barriers to interoperability impacted the participating cities. Additionally, what constitutes a challenge or barrier to interoperability can also be subjective. Some participants might have interpreted certain challenges as part of the regular process and thus not mentioned them. One of the greatest limitations of this research might be that the adoption processes have taken place throughout different years, which can also have an impact on the results. For example, challenges that were faced by Berlin in 2017 might be very different to challenges faced by Munich in 2021, since technology advanced over time. Consequently, the processes to adopt AI-based chatbots are becoming easier as well and various private and public organisations start to offer standardised solutions specifically for public administrations, which has not been the case a couple of years ago.

6.4 Future Research

This research can serve as a starting point for further research on AI-based chatbot adoption in the German public administration landscape. The very limited research on interoperability with a focus on AI applications in the German administrative sector would benefit from more empirical research. The continuous technological advancements will enable more and more citizen service offices to adopt chatbot systems to support their administrative tasks and services. Further, citizens will only continue to demand to access services and handle transactions online as they are already used to doing so from the private sector. Since the empirical results did not correspond with the conceptual framework on all accounts, further research is needed to investigate this trend. Considering that most research is concerned with the user perspective, more in-depth investigations on the managerial, public administration side will be needed to successfully overcome the barriers to interoperability that impact the seamless adoption of AI-based chatbots.

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8 Appendix

8.1 Interview Guide

These interview questions served as a general guide for the semi-structured interview conducted for the purpose of this thesis. Some more questions have also been customized to the specific interview partners. Furthermore, follow-up questions have been asked during the interviews

1. Introducing myself and the reasons for the interview

2. Declaration of consent to record and transcribe the interviews and use them for the analysis of my Master Thesis

3. General Questions:

- Wieso haben Sie sich für einen chatbot entschieden? (Motivation)
[Why did you choose to adopt a chatbot?]
- Wieso haben Sie sich dazu entschieden den chatbot gemeinsam mit (*Firma/Uni*) zu entwickeln?
[Why did you decide to work together with (company/university) to develop the chatbot]
- Wie lange hat die Entwicklung gedauert?
[How long did the development of the chatbot take?]
- Name/Design? Komplexität? Sprachen? Wie ist Feedback geben möglich?
[Name/Design? Complexity? Languages? How can users provide feedback?]
- Wie sehen die Pläne für die Zukunft für den chatbot aus?
[What are future plans for the chatbot?]
- Wie haben sie für (externe/interne) Akzeptanz gesorgt?
[How did you ensure (external/internal) approval]
- Wie viele Nutzer? (pro Monat/Woche/Tag je nach Datenlage)
[How many users? (monthly/weekly/daily depending on available data)]
- Generelle Herausforderungen?
[General challenges?]

4. Organisational Questions

- Wie viele Mitarbeiter arbeiten mit dem chatbot?
[How many employees work with the chatbot?]
- Wie wurde das Personal geschult bzw. auf die neue Aufgabe vorbereitet?

[How has the personnel been prepared for the new tasks?]

- Haben sie mit anderen Verwaltungsbereichen kooperiert?

[Did you cooperate with other departments?]

- Haben sie mit anderen Städten kooperiert?

[Did you cooperate with other cities?]

- Wie hat sich ihre Arbeit verändert seit der Inbetriebnahme des chatbots?

[How did your work change since the adoption of the chatbot?]

5. Technological Questions

- Gab es Probleme bei der Entwicklung bezüglich der digitalen Infrastruktur? Bzw. gibt es diese heute noch?

[Which digital infrastructure challenges did you encounter?]

- Wie wurde entschieden welche Szenarien mit einbezogen wurden?

[How did you decide which scenarios to include?]

- Woher erhält der chatbot die Daten/Informationen?

[Where does the chatbot get the data/information from?]

6. Legal/Regulatory Questions

- Wie sieht der Datenschutz aus?

[How do you assure data protection?]

- Wie haben sie die ethische Integrität sichergestellt bzw. wie stellen Sie diese sicher?

[How have you ensured the ethical integrity of the chatbot?]

- Wer hat die regulative Übersicht? Gab es hier Einschränkungen?

[Who or what holds the regulatory oversight? Were there restrictions?]

7. End of Interview

Thanking the participant(s) and providing them with the opportunity to receive the thesis once it is done.

8.2 Interview Transcripts

The interview transcripts have only been made available for the first and second reader to guarantee the privacy of the respondents. Thus, the publicly published version does not include the interview transcripts.

8.2.1 Interview Hamburg: *Frag den Michel* - 7 January 2021

8.2.2 Interview Heidenheim an der Brenz 1: *Kora* - 10 March 2021

8.2.3 Interview Berlin: *Bobbi* - 19 March 2021

8.2.4 Interview München 1: *Münchner Kindl* - 26 March 2021

8.2.5 Interview Heidenheim an der Brenz 2: *Kora (Komm.One)* - 14 April 2021

8.2.6 Interview München 2: *Münchner Kindl* - 19 April 2021

8.3 Codebook ATLAS.ti

ATLAS.ti Report - Interview Codes

- **AI**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx







- **Amtsprache**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx







- **Beginning Chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx






- **Cooperation**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx







- **Corona**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx







- **Data (Quality) Challenges**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx




- **Data Protection**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx







- **Data Security (Technological)**

Used In Documents:

 1 Interview Berlin.docx  3 Interview Heidenheim an der Brenz.docx  5 Interview München 2.docx







- **Design & Name**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx






- **Development Chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx

- **Employees Responsible for chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx

- **Feedback**

Used In Documents:

 2 Interview Hamburg.docx  6 Interview Heidenheim:Komm.One.docx

- **Functioning of chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx

- **Future Visions**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx

- **Internal Challenges**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx

- **Internal Strengths**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx

- **IT Infrastructure**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx







- **Languages Chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  5 Interview München 2.docx

- **Learning**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx  6 Interview Heidenheim:Komm.One.docx

- **Limitations Chatbot**

Used In Documents:

 1 Interview Berlin.docx  4 Interview München 1.docx





- **Open-Source**

Used In Documents:

 1 Interview Berlin.docx  4 Interview München 1.docx  5 Interview München 2.docx





- **Political Challenges**

Used In Documents:

 1 Interview Berlin.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx

- **Regulatory/Legal Challenges**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  6 Interview Heidenheim:Komm.One.docx

- **Service Center (Employees)/Internal Acceptance**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  5 Interview München 2.docx

- **Technological Challenges**

Used In Documents:

 1 Interview Berlin.docx  5 Interview München 2.docx

- **Usage Chatbot**

Used In Documents:

 1 Interview Berlin.docx  2 Interview Hamburg.docx  3 Interview Heidenheim an der Brenz.docx  4 Interview München 1.docx  6 Interview Heidenheim:Komm.One.docx