D2.1

Business Model and Stakeholder Ecosystem Development

Project number:	959072
Project acronym:	mGov4EU
Project title:	Mobile Cross-Border Government Services for Europe
Start date of the project:	1st January, 2021
Duration:	36 months
Programme / Topic:	H2020-SC6-GOVERNANCE-2020, Governance for the future

Deliverable type:	Report
Deliverable reference number:	DT-GOVERNANCE-05-959072 / D2.1 / V2.0
Work package contributing to the deliverable:	WP2
Due date:	December 2021 – M12
Actual submission date:	20th May 2022

Responsible organisation:	Fraunhofer
Editor:	Rachelle Sellung
Dissemination level:	PU
Revision:	V2.0

Abstract:	This deliverable presents insights to relevant market structure and overviews, stakeholder ecosystems, roles and perspectives. It also dives into User Experience and Design Research and good practices. In addition, it presents Business Model patterns that are relevant for the mGov4EU mobile application.
Keywords:	Stakeholder Analysis, Market Structure, Market Overview, Business Model Patterns, Business Model,

Editor

Rachelle Sellung (Fraunhofer)

Contributors (ordered according to beneficiary numbers)

Lisa Burgstaller-Hochenwarter (TEC)

Luana Fabrete (TEC)

Barbara Gaggl (TEC)

Mohamed Ali Masmoudi (Fraunhofer)

Marie Hölscher (Fraunhofer)

Heiko Rossnagel (Fraunhofer)

Disclaimer

Executive Summary

This deliverable is the output of **task 2.1**. In this task, the stakeholders are in focus. To understand the stakeholders, first a market structure and overview is researched. Next, the stakeholder ecosystem identified. This is identified by establishing different stakeholder groups, such as active and enabling. In addition, the stakeholder analysis elaborates on the different roles, perspectives, and values between stakeholders. In addition, business model patterns are evaluated and the most relevant business model patterns are established for the mGov4EU mobile application.

The following table shows the relation between D2.1 and other tasks, work packages and deliverables:

Contributing tasks of this WP	T2.1
Input from other tasks/WPs	T1.1,T1.3
Output to other tasks/WPs	T2.6, T2.7 , T5.1
Output to other deliverables	D2.6 , D2.8

Table of Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation	Meaning
AdES	Advanced electronic signature
ASQ	After Scenario Questionnaire
CA	Consortium Agreement
CEN	Comité Européen de Normalisation]
CEO	Chief Executive Officer
BMDW	Ministry of Digital and Economic Affairs
BMF	Ministry of Finance
CEF	Connecting Europe Facility
DESI	Digital Economy and Society Indix
DoA	Description of Action (Annex 1 of the Grant Agreement)
DOI	Diffusion of Innovation Theory
DUK	Danube University Krems
EB	Executive Board
EC	European Commission
eGov	Electronical Government
eIDAS/eID	electronic Identification/electronic Identification, Authentication and trust Services
ESPON	European Observation Network for Territorial Development and Cohesion
ETSI	European Telecommunications Standards Institute
EU	European Union
EU28	Member States of the EU
EUCARIS	European Car and Driving Licence Information System
E-Wallet	Electronical Wallet
FAQ	Frequently asked Questions
G2B	Government to business
G2C	Government to consumer
G2E	Government to employee

Abbreviation	Meaning
G2G	Government to government
GA	Grant Agreement
GAM	E-Government Adoption Model
GAUM	E-Government Adoption and Utilization Model
GDPR	General Data Protection Regulation
GPS	Global Positioning System
H2020	Horizon 2020
ICTs	Information and communication technologies
IdM	Identity Management
IETF	Internet Engineering Task Force
IMR	Interim Management Report
LoA	Level of Assurance
MAXQDA	Max Weber Qualitative Data Analysis
MGAUM	Mobile Government Adoption and Utilization Mode
mGov	Mobile Government
mGov4EU	Mobile Government for the European Union
MS	Member States
MS teams	Microsoft Teams
NDA	Non-Disclosure Agreement
NemID	EasyID
NFC	Near Field Communication
OASIS	Organization for the Advancement of Structured Information Standards
OOP	Once-Only-Principle
OpenPeppol	Open Pan-European Public Procurement On-Line
OZG	Onlinezugangsgesetz
PM	Person Month
PKI	public key infrastructure
PR	Periodic Report
PSE	Public Sector Entities
SB	Stakeholder Board
SCOT	Social Construction of Technology Theory
SDG	Single Digital Gateway

Abbreviation	Meaning
SDGR	Single Digital Gateway Regulation
SSI	Single Sign In
SUMI	Software Usability Measurement Inventory
TAM	Technology Acceptance Model
TEF	Technology Enactment Framework
TEP	Techno-Economic Paradigm
TOOP	The Once-Only Principle Projec
TPB	Theory of Panned Behavior
TRA	Theory of Reasoned Action
UI	User Interface
UTAUT	Unified theory of acceptance and use of technology
UTARTU	University of Tartu
UX	User Experience
WIM	Web Identity Management
WP	Work Package

Chapter 1   Introduction

This deliverable is the result of **Task 2.1** Business Model and Stakeholder Ecosystem Development. The aim is to develop the stakeholder ecosystem and the relevant stakeholders for mGov4EU.

First a market structure and overview is conducted in Chapter 2. In order to do this, the market overview and structure is built on the research conducted in the **D1.1.** The research presented in **D1.1** provided a foundation of relevant perspectives that are key for understanding a market perspective. Therefore, section 2.2 Market Overview points out again key references that were already mentioned in **D1.1** and presents more insights specific to the market, for example, the market trends, opportunities, and challenges. After this, Chapter 3 focuses on the stakeholder ecosystem by identifying two groups, active and enabling stakeholders. These groups are further depicted and derived. In order to understand one of the key active stakeholders - the service providers - better, a cross-country qualitative research study is conducted and presented in Chapter 4. This helps to get a current understanding from service providers on relevant topics for our project, understand differences between the countries' perspectives and structures, and gain a greater insight to the needs of the service providers.

The end-user (citizens) research regarding the quantitative research will be carried out in **T2.7**, Sustainability and Governance. However, to prepare for that this deliverable provides a summary of desk research that was conducted on User Experience and Design Research on mGovernment and eGovernment research. From this, good practices were derived as recommendations for the technical partners. In addition, a case study was conducted to gain a cross-country insight on the different web portals, mobile apps, and their basic functions or SDG use case ability in Chapter 6. Lastly, this deliverable presents possible relevant business model patterns that are relevant for the mGov4EU mobile application in Chapter 7.

Chapter 2   Market Structure and Overview

This chapter presents a summary of relevant insights to the current market structure and overview for mGov4EU. Underlying this Chapter is **D1.1** "Survey of related work" (R, PU, M03), which provides a comprehensive overview of related work and relevant specifications in the three areas of (a) Mobile Government, (b) eID and (c) Cross-border data exchange. This chapter build offs of **D1.1** by adding a market perspective to the forementioned topics. The section is divided into three parts; part one is dedicated to the state of the art of mobile government, which highlights

2.1   State of the Art of Mobile Government

Mobile Government, or mGovernment (mGov), is a subcategory of eGovernment and can be described as the use of mobile and/or wireless information and communication technologies (ICTs) in activities of the public sector (Kumar and Sinha, 2007; Trimi and Sheng, 2008). mGovernment services bring many benefits for citizens, government employees, businesses, and other stakeholders: they are mobile-friendly, accessible from everywhere and much more flexible than traditional public services. Their benefits have been researched extensively by (Ntaliani et al., 2008; Tseng et al., 2008; Wang, 2014). The reformation of traditional public administrations to more digitalized administrations, which occurs more and more often, increases the need for mGovernment applications. Such applications usually rely on sensors and functions of modern smartphones (e.g. GPS, NFC, fingerprint, facial recognition, voice messaging etc.) (Wirtz et al., 2019) and are often used for real-time services such as terror alerts, traffic information and road conditions or severe weather forecasts (Blackman, 2006).

The acceptance and adoption of mGovernment services by users is crucial for public administrations, and governments and a lot of research has been done in this regard (see **Chapter 2.1 in D1.1**). However, an initial analysis within **Task 1.1** showed that more research is needed to be able to build a comprehensive framework for the adoption of mobile-government services. This finding was the starting point for mGov4EU partner DUK, who carried out a study on the key factors driving adoption. The results of this study can be found in **D1.1, Chapter 2.3**.

2.2   Market Overview

This section provides an overview of the European market, as this is what the focal point is for mGov4EU. First, there is a brief summary of the European eID schemes that were presented as results of **D1.1**. Next, there is an overview of the EU Cross-Border eGovernment and mGovernment services. Following, key insights are mentioned regarding the market trends, opportunities, challenges, and limitations.

2.2.1   European eID Schemes Overview

In **D1.1** "Survey of related work", **Chapter 3**, there is an extensive overview of existing and emerging eID solutions. This is important as secure electronic identities are key in digital transformation initiatives and for the foundation of the work in mGov4EU. This sub-section briefly gives an overview of the notified and non-notified eID schemes within the European Union. To read about these schemes in greater detail, please refer to **D1.1, Chapter 3,** in which a study of both notified European eIDs based on the eIDAS Regulation, as well as of solutions not covered by the eIDAS Regulation, such as non-notified eIDs, was conducted. The findings of this study can be summarized as follows:

- eID is of global interest.
- The EU offers a strong policy and technical framework for eIDs.
- Mobile eID solutions, the core of mGov4EU, are becoming more and more popular.

- The technical implementation of mobile eID solutions is very heterogeneous. Two protocols (SAML 2.0 and OIDC) are used in most cases to connect identity providers with service providers. App2App and SSI solutions are underdeveloped at the moment.
- eID solutions are driven both by public and private initiative and thus, the specific eID strategy of each country plays an important role regarding the targeted user groups.
- The majority of notified eID schemes support Level of Assurance (LoA) high.
- Electronic signatures are only partially supported.
- The unique and persistent identification of a user remains a challenge.

Notified European eIDs

There are now 19 notified eID schemes, coming from 15 different Member States.(New notified eID schemes in 2020 (europa.eu))(06.12.2021)

The other four Member States (Belgium, Italy, Portugal and the Netherlands) follow another separate notification process of their eIDs. The technology, on which each of these eID schemes is based, the supported eIDAS LoA, as well as other characteristics, such as support of electronic signatures, integration with relying parties or identity matching are described in detail in **D1.1, Chapter 3.5.1**.

Non-Notified European eIDs

Within **D1.1, Chapter 3.5.2**, several non-notified eID solutions were investigated including mobile solutions from the private sector. The questions driving this study were comparable to the ones chosen for the notified solutions, except for the two about eIDAS LoA and identity matching, which were slightly modified because they do not necessarily apply to non-notified eIDs. All in all, partner A-SIT analysed (31.03.2021) two national eIDs in the pre-notification process, three national eIDs, for which notification has been announced, and four private mobile eID services identified by the mGov4EU consortium as interesting show cases. In addition, seven mobile solutions from outside Europe are presented in **D1.1, Chapter 3.5.3**.

2.2.2   EU Cross-border eGovernment Services Overview

The upswing of eGovernments has been predicted and anticipated for the last several years in the European Union. Various initiatives and benchmarks have been developed by the European Commission to encourage the EU28 to embark on the eGovernment journey to develop a digitalized government that will enable citizens and businesses to access government services faster and easier (European commission, 2020). The benchmark proposed by the European Commission aims at evaluating the state of an eGovernment by measuring four key indicators: User Centricity, Transparency, Cross-border Mobility and key enablers (Tinholt et al., 2019).

The DESI assigns three key elements to the User Centricity indicator. The first is online availability, i.e., the extent to which information and transactional services and information relating to these services are available online and can be accessed via a portal. The second is user support, which is the extent to which online support, tools and feedback mechanisms are available in government portals. The third is mobile friendliness. The extent to which a service is offered through a mobile-friendliy interface.

For 2020, online availability stands at 89.5 out of 100, with Malta, Denmark, Portugal, Finland, Austria, Estonia and Spain scoring above 95. Mobile friendliness scored 89.1 points, with Sweden, Finland and Denmark scoring close to 100. User support was at 92 points. Finland, Malta and Italy scored 100 points, with all other changes scoring over 95 points. Overall, Malta, Finland, Denmark, Portugal, Austria, Estonia, Netherlands, and Spain led the User Centricity, all with scores above 95. Romania, Cyprus, Bulgaria, Greece, Croatia, Slovakia and the Czech Republic, on the other hand, all scored less than 85 points.
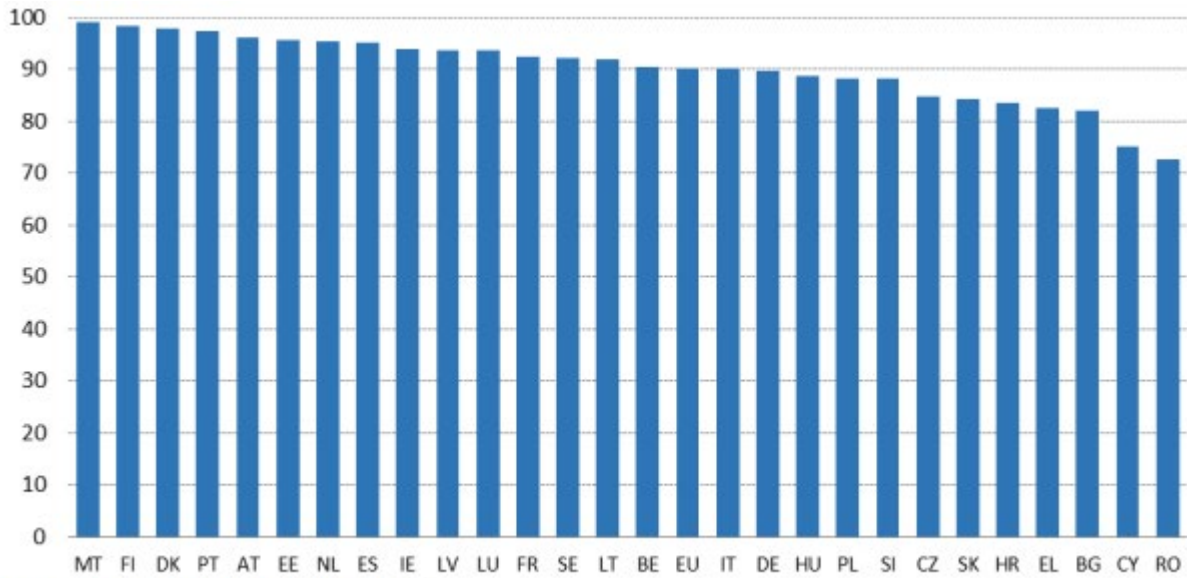
Source: eGovernment Benchmark, Capgemini.

Figure 1: User centricity status in Member States (Score 0 to 100) ("eGovernment Benchmark 2021," 2021; The European Commission, 2021)

Transparency measures the extent to which a service process is transparent, services are designed to involve the user, and the extent to which the user can manage their personal data. This indicator includes the following elements: service delivery transparency, personal data transparency, and service design transparency. The transparency of service delivery is 2020 at 62 out of 100. Malta, Estonia, Latvia and Lithuania scored more than 85. The transparency of personal data was at 72.2, Malta, Lithuania, Luxembourg, Estonia, Austria and Poland scored just above 85. The transparency of service design was at 63, 7.

Overall, Malta, Estonia, Lithuania, Luxembourg, Denmark, Portugal, the Netherlands, Ireland, Austria, Latvia and Finland led in transparency, all with more than 65 points. Cyprus, Romania, Poland, Slovakia, Greece, Germany and Bulgaria, on the other hand, all scored less than 55 points.
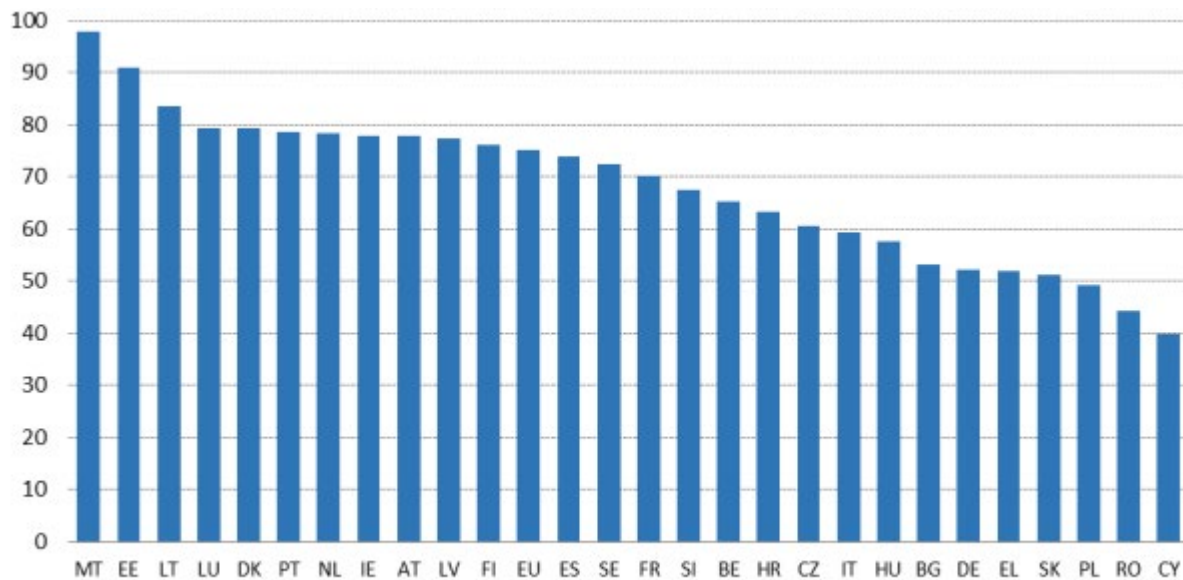
Source: eGovernment Benchmark, Capgemini.

Figure 2: Transparency status in Member States (Score 0 to 100) ("eGovernment Benchmark 2021," 2021; The European Commission, 2021)

The key enabler indicator includes the following four elements of online service delivery and availability. First, the extent to which eID can be used for online identification during service

processes. Second, the extent to which electronic documents can be used to complete a service. Third, the extent to which Authentic sources can be used, and fourth, the extent to which public institutions allow citizens to communicate electronically.

In 2020, the eID indicator was 63 out of 100, with Malta and Estonia leading, while Romania, Cyprus and Greece were behind. eDocuments was 73.8, with Portugal, Denmark, Malta and Estonia leading, while, Romania, Greece and Czech Republic had less than 50 points. The authentic sources were at 63.4 with Estonia, Malta and Finland with more than 84 points, while Romania, Slovakia, Greece and Cyprus were behind. Digital post was at 80.3 and many countries had 100 points, while Romania, Greece, Ireland and Poland had less than 50 points. Overall, Malta, Estonia, Finland, Denmark and Lithuania led in key enablers with more than 90 points each. Romania, Greece, Cyprus and Ireland, on the other hand, had less than 40 points (The European Commission, 2021).
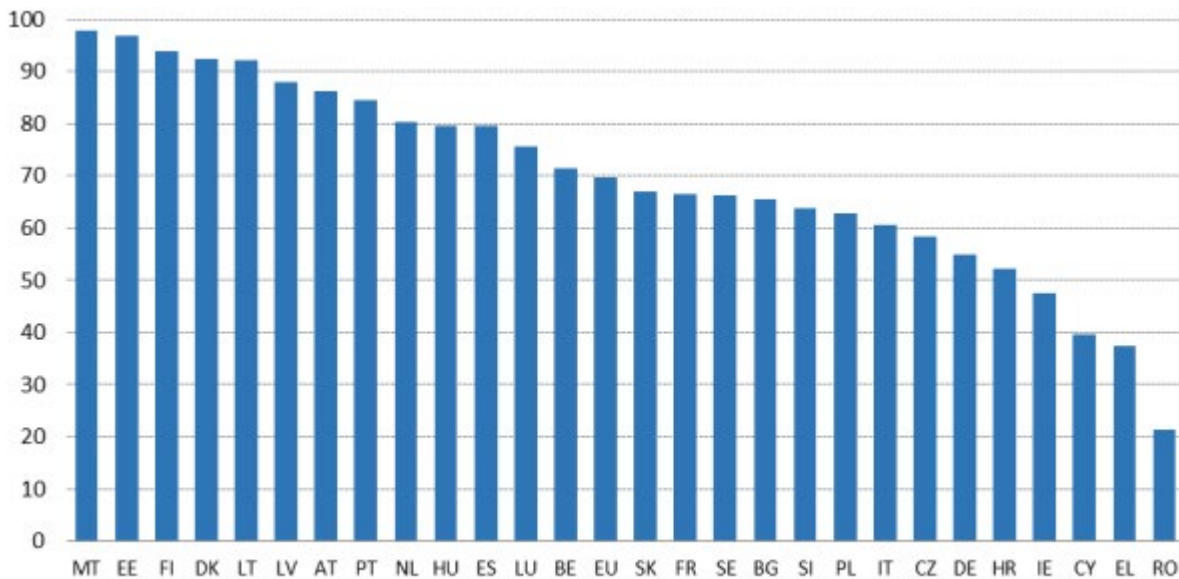
Source: eGovernment Benchmark, Capgemini.

Figure 3: Key enablers status in Member States (Score 0 to 100) ("eGovernment Benchmark 2021," 2021; The European Commission, 2021)

An Insight report produced by the European Commission in 2019 shows that the cross-border mobility of services has the lowest average top-level benchmark rating, expressing the need for improvement in the area of cross-border services which can enable citizens to access public services outside of their country.

The spectrum of eGov services encompasses a multitude of sectors and activities from getting an e-ID, starting a business, or managing payments. According to the Single Digital Gateway Regulation (SDGR), main regulation addressing cross-border access to digital public services, Member States in the EU should offer access to digital public services and procedures to the users from other Member State. These procedures are divided into the main life events for citizens and businesses, such as travel, work, birth, residence, moving, retiring, and starting, running and closing the business (Annex II SDGR). Furthermore, the National Interoperability Framework Observatory, which publishes digital public administration factsheets every year, gathered and grouped cross-border public services available in EU28 according to the entity using it. The first section of services contained services that are relevant for citizens and included groups of services like Travel, Work and retirement, vehicles, and education. The second section contained the services relevant for businesses that included service groups like running a business, taxation, human resources, and financing (National Interoperability Framework Observatory, 2020). A clearer view of these service groups can be found in Table 1.

Cross-border services for citizens	Cross-border services for businesses
Travel	Running a business
Work and Retirement	Taxation
Vehicles	Selling in the EU
Residence formalities	Human Resources
Education and youth	Product requirements
Health	Financing and Funding
Family	Dealing with customers
Consumers	

Table 1: Cross-border public services by NITO (National Interoperability Framework Observatory, 2020)

ESPON, The European Observation Network for Territorial Development and Cohesion, grouped the cross-border services in Europe in themes that contain a series of services within them and identified the number of services within a theme. The most implemented cross-border services were found in the Environment protection theme as well as in the civil protection and disaster management, and transport theme. The distribution of services across Europe has been linked to two primary factors. Countries with a long history of cross-border cooperation in areas with high populations and countries that have a low population density and long distances between villages were found to develop and use more cross-border public services. Another important aspect of cross-border public services is the fact that most services are found between two neighboring countries and rarely involve three or more countries because of the implementation complexity (ESPON, 2020). An Overview of these themes and potential services can be found in Table 2.

Theme	Services
Environment Protection	Protecting/restoring and managing terrestrial freshwater bodies, production/distribution of energy derived from renewable sources….
Civil Protection and disaster management	Firefighting and assistance in accidents, Flood Management…
Transport	Public Transport services, transport infrastructure maintenance
Healthcare and social inclusion	Primary, Secondary, and tertiary care, services for hospitals, medical emergency care….
Education and Training	Services for primary, secondary, and tertiary education, recognition of diploma and professional qualification certificates.
Spatial planning, tourism, and culture	Services supporting economic development, services for tourism development……

Theme	Services
Labor market and employment	Information/advice services for facilitating mobility of works, services for job placement……
Citizenship, justice, and public security	Public advice and support services for citizens, Customs…
Communication, Broadband, and Information security	Mail delivery, broadcasting services, digital services….

Table 2: Cross-border public services by ESPON (ESPON, 2019, 2018)

2.2.3 *EU Cross-border mGovernment Services Overview*

DESI, the Digital Economy and Society Index, published its 2020 report about the integration of digital services in the public domain across the EU, which indicated that the usage and quality of digital public services have doubled since 2019. Part of the report discussed the leaders and followers in the area of public digital services and concluded that the most advanced countries were the following: Estonia, Spain, Denmark, Finland, Latvia, Lithuania, Netherlands, Austria, Ireland and Sweden (Digital Economy and Society Index, 2019).

Following the service themes defined by ESPON, a vast majority of mobile cross-border services provided by these countries were found in the themes of Citizenship, Justice and public security, Communication, Broadband and Information Security, and Labor market and Employment. Spatial Planning, Tourism, and Culture as well as Civil Protection and disaster management where the second most deployed themes were mobile cross-border services were adopted.

The most popular services provided by these countries consisted in accessing relevant public Information via Apps or mobile browsers. E-Law and e-land registry, as an example, are registries available to all citizens from anywhere in the world that can be accessed using the browser on mobile devices (e-estonia, n.d.).(("Eesti id," n.d.) The Netherlands, as mentioned in **3.5.1.11 in D1.1**, and Austria on the other hand, provided mobile applications along with a mobile browser compatible website (Austrian Digital Government, n.d., n.d.) ("ID-Austria Mein Ich-organisiere-das- von-überall-Ausweis," 2021). Another highly implemented cross-border mobile service included the filling of tax forms, finding or proposing employment, receiving notifications , messages or digital post from the government when needed (administracion, n.d.; Digital Denmark, n.d.; eBoks, 2021.; e-estonia, n.d.; National Interoperability Framework Observatory, 2020; portal administracion, n.d.). ("Eesti id," n.d.; "NemID und digital post in Dänemark," 2018) Another attractive service was the e-residency service proposed by Estonia, that allows anyone in the world apply for electronic residency which enables entrepreneurs to apply and start establishing a business there. Estonia was also the first country that initiated the I-Voting process that allowed the Estonian citizens to participate in nation-wide and parliamentary elections from all over the world (e-estonia, n.d.). ("Eesti id," n.d.)

2.2.4 *Market trends*

Once Only Principle

The leading eGov countries share the same Once Only Principle (OOP), since they started by providing one or more electronic identification methods, that would be used for accessing the majority or all public services. Within the EU, understanding of the OOP varies. In case of few countries, OOP is understood in legislation that there is existing only original data with no duplication in other databases, while in other OOP is understood that data is provided only once by citizens or businesses. In the EU framework the OOP means that a citizen does not have to constantly provide his basic data if he had been already provided once to the government entities. The Once Only Principle states that a citizen does not have to constantly provide his standard information before using a digitalized public service by allowing public administrations to share his data (European Commission, n.d.). Estonia, as stated in **D1.1**, started by providing the mobile-id solution with an

integrated e-signature solution, which allows its citizens to securely login to and use all of Estonia's online services inside or outside the country (e-estonia, n.d.). Countries like Sweden, Ireland, the Netherlands, and Denmark also use the same methodology to facilitate the access to their digital services (Digital Denmark, n.d.; elegitimation, n.d.; government of the netherlands, n.d.; Irish Government, n.d.). Latvia on the other hand, allows identity providers from the public and private sector to interact with the public services, as well as some banks, that allow the login and access of services (Latvian Government, n.d.). **D1.1** can provide a closer look at the Danish NemID, the Estonian MobilID as well as the Latvian eID solutions.

This principle not only allows administrations and businesses to save money and time when transferring business data from one register to another but also makes it quicker to update the businesses' information without accessing every register (Dembecka and Mamrot, 2018). The increase of interoperability between systems using the OOP does come with a high cost when addressing the security and privacy aspect of it but also allows governments to minimize identity thefts and increase the overall chances of fraud detection (Akkaya and Krcmar, 2018). From a citizen's point of view, the Once Only Principle offers an effortless and user-friendly experience when accessing public services but also presents a threat to some citizens. Akkaya's results showed that the citizens of Germany, Austria and Switzerland were skeptical of the idea of European organizations sharing their personal information to offer better services (Akkaya and Krcmar, 2018; Krimmer et al., 2017).

Mobile-first design

The mobile-first design method is a concept that aims at designing websites in a way that would allow them to be displayed in different sizes. This guideline eliminates the burden (zooming, scrolling) for the user when accessing a website on any device (Xia, 2017). Another guideline in mobile-first design suggests that a website should first be developed to suit mobile devices and then extended to the desktop features. By developing websites this way, the developers get to produce a clean and understandable website that contains the most important features that can later be extended when developing the desktop version of the website. Wroblewski and Curinga argue that mobile versions of a digital service are more efficient than the desktop version since the user can use some device features that include voice recognition, cameras, and GPS (Curinga and Saravanos, 2016; Wroblewski, 2011). Curinga states that mobile applications are best suited to take full advantage of the mobile device's features and for storing information, while web applications offer a less rich user experience to the citizen.

The Austrian Government, as an example, took the mobile-first initiative in 2019 when launching the "Digitales Amt" App. The App not only allowed citizen to access all the available public services via a mobile device but also provided a way to sign with a mobile signature, thus creating a user-friendly and efficient mobile government Interface (European Commission, 2020).

SDGR

The Single Digital Gateway Regulation (SDGR) is a regulation that requires, as stated in article 6, that EU countries must provide twenty-one cross-border services online by December of 2023 (The European Parliament, 2018). The SDGR also states that digital public services should not only be accessible to domestic citizens but also EU citizens, thus encouraging the development of cross-border public services. As mentioned in **D1.1**, one of the Single Digital Gateway's priorities consists in encouraging European administrations to implement the Once-Only Principle in their approach. This legal frame and services provided by the SDGR binds the EU28 to develop cross-border solutions in a more structured and collaborative way. These services are based on pre-defined life events that include birth, residence, studying, working, moving, retiring, and managing a business. Typical services include requesting proof of registration of birth or residence, submitting applications to universities or potential employers, and registering a change of address.

Estonia as an example successfully implemented 99% of its public service online, which makes it one of the few countries that provides all services demanded by the SDGR (Bhattarai et al., 2019). However, still not accessible for the cross-border use and users from other Member States.

Cross-border

The Single Digital Gateway Regulation states that the aforementioned cross-border digital public services need to be implemented across the European Union, to provide an easier access for services to citizens that cross-borders frequently (The European Parliament, 2018). Cross-border services have also been prioritized by the European Commision in their 2014-2019, as well as in their 2019-2024 Single Digital Market Strategy so that Europe becomes a pillar in the digital age. For that, governments need to make sure to develop their services so that eIDAS notified countries can access them. These services are especially attractive for students, employees, and employers, that are seeking to leave their country and can therefore apply for the university or a job from their hometown. In addition, opening businesses abroad becomes easier for the citizens, as language barriers and legal barriers become less intimidating (ESPON, 2020). Typically, cross-border public services have been identified to be either present between two countries with a long history of cross-border cooperation or between countries that have low population densities (ESPON, 2019; Kalvet et al., 2018). Cross-border services are also rare to find between three or more countries as interoperability challenges begin to rise (ESPON, 2019).This shows that the reach and deployment method of mobile cross- border services need to be improved so that all EU citizens can profit from them (Kalvet et al., 2018).

According to the European Observation Network for Territorial Development and Cohesion (ESPON), 60% of the cross-border services identified in the European Union can be assigned to the three first themes presented in Table 2. Environment protection, civil protection & disaster management and transport are the themes that encompass the most cross-border services in the EU, while spatial planning, healthcare, and education account for less than 30% of the cross-border services themes (ESPON, 2018). As for the countries that offer the most cross-border services, Belgium, the Netherlands, Luxembourg, France, Germany, Sweden, Norway, and Finland can be seen as leaders in this area. Germany, as an example, provides a high number of cross-border services across the German-Austrian border. The same phenomenon can be observed along the German-Czech border (ESPON, 2019, 2018). Some solutions have also been identified across Europe such as eDelivery, EUCARIS, OpenPeppol and the TOOP among many others (Burgstaller et al., 2021, p. 4).

In DESI 2021, cross-border mobility indexes which information is available online, usable and provided with feedback and support functions. It also describes to what extent eID and eDocuments are usable for users outside the EU (The European Commission, 2021).

For 2020, online accessibility is 65 out of 100 points. Luxembourg, Italy, Germany, Portugal and Croatia are above 85 points. Slovenia, Poland, France and Denmark score below 30. User support is at 70.7 with Luxembourg, Malta, Netherlands and Ireland above 95, while Hungary, Poland and Romania are below 40. eID is at 25.3 with Austria, Luxembourg and Malta above 60, while Romania, Poland, Germany, Bulgaria, Ireland and Cyprus are far below. eDocuments is at 48.4 with Finland and Germany leading, while Poland, Romania, Italy and Bulgaria are below 20.

In this measurement, Malta, Luxembourg, Estonia and Austria lead the EU, all with scores above 75. The countries with less cross-border flexibility and advancement are Romania, Hungary, Poland, Greece and Balgaria, each with scores below 40 (The European Commission, 2021).
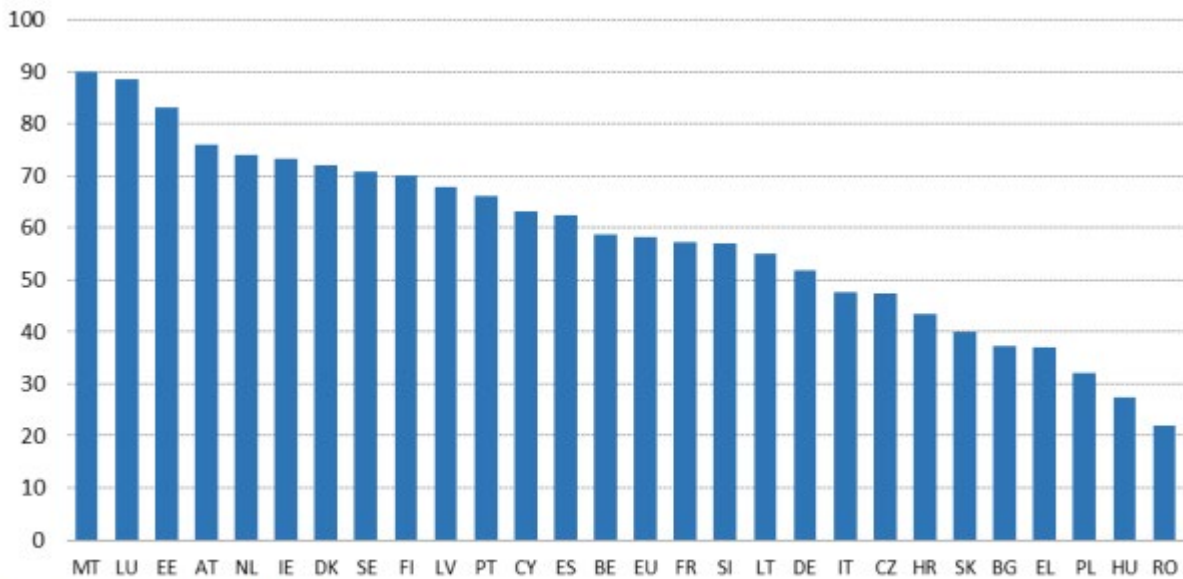
Source: eGovernment Benchmark, Capgemini.

Figure 4: Cross border service status in Member States ("eGovernment Benchmark 2021," 2021; The European Commission, 2021)

2.2.5 Market Opportunities

The Introduction of mGovernment affects all parties linked with the services provided, thus creating an impact on citizens, businesses, and the public sector itself. This section provides an overview of the influence of mGov on these groups.

Impact on citizens

The introduction of an eGovernment changes the way public services are designed. Designers must consider the preferences and requirements of citizens in order to promote the use of the service, thus making government services more citizen-centric, transparent and user friendly. eGovernment also allows building a trust relationship between the government and the citizen since it is the government's role to ensure the safety and privacy of the citizen's information when using a digital service (Ogunleye and Van Belle, 2014; Welby, 2019). The introduction of services like online voting has the potential to include citizens more actively in the public sector and improve their participation in their democracy (Abu Bakar et al., 2017; Ogunleye and Van Belle, 2014).

The introduction of mobile government services has been proven to be very helpful in certain situations like refugee crises since it is easier for a refugee to access a smartphone than a computer. The Implementation of mobile public services allows the government to understand the citizens' behavior which results in a constant optimization and personalization of services (Abu Bakar et al., 2017; Rosenbaum et al., n.d.). Mobile cross-border public services do not only deliver the same advantages as eGov services to the citizen but also provide the convenience of being location and time-independent which translates in less waiting and processing time as well as less transportation fees (Federal Ministry of digital and Economic Affairs Austria, 2017; Rosenbaum et al., n.d.; Sideridis et al., 2017) (Federal Ministry of digital and Economic Affairs Austria, 2017).   In some cases, it is even cheaper to use the mobile version of a public service: The Austrian Government, as an example, aimed at promoting the use of mobile government services by lowering the fees for some paid services if they were accessed by a mobile phone.

Impact on businesses

An electronic or mobile government allows businesses to access services and execute actions more efficiently. Tax procedures, as an example, can become quicker and easier to complete as the need for transport is eliminated, processing and writing time decline, and waiting lines disappear (Kalvet et al., 2018). Mobile cross-border public services offer some opportunities to businesses that would

allow them to easily open a new franchise or shop abroad as well as recruiting and registering employees, paying their contributions, and submitting corporate tax declarations without the need for a physical administration (European commission, 2020).

The access to business related information across-borders saves research and consulting time as public administrations create cross-border services that provide all the necessary taxing regulations. Austria, Finland, and Estonia, along with other EU countries launched business service portals intending to create a single platform for all administrative activities that businesses need including starting a business, finding relevant laws and regulations, and paying administrative fees (e-estonia, n.d.; National Interoperability Framework Observatory, 2020). Mobile cross-border public services would also allow businesses to apply for credit, register a property, and facilitate trades across-borders (Martins and Veiga, 2018). These services will allow businesses to eliminate huge costs when entering a new market as well as encourage them to enter these markets, since regulatory barriers are being resolved.

Impact on public administration

The outcome of a successfully implemented mGovernment is very attractive for governments as it translates in overall reduced costs. Human resources, physical locations, and other related costs can be reduced or eliminated as the automation and availability of the service increase. Administrations will provide quicker processes, thus an improved quality of services, while retaining a low workload (Abu Bakar et al., 2017; Kalvet et al., 2018; Ogunleye and Van Belle, 2014). The time and costs saved alongside with the automation process allows governments to offer their services around the clock thus increasing their service delivery capacity and improving their decision making with the use of the collected data (Ogunleye and Van Belle, 2014). Mobile cross-border services allow for a wider reach for the government as its services cross-borders and amass new users. The feedbacks and flows of information that the users produce can then be analyzed and used to increase the quality of the services. These improvements can cultivate the relationship between government and citizen, therefore promoting civic engagement and easier collaborations between governments and citizens(Alkaabi and Ayad, 2016; Sharma et al., 2018; Szabó, 2018).

2.2.6   Market Challenges

The challenges that come with the research, development, introduction, implementation, and use of mobile government services can be categorized in various ways. One of the most important technical challenges presented themselves as challenges that belong to the interoperability side of developing such services, while the non- technical challenges included some cultural, UX, and economical as well as strategic aspects. The following section provides a closer look at the technical and non-technical challenges faced by governments in the world of mobile public cross-border services. These technical and non-technical challenges should be considered throughout the development of the project, especially in regards to the pilots.

Technical

To develop efficient cross-border mobile public services, countries should be prepared to collaborate from the very beginning in order to easily resolve interoperability challenges. Following the Once Only Principle, a persons' eID should be recognizable at any administration or public service it can access, which means that the same e-ID provided by Germany, for example, needs to be recognizable to public institutions outside German borders (Müller et al., 2018). In conformity with the factors used in the evaluation conducted in **D1.1**, there can be certain differences in the infrastructure, system distribution, public access (private vs. public network), service delivery (centralized vs. decentralized), number of identity providers, Internet speed, technological advancement, and development status of the eGovernment alongside other technical factors that can increase the difficulty of implementing electronic and mobile government solutions (Kalvet et al., 2018; Martins and Veiga, 2018; Sideridis et al., 2017; Wroblewski, 2011). Governments should prepare for these differences and work on the compatibility of their digital e-IDs, services and mobile applications that need to be designed in a way, that allows them to seamlessly share information across-borders when needed. Mobile public services should also be prepared for growth as

scalability plays a very important role in improving the service delivery. Governments must also satisfy the standard user requirements of mobile applications which means that security, privacy, usability and interoperability have to be taken into account from the very beginning of the development(Alkaabi and Ayad, 2016; Alssbaiheen and Love, 2016; Isagah and Wimmer, 2018). Continuing, another technical challenge is that guidelines such as WCAG, ATAG and UAAG are taken into account in the tools created by mGov4EU. On one hand, it is ensuring digital inclusion where the mGov4EU solution is accessible for people with disabilities and on the other hand, it is a matter of service availability and that it is available for as many groups of users as possible.

A more detailed view of the technical challenges faced by mobile public cross-border services is displayed in Figure 5.
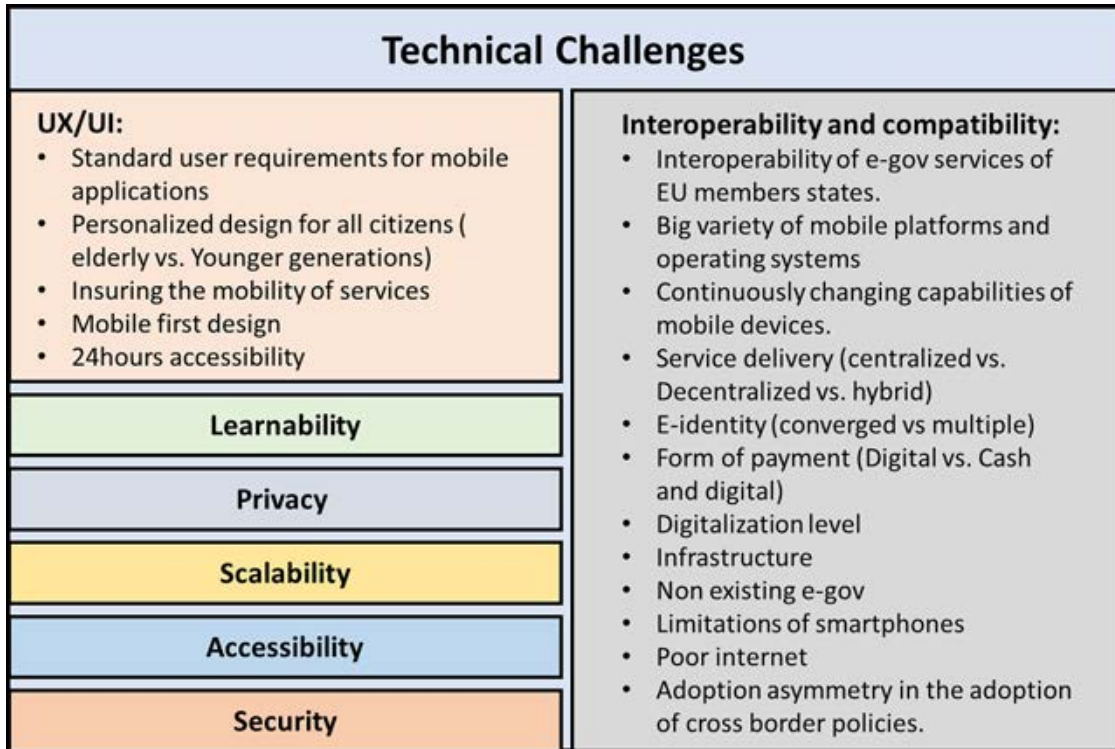
Figure 5: Technical Challenges of cross-border public services (Alkaabi and Ayad, 2016; Alssbaiheen and Love, 2016; Isagah and Wimmer, 2018, 2017; Kalvet et al., 2018; Rosenbaum et al., n.d.; Williams et al., 2018)

Non-Technical

One important aspect to consider when approaching the development of a mobile public service is the relationship between citizen and government. The political situation, history, demographics, and many more factors affect this relationship, which ultimately acts on the trust that citizens have in their government (Alotaibi et al., 2016; European commission, 2020; Williams et al., 2018). The citizen's intent to use the mobile service depends severely on this relationship, since privacy and security are one of the building blocks of such services. The citizen's perception of the service plays an important role in the adoption of mobile services since they can have a different perception than the government about the reliability, security, and usefulness of the service (Shareef et al., 2016). Overcoming this challenge means that governments need to start making the citizen aware of the services, which presented itself to be a challenge in some countries on account of different cultural and demographical factors(Alotaibi et al., 2016; Alssbaiheen and Love, 2016; Federal Ministry of digital and Economic Affairs Austria, 2017). The Government also has to take into account the learnability of the applications or mobile services they offer since multiple research studies concluded that the adoption of new technologies and services is much easier for young generations than for the elderly (Isagah and Wimmer, 2018; Kureerung and Ramingwong, 2019a; Müller et al., 2018; Talukder et al., 2020).

Furthermore, another challenge is to achieve user acceptance. Therefore, it is important to focus on overcoming the challenge by involving a user centric approach, where the user of the product needs to be at the center of product development. To do this, certain expectations should be taken into account: a multi-channel service approach, a one-stop shop for users, and collecting and evaluating user feedback to improve the website or application. There also can be challenges that arise in adapting or meeting the website/application to the users' requirements. However, these challenges can be addressed by consistently involving the user, for example by user acceptance testing of the mGov4EU pilots to meet the needs of the user. The Figure 6 below summarizes desk research of various non-technical challenges found in cross border public services regarding user perception of the service and user related challenges. These should be considered for each of the pilots throughout development. These are necessary to address while including a user centric approach and to achieve user acceptance.

The European Union has 24 official languages, including German, French, and English as procedural languages. This high number of languages presents one of the most significant cultural challenges to the developers of a digital cross-border service since there are high research and human resources costs as well as long processing and developing times tied to overcoming this obstacle (Williams et al., 2018). The potential lack of expertise can also be a challenge in some countries, which translates into higher costs if governments decide to bring in experts and consultants from other countries that already achieved a higher grade of development. Alongside these potential costs lie the high implementation and scalability costs of public mobile services, especially if the mobile-first principle has not been followed from the start (Alkaabi and Ayad, 2016; Isagah and Wimmer, 2018; Rakotonirina and Raoelson, 2018; Rosenbaum et al., n.d.). These high costs alongside the lack of mobile government laws can then cause a resistance from governments to take the firsts steps into developing their mobile cross-border services (Alssbaiheen and Love, 2016; Falch et al., 2020). Figure 6 showcases the categories of non-technical challenges, as well as some examples:

Figure 6: Non-Technical Challenges of cross-border public services (Alonazi et al., 2018; Alssbaiheen and Love, 2016; Falch et al., 2020; Kalvet et al., 2018; Kureerung and Ramingwong, 2019a; Müller et al., 2018; Munyoka and Manzira, 2014; Rakotonirina and Raoelson, 2018; Rosenbaum et al., n.d.; Shareef et al., 2016; Talukder et al., 2020; Williams et al., 2018)

2.3   General Market Structure

This section elaborates on the general market structure and literature that is supporting it. It summarizes and builds on work done by (Zibuschka and Roßnagel, 2012) in respect to Stakeholders

of Identity Management (IdM) Infrastructures for the Web and for work by (Kubach and Sellung, 2021) that looked at Stakeholders of Identity Management Structures in an SSI/Decentralized Identity Ecosystem (see Figure 7).
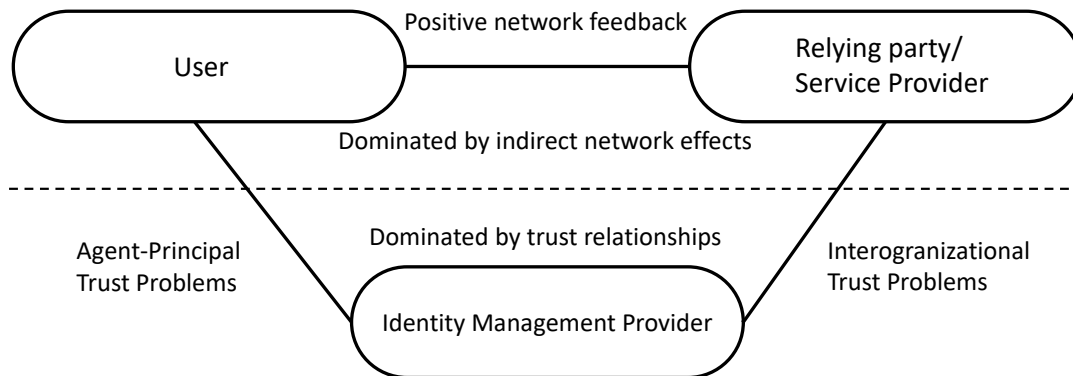
Figure 7: Extension of Market Structure by (Zibuschka and Roßnagel, 2012)

2.3.1 Actors and Relations

Between User and Relying Party

It's been observed that the relationship between user and relying to parties (e.g. Service providers using the WIM) are heavily influenced by indirect network effects. For instance, as mentioned by (Kubach and Sellung, 2021) , there is an observation of a two-sided market, which implies that there is a "the chicken or the egg" problem, of which comes first. This can be seen by one side, if there are no services that are supporting web identity management (WIM), then it is not of use for the user. While on the other side, if there are no users that have adopted the WIM, then there are no Service Providers that are driven to implement it as there's no users to reach yet.

Regarding the Relying Parties, there are multiple examples of existing protocols that have massive user bases, however, haven't been adopted by relying parties (e.g. CardSpace, OpenID). For example, every German citizen that's older than 16 has a German National eID, however, hardly anyone uses it due to lack of service providers supporting it (Kubach and Sellung, 2021).

Between IdM System, End-User, and Relying Party

(Zibuschka and Roßnagel, 2012) points out that the relationship between identity providers and the Relying Party/Service Providers and Users are controlled by trust issues, at least in the WIM market. They describe a principal- agent trust between the end-users (principal) and identity providers (agent). Having a principle-agent relationship between the end-users and identity providers could lead to problems such as; the identity providers (agents) are market participants and therefore want to provide a high standard of service such as, having high security and privacy, where users may not be able to value these terms of quality (Zibuschka and Roßnagel, 2012). This could then lead to users choosing other solutions that provide a lower quality of standard but another apparent value such as ease of use, price advantage, or a large base of service providers (Kubach and Sellung, 2021).

As for relying parties and identity providers, there is an inter-organizational trust between them (Zibuschka and Roßnagel, 2012), (Kubach and Sellung, 2021). Trust is a sensitive and vital relationship, where its been argued that insecurity and trust issues can very well lead to the failure of identity management systems, as users may not be willing to trust them with personal identity information they don't trust.

2.3.2 Challenges

Trust

(Zibuschka and Roßnagel, 2012) observes that as a response to the trust problems between the IdM, End-User, and Relying Parties, that research and development turned to more security and privacy in IdM systems.

(Kubach and Sellung, 2021) points out that trust is not a completely objective decision, but also subjective to individual perception, which could imply that even a system with higher security or privacy does not match the end user's subjective perception of trust

Network Effects

As observed by (Zibuschka and Roßnagel, 2012) and in (Kubach and Sellung, 2021), the relationship between users and relying parties (service providers) is influenced by indirect network effects, where one can observe the chicken and the egg problem. They point out that if no services are supporting the Identity Management system then it is not useful for the users. However, if there are no users that have adopted the services, then why should service providers invest more in creating more services.

Viable Business Models

As referenced in (Kubach et al., 2013) and (Kubach and Sellung, 2021), in order to achieve viable business models, it is necessary to have a better understanding of the ecosystem and the active stakeholders within them. The challenge here is that each stakeholder has varying priorities and requirements which are at times contradicting. Therefore, it is important to put effort into overcoming this challenge (Kubach et al., 2013).

Chapter 3   Stakeholder Ecosystem

This chapter elaborates on the stakeholder perspective of mGov4EU. First, it defines the stakeholder concept. Second, it depicts the stakeholder groups, which are active and supporting. In addition, a stakeholder analysis is conducted for each pilot. Fourth, stakeholder research is presented and evaluated. Fifth, a summary of the stakeholder priorities and requirements is given.

3.1   Definition of Stakeholder Terminology and Presentation

The most common definition of the term stakeholder was coined by Freeman in 1984. An organisation's stakeholder is, by definition, a group or individual who influences or is influenced by the achievement of organisational goals (Freeman, 1984).

However, according to (Pouloudi, 1997), this definition needs to be clarified and may also be problematic in terms of stakeholder analysis. (Pouloudi and Whitley, 1997) therefore define stakeholders in terms of information systems as those actors involved in the development process, with all persons, groups or organizations whose actions influence or are influenced by these factors, both directly and indirectly, in the development and use of a system.

For further analysis, and to address their requirements specifically, the group of stakeholders can be subdivided into groups, which in turn pursue similar demands or can influence the success of the project in different ways. Different categorization approaches have been presented. Cotterell and Hughes, for example, (Cotterell and Hughes, 1995) distinguish the following three categories of stakeholders:

- Project team internal
- Project team external but internal to the company
- Both external to the company and external to the project team

Newman and Lamming (Lamming and Newman, 1995) on the other hand define four categories of stakeholders involved in computer systems:

- Responsible for design and development
- Responsible for sale and purchase
- Responsible for implementation and maintenance
- Interested in the use

Sharp and colleagues (Sharp et al., 1999) categorise three main types of stakeholders:

- "Baseline": is the starting point, it is divided into four groups
    o User
    o Developer
    o Legislator
    o Decision-makers
- "Supplier": provides information to the "Baseline" and works in support of
- "Client": inspects or develop products

The stakeholder concept according to Sillitti and Succi (Sillitti and Succi, 2005) can also clearly be applied to research and development projects and new technologies, but it is extremely simple. The authors distinguish only three types of stakeholders:

- Customers
- Developer
- Manager

The customer is involved in the development process and even acts as part of the team in some cases. The close cooperation between customers and developers is of great importance and ensures permanent feedback for the developers. In this way, the implementation of useless or

inapplicable features can be avoided and an effective product optimized to the customer's requirements can be designed. Finally, managers design the framework conditions for productive cooperation between customers and developers (Sillitti and Succi, 2005).

It is clear that those stakeholder categorizations, when viewed individually, each have clear gaps. However, these generic groups of stakeholders proposed in the literature can serve as a starting point to identify stakeholder groups that are relevant for the success of mGov4EU.

3.2   Stakeholder Groups

First, we differentiate between direct participants of the ecosystem and such actors that are only indirectly involved in the daily business of the ecosystem. We call the first group "Active Stakeholders" and the second group "Enabling Stakeholders". Figure 8 gives an overview of the Active stakeholders and Figure 9 of the Enabling Stakeholders of the mGov4EU ecosystem.

3.2.1   Active Stakeholders

The Active Stakeholders for the mGov4EU Ecosystem can be categorized into two sub-groups; Users of Governmental/Identity Services and Identity-/Credential/-Trust Providers. These two groups are actively involved in the everyday processes of the ecosystem. The active stakeholder actors like the ID-/Credential-/Trust Providers have a high economic interest in the sustainable success of the ecosystem. Another point regarding active stakeholders, is that they typically derive some kind of direct value from the ecosystem (e.g. as it supplies them with secure and easy to-use digital services). Overall, the active stakeholders are of high relevance for the value creation in the ecosystem, and thus for the business models.

In Figure 8, there is an overview of all the Active Stakeholders. As mentioned before, there are two main groups of active stakeholders: Users and ID-/Credential/Trust Providers. The Users are divided into two further groups, End Users and Service Providers or Relying Parties. The Service Providers or Relying Parties are largely from Public Sector Entities (PSE). These Public Sector Entities include Public Sector Organizations, Institutions, and Administrations. The asterisk found by G2B in the figure is meant to disclaim that the Business or Enterprise mentioned can differentiate between different types of enterprises or businesses (e.g. micro, small, medium, large, etc). The asterisk found by G2C in the figure disclaims that the citizens can also differentiate between different types of citizens (e.g. immigrants, children, people with special needs, etc.)

Active Stakeholders					
Users					**ID-/Credential/ Trust Providers**
End Users	**Service Providers/ Relying Parties**				Government / Administration ID Provider
End Users	Public Sector Entities (PSE)				
End-Users/Consumer (without Special Features)	G2E	G2B*	G2C*	G2G	IT Platform ID Providers
End-Users (in Government Administrative Entites	Services for Employees	Services by Local PSE for Enterprises	Services by Local Level of PSE's for Citizens	Service by Local Level PSE to Other PSE	ID-Consortia
End-Users (in Private Enterpise)		Services by regional PSE for Enterprises	Services by Regional Level of PSE's for Citizens	Service by Regional Level PSE to Other PSE	Traditional Credential- Providers
		Services by Naitonal Level of PSE for Enterprises	Services by National Level of PSE's for Citizens	Service by National Level PSE to Other PSE	Alternative ID Providers
		Services by Public Institutions (e.g. Universities) for Enterprises	Services by Public Institutions (e.g. Universities) for Citizens (e.g. Students)	Service by Supra National Level PSE to Other PSE	Trust Service Providers
				SDG related Service Providers	Other Credential Providers

Figure 8: Active Stakeholders of mGov4EU Ecosystem

Active Stakeholders: Users

The user stakeholder group can be further divided into two groups: End Users and Service Providers/Relying Parties.

End-Users

The End-Users are the actual persons/consumers, end-users in a government administrative entity, or from private enterprises, who use the services in the ecosystem. The End-Users are the stakeholders, who would be using the services provided by Service Providers and ID-Credential-Trust Providers. They would also be considered to be the active stakeholder that is a data provider.

The goals of the End Users would be to use services either for private purposes, such as, registering their new address at the city hall or to go vote. In addition, the End-Users could also be in a work environment (e.g. in the public or private sector), where they would be completing tasks for their job.

Service Providers

The Service Providers and Relying Parties are the active users that make use of the ID/Governmental Services, but are organizations.

The Service Providers or Relying Parties that are important for the mGov4EU ecosystem are mainly from Public Sector Entities (PSE). Further, the groups can be divided into different relations; government to employee (G2E), government to business (G2B), government to citizen G2C, and government to government (G2G).

The goals of the Services Providers and Relying Parties are to provide services that are utilized by the end-users. It is possible that the PSE outsources their services by hiring an external IT Service Provider to provide their services. Overall, the Service Providers and Relying Parties are the data consumers, as well as data providers The Service Providers are the key stakeholders for data exchange and interoperability of the e-services and thus are relevant for data exchange infrastructure such in CEF eDelivery building block.

As the MGOV4EU ecosystem, largely relies on Public Sector Entities, their interests are divided in providing useful and user-friendly services to their employees, businesses, citizens or other governments. Other Interests of Services providers, could be to reduce costs, implement more efficient processes, time reduction, and digitalization.

The Public Sector Entities that take on the role Service Provider/Relying Party stakeholders can be described in the following roles:

- *G2E:* PSE's that are providing services for their employees within their entities or across entities. For example, a State X Immigration of Country A office provides services to their employee directly, but also has interactions or work with another State Y Immigration office of Country A employees.
- *G2B:* PSE's that are providing services for various types of businesses, such as, Micro Enterprises, Small enterprises, Medium Enterprises, Large Enterprises, Other Organizations. For example, the PSE provides a service for businesses to submit their corporate tax declaration.
- *G2C:* PSE's are providing services for citizens. This can vary depending on the type of organization. One example is where a PSE's, like a City Hall that offers the service to register a new address to a Citizen. Another example could be that a university offers a service to request their diploma or proof of studies to a Consumer/Student.
- G2G: PSE's are providing services to other PSE's. For example, this could be an example of cross-border e-services between different universities that work together exchanging documents or evidence for exchange students. Another example could be when one specific PSE requires evidence or documents from another PSE, i.e in case of child benefit service.

Active Stakeholders: ID-/Credential-/Trust- Providers

The main active stakeholder group are the ID-/Credential-/Trust Providers. The ID/Credential/Trust providers provide digital IDs, components or related services to the ecosystem. The types of organizations and interests between these providers may vary. These stakeholders have a high interest in establishing successful business models and ecosystems. This is largely due to their need for compensation for the effort in making an ID ecosystem.

In regards to mGov4EU, these stakeholders could be Government/Administration ID Providers, IT-Platform ID providers (e.g. Google Login, Apple ID, Facebook Login etc.), ID Consortia (e.g. Verimi, Yes etc.), Traditional Credential Providers, Alternative ID providers (e.g. SSI Startups or Organizations like Sovrin/Evernym, Jolocom etc.), Trust Service Providers (e.g. Schufa, etc), or Other Credential Providers (e.g. Mobile Connect etc.).

3.2.2 Enabling Stakeholders

Enabling Stakeholders are not actively involved in the daily business of the mGov4EU Ecosystem. This role does not include direct users, services providers or any providers of identity services or components. However, they are still relevant for the overall success as they are indirectly involved in various forms. The Enabling Stakeholder are divided further into "Developing Stakeholders" and "Framing Stakeholders". The consortium partners of the mGov4EU project are all enabling stakeholders (at least in one role aspect).

Regarding Developing Stakeholders, they consist of various actors that are developing the technology and standards that are required for the ecosystem. Therefore, those stakeholders have an interest in the success of the technology and would need to generate some kind of revenue to cover costs for Research and Development. It could also be the case that some of these stakeholders in this category could be an active stakeholder at the same time, for example if they operate some Identity Management Components, however, this is not always the case. Therefore, the business model of those stakeholders can differ from active stakeholders. In regards to the mGov4EU ecosystem, important Developing Stakeholders could be Standardization Bodies such as, ETSI, CEN, OASIS, or IETF. As mGov4EU focuses on mobile solutions, another key developing stakeholder are the telecommunication companies.

Regarding the Framing Stakeholders, these actors set the framework conditions for the Identity management systems without actively using or developing the actual technology or its components. However, through the development of basic technologies (Research Organizations) or forming the regulatory framework (Regulatory Bodies), overseeing Data Protection regulations (Data Protection Institutions), influencing public discussions and the legislative process (Civil Society and Multiplicators) and so on, they can be a significant influencing factor for the success of the

ecosystem. Their economic interest in the Ecosystem is very low and their relevance for a business model in the ecosystem is therefore limited (see Figure 9).
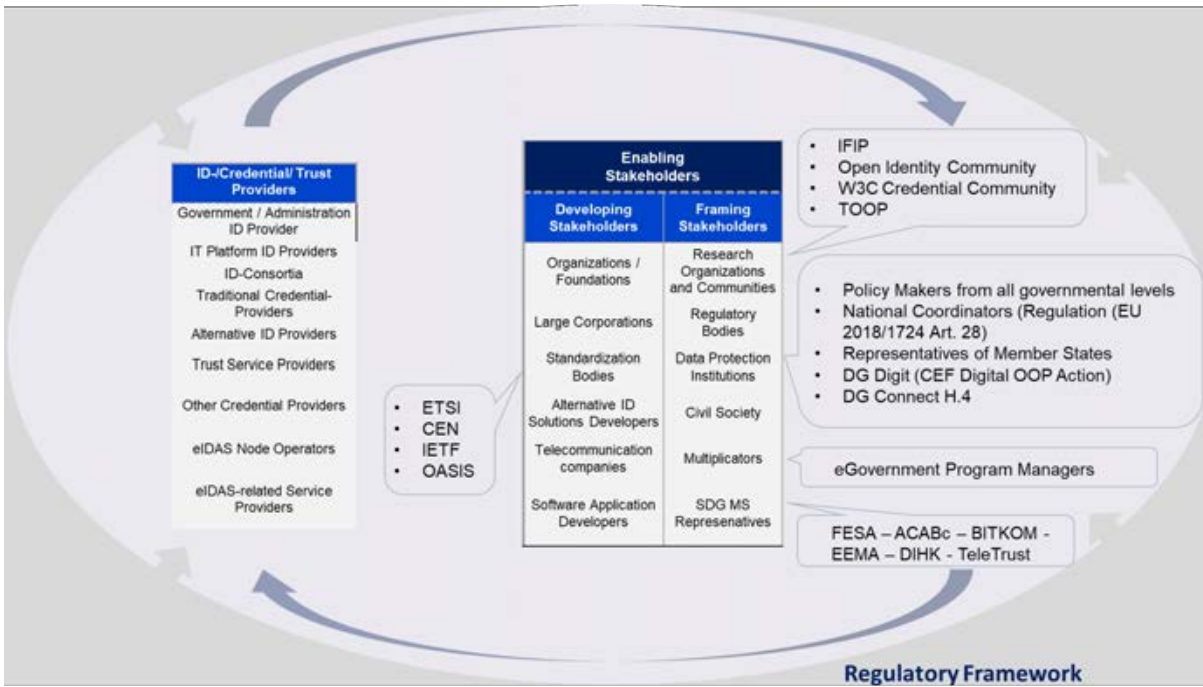
Figure 9: Enabling Stakeholders of mGov4EU Ecosystem

Chapter 4 mGov4EU Conceptual Model

The mGov4Eu Conceptual Model is a framework that harmonizes all of the key elements in the mGov4EU project that will be showcased in the mGov4EU pilots. The key components refer to the mGov4EU goal to present use cases that show the implementation of use cases that are cross-border, mobile first, SDG compliant, and eIDAS compliant.

In this deliverable, a first collection of different methologies and theories that were considered relevant for the mGov4EU conceptual framework are given. This collection reflects other eGov and mGov frameworks that have been presented in research along with other technological adoption models. This can be found in the Appendix 9.1.

There are three basic requirements that need to be fulfilled for the mGov4EU conceptual model at this stage. First, it should be flexible and have the ability to be applied to a non-technical and technical context. This means that it should be able to be applied to the technical development of the project as well as the economic or usability aspects of the project. Second, the model should be able to be tangible. This implies that it is a model that is easy to apply to varying situations in the project's development. Third, it should be a model that takes into consideration the bigger picture and consider elements that are beyond the project. This considers external factors that are key for the project's success.

After having these requirements in mind, each method was considered. Many of the methods fit different aspects of these general requirements. However, the method that was the most fitting was the Social Construction of Technology Theory approach. Starting with this approach will fulfil the basic requirements above and also allow to easily extend or adapt this model if desired in the further development of the mGov4EU conceptual model in WP5. One way that the model could be extended, would be to apply the Diffusion of Innovation approach in the third element of the SCOT approach.

4.1 The Social Construction of Technology Theory Approach

The Conceptual Framework that is followed by **D2.1** is The Social Construction of Technology Theory (SCOT). This is a social theory and framework developed by Pinch and Bijker in 1984 that examines human knowledge, cultures, and skills. This theory is used to study the behavior of a society, or social group, towards innovations in order to understand its impact more deeply and solve related technological problems that have negative effects on society. The SCOT is formed of three elements that are introduced in Figure 10 (Klein and Kleinman, 2002; Maky et al., 2016).

1 Interpretative Flexibility
Different technologies have different interpretations for different groups

2 Closure and Stabilization Efforts
2a – Relevant Social Groups: Identifying the relevant social groups for the research
2b – Redefinition of a Problem: Adjusting the problems to the perspective of the group

3 The broader Context
Relating the content of a technological artefact to the wider sociopolitical milieu

Figure 10: Visualization of the Components of the SCOT by Pinch and Bijker

This theory was chosen as it provides a logical and comprehensive overview to incorporating stakeholders, their priorities, and requirements, harmonizing between technology needs and social demands.

The SCOT Theory has also been applied in other works related to eGov. Maky, Shafiz, and Wan Rozaini's work involved the usage of the SCOT theory in order to conceptualize a decision-making model to complement eGov services. In their paper, they found that SCOT is one of the most useful theories when it comes to studying eGov services since it incorporates the relationship between social groups and technologies in its process (Maky et al., 2016). Another work proposed by Sivamalai, explored the use of the Social Construction of Technology theory in order to understand the design and implementation of the world's largest biometric ID system, the Aadhar Project. Sivamalai concluded that using the SCOT theory is very useful when it comes to studying and analyzing the problems that affect each stakeholder differently and thus provides a way to have an overview of the challenges and their interdependencies (Sivamalai, 2013).

SCOT Approach for Task 2.1 Stakeholder Ecosystem and Business Models

Refer the following elements described as seen in Figure 10.

1. Interpretive Flexibility

Simply said, this element is described by (Pinch and Bijker, 1984) as the step where the technological artifacts are constructed and interpreted. In addition, there should be flexibility in how the artifacts are designed. Esspecially given that different technologies have different intrpretations for different stakeholders.

In **D2.1**, we assume that the technological artifacts that are interpreted are the MGOV4EU pilot use cases. One of the main goals of this deliverable is to understand the perception and interpretation of key stakeholders of the technological artifacts that we are developing in the project. Therefore, **D2.1** presents a first insight to how active stakeholders such as Service Providers percieve the eGov market and elements of the pilots at this stage of the project. This is done by conducting qualitative research analysis of semi-structured interviews given to Service Providers.

2. Closure and Stabilization Efforts

This element of the SCOT Theory focuses on the relevant social groups and redefinition of a problem.

For the Relevant Social Groups aspect, it is the process of identifying the relvant social groups for the research. In regards to **D2.1** and MGOV4EU, this step is assumed in understanding the stakeholders in the MGOV4EU stakeholder ecosystem. After conducting market research and identifying the MGOV4EU pilots (the technological artifacts, the next step is to conduct an initial stakeholder analysis, which is presented in Chapter 3. After identifying the active and enabling stakeholders for MGOV4EU, this allows to focus and understand on their perception, especially concerning potential barriers or opportunities in relation to the pilots.

For the redefinition of a problem part of this second element, the model focuses on adjusting problems to the perspective of the group. The market analysis in chapter 2 has already provided an overview of the potential technical and non technical challenges. However, in the qualitative research done with Active Stakeholders like the Service Providers will give a greater insight into any 'problems' or challenges that are perceived.

3. The Wider Context

This element of the SCOT theory concentrates on how to relate the content of the technological artifacts to the wider socio-political milieu. It focuses on understanding how the artifact can fit into the larger picture. This element could also bring the opportunity to include other models such as the Diffusion of Innovation model by (Rogers, 2003) into the conceptual framework. This could be in the form of using the DOI model to expand on models defined four dimensions to explain the how, why, and in what pace the innovation could spread among the society or target groups.

This element will be considered in the Chapter 7 on the business model patterns of stakeholder for MGOV4EU. This chapter presents ideas and potential business model patterns that would be useful in business model creation for relevant active stakeholders.

In conclusion, The SCOT theory approach offers structure in **D2.1** Stakeholder Ecosystem and Business Model task to identify the stakeholders, trying to better understand their perceptions concerning assumptions or expectations of the market or the mGov4EU pilots. In addition, there is an opportunity to dive into learning more about identifying different potential problems and to deeper understand the problem perspective of different stakeholders. On the other hand, the SCOT model and the DOI model could assist in understanding the wider context and potential of active stakeholders and future development in regards to business model pattern opportunities. It is also a model to consider in future WP where stakeholders and sustainability are involved.

Chapter 5   Qualitative Stakeholder Research

In this section we present the methodology and results of our empirical evaluation of insights from relevant stakeholders for the mGov4EU solution. To gain comprehensive insights into an emerging field, we're employing a mixed-methods research methodology that combines qualitative with quantitative empirical methods. Moreover, we build on the theoretical and conceptual work that has been presented in the previous chapters.

We focus our empirical stakeholder evaluation for mGov4EU on the active stakeholders. The reason is that they are directly involved in the operation of the solution that is developed in the project and, thus, most relevant for its longtime success. Moreover, they are also not directly involved in the project. Enabling stakeholders are either part of the project consortium and can participate directly or are addressed through mGov4EU's communication and dissemination activities that are covered by WP 6.

Given the timing of this task, it has been decided to conduct the qualitative research on the service providers during the duration of **T2.1**. However, the quantitative research that is planned for the End Users will be concluded in the sustainability work in **task 2.6**.

5.1   Qualitative Stakeholder Research Process

For an understanding of the goals, requirements, resources, constraints, and experience of the institutional/organizational active stakeholders, we chose to follow a qualitative research methodology.

Recruitment of respondents from institutions and organizations for empirical evaluations is a huge challenge. Gathering a sufficient number of usable questionnaires spanning all relevant stakeholders would require efforts that would exceed the resources of the project. Hence, a qualitative approach is applied. It produces valuable answers though a lower number of semi-structured interviews of all relevant stakeholders of this group. The respondents are recruited through the network of the project consortium.

The qualitative stakeholder research is structured according to the following process:

1. Based on the initial stakeholder analyses of relevant stakeholders in Chapter 3 the target group for the qualitative analysis is identified.
2. A semi-structured questionnaire based on the market overview and previous research is constructed.
3. Pre-Test of the semi-structured questionnaire with experts that are recruited from the project. Analysis of the results and learnings for the refinement of the questionnaire.
4. Recruitment of respondents from relevant stakeholders for mGov4EU through the network of the consortium partners.
5. Instruction of the interviewers.
6. Semi-structured interviews are led by at least one – better two – instructed interviewers that are either supported by an assistant that notes down the answers or recorded for later transcription by an assistant.
7. Analysis of the answers that could be supported by a software for qualitative research such as MAXQDA.

The qualitative research approach of mGov4EU follows Myers (Myers, 2009; Myers and Newman, 2007). Hence, the interviewer's job is to listen, prompt, encourage, and guide the conversation. Overall, the more pleasant the interview atmosphere is and the more the stakeholders are willing to open up and talk, the better the expected results will be.

The surveys took the form of semi-structured interviews. In such interviews, some prepared questions are used, but there is no strict constraint to adhere to a particular set of questions or sequence. New questions may arise at any time during the interviews and improvisation by the

interviewer is encouraged and necessary. However, this form of interviewing also ensures a certain overall consistency across all interviews, as the interviewer usually starts with a similar basic set of questions.

This form of interviewing allows for the adherence to a framework structure while leaving enough room for improvisation. It allows the interviewee the opportunity to add important insights and findings as the conversation progresses, while the prepared questions ensure that a certain focus is maintained.

Further materials regarding the process and materials used can be found in the Chapter 9 Appendix.

5.2 Overview of the Stakeholder Research

This section provides a brief overview of the sample of the interviews that were conducted and the data analysis process.

5.2.1 Sample

Regarding data collection, we conducted expert stakeholder interviews. We chose to focus on the User - Service Providers, which could be either Public Service Entities or IT Service Providers. They use, provide or interact with the end users (citizens) for their governmental digital services, that would be elevated with the solution created in mGov4EU. This is further elaborated in section 3.2.1.

Therefore, the Governmental Service Providers interviewed came from all levels of government (national, regional/state, or municipal/city) depending on the structure of the government's services. It is more common that in smaller populated countries to have their governmental services provided from a national governmental service, rather than a state or city government level. As for larger countries, it is necessary to have a more decentralized approach in provided services. We chose to conduct interviews in order to gain deeper and more dynamic insights or view-points directly from the experts that are closely working with or providing these services.

Given that mGov4EU is an EU project, we found it key to include multiple countries in this research. Therefore, we included a multi-country analysis of Austria, Estonia and Germany. These countries provide greater insights into the differences between different sized countries, structures, cultural differences, and digital advancements.

Purposive sampling was chosen for our research. We wanted to explore the insights of one of the two kinds of users, from a service provider perspective. In addition, we chose experts that represented a specific location as a key criterion to gain a greater insight of different governmental structures and how these governmental services are provided and used. In addition, we made other selection criteria as mentioned above given their association to being a service provider of digital governmental services. We found that having these criteria would provide necessary insight to viewpoints of Service Providers, in order to define critical requirements for stakeholders.

In total, 24 experts were interviewed. Of these experts, 8 were interviewed in Austria, 6 were interviewed in Estonia, and 10 were interviewed in Germany.

Austria

For Austria, there were eight interview partners. Three people from federal ministries were interviewed. In addition, one person was interviewed from a municipality, one from the Rundfunk- und Telekom Regulierungs-GmbH, and one from IT Kommunal, the main IT service provider for Austrian egov portals and online forms. Lastly, two governmental offices regarding various parts of the federal eGov services were interviewed (see Table 3).

Table 3: Interview partners from Austria and their connection to Governmental Services

Interviewee	Governmental Level	Connection to Governmental Services
Rundfunk und Telekom Regulierungs-GmbH	National	Provides eGov services to citizens related to their general media state provided services; radio, state TV, etc.
Amt der NÖ Landesregierung	National	eGov portal of the federal state providing a wide range of eGov services either through fully online forms or partly online forms (editable pdfs) for citizens.
Bundesministerium der Finanzen	National	FinanzOnline is the main tax income portal for citizens and businesses in Austria.
Stadtgemeinde Weiz	City	Civil Servant representing the city of Weiz that provides governmental services to citizens.
Amt der Steiermärkischen Landesregierung, Landesamtsdirektion, Referat Kommunikation Land Steiermark	National	eGov portal of the federal state providing a wide range of eGov services either through fully online forms or partly online forms (editable pdfs).
Bundesrechenzentrum	National	IT service provider for the federal administration in Austria.
Bundesministerium für Digitalisierung und Wirtschaftsstandort	National	Austrian Ministry providing a wide range of governmental services to citizens.
IT Kommunal GmbH	Private	They provide IT services portals for citizens to use in different cities of Austria for their eGov services

Interview Partners

Among the interview partners in Austria who represented either eGovernment portals and services on a city or on a national level, four offer both G2C and G2B services, two only G2C, and two only G2B.

Two of the eight interview partners (25%) offer a mobile app, in six cases (75%) this was not the case. Meanwhile, 7 out of 8 provided a mobile configured website.

Half of the people interviewed reported that it is possible to log in to their portal with a user account. Two (25%) out of eight interviewees stated that it is possible to identify themselves with eIDAS/eID (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

All except for one interviewee, for whom no information was provided, stated that the use of administrative services on their websites is possible entirely online.

Estonia

Among those interviewed in Estonia, four people belong to the Estonian government, more specifically to the national information agency providing eID services, data protection office and Centre of Registers and Information System providing e-Business services. One interviewee belongs to a non-profit organization providing support and development of core national data exchange infrastructure X-Roadand, one to a private company providing national identity solutions to Estonian Government (see Table 4.

Interviewees that were invited and participated in the data collection process from Estonia were mainly located and involved into some core process of digitalization of Estonia. They were not involved into specific service provision for example G2C and G2B (except one), but they were involved into the core infrastructure technology that is a foundation for Estonian services, such as Information system agency, X-Road and business registry.

Most of the interviewees were mainly developed into the services addressed to G2G such as providing the data exchange software (X-Road) or identification and authentication services for PSE, while one interviewee was involved as technology director in data protection office with specific focus on GDPR issues in technology.

Table 4: Interview partners from Estonia and their connection to Governmental Services

Interviewee	Governmental Level	Connection to Governmental Services
State Information System Authority (RIA)	National	They provide development and support for governmental electronic services.
State Information System Authority (RIA)	National	They provide development and support for governmental electronic services.
Data Protection Office	National	Public official that provides IT advisory to the data protection office in Estonia.
Nordic Institute for Interoperability Solutions	National	They provide the development and strategic management of the data exchange layer X-Road.
Center of Registers and Information Systems (RIK)	National	They provide IT services related to the business registers.
SK ID Solutions	National	They provide eID solution for Estonian government and private services.

Germany

There were 10 expert interviews conducted in Germany. There were five cities studied that were located in three different states. In addition, there were three state level service providers that were interviewed. Lastly, there was one private IT service provider was interviewed, who provides services for various cities and states in Germany.

Of the interviewees that participated in the 10 interviews carried out with German stakeholders, four offer G2C and G2B services and two offer only G2C. Four others offer G2Administrations services and one offer services to state administration and municipalities (see Figure 11).
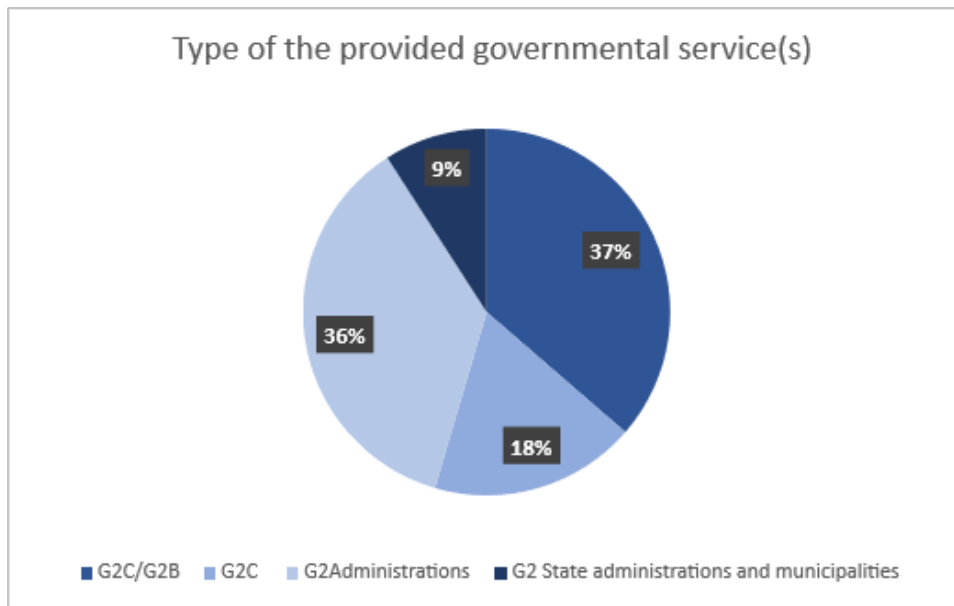
Figure 11: Types of the provided governmental service(s) from German interview partners

Two of the interviewees, or 20%, provide a mobile app in addition to their eGov portal, while nine, or 80%, do not.

In five of the eGov portals, which the interviewed persons represented, a service account is needed to log in (40%), but in the majority of cases this possibility does not exist (60%).

70% of the interview partners offer downloadable forms on their eGov portals (hybrid type). In three cases 30% there is no possibility to download forms or to use an administrative service online at all.

Table 5: Interview partners from Germany and their connection to Governmental Services

Interviewee	Governmental Level	Connection to Governmental Services
Stadt Weimar	City	City Government that provides governmental services to Citizens.
Stadt Ulm	City	City Government that provides governmental services to Citizens.
Stadt Jena	City	City Government that provides governmental services to Citizens.
Stadt Stuttgart	City	City Government that provides governmental services to Citizens.
Stadt Nürnberg	City	City Government that provides governmental services to Citizens.
Kommunale Informationsverarbeitung Thüringen GmbH	State	They provide IT Services to different cities for their e-governmental services
Sachsen Anhalt-Ministerium der Finanzen	State	They provide IT Services to different cities for their e-governmental services

Interviewee	Governmental Level	Connection to Governmental Services
Metropolregion Rhein-Neckar GmbH	State	They provide IT Services to different cities for their e-governmental services
service-bw	State	They provide IT Services portal for citizens to use in different cities in the German State Baden-Wuertemburg for their e-governmental services
Dataport	Private	They provide IT Services to different cities for their e-governmental services

Data Collection Procedure

The expert interviews were largely conducted online using MS teams or Webex. The videos were preferred to be face to face with video, however, with most interviews that was not possible. The interview guidelines that can be found in the Appendix present the process and material, which was provided to the interviewers. The interviews were conducted in either English or German. The German interviews were then translated to English in preparation for analysis. It is thus possible that some meaning could be lost in translation.

The interviews were conducted between August and November 2021 by Fraunhofer, TEC, DUK, and UTARTU. Fraunhofer conducted the interviews for Germany, TEC and DUK conducted the interviews for Austria and UTARTU conducted the interviews for Estonia.

The partners followed the interview guidelines as presented in the Appendix. The interviewers asked interviewees to be recorded for accuracy purposes regarding the transcriptions. In addition, the interviewers followed instructions from our Data Protection Officer and informed interviewees.

5.2.2   Data Analysis

This section elaborates on a simplified data analysis that was initiated to ensure that the key take away from the interviews were extracted and recommendations from a Service Provider perspective could be taken for this deliverable.

5.2.2.1   Data Analysis Procedure

The expert interviews were transcribed and processed through MAXQDA, a qualitative research tool. A coding taxonomy was established for the analysis of the transcriptions. This coding taxonomy was framed around key topics relevant for the project. This coding taxonomy was refined and adapted to be suitable for the content of the interviews to help ensure comparison and summarization of the content. The coding taxonomy can be found in the Appendix 9.3.

5.2.2.2   Conceptual Framework alignment

Aligning with the SCOT theory, this research has provided insights to the first element "*Interpretive Flexibility*". This is the step where the technological artifacts (e.g. in our case this could be "technologies" like eIDAS or SDG) are interpreted. The qualitative research helped to gain necessary insight on these four key points: eID/eIDAS, Cross-borders, SDG/OOP, and Mobile Services. The interviews attempted to gain a greater understanding from the Service Provider perspective on their general understanding, perceived importance, challenges or impact on the various points.

The *Closure and Stabilization Efforts* element is focused on only the Service Provider Stakeholders, whether it is a city government, state government, federal government, or an IT service provider. The second half of this step focuses on the redefinition of the problem, this can be observed in the overall challenges stated among the key points.

The *Broader Context* element is observed within the qualitative research when asked about the future impact or how future adopters will react to their services. This step could be further elaborated in **T2.7**.

5.2.2.3 Limitations and Remarks

Given that this qualitative research has been conducted by various interviewers and in different countries, it is understandable that there are some differences between the results of the interviews regarding content provided. Each interview and each service provider's perspective were unique.

In hindsight, there are some questions or sections of the interview questions provided that could have been refined. However, overall, there were no major limitations regarding the purpose of the goal of the research.

5.3 Summary of the Results

This section provides a summary of what could be inferred from the interviews. This section is divided into four sections, where they focus on key pillars of the mGov4EU project, SDGR/OOP, Cross-borders, Mobile and Digital Services, and eID, eIDAS and Identity Management.

The summaries length and depth are dependent on the interviews, as each interview was unique and the interviews were given by different interviewers, this can vary.

5.3.1 SDGR and OOP

This section describes the impressions that were given from the interviewees regarding how aware they were of SDGR and OOP in general, their perceived impact, the effort needed for implementation and other remarks that they had regarding this topic.

5.3.1.1 Germany

SDGR

9/10 interviewees were aware of the SDGR and had a basic understanding of it. Overall, many cities did estimate a strong impact on their services from the SDGR. However, one interviewee from a city, pointed out that before it will impact them it will need to go through the federal and state levels first on a legal level. Regarding the Implementation, most of the interview partners expressed that they were unsure how much implementation effort it would need to bring their current standards up to the SDGR standards. The overall way or path forward appeared unclear to most interview partners in regards to how they could have their current services meet the SDGR.

Given the uncertainty of the efforts for implementation that would be needed, interviewees were not able to provide a timeline of when they could implement this.

OOP

9 of 10 Interviews were aware of the OOP, 1 was not aware of the OOP. In Germany there is a new regulation that is currently in the process of being implemented, which is called the "Onlinezugancgsgesetz", the Online Access Act. This act has been created to prepare the German government services for the OOP. The deadline for implementation of this is by the end of 2022. Regarding foreseen impact, many Interview partners found the OOP to provide a positive impact and one mentioned that it would be „an important building block for building collaborative data infrastructures". Regarding the effort of implementation, some challenges that were mentioned regarding the implementation, are due to the governmental structure and processes. In Germany, the municipalities have the responsibility to provide the services to the citizens, however they are also dependent on the services and regulations or decisions are given by the state and federal governments. Another challenges that was mentioned was the challenges of changing internal processes.

5.3.1.2   Austria

SDGR

All Interviewees have at least heard of the SDGR and most had a basic understanding of it. Most could not or did not specify how the implementation of their services to meet the SDGR could be. However, one did mention their concern about high costs related to the implementation. Another voiced their opinion, that it would take a 'medium effort' to adjust their services.

OOP

Most interviewees had a basic understanding of what the OOP is intended to do, however could not explain in greater detail how it would affect them. Only, one of eight interviewees did not know what the OOP was.

5.3.1.3   Estonia

SDGR

Most Interviewees were aware of the SDGR. One challenge that was mentioned about the implementation of the SDGR is the issues related to identity matching and how one needs to solve this challenge.

Another Interview partner mentioned that how it will be implemented needs to be decided first at a national level, then it would be possible for them to better estimate.

OOP

All interview partners were well aware of the OOP. There were some challenges given for the implementation of the OOP in the cross-border context. Implementation of the OOP in Estonia in national context has been very mature and successful, however, in cross-border context there was overall doubt in how the implementations could look like and used in practice. Data protection officer mentioned there are good idea but current legislation doesn't support it.

5.3.2   Cross-border

This section focuses on summarizing the impressions the interviews had regarding the perceived relevance of cross-border use cases, their potential future demand or impact, and other remarks related to cross-border use cases.

5.3.2.1   Germany

The relevance of cross-border use cases appeared to have mixed responses from interviewees. Those who found cross-border use cases irrelevant, stated that they are either focusing on higher demanded topics of development or that they did not see demand for those use cases. In addition, some interviewees mentioned that without a legal demand for it, they do not see a need to offer such services. The Interviewees that viewed them as very important took it more as an opportunity to offer more to a larger community of people. However in relation to offering governmental services to foreign nationals, foreign residents could apply for a State or City ID or use their electronic Visa (if able). However, most interview participants stated that that the number of foreign nationals using their services is very small or not recorded.

However, the majority of interviewees stated that they thought the future of cross-border services would increase over the next five years, while a few stated they thought it would remain the same.

5.3.2.2   Austria

The interview partners also provided mostly a positive impression of the relevance of cross-border Use cases, however there were still a few that did not see a large advantage or need for cross-border services. Those that found Cross-border services relevant stated that it's relevant especially due to the eIDAS compliant identification. Another stated that they believed that they saw cross-border use cases becoming even more important due to their increasing need of digital transfer and digital exchange between other EU states. A similar mixed opinion was found also for the expected future impact of cross-borders. Many believed that cross-border use cases would increase in

demand and relevance. One mentioned that infrastructure could be a deciding factor here to enable cross-border use cases if they are offered digitally. In regards to foreign users, the majority of interview partners explained that they do not have many foreign users or very little.

5.3.2.3 Estonia

All of the interview partners were in favor of cross-border use cases and further implementation. Some interviewees mentioned that as long as the country has a notified eID from the EU that it is possible to use most of their services.

The interview partners appeared to all be in favor that cross-border use cases will have an increasing future impact. One reason that was stated is that for large companies it is important that these services are working as their headquarters are often located outside of Estonia. Some challenges that were mentioned in reaching this increase in demand is of course establishing the proper infrastructure and building blocks for cross-border data exchange.

5.3.3 Mobile and Digital Services

This section shows an impression of how mobile services are generally provided currently by service providers and what their perceived opportunities or benefits and challenges are.

5.3.3.1 Germany

Overall the greater majority of the interview partners that had mobile services stated that their services were not offered via a mobile application. However, most stated that they had a mobile configured website, where it is configured to a smart phone. Many voiced also that they do see room for improvement of creating a mobile-friendly experience for users.

There were a few interview partners that mentioned their involvement with various pilot projects to improve or establish their mobile services. One interviewee mentioned how their big project right now is to replace the frontend with a more modern framework to ensure its availability for mobile devices as there are still some inconsistencies. While another interviewee mentioned how they are focusing on a pilot project that is establishing more of a proof of concept of how mobile services could be provided , where it is more focused on the first implementation but not yet the mobile-friendly or usability aspects.

Regarding importance, the majority of the interviewees stated that they found the future of mobile services important. A few mentioned that it has a great impact on the market acceptance of the use of their services. Another mentioned the importance mobile services are for students and younger generations. In addition to offering mobile services to citizens, it was also mentioned by an interviewee the demand or motive for offering mobile and digital services internally among governmental processes and services.

Opportunities/Benefits

These were some of the opportunities that were mentioned by the interviewees of offering mobile services:

- Citizen Friendly Impression
- Better outreach to younger generation
- Higher market acceptance
- Time efficiency
- Higher Accessibility
- Greater Availability
- Secure digital identities
- Digital Sovereignty

Challenges

- Data Protection
- Medium Breaks

- Complicated Processes for Services
- Finding time for technical system maintenance
- Creating a mobile friendly / user friendly service
- Educating employees about the transitioning from Analog processes to Digital Processes
- Changing existing workflows
- Unexpected integration problems of changing the workflow
- Organizational Challenges
- Implementing and getting users to use secure authentication and identification
- Legal Obstacles, where some processes require in person presence
- User Readiness of data processing

5.3.3.2   Austria

The Interview partners that had mobile services offered the majority of them online with a mobile configured website that had a responsive design, which implies it can be used for a smartphone. Overall, interview partners gave the impression that mobile-friendliness and mobile-first services are in focus.

Regarding importance, many interview partners emphasized the importance of offering mobile services. One interviewee explained that there is an increasing importance due to the overall greater use of mobile devices and the need to fulfill the markets growing need for mobile services.

Opportunities/Benefits

- Increasing the number of users
- Keep current users
- Easier Usability
- More Diffusion
- Ease of Use
- Convenience
- Ubiquity
- Accessibility
- Availability
- Ability to retrieve information (governmental side)

Challenges

- Processing of Complex Data
- Workflow management
- Conflict of Use according to different mobile devices
- Keeping up to date with new technical challenges
- Costs of Designing Mobile Services
- Digital Identities
- Interoperability of Digital Identities
- Limited availability of developers
- Secure Items
- Security in Mobile Devices
- Input of Complex Data
- Security of Authentication

5.3.3.3   Estonia

Regarding importance, one of the interviewees mentioned that having a mobile configured website it is more scalable. Given that it is more scalable, this is a key reason why it is chosen over offering

a mobile app. Overall, it appeared that the impression from the interviewees is that it is important to offer online services with a mobile configured or mobile responsive website that fits to smartphones.

Challenges

- Changing Technologies (E-Wallet development)
- Legal Requirements that are driven by Public specifications and standards
- Educating users with new processes and technology
- Chicken and Egg problem of public authorities connecting to the services, building an ecosystem
- Organizational Challenges
- Accessibility for those with disabilities
- Various operation systems and developing services for them
- Capability for adequate testing
- Cost-benefit trade off

5.3.4   eID, eIDAS and Identity Management

This section gives an impression on the varying countries' landscape regarding identity management, eIDs, and eIDAS.

5.3.4.1   Germany

eID and eIDAS

The majority of the interview partners stated that their services are eIDAS compatible. One of ten interviewees stated that it was not compatible. It appears that while most interview partners highlighted that their services and eIDAS are compliant, Interview partners mentioned numerous projects that are ongoing about integrating eIDs in their services and improving this implementation. Regarding the use of foreign eIDS in services and the compatibility, largely the interviewees stated that this was not yet possible.

Identity Management

Challenges

- Implementation eID function of the identity card and functionality for the user
- Educating users for using eID functions
- Ease of Use for digital identity /ID Cards
- Acceptance of the eID
- Poor Dissemination/Marketing of the use of eID cards
- Poor User Experience (time-consuming, not straight forward, complicated for non-technical users)
- Chicken and Egg problem
- Costs and Resources for implementing better identity solutions
- Legal Requirements

Drivers

- Legal Requirements (e.g. OZG)
- Society
- User Acceptance
- Future of Secure Digital Identities and Wallets

User Authentication

As there are different levels of trust needed for different processes, there are various ways for the user to authenticate themselves. If a low level of trust is needed, then a user name and password would suffice for the service provider, in most situations explained by interviewees. If a higher level

of trust would be needed, then an eID would be needed to ensure a high level of trust or security. Interviewees most commonly listed a national eID, or Residence Permit eID, or another trusted eID (e.g. state eID). This is how it was explained for most service providers, however there were still a handful that explained that the integration of including an eID option is still in the planning or a piloting phase. One interviewee stated that only 6 percent use their eID function for their services.

User Self Management

Many Interviewees supported user self-management of being able to decide what to use to authenticate themselves but seemed more skeptical of user self-management if the user could create their own identity or certificates themselves.

Attribute Based Credential

Most stated that they saw relevance or potential use cases for attribute-based credentials. Some interviewees also mentioned how it could simplify some processes by having something like this implemented. However, most interviewees implied that this is more of a potential idea however isn't something that has been so widely implemented.

Outsourcing

Regarding outsourcing, the majority of the city governments outsource their identity management either to a service provider from the state governments or a IT service provider.

5.3.4.2 Austria

eID and eIDAS

Overall, the interviewees gave a very supportive impression regarding eID in Austria and have emphasized the importance on its development. One interviewee mentioned that there are three kinds of eIDs in Austria depending on which services that you would like to access, the Buergerkarte, Handy-Signatur, and ID Austria. One interviewee highlighted the demand and advantages of having the Austrian Cell Phone Signature (Handy-Signatur), especially given the current situation of the COVID-19 pandemic, there has been a much greater demand for cell phone signatures due to increased digital processes and transactions. Another interviewee talked about the next generation, ID Austria, which is in a pilot phase, where you can use the authentication and signature function provided with the same service.

In addition, it appears there is a high eIDAS compatibility with any notified country. Overall, there appears to be a lot of support for foreign eID compatibility. One of the interviewees mentioned that they have 730,000 visits this year (until August 2021) from EU countries for their services, two-thirds of those visits were from Germany.

Identity Management

Challenges

- Chicken and egg problem with using eIDs
- If people don't have as many opportunities to use it, then it's hard for them to use it properly
- Lack of adoption of eIDs
- Users forgetting passwords
- Lack of full implementation and integration of eIDs in digital services
- Legal requirements of some services require in-person identification

Drivers

- eIDAS

User Authentication

Overall, the interview partners showed a high importance on the use of the Austrian eID for their services. There are of course low trust level ways to authenticate for users that are trying to complete

some services, where a higher level is not needed. However, the Austrian eID is overall in a positive impression from service providers.

User Self-Management

One of the Four Interviewees that elaborated on the importance of user self-management stated that they found it important for the users to be able to self-manage. Other interview partners depicted a more skeptical impression stating that it could lead to a disadvantages like lack of data quality.

Attribute-Based Credential

There were mixed impressions on the relevance of attribute-based credentials. One interviewee clearly saw a need for verifying attribute-based credentials of users, while others saw no need at all. It did not appear that use cases for attribute-based credentials have been implemented at this time.

5.3.4.3 Estonia

eID and eIDAS

Regarding eIDAS, the interviewees that discussed this topic, their services were compatible with eIDAS by enabling and establishing eIDAS infrastructure such as eIDAS connectors and eIDAS receiving nodes. Thus, eIDAS notifed eID schemes are enabled to identify and authenticate for Estonian e-services. In Estonia in total 6 eID schemes are notified under eIDAS regulation such as ID card, Digi-ID card e-residency card, Mobil -ID and diplomatic ID card. Thus, holders of these provided eID means should be able to consume and use e-services across-borders in the EU.

Identity Management

The interviewees discussed Identity matching challenges at length. One interviewee mentioned how on a smaller scale where some group of countries have similar identity management systems that these problems can be solved, however on a large scale it is much more difficult. However, here are some other challenges that were highlighted below.

Challenges

- Identity Matching
- Legal challenges for some countries to change how the identity management is constructed and that it cannot be changed so easily as it is bound to the countries constitution
- Many political challenges
- Lack of harmonization between member states and eID applications and solutions
- Varying Trust Levels of different eID applications from different solutions
- Trust Management
- Costs towards Member states every time the existing eID ecosystem is changed
- Adhoc solutions lead to even more complex processes

Drivers

- New digital wallets

User Self-Management

One interviewee expressed their uncertainty about users' perception of trust and trust in general when interacting with different data transactions. An interviewee stated that they thought that concepts like SSI were a good option for people to maintain their data, however they felt that people may not be ready for this responsibility or understanding of all the implications of sharing some data or information. Another challenge with user self-management is that there could be some users that are not tech-savvy enough, stated one interview partner. Overall, some of the interview partners stated strong support and interest in using SSI solutions and following the future of that development. However, interviewees did mention that while there could be many advantages of new functions, the processes and development to a working solution are expected to bring many challenges.

Attribute-Based Credential

The Interviewee that talked about this topic supported and though that having use cases for attribute-based credentials could bring value.

Digital Wallets

One interview partner elaborated about how in theory a digital wallet or using SSI could be good for the user, however there are many other complications with using these technologies that could disrupt its intention. For example, they emphasized the challenges of privacy and data protection. It could also happen that through these privacy and data protection requirements that some information or items would become untraceable or unfindable in times of need. Another major challenge would be if someone would steal the wallet or identity and how to get it back to the rightful owner, if possible.

5.4   Service Provider Insights and Key Take-Aways

This section provides an overview of the key take-aways learned from the Service Provider Stakeholders from Austria, Estonia, and Germany. There is a short summary regarding the four key topics and then an overview of the drivers, challenges, and technical barriers. These findings should help the technical development of the project. In addition, these insights should contribute to future work done in **T2.7**, regarding sustainability.

5.4.1   SDGR and OOP

The majority of the service providers interviewed, regardless of the country were aware of the SDGR or OOP. Understandably, given the centralized approach of Estonia and the interview partners SDGR and OOP are foreseen as a very important topic with a great impact. While it appeared that in Austria and Germany, there is an overall impression of uncertainty of what the direct impact or way of implementation will be. This could be due to the decentralized approach and the different roles of those service providers within this decentralized ecosystem. In Germany, there was a great focus on the OZG, Online Access Law, which has complimentary goals to the OOP and could be seen as a steppingstone for future requirements needed from service providers given the SDGR.

5.4.2   Cross-border

This topic had a wide range of impressions regarding the different countries interviewed. In Estonia, it appears that the interviewees have set Cross-borders in focus and are actively looking for solutions to meet their foreseen potential demand of these use cases. On the other hand, the interview sample from Germany and Austria gave very mixed responses regarding the use of cross-border use cases and the future of cross-border services. Even though the majority of service providers in Germany did state that they thought the demand for cross-border services would increase over the next five years, they also stated that most don't have a high demand or are so compatible with foreign eIDs.

5.4.3   Mobile and Digital Services

Overall, the majority of service providers, regardless of the country emphasized that their services are provided online with a mobile configured website. In Estonia, one service provider mentioned that it is more scalable and that is why their preference is to stay with a mobile configured website. Even though the preference remained with a mobile configured website over a mobile application, the service providers did mostly imply that mobile services are important for the future and that there is an overall growing demand.

5.4.4   eID and eIDAS

Overall, the majority of the service providers from each country stated that their services are eIDAS compatible. Germany's service providers did have one out of ten in the sample that was open about not having a compatible solution. It appears that better integrating the eID into their digital services in Germany is a focus. However, foreign eID compatibility in services are not on the forefront. On the other hand, the Austrian service provider sample showed a greater integration of eIDs into their services, also by having multiple types of eIDs that are nationally supported for their services.

Estonias Service provider interviews didn't focus as much on the topic of eIDs and eIDAS, however, the interviews that did were compatible and overall Estonia is an example of how well eIDs can be integrated into services.

Hurdles and Challenges

One can observe that Germany and Austria have more overlapping challenges, in comparison to Estonia. One explanation to this could be the different governmental structures, where Germany and Austria follow a more decentralized structure and Estonia has a centralized structure.

One reoccurring theme are the internal organizational challenges that are foreseen by switching to mobile services. For example, changing existing workflows or educating employees on new processes. Another reoccurring theme are the challenges regarding secure data exchange, data protection, security in mobile devices, and security of Authentication. These security reasons also appear to be a major factor in why Service Providers lean towards offering mobile configured websites over mobile applications. In addition, legal requirements and challenges were mentioned across all countries regarding mobile services, an example of this could be the legal requirement of some processes that require the user to physically be present for part of the process of the service. Find a summary below of the challenges for mobile services in Table 6.Table 6: Comparison of the Challenges for Mobile Services

Challenges for Mobile Services		
Germany	**Austria**	**Estonia**
Data Protection	Processing of Complex Data	Changing Technologies (E-Wallet development)
Medium Breaks (e.g. services that need analog and digital assisstence)	Changing existing workflows	Legal Requirements that are driven by Public specifications and standards
Complicated Processes for Services	Conflict of Use according to different mobile devices	Educating users with new processes and technology
Finding time for technical system maintenance	Keeping up to date with new technical challenges	Chicken and Egg problem of public authorities connecting to the services, building an ecosystem
Creating a mobile friendly / user friendly service	Costs of Designing Mobile Services	Organizational Challenges
Educating employees about the transitioning from Analog processes to Digital Processes	Digital Identities	Accessibility for those with disabilities
Changing existing workflows	Interoperability of Digital Identities	Various operation systems and developing services for them
Organizational Challenges	Limited availability of developers	Capability for adequate testing
Implementing and getting users to use secure authentication and identification	Secure Items	
Legal Obstacles, where some processes require in person presence	Security in Mobile Devices	
Users are not ready for data processing	Security of Authentication	

Table 6: Comparison of the Challenges for Mobile Services

Regarding Identity Challenges, the obvious challenges arouse with having a chicken and egg problem with the use of eIDs. There are three different starting situations for each of the countries. For instance, Germany still doesn't have a national eID that is widely used by users, which was reflected in the service providers challenges like, acceptance of the eID, poor dissemination of the use of eIDs, or just the challenge of educating users of eIDs and their functions. Austria has an established set of eIDs and services. However, their service provider sample still raised challenges in adoption on eIDs or lack of full implementation and integration of eIDs in digital services. Estonia, who also has an advanced eID scheme and use, found more challenges related to identity matching, challenges on a larger scale for political or legal challenges. Table 7 provides an overview of the identity challenges.

Identity Challenges		
Germany	**Austria**	**Estonia**
Implementation eID function of the identity card and functionality for the user	Chicken and egg problem with using eIDs	Identity Matching
Educating users for using eID functions	If people don't have as many opportunities to use it, then its hard for them to use it properly	Legal challenges for some countries to change how the identity management is constructed and that it cant be changed so easily as it is bound to the countries constitution
Ease of Use for digital identity /ID Cards	Lack of adoption of eIDs	Many political challenges
Acceptance of the eID	Users forgetting passwords	Lack of harmonization between member states and eID applications and solutions
Poor Dissemination/Marketing of the use of eID cards	Lack of full implementation and integration of eIDs in digital services	Varying Trust Levels of different eID applications from different solutions
Poor User Experience (time consuming, not straight forward, complicated for non-technical users)	Legal requirements of some services require in person identification	Trust Management
Chicken and Egg problem		Costs towards Memberstates everytime the existing eID ecosystem is changed
Costs and Resources for implementing better identity solutions		
Legal Requirements		

Table 7: Comparison of the Identity Challenges

Drivers

The common theme of the drivers, at least for Austria and German, are surrounded by legal requirements. Other than legal drivers, availability and more options for the services are also some driving factors.

Digital and Mobile Service Drivers	
Germany	**Austria**
OZG	Providing services on future mobile devices
SDGR	Legal requirements
Legal Requirements	Digital identity documents (e.g. drivers license)
Availability 24/7	

Table 8: Digital and Mobile Service Drivers in Germany and Austria

Regarding the opportunities for mobile services or offering services in a mobile form (including configured mobile websites), the service providers were focused on various user driven opportunities that would help to gain or maintain their users, for example to improve the availability, convenience, usability, or give a more citizen friendly impression. From a technical point of view, opportunities could be seen as improving time efficiency or better security.

Opportunities from Mobile Services	
Germany	**Austria**
Citizen Friendly Impression	Increasing the amount of users
Better outreach to younger generation	Keep current users
Higher market acceptance	Easier Usability
Time efficiency	More Diffusion
Higher Accessibility	Ease of Use
Greater Availability	Convenience
Secure digital identities	Ubiquity
Digital Sovereignty	Accessibility
	Availability
	Ability to retrieve information (governmental side)

Table 9: Opportunities from Mobile Services in Germany and Austria.

Digital and Mobile Services Technical Barriers

The technical barriers among the service providers varied between each of the countries as seen in Table 10. One can observe that Germany, as a much larger and decentralized country had a larger range of technical barriers that also reflected some potential pain points due to such a structure. The decentralized structure, leaves smaller service providers with a potential higher burden due to lack of financial resources or IT know-how. Other technical barriers found, were connectivity in both Austria and Germany. For Estonia, the service providers elaborated at length the issues with identity matching and the challenges there are with data exchange on a security and technical level.

Digital and Mobile Services Technical Barriers		
Germany	**Austria**	**Estonia**
Financial Strength to Address Technical Maintenece needs	Accessibility	Cross Border data exchange between all the member states
Lacking IT know how in some smaller cities, where it could lead to being offline for a couple months since it wasn't possible to get it fixed after being hacked	Unavailable data	Identity Matching
Data protection	Complications between interorganizational data exchange	Secure data exchange channel
IT security	Connectivity	IT Secruity of complex systems
EU regulation accessibility		
Secure transaction via mobile device		
Usability		
Data storage and transaction		
Signature requirements		
Connectivity		
Interface Problems		
Decentralized systems		

Table 10: Digital and Mobile Services Technical Barriers in Germany, Austria and Estonia

Overall, these are only three member states of the EU and one can see some significant differences in perception and current status related to these different topics. However, there are a lot of common drivers and foreseen opportunities and challenges that are given by Service Providers. This section is to provide a greater insight to a key active stakeholder.

5.5 Future Qualitative and Quantitative Research Plans

Due to the timeframe of this task, the quantitative research on the end-users (citizens) has been moved to **T2.7** and will be led by Fraunhofer. In addition, it could be beneficial to follow up with more detailed questions on certain aspects of the key topics mentioned above.

Chapter 6   User and Design Research and Mobile Applications

This chapter takes into deeper consideration research that has been done on user experience and design research for both eGovernment and mGovernment. This research gains insights on different methods and frameworks that were used, and what processes, challenges, and requirements that were learned from this previous work. In addition, this chapter highlights the user experience goals mentioned in the SDGR, as mGov4EU sets to meet and compliment the goals for the SDGR. After collecting the previous and relevant research, a summary of Good Practices for User Experience and Design Research were developed. These 'Good Practices' are intended to assist the technical development into creating solutions that are user-friendly from the start.

6.1   Overview of User and Design Experience Research on Governmental Mobile Applications

This section provides an overview of the Design and User Experience Research on eGovernment and mGovernment applications and highlights the SDG user-friendly goals. First, it starts with a literature review of methods and frameworks found in research. Continuing, it provides an overview of the results and finding regarding the eGovernment research. Next, the limitations found in the research are summarized. Lastly, there is a subsection dedicated to summarizing the user-friendly goals stated in the SDG. Overall, the goal of this section is to be used as an input of the good practices of the User Experience and Design.

6.1.1   Methods and Frameworks

6.1.1.1   eGovernments

As a result of desk research, there has been three design research papers that have met requirements and been found to discuss the design approaches and design features of eGov services and portals. The first study on eGovernment design research employed an extensive literature review to establish an eGovernment design research model and a design research approach that consists of three principles: The policy principle, the co-design principle, and the theorizing principle. A brief explanation of these principles can be taken from the following figure (Goldkuhl, 2016).

The Policy Principle

1   The policy design describes the need to use public policy as a design base

The Co-Design Policy

2   The co-design principle describes the need to combine and integrate the analysis of the workpractice and the IT-artifact with each other

The Theorizing Principle

3   The theorizing Principle describes the need theorize and work parallelly in order to support the design process and the need to produce results from design research
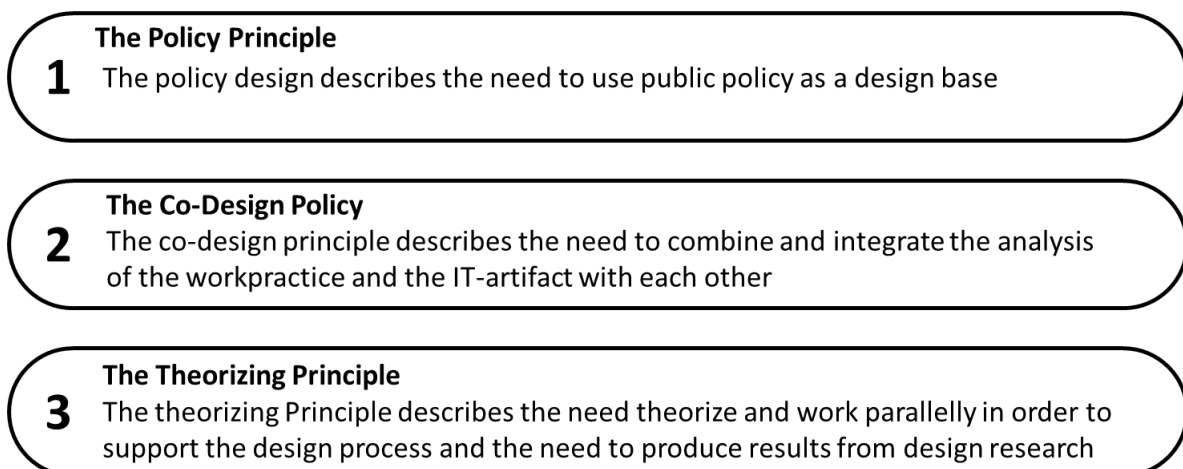
Figure 12: The three principles of design research approach by Goldkuhl

An approach that has been employed when studying the influence of emotional design in eGovernment portals on the user satisfaction consisted in evaluating two portals from the Malaysian and Singaporean Government. In this study, five snapshots of each website have been presented to a study group along with a semantic differential scale evaluation form that had to be filled out (Nor Laila et al., 2016). The last paper in this section studied the transparency, accessibility, and usability of governmental websites. For that, the authors measured the levels of information disclosure according to the Global Reporting Initiative guidelines by splitting them into strategic and general information, economic, societal, and environmental information. In order to measure the level of accessibility and the usability, the authors measured the time it takes a citizen to find specific information in a website and employed a questionnaire that addresses usability concerns such as the availability of languages, search engine motors and FAQs in governmental websites (Alcaraz-Quiles et al., 2018).

6.1.1.2 mGovernments

Regarding UX and Design research conducted in mGov situations, this section highlights some different approaches that have tested usability and design. The first two paragraphs in this section describe processes in which multiple usability evaluation models have been analyzed and employed, in order to develop an mGov design framework and identify the most important design patterns for the usability of mGov services. Following that, we provide an overview of methods that include interviews, surveys, and case studies of mGov applications and websites. These studies aimed at gathering feedback about the usability, design, and user experience from mGov developers, designers, and users which were then used to present UX principles and improvements for the development of mGov services. Belonging to the same kind of research, an approach relying on the examination of the TAM and a method that relies on the analysis of the brain activity will be briefly presented, to provide a look at the variety of methods can be used to assess the usability of mGov services.

First, an analysis of existing usability models has been carried out in one of the studies, that aimed at developing a framework for usability design, that promotes the awareness of the Information disseminated via mGov applications (Kureerung and Ramingwong, 2019b). Several usability models used in the topics of mobile applications evaluation, mGov, and user interface design were identified and analyzed. The authors examined the recurrency of the usability characteristics of usability models like Nielsen's usability model, the ISO 9241-11 usability norm, and the Software Usability Measurement Inventory (SUMI) along with four other usability models. Based on the most recurrent characteristics such as efficiency and ease of use, the authors then developed a framework for designing mGov applications (Kureerung and Ramingwong, 2019b).

The second process that involved the use of usability models aimed at studying the Interaction Design Patterns in governmental apps with the help of the 76 mobile interaction design patterns developed by Hoober and Berkman in 2011 (da Silva and Freire, 2020; Hoober and Berkman, 2011). For this process, the 13 categories of interaction design pattern designed by Hoober and Berkman were summarized into 6 categories: User Action, Help & Feedback, Search & Filter, Content Design, Input, and Navigation. The authors then evaluated 27 governmental applications in order to find the implemented design patterns in each one of them (da Silva and Freire, 2020; Hoober and Berkman, 2011). The following figure provides an overview of the interaction design pattern categories by (Hoober and Berkman, 2011) and by(da Silva and Freire, 2020).
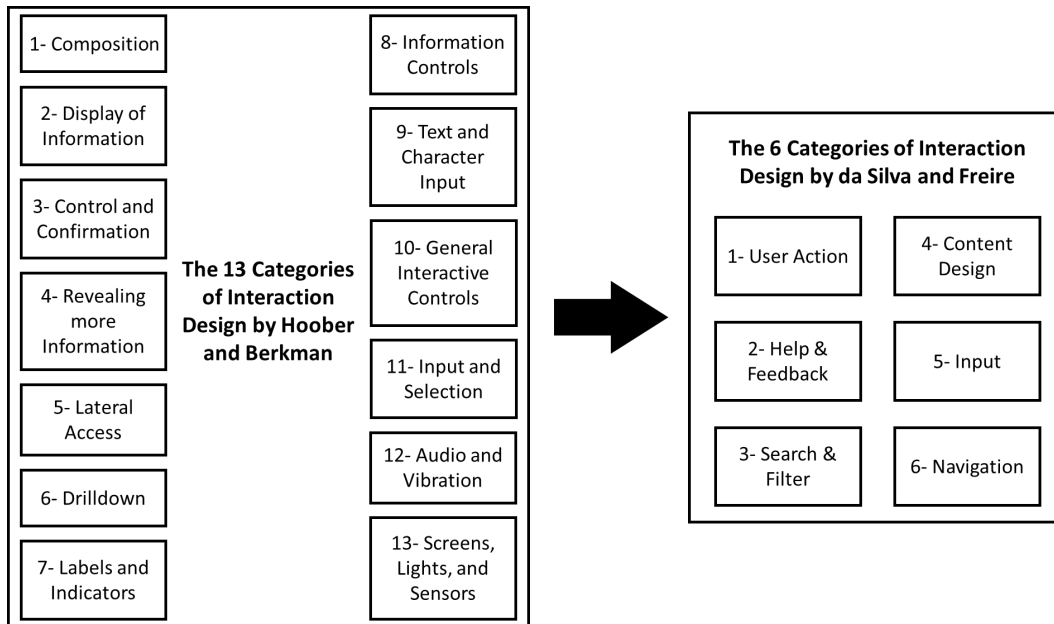
Figure 13: Visualization of the methodology employed using Hoober and Berkman's interaction design patterns (da Silva and Freire, 2020; Hoober and Berkman, 2011).

The third kind of approaches employed empirical research methods to examine the design of gov applications by conducting surveys, interviews, and case studies with citizens and mGov designers and developers (Chang et al., 2020; Isagah and Wimmer, 2018; Lönn et al., 2016). An approach used for a case study on Shanghai's Minhang's government application, as an example, included four stages (Chang et al., 2020). The first stage consisted of a survey that aimed at collecting the expectations and feedback from citizens towards the app. Second, user experiments have been conducted where the user's behavior has been recorded while using the app. In addition, the subjective evaluation ratings and comments from the users have been collected. The design problems found in the second stage are then addressed in the third stage, as an improved version of the app gets developed. The fourth and final stage, the design validation, consists in conducting a second user interview to record the user's feedback and opinions regarding the new and improved prototype. The goal of this approach is to demonstrate the effects of design improvement in governmental apps and how it can positively affect their performance (Chang et al., 2020).

A similar approach has been employed for the examination of the collaboration through citizen sourcing for the improvement of the development of mobile government applications (Lönn et al., 2016). For that, workshops were conducted with municipality officials from multiple municipalities and discussed the potential process that can be implemented or invented that would allow citizens to send complaints directly to the government. Based on the results of the workshops, the authors developed three prototypes: An App, an app integrated with an ePlatform, and a final solution integrated with a case management system. The prototypes were then demonstrated to the municipality officials and evaluated via simulations, informed arguments from the government and citizens, tests, and a survey with 35 citizens (Lönn et al., 2016). A mixed approach to evaluating requirements of mGovernment services can also be carried out by surveying and questioning designers and developers of government mobile services (Isagah and Wimmer, 2018). One survey, for example, aimed at examining the requirements, design approaches, challenges, and recommendations for mGovernment services. In addition to the mentioned aspects, the survey also included some questions about the demographic details and designing experience to provide a more detailed result (Isagah and Wimmer, 2018).

In order to determine the most important factors in mGov applications for the elderly, a fourth approach has been identified, that consisted in deriving some design factors from the TAM such as perceptions and attitudes towards the system (Kö et al., 2018). The factors derived were then used to develop an After Scenario Questionnaire (ASQ) that has been filled out by elderly citizens after getting a demonstration of a conceptual model of an mGov service. Based on those results, a

prototype has been developed and demonstrated and a survey has been conducted to assess if the improvements were effective (Kö et al., 2018).

Fifth, Cahyano and Susanto presented the following approach regarding the examination of user design of mobile eGovernment websites. The authors installed an eye tracker and MindWave to record the retina's activity and the brain waves, as participants were searching for a specific information in 9 governmental websites. After that, an interview with 28 statements has been conducted with the participants to determine the impact of the human computer interaction aspects, and mobile website design on the efficacity of mGov services in Indonesia (Noprisson et al., n.d.).

Overall, this section shows that different methods and approaches can be utilized for the evaluation of the user experience in mGov websites and applications. The variety of the methods used does not only display the difficulty of properly evaluating mGov services, but also proves that different target groups require different research approaches. This section first provided a look on the usage of existing usability models and how mobile application characteristics are relevant for the evaluation of mGov services. Case studies were also a popular evaluation method, as multiple authors employed different techniques in conducting these studies, including ASQs, workshops, and the analysis of the brain activity.

6.1.2 Overview of Results

6.1.2.1 eGovernment Research

The findings in this section provide a look on different factors affecting the design of eGovernment services, as well as a design research model that aims at designing policy-ingrained artifacts.
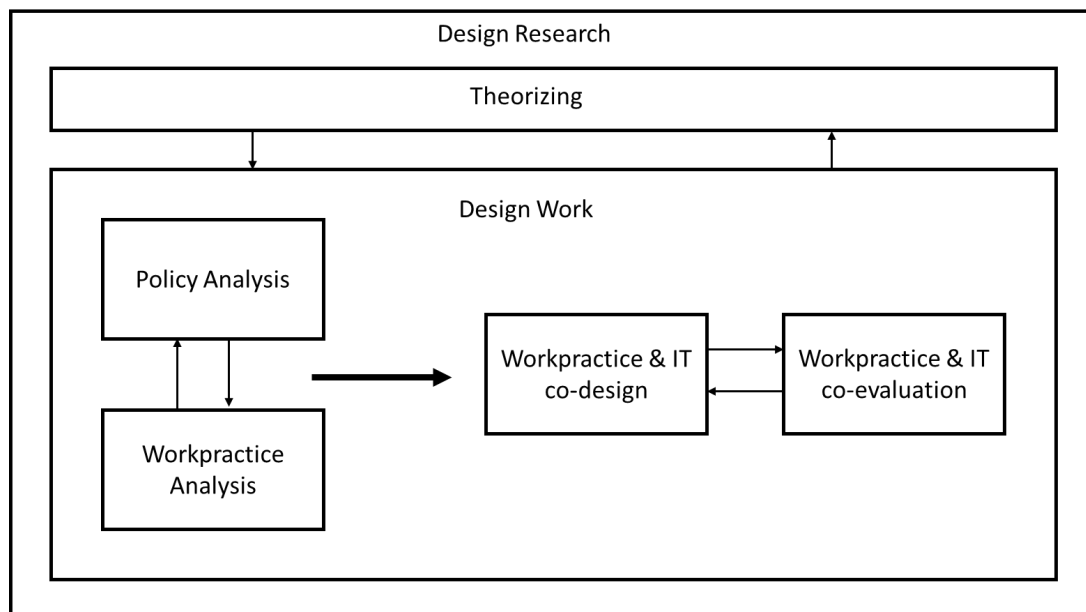

Figure 14: Visualization of the design research model by Goldkuhl

Goldkuhl's additions and modifications to Hevner et. Al.'s and Peffers et. Al.'s Design research models resulted in the development of his own eGovernment research model as seen in figure 10 (Goldkuhl, 2016). In this model, theorizing has been added as a construct that would provide some governance for design in addition to the policy analysis that helps create policy-suitable artifacts. Furthermore, this model contains the workpractice analysis for ensuring that the artifact is suitable for organizations and businesses (Goldkuhl, 2016; Hevner, 2004).

6.1.2.2 mGovernment Research

Concerning the matter of mGov design, a set of factors, solutions, and methods have been identified and developed for the improvement of mGovernment design. First, this section provides an overview of design framework for mGov applications, that focuses on satisfying the primary requirements of the user interface. Second, there is an overview of a set of design pattern categories and usability

requirements found in empirical research carried out with mGov developers and designers. These findings were found to be the most impactful in the improvement of the usability in mGov applications. Third, UX principles that derived from empirical research from a citizens and mGov users perspectives are presented. These principles can be used for the improvement of the information layout and user interface in governmental apps.

Overview of design framework for mGov applications

The analysis of usability models such as Nielsen's heuristics and the SUMI resulted in the development of a framework for the development of user interface design for mGov applications (Kureerung and Ramingwong, 2019b). As seen in Figure 15, the framework consists first in defining the inputs required and the goals that need to be met. The findings are then used to raise questions and start with the design process. In this process, security, privacy, simplicity, learnability, memorability, and satisfaction are the most important factors in use to be improved. Within the factor of use, factor requirements, that are based on specific criteria, need to be fulfilled in order to present an improved user interface for the mGov service (Kureerung and Ramingwong, 2019b). This method allows mGov developers to first identify and describe the main functionality of the user interface, which in return provides a way to determine the main requirements of the application. From there, mGov developers can work on developing mobile applications and websites that are focused on providing the main functionalities in the most usability-satisfying and user-friendly way. These findings also align with other studies, that emphasize the importance of user interface design (Chang et al., 2020; Isagah and Wimmer, 2018; Kureerung and Ramingwong, 2019b)
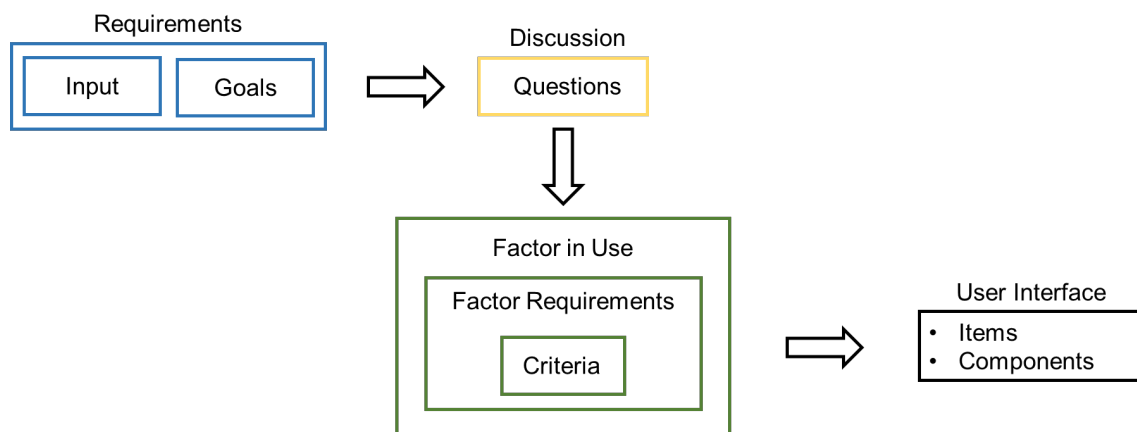

Figure 15: Visualization of the design framework developed by Kureerung and Ramingwong (Kureerung and Ramingwong, 2019b).

Design pattern categories and usability requirements gained from mGov developers

The analysis and categorization of Hoober and Berkman's interaction design patterns resulted in the identification of 6 interaction design categories, that are most impactful in the design of mGov services (da Silva and Freire, 2020; Hoober and Berkman, 2011). These categories contain different components that allow mGov application designers to provide a cleaner user interface, an effort free user experience, and an overall more user-friendly product (da Silva and Freire, 2020). The 76 interaction design patterns from which these categories were derived can be further studied in (Hoober and Berkman, 2011). As for the pattern categories, a brief explanation and some examples of interaction design patterns are presented in the following figure.

Content Design	The Content Design category describes the way content is presented to users in a mobile application. It includes Patterns like Titles, Icons, Lists, Pop-ups, and grids along with the dynamic arrangement of graphical or textual information.
User Actions	The User Actions define the set of methods the app provides to the user to interact with the application and execute the wished-for operation. This category contains interaction strategies such as gestures, touch, voice, and sign on.
Input	The Input patterns category consists of patterns that concern data entry activities. These patterns include Keyboards, Input areas, form selections, voice inputs, and mode switches along with other data entry related patterns.
Navigation	The Navigation category incorporates all activities related with the navigation, access, and movement of the user between content pages. The patterns included in this pattern category are tabs, revealable menus, scrolling, links, and fixed menus along with many more patterns.
Help & Feedback	The Help & Feedback patterns category consists of patterns that informs the users about the status of the operations they are conducting. Wait indicators, notifications, and haptic output are some of the patterns that belong to this category.
Search & filter	The Search & filter patterns category includes search engines and filters that aim at optimizing the search for data and functionalities. These patters are also employed to limit the data volume that the user is exposed to.

Figure 16: The most impactful interaction design pattern categories for the design of mGov applications (da Silva and Freire, 2020; Hoober and Berkman, 2011).

The empirical studies carried out with mGov designers and developers that aimed at identifying the requirements of mGovernment services from designers' perspective, showed that most mGov designers and developers prioritized the usability over other requirements of mGov services such as security, privacy, interoperability, integration, compatibility, and scalability (da Silva and Freire, 2020) (Isagah and Wimmer, 2018, 2017). A detailed overview of the usability requirements expressed by mGov developers and designers, as well as their characteristics is presented in Table 11:

Usability requirements from the perspective of mGov developers and designers	
Learnability	Easy to learn Easy to use Easy to remember
Recognizability	Meets Service Goals Convenient to user environment Easy to understand
Operability	Suitability for the device Conformity of the device with user expectation
User Error Protection	Error Tolerance
User Error Aesthetics	Clear and attractive Interface
Accessibility	The use of multichannel The use of multi-language The use of common and cheap channel

Table 11: Usability requirements from the perspective of mGov application developers and designers (Isagah and Wimmer, 2018, 2017)

As displayed in Table 8, the usability requirements of mGov applications are categorized into Learnability, Recognizability, Operability, User Error Protection and Aesthetics, and Accessibility (Isagah and Wimmer, 2018, 2017). Each of these requirements vary in importance according to the kind of service and kind of users it attracts. For the elderly, for example, the ease of use is the most important requirements, since most of the elderly lack experience with new technologies (Kö et al., 2018; Susanto et al., 2017; Talukder et al., 2020). The main challenge in satisfying these requirements consists in finding or developing principles, methods, or frameworks that could cover these concerns but can also be employed across different mGov applications. Furthermore, most designers and developers rely on the existing agile methods used as a substitute for traditional software development methods. These agile methods differ in practices and tactics and do address service requirements in different ways, which shows that there is a lack of standards in the development of mGov services (Isagah and Wimmer, 2018). Most designers were also found to employ design approaches that do not involve the user, nor do they use development frameworks that address all usability requirements (Isagah and Wimmer, 2018). Cross-platform frameworks, as an example, address compatibility requirements but do pose some challenges regarding the user interface and performance of an app. In addition, the employed guidelines such as material design guidelines, SMS guidelines, and mobile operating systems guidelines are very different for each kind of device. With the technological development happening in the smartphone industry, it becomes hard for mGov designers and developers to agree on a specific guideline. Therefore, standardized principles, guidelines, and best practices should be developed, that address the requirements of m-government services, regardless of the type of device the service is provided on (Isagah and Wimmer, 2018).

UX principles derived from citizens for the improvement

Regarding the usability of mobile government applications, the results from case studies and empirical work with citizens can be matched to the Content Design and Search & Pattern categories in Figure 16: The most impactful interaction design pattern categories for the design of mGov applications (da Silva and Freire, 2020; Hoober and Berkman, 2011).(Chang et al., 2020; Isagah and Wimmer, 2018). The layout of information is the first design aspect that has a large potential of having a usability reducing effect on mGov apps. To reduce the efforts that the user must make when using the app's functionalities, repeated entrances should be avoided. A proper display of information and functionalities according to their importance also showed signs of increased usability in our findings (Chang et al., 2020; da Silva and Freire, 2020; Isagah and Wimmer, 2018, 2017). In addition, mixed or large quantities of displayed information proved to be discouraging for potential mGov users (Kureerung and Ramingwong, 2019b) (Chang et al., 2020).

The next design aspects that showed some negative effects on the usability were colors and icons. The effect of different colors on the human brain has been largely documented, thus making the choice of color a somewhat important decision in the appearance of the interface (Chang et al., 2020; Kö et al., 2018). The colors used should therefore not be too heavy or occupy too much space, nor should the background color be too near to the colors of the buttons. In some cases, where an administration possesses a logo, the colors used in their mobile website or applications should match the colors of the logo (Chang et al., 2020). The icons used in mobile government applications also proved to affect the user-experience, since icons that are hard to recognize or to understand lowered the usability of the app. Inconsistencies in design styles were also found to be negatively affecting the mGov app (Chang et al., 2020; Isagah and Wimmer, 2018). Regarding the aforementioned usability aspects, the following principles have been applied and have been proven to improve mobile government applications from an user-experience point of view (Chang et al., 2020; Isagah and Wimmer, 2018):

- Multiple entries for the same functions need to be simplified.
- Redundant entries need to be removed.
- Important services need to be placed at high priority positions in the layout.
- The size of visual elements needs to be adapted to their importance.
- The popular services identified in surveys and user experiments need to be added.
- The information architecture needs to be changed to show the most important information first.

- Government applications should need to have a uniform design across administrations to reduce the cost of training users.

Challenges

In an effort to provide a clear look on the usability requirements of mGov services, some challenges did come up in multiple occasions. Our research showed that the design process of mGov applications and websites does come with some difficulties, since multiple outside factors such as demographics and politics play a crucial role in their development. In addition, the challenges shown in the **Fehler! Verweisquelle konnte nicht gefunden werden.** , provide a look on how the design process of mGov solutions needs to be studied further and modified, so that the usability requirements of mGov services are met.

Table 12: The challenges in designing mGov services

	Challenges of designing mGov services	Source
1	Different smartphones and mobile interfaces require different approaches for the development of mGov applications.	(Isagah and Wimmer, 2018, 2017)
2	There are no standardized approaches (principles, frameworks, or best practices) that address the usability requirements of mGov services.	(Chang et al., 2020; Isagah and Wimmer, 2018; Lönn et al., 2016)
3	Most mGov developers and designers use approaches that concentrate on the development of functioning mobile applications. Most of these developers aim at achieving good working applications more than mGov applications that do address the usability requirement of the users.	(Isagah and Wimmer, 2018; Kureerung and Ramingwong, 2019b)
4	Demographics, political status, familiarity with the technology, trust, and the nature of the service to be provided are the most impactful factors on the usability of mGov services. This makes developing standardized approaches more challenging.	(Chang et al., 2020; da Silva and Freire, 2020; Isagah and Wimmer, 2018; Kö et al., 2018; Kureerung and Ramingwong, 2019b; Lönn et al., 2016)
5	Most mGov solutions do not involve the citizens in the development process, which makes it more challenging to address the usability requirements	(Kö et al., 2018; Lönn et al., 2016)

6.1.2.3 Limitations found in Research

Regarding the research limitations of design research for eGov, a small number of limitations has been found in the papers. Nor Laila et. Al. were limited in their study, as they also wanted to examine the specific emotions that a website design would induce in addition to examining the preference for emotional design in eGovernment portals (Nor Laila et al., 2016). Quilles et. Al. mentioned in their work on eGovernment implementation, that the design approaches for regional government portals or websites do not necessarily fulfill the requirement of local or national eGovernment websites. Thus, creating the need to develop certain design approaches and guidelines that fit the specific category of eGovernment (Alcaraz-Quiles et al., 2018).

Concerning the limitations found in this part of the research Isagah and Wimmer mentioned that their research was conducted in a developing country and that a comparative analysis between designers

from developed and developing countries would help understand the design principles used in eGov development more and find differences between eGov services in developing and developed countries (Isagah and Wimmer, 2018) .

6.1.3   SDG Regulations User Friendliness

mGov4EU will implement user-friendly mobile consent-management solutions, in line with the requirements of the SDG Regulation(The European Parliament, 2018). The SDGR aims at establishing "a user-friendly, interactive gateway which, based on users' needs, should guide them to the most appropriate services" by offering "easy and user-friendly access to information". The SDGR does not further specify what is meant by "easy" and "user-friendly", however, it is clear that the user, when using a web-based or mobile eGov service, must be able to easily find the relevant information to complete the service. This approach perfectly reflects the usability principles described in the previous chapters. mGov4EU will do its best to ensure that its solution fulfills the same requirements as the ones required by the EC for the Single Digital Gateway.

6.2   Good Practices for User Experience and Design

This section provides a list of 11 Good Practices for User Experience and Design to keep in mind for future technical implementation. These good practices were extracted from the summarized desk research done in Chapter 6.1, findings found in **D1.1**, and reference points and requirements found in **D1.3**. These good practices could be a stepping stone for future user research and usability research found in **T2.7** or in the **WP5** evaluation task.

1.   **Learnability**

According to (Krimmer et al., 2017) learnability means that the user is able to easily learn, use and remember. The importance of learnability has already been highlighted in **Chapter 2.4 of D1.3**, in which we provided an initial set of usability requirements for mGov4EU (see requirement R-U-03). In the context of eGov and mGov applications learnability means that the user would easily learn how to use the app or service, not have any difficulties using it and finally, easily remember how to use the app or service or how to find certain information within the application. Learnability contributes to the increase of user-friendliness in the short term and user acceptance in the long term. Thus, learnability is also a way to overcome challenge 3 in Table 12 (Isagah and Wimmer, 2018; Kureerung and Ramingwong, 2019b), where developers would only focus on technical aspects rather than on usability aspects of the solution. To conclude, the three aforementioned aspects of learnability (easy to learn, easy to use, easy to remember) comply with the requirements that the EC set out in the SDGR (see Chapter 6.2).

2.   **Accessibility**

Accessibility is divided into two areas: service availability and digital inclusion.

Service availability is ensured by the fact that the tools and solutions created within mGov4EU support accessibility services that comply as much as possible with current standards such as WCAG, ATAG and UAAG. These standards can also serve in the development of accessible websites/applications. Among other things, they explain how to make web content accessible to people with disabilities and address text images, forms, sounds and videos, and other content on a website or web application (WCAG 2.0 at a glance: Einfach für Alle (einfach-fuer-alle.de).

Digital inclusion means that mGov4EU solutions must be as accessible as possible in terms of digital accessibility. There must be support for all types of users in different situations. This also applies to people with disabilities. This user group must not be excluded in order to maximize the user base.

3.   **Minimalistic and simple design**

One of the requirements set out in **D1.3** is the need for a minimalistic and simple design of the service that allows the user to focus on the important things (see requirement R-U-11 in **D1.3**). Simplicity automatically increases accessibility, which means that no user groups are excluded because they lack certain capabilities. Therefore, our common goal should be to provide a barrier-free and user-friendly solution in order to overcome challenge 4 in Table 12, which highlights the inevitable different

characteristics of users (Chang et al., 2020; da Silva and Freire, 2020; Isagah and Wimmer, 2018; Kö et al., 2018; Kureerung and Ramingwong, 2019b; Lönn et al., 2016) that make it difficult to develop a service that fulfills the needs of different user groups.

4. Language

Language refers to the language in which the eGov or mGov service is offered. Is the service only available in English or in several languages? If the latter is the case, are global language requirements considered, including languages that use special characters? This has already been asked in requirement R-U-4 defined in **D1.3**. In the "Guidelines for the implementation of the single digital gateway Regulation"(The European Parliament, 2018) the European Commission requires that all explanations in the SDG should be provided to the user in a language "broadly understood by the largest possible number of cross-border users", which according to the Commission is English. The aim of all mGov and eGov services, especially if they are used in a cross-border setting, should be to reach as many people as possible. This is only possible if the language of the service is understood by a broad user group. Similarly to a simple design, language can help to overcome the differences between user groups (see challenge 4 in Table 12).

5. User readable terminology

In requirement R-U-05 defined in **Chapter 2.4 of D1.3**, we state that "all terminology (labels, buttons, messages etc.) MUST be understandable for users with little technical understanding, users new to the software and the subject." This requirement does not only enhance usability, but it also guarantees that no user group is excluded, independently of the "demographics, political status, familiarity with the technology" of the users (see challenge 4 in Table 12).

6. Help & feedback

Another good practice has been defined in **Chapter 2.4 of D1.3**, namely the usability requirement R-U-06. This requirement foresees a "helpdesk" for users that answers any questions that might arise during the user experience. Whenever the user is not able to proceed within the application, he or she must be able to get assistance. This assistance can be provided either by means of direct interaction with a team or a software in the background e.g. through a chatbot, or by means of simple clickable "i" that provides the user with additional information. Feedback in mobile or web-based applications refers to patterns that "inform the users about the status of the operations they are conducting" (see Figure 16). Such patterns include for example notifications or haptic output (da Silva and Freire, 2020; Hoober and Berkman, 2011). However, feedback can also mean that the user provides feedback to the developer, which is foreseen for instance also for the Single Digital Gateway. Both help and feedback contribute to an enhanced user-friendliness.

7. Error handling

Error handling is an important step within the development of any application and has been described in many user design studies. In **D1.3** we have thus defined the usability requirement R-U-13 as follows: "In all predictable cases the system MUST hinder the user to make mistakes. But the system should not just block an operation. Instead, it should explain to the user why this operation is not available at the moment. If there is an error, or the user makes a mistake the system MUST provide clear and understandable cause, also giving the user clear instruction on how to fix it." It shows that there is a strong interdependency between error handling and feedback and therefore, both must be installed.

8. Search & filter

One of six interaction design patterns defined by Hoober and Berkman is the search & filter design pattern (da Silva and Freire, 2020; Hoober and Berkman, 2011). As in any other web-based or mobile application, there must be a way for the user to search for certain information, data or functionality through a search engine implemented in the application. Even if all good practices described in this chapter are fulfilled by the developer, some users might prefer to look for data

through a search engine instead of using other functionalities that are already there. Another add-on that comes along with that search engine is a filter. Such a filter makes it much faster for the user to find what he or she is looking for. The search facility is a crucial part of the Single Digital Gateway, which is being implemented by the European Commission.

9. Operability

Another challenge that many developers of mGov services have faced is the huge variety of devices available on the market, through which the user can access a service. This challenge (see challenge 1 in **Fehler! Verweisquelle konnte nicht gefunden werden.**) requires that any solution is operable and supported by all mobile devices available on the market. In **D1.3** we described operability or adaptability (see requirement R-U-08) as the requirement that "the User Interface for the mGov4EU project MUST be adaptive, so the content shows well on small screens as well on large ones. According to (Isagah and Wimmer, 2018, 2017) operability stands for (a) suitability for the device, and (b) conformity of the device with user expectation. Independently of the definition, the developer must make sure that the service can be accessed through any device.

10. Placement of information

Two good practices for user interaction and design of mGov services have been already studied intensively in case studies and empirical work with citizens by (Kureerung and Ramingwong, 2019b), (Chang et al., 2020; da Silva and Freire, 2020; Isagah and Wimmer, 2018, 2017). One important factor is the right placement of information within the application. It has been shown that a straight-forward layout and arrangement of instructions and functionalities is crucial for the usability of the service. Also, overlaps and replications of text and generally, large quantities of text should be avoided. The user must always be clearly directed to the most important functionalities. If this requirement is fulfilled, usability and learnability are guaranteed and therefore, challenge 3 in Table 12 overcome.

11. Use of colors

The second good practice that proved to be important in case studies and empirical studies with citizens is the right choice of colors (Chang et al., 2020; Kö et al., 2018). Not only the wrong choice of colors can negatively impact the user, but also the inconsistent use of logos or corporate identity of a service provider. Moreover, icons play an important role in the user experience. Well-designed and well-placed icons can definitely be a benefit for the user (Chang et al., 2020; Isagah and Wimmer, 2018). All in all, the "look and feel" of the application for the user must be as good as possible. The aforementioned studies show, that the involvement of citizens in the user design process can help a lot to design a user-friendly service that attracts many users (see challenge 5 in Table 12).

6.3 Case Study of Selected Governmental Online and Mobile Services

This section provides a survey of current governmental services that are accessible either online (eGovernment) or through a mobile app (mGovernment). As resources are limited, a case study analysis of three countries was made. The three countries that were chosen were Germany, Estonia, and Austria. With these three countries, one can see a wide spectrum of differences between various structures, sizes, digitalization, etc. Each country will have a brief overview of the structure, the eGovernmental Services, mGovernmental Services that are offered and insights on the observations of how many of the SDG use cases are already implemented.

6.3.1 Germany eGovernment and mGovernment Service Overview

6.3.1.1 Structure

The citizens in Germany received their main governmental services directly from the city governments, where they are residents. After a citizen is registered in a city, they are able to

complete various governmental services. However, the city governments are often dependent on their state governments for technical support and services. Typically, the state governments will develop or provide services for key infrastructure, such as portals, identity infrastructures, etc, that the cities can decide to use or to create their own solutions. There are federal or national infrastructures that are also offered to the state governments for use as well, however, it appears the states are responsible for providing their cities with the main infrastructure for governmental services.

6.3.1.2   eGovernmental Services

It appears that most states and cities offer at least a hybrid model for their services. This implies that the citizens are able to download the forms needed for a service and to mail it into their local authority. It seems that there is movement to put most services on e-government portals. This seems to be driven by a law, the Onlinezugangsgesetz (OZG), which has set a deadline at the end of 2022 for online governmental services.

Regarding identity, most e-governmental portals in Germany do not offer the possibility to fulfil their services completely with the use of an eID.

6.3.1.3   mGovernmental Services

There are some states and cities that are piloting different apps for various services. However, most of the states or city governments that provide services to the citizens offer the e-gov portals, where it is mobile configured websites.

There are a few federal apps that are offered for different services, such as for completing one's taxes.

6.3.2   Austria eGovernment and mGovernment Service Overview

6.3.2.1   Structure

The most popular eGov services in Austria are offered by the federal republic of Austria and by the nine states and their capitals. Not many eGov services are provided at city or municipality level. Most of the local services aim at providing news and information to the citizen or at giving the citizen a possibility to interact with the city/municipality (e.g. by reporting a damage), but not at digitalizing governmental or administrative processes. Only in some cases, local eGov portals and apps also provide eGov services, but those depend a lot on services offered by the federal or state government.

6.3.2.2   eGovernmental Services

Austria already offers a lot of web-based egov services to its citizens. Most of them are implemented as online forms that can be accessed via a web browser, filled online and then signed with the so-called "Handysignatur" or the recently started "ID Austria", both valid eIDs. This applies to all online forms, independently of the level of the service (state-wide, regional or local). Some portals also allow a login with a European eID, but not all of them.

Many cities and states still have a "hybrid" form of eGovernment, meaning that a lot of services can either be processed fully online or the user downloads a pdf, fills it in, prints it, signs it and sends it to the responsible administration. However, the number of web-based eGov services provided by local and federal governments is growing every year.

A lot of the online forms in Austria are developed and hosted by the same service provider (aforms2web solutions & services GmbH), which offers eGov services also to governmental institutions in Switzerland and Liechtenstein.

Some eGov services in Austria are handled in a centralized manner by the state, for example the registration of a new business. Indeed, regional eGov portals always redirect the user to this centralized service.

From a user-friendliness and usability point of view, it has to be highlighted that all eGov portals and apps analyzed in **task 2.1** are mobile-responsive and therefore, accessible from everywhere at any time with a mobile device.

6.3.2.3 mGovernmental Services

With respect to mobile governmental services Austria lacks behind in comparison to its egov services. Indeed, there are only a few widely used mobile apps around and almost all of them are provided by a federal ministry with the exception of two regional apps (Land Salzburg und Land Oberösterreich) and one local app for municipalities ("Gem2Go").

The most popular mGov apps in Austria are the "Digitales Amt" by the BMDW (Ministry of Digital and Economic Affairs) and the "finanzonline+" by the BMF (Ministry of Finance). Both of them require a login with username and password and/or eID. The citizen-centred app "Gem2Go" is also becoming more and more important by helping municipalities and towns to engage with their citizens in a smart way, as well as to offer them mGov services.

When a service is not offered directly in the app, the app redirects the user to the mobile-responsive version of the respective web-based eGov portal, where the process can be fully completed online.

6.3.3 Estonia eGovernment and mGovernment Service Overview

6.3.3.1 Structure

Estonian citizens and residents who possess an ID or residence permit card are able to use the electronic government services provided by the Estonian government. The electronic services are offered on a centralized level by the federal government. On this national level, after obtaining any of the eID means, such as an ID card, residence permit card, Mobile ID, Smart ID or e-residency card, (e-) residents are allowed to access and use 99% of the electronic services offered through national portals. For example, even the service of registering in the population registry a residence address, is provided by the national state portal by government ministries or agencies. Thus, the main eGovernment service providers in Estonia are national government agencies and ministries.

6.3.3.2 eGovernmental Services

In Estonia, digital government is perceived as the main competitive advantage in the country. This is the case because of the fact that 99% of the government services are digitalized. These electronic services are mostly automated and fully electronic, which means that there is no need for downloading a form and sending it through e-mails, but the whole process is conducted electronically. For example, annual submission of tax declaration is fully electronic and it enables the user to have automatically retrieved data on the incomes, thus, the user is required only to add additional information in case there is undeclared income.

The infrastructure that enables these e-services within Estonia are primarily highly developed ecosystems which includes, inter alia, data exchange centralized layer X-Road, electronic ID cards, public key infrastructure (PKI) and National Base Registries. The X-Road data exchange layer enables the secure communication between service providers and connection of its database in the secured data exchange system. The eID cards enable secure identification, authentication, authorization and digital signature to all government and some non-government services. The PKI enables privacy and secure data and document exchange within the digital ecosystem in Estonia, while National Registry contain database with necessary base data registry data related to the citizens and businesses.

The combination of the above-mentioned enablers, allow the once-only principle and use of 99% provided e-services.

6.3.3.3 mGovernmental Services

In Estonia, many of the e-services are mobile-friendly and accessible through a mobile browser. However, there are no mobile apps known at the moment that provide eGovernment services.

The only app currently used widely by the public is the HOIA app, which is a contact tracing app developed as open-source app for COVID-19 contact tracing purposes.

6.3.3.4 Relevant Remarks

It can be seen that authentication to e-services in Estonia is mainly through eID means. This is very useful for the entities containing eID means. However, when it comes to short term stays when eID mean is not provided, entities are not able to use most of the e-service. Having in mind that some part of the cross-border use cases are also for entities on short term basis this can be perceived as disadvantage of highly digitalized country depended on its solutions.

Another interesting fact is that with the eID cards it is possible to use some of the private e-services, such as bus transport, bank services etc. The reason for this is that unique personal identifiers (UPI) are perceived as public data thus enables use of eID means for private e-service cases.

6.3.4 Overview of Available Services and Functionalities

In this subsection the results of the eGov and mGov service research concerning their functionalities are presented. For Germany and Austria we investigated three levels: 1) capital cities of the federal states, 2) federal states, 3) interview partners (see section 5.2.1) where the results of the qualitative interviews are summarized). For Estonia we focused on the national level only because all governmental services are offered centralized by the state and the interviewees were representatives of those national services.

In our research we analyzed the following functionalities; type of provided governmental services, availability of mobile website, availability of mobile application, type of log in, eID log in capable, availability of services.

6.3.4.1 Germany

City Level

Of the 16 state capital cities in Germany twelve offer G2C and G2B, 3 offer G2C, and no information could be provided for one city because this information was not available on the website. This implies that 75% of the state capital cities offer both G2C and G2B services, 19% offer only G2C services and the rest was not able to be accounted for (see Figure 17).
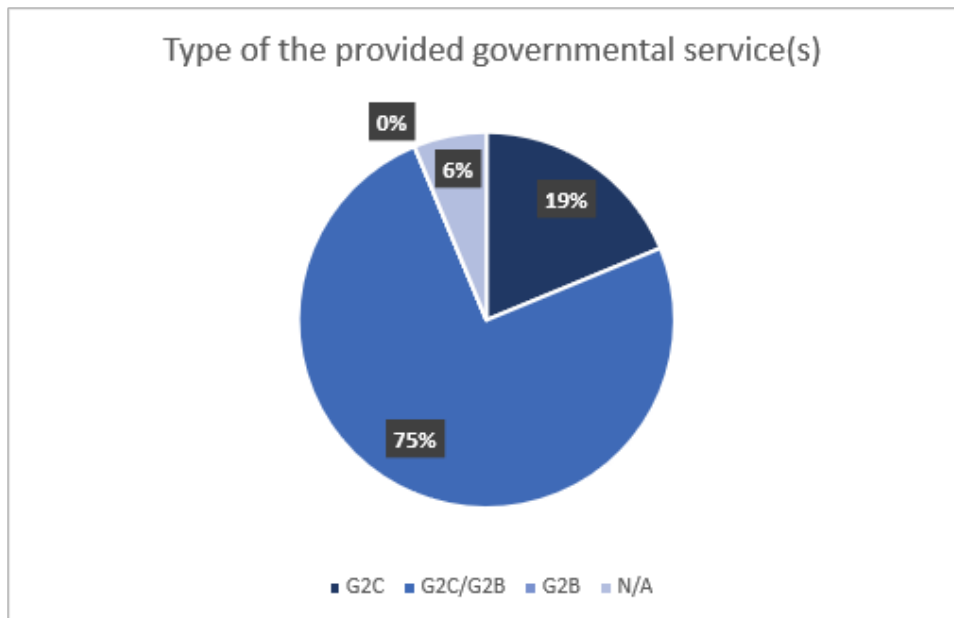
Figure 17: Type of provided governmental service(s) in German capital cities

None of the cities currently offers a mobile app. However, it is visible that the cities are making an effort for being mobile-friendly, as 14 of the 16 cities have a functioning mobile website.

Four cities have a service account, where a citizen can log in with a username and password. One city offers two types of service accounts: the normal service account and a service account Plus, which allows the use of services that require proof of identity. On eleven websites there is no possibility to register with a service account.

In five cities there is the possibility to identify oneself with the eID, in one city there is no information about this, and in ten cities this possibility does not exist at all. This means that 31% of the eGovernment portals on city level support eID, while 63% do not (see Figure 18).
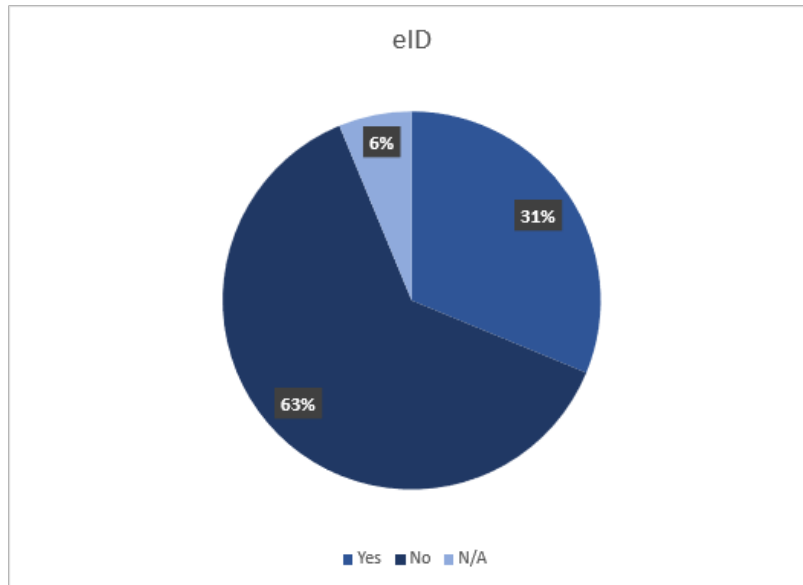

Figure 18: Cities with implemented eID in Germany

Concerning electronic versus non-electronic accessibility, in ten of the sixteen cities eGovernment services can be carried out completely online (full). In five cities editable forms can be downloaded in order to make use of a service (hybrid), and no information could be provided for one city (N/A).

State Level

On state level in Germany of the 16 states, six offer G2C and five offer G2C and G2B services. Two states offer all types (G2C, G2B and G2G), and another two offer G2C and G2 administrations and companies, while one state offers G2C/G2 authorities and companies services. The difference between authorities and administrations in Germany is that authorities are public administrations, that is, every authority is an administration, but not every administration is an authority.
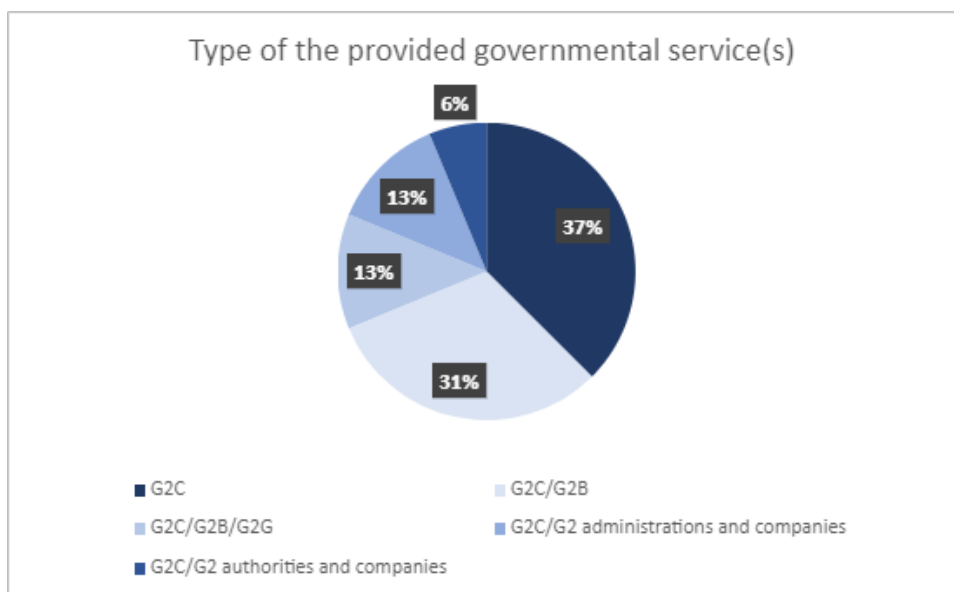
Figure 19: Types of the provided governmental service(s) in German states

The picture for the states is similar to that for the cities. Except for one federal state (Thuringia), none has a mobile app. However, it can be observed that attempts are being made to make mobile use more friendly by offering a mobile website. All federal states offer this.

Concerning login functionalities, nine federal states have an account where you can log in, seven have not. Concerning eID, 13 states (81%) support it, three (19%) do not (see Figure 20).

In four (25%) of the 16 states it is possible to download a form and fill it out to claim an administrative service, in the other 12 states (75%) it is possible to do it completely online.
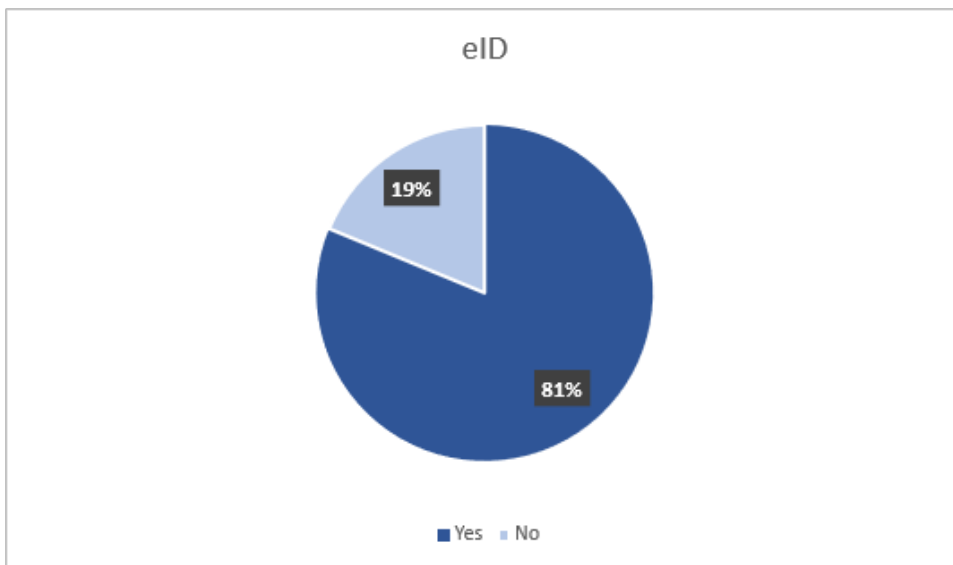
Figure 20: States with implemented eID in Germany

6.3.4.2 Austria

City Level

Also for Austria the nine capitals of the federal states, as well as the nine federal states were analyzed. Note that Vienna was included both in the city, as well as in the federal state analysis, although from an administrative point of view, it is only a federal state and not a capital city.

Of the nine cities, eight (89%) offer G2C and G2B services, and one city (11%) offers only G2B.
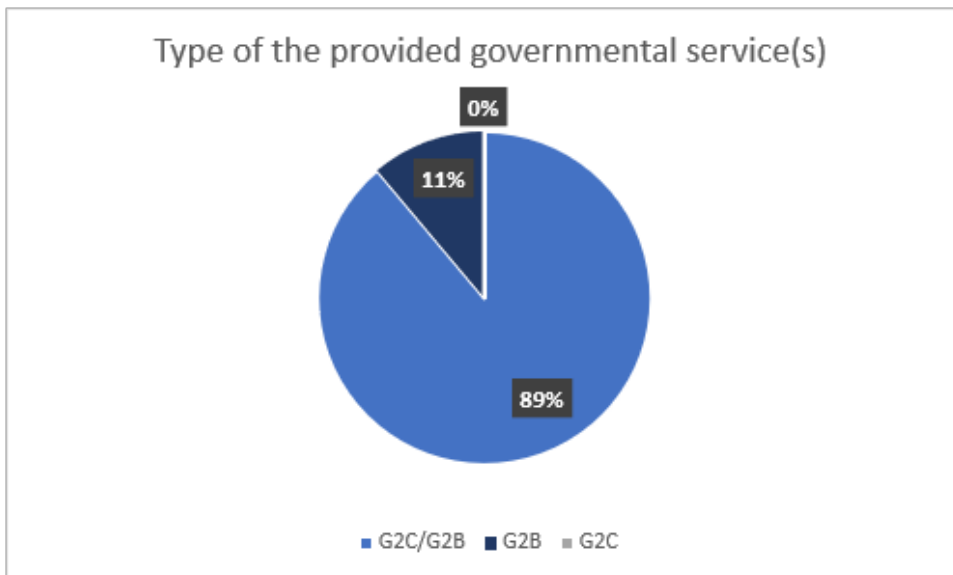
Figure 21: Types of the provided governmental service(s) in Austrian cities

None of the cities currently offers a mobile app. However, all cities have a well-functioning mobile website.

In addition, none of the cities offer a service account where you can log in. There is also no eIDAS or eID support in any of the capital city portals.

Six of the nine cities (67%) offer to download editable forms and carry out administrative services partially online (hybrid). One city does not provide any information on this, and in two cities administrative services can be performed completely online.

State Level

On state level only one state (Vorarlberg) does not have an eGovernment portal at all. That's why only eight states are mentioned in the following.

Of the eight states analyzed, seven (87%) offer G2C and G2B and one offers only G2C services (13%) (see Figure 22).
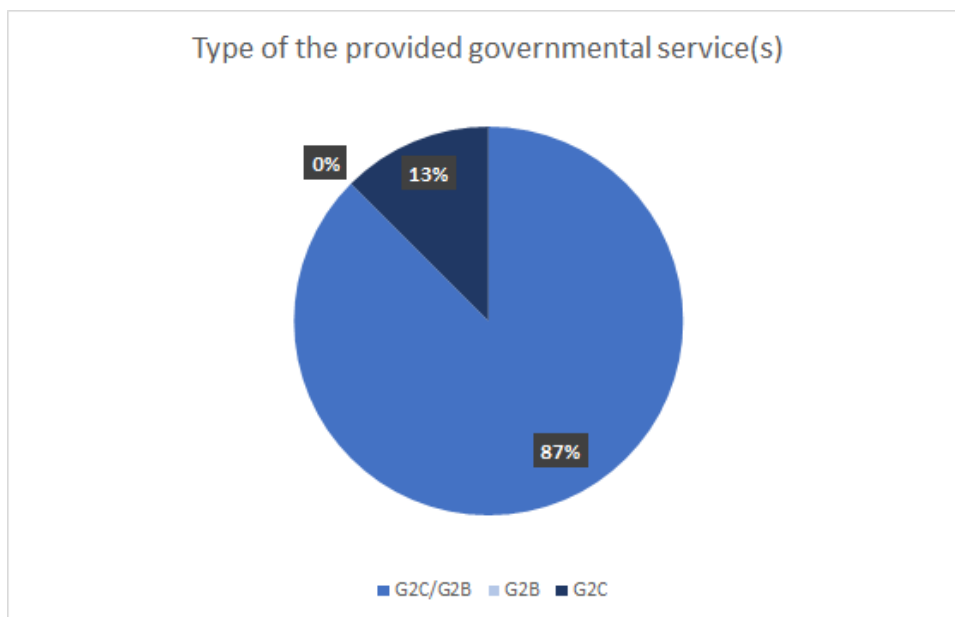
Figure 22: Types of the provided governmental service(s) in Austrian States

A similar picture emerges when looking at how many states offer a mobile app. Two out of eight have one (Salzburg and Oberösterreich). With regards to mobile-friendliness, only one state (Styria) does not have a mobile-friendly website, all others do.

None of the state portals have the possibility to set up a service account to sign in. Neither does any of them support eID.

All portals have the option to download forms and print and fill them out in addition to the possibility of doing some services completely electronically. None of the states offers the possibility to perform all administrative services exclusively online.

6.3.4.3   Estonia

Estonia is quite different to Germany and Austria when it comes to eGovernment and mGovernment services because all of them are provided directly by the state. That's why in the following only national services are presented.

The types of government services provided vary widely in Estonia. Three portals offer G2C and G2B services (30%), two portals offer G2C (20%), G2B (20%) and G2C/C2G (20%) each, and one portal offers C2G services only (10%) (see Figure 23).

Currently none of the eGov portals is available as a mobile app. However, every website is compatible with mobile devices.

Regarding eID support, Estonia is clearly ahead of Germany and Austria. All examined portals offer this possibility.
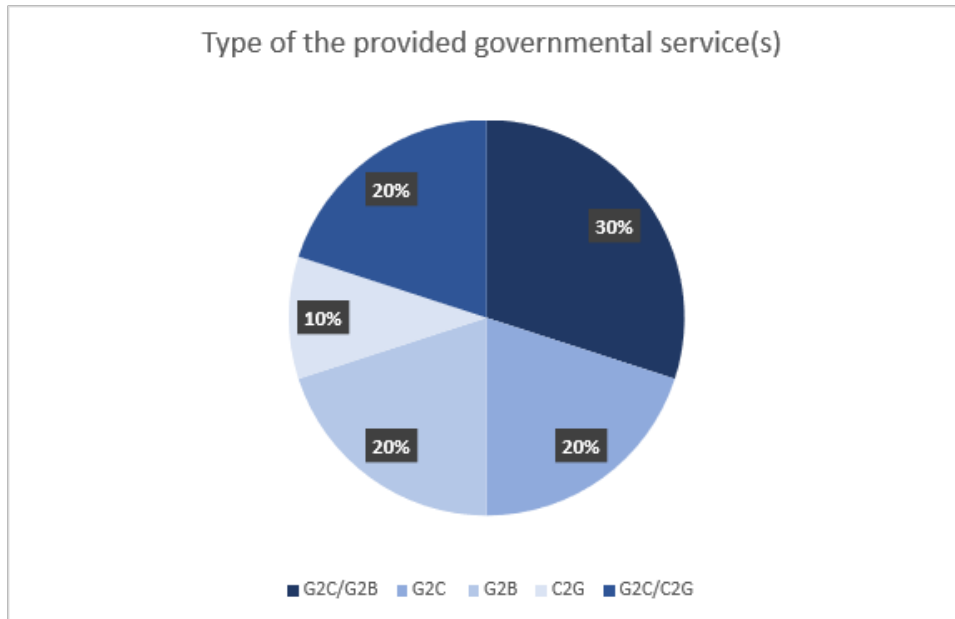
Figure 23: Types of the provided governmental service(s)

6.3.5 Country Overview of SDG Use Case Implementation

In this section the degree of SDG use case implementation in countries' governmental services is presented. In fact, SDG use case implementation varies a lot among the three countries and is most advanced in Estonia. The complete list of the 21 SDG Use Cases can be found in Annex 2 of the SDG Regulation (The European Parliament, 2018).

6.3.5.1 Germany

The most common SDG use cases that are available on German eGov portals are the "Proof of Registration of Birth" (Use Case 1), "Proof of Registration of Residence" (Use Case 2), and "Registration of a Motor Vehicle" (Use Case 11). Details on city and state level are provided below.

City Level

Of the 16 German capitals, 15 (94%) have at least one SDG Use Case integrated in their eGov portal. On average, about 4 SDG use cases are offered (see Figure 24). The most offered use case is "Requesting proof of birth registration" (Use Case 1), while the least offered are Use Cases 5, 6, 8, 17, 18, 20 and 21, which are not offered at all (see Figure 25). This includes for example "Requesting academic recognition of diplomas, certificates, or other evidence of study or training" (Use Case 5), "Registration of employees with statutory pension and insurance schemes" (Use Case 18), or "Payment of social contributions for employees" (Use Case 21).
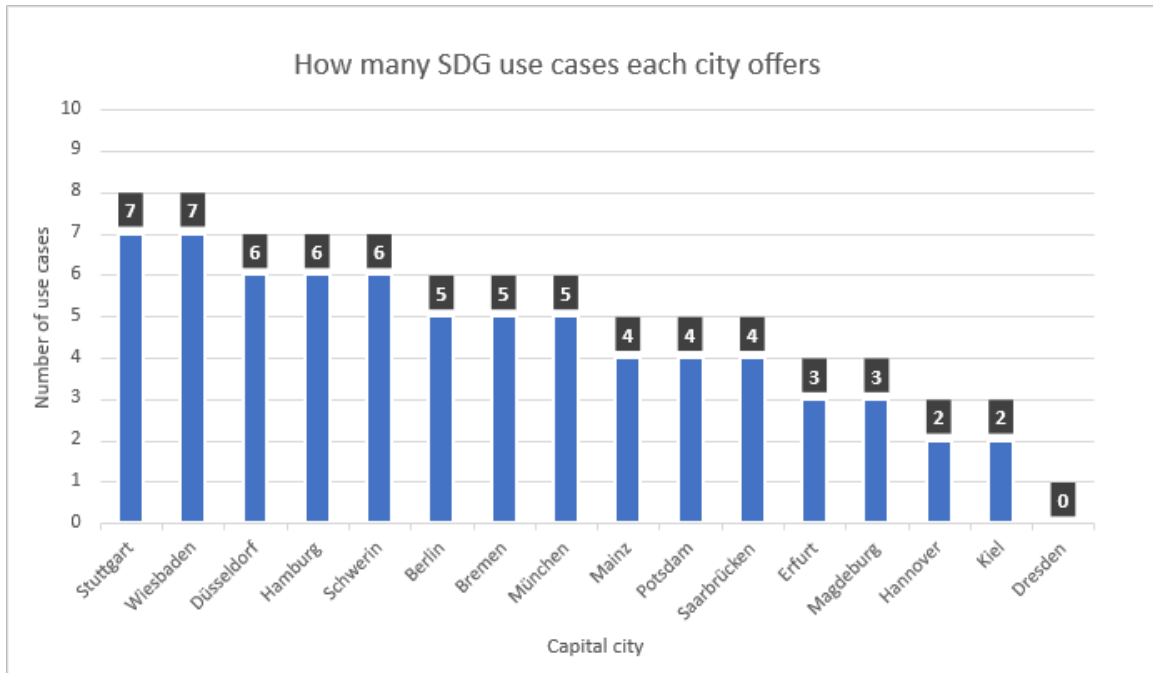
Figure 24: Quantity of the SDG Use Cases of German cities
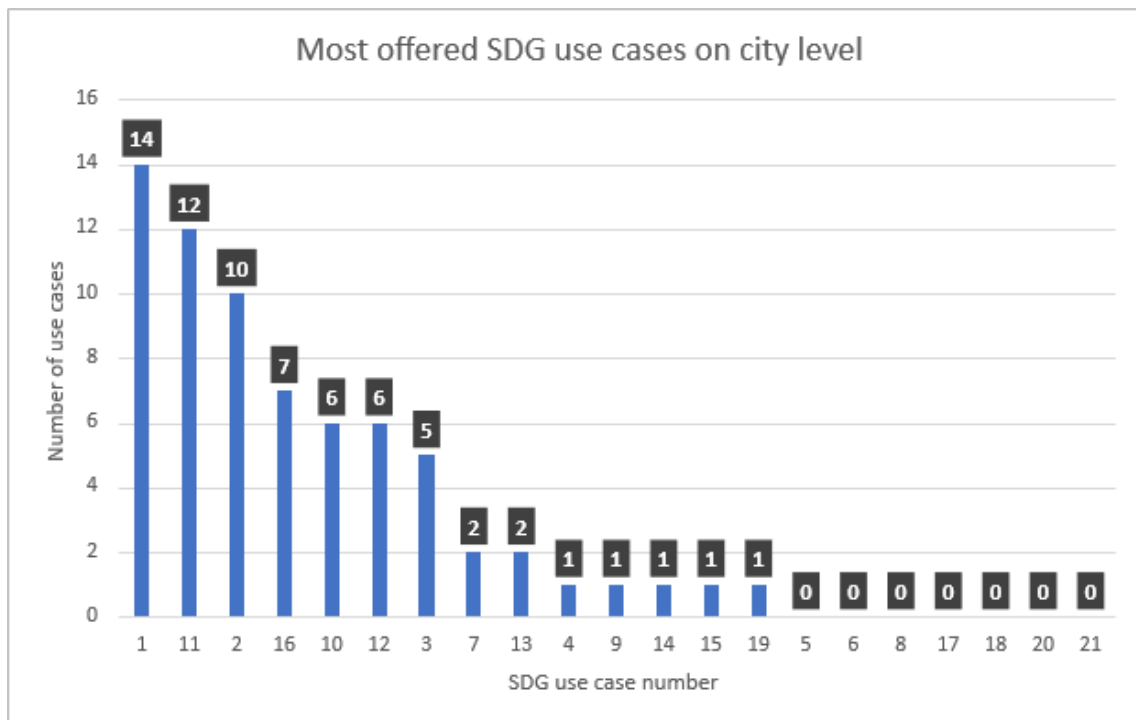
Figure 25: Most offered SDG use cases in German cities

State Level

Nine of the 16 states offer at least one SDG Use Case, of which Baden-Württemberg offers the highest number. The other states have around one to six use cases implemented each (see Figure 26).

The most commonly offered SDG Use Case on state level is Use Case 1 ("Proof of Registration of Birth", followed by Use Case 16 ("Notification of business activity, permission for exercising a business activity, changes of business activity and the termination of a business activity not involving insolvency or liquidation procedures, excluding the initial registration of a business activity with the

business register and excluding procedures concerning the constitution of or any subsequent filing by companies or firms within the meaning of the second paragraph of Article 54 TFEU."

Five of the 21 SDG Use Cases are not offered by any of the states, namely Use Cases 8, 13, 17, 20, 21 (see Figure 27).
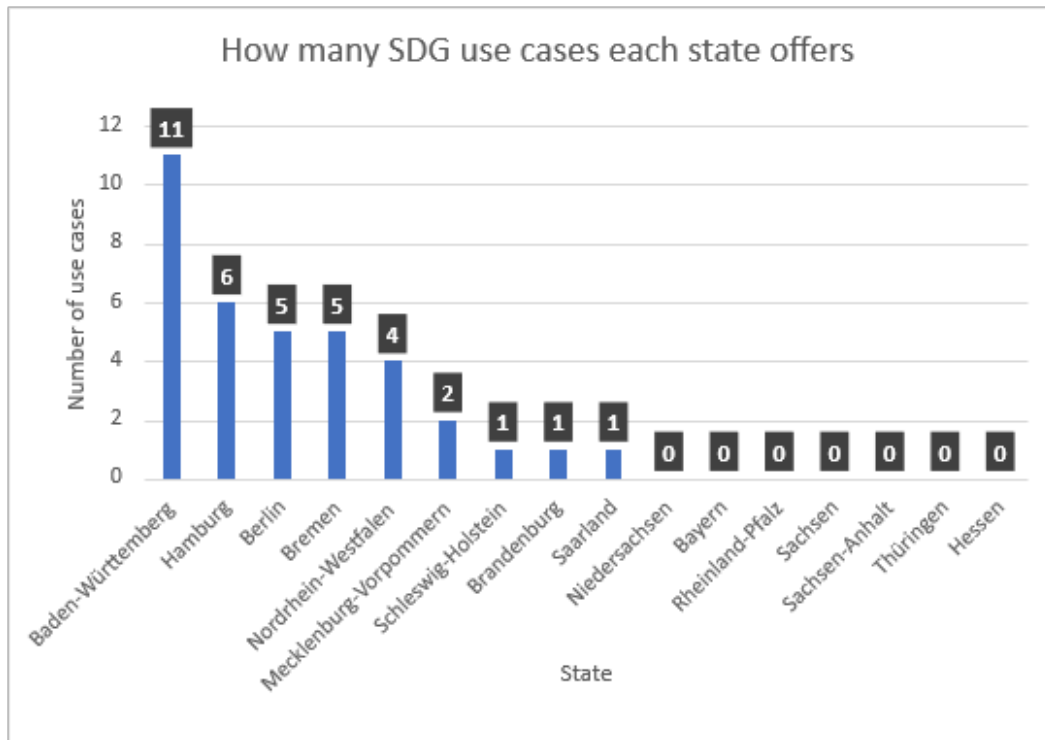
Figure 26: Quantity of the SDG Use Cases of German states
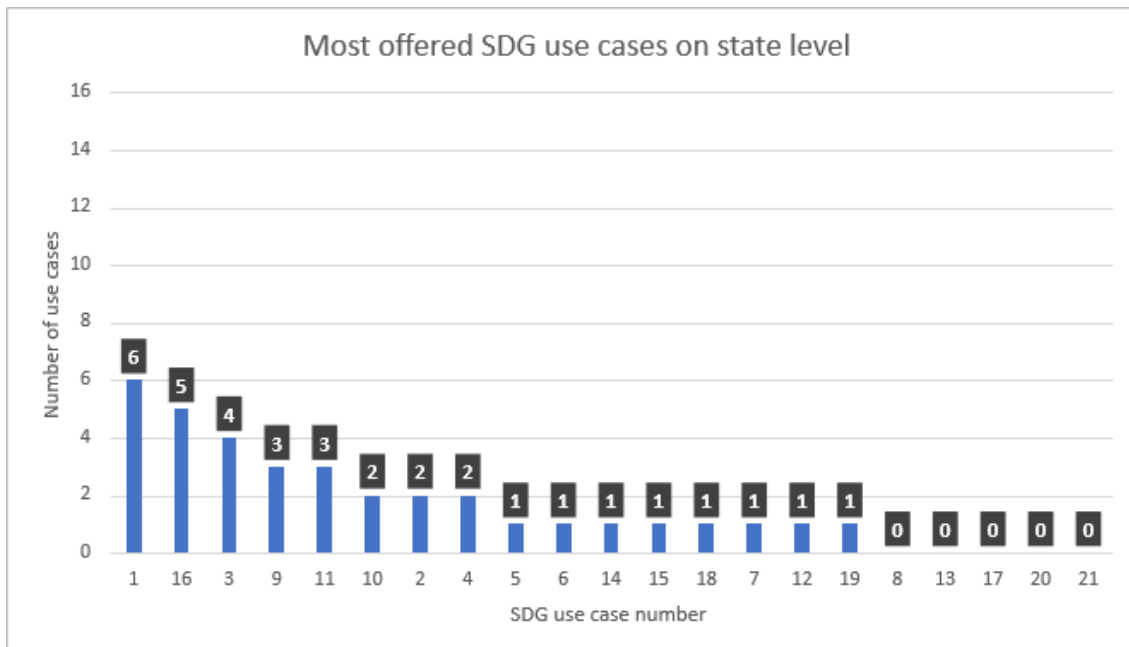
Figure 27: Most offered SDG use cases in German states

Interview partners

Among the governmental services represented by the German interview partners, eight (72%) offer at least one SDG use case.

6.3.5.2 Austria

The desk research carried out in **task 2.1** proofed that Austria's eGov and mGov services only cover a few of the 21 SDG use cases. Indeed, those use cases implemented as eGov services with the highest frequency on federal, regional and local level are: "Requesting proof of registration of birth" (Use Case 1), "Requesting proof of registration of residence" (Use Case 2) and "Registering a change of address" (Use Case 10).

Some other SDG use cases are provided directly by the state, for instance "Submitting an income tax declaration" (Use Case 9) and "Submitting a corporate tax declaration" (Use Case 19) through finanzonline.at and "finanzonline+" (BMF) or "Notification of business activity etc." (Use Case 16) through "GISA" (Gewerbeinformationssystem Austria), which was the first service of its kind in the EU.

Some eGov portals on state level provide a service for "Requesting academic recognition of diplomas, certificates or other proof of studies or courses" (Use Case 5), but not all of these services can be completed fully online.

City Level

33% or three of the portals analysed on capital city level, do not offer a SDG use case at all, while six, or 67%, do. Therefore, in Austria two thirds of the capital cities have at least one SDG use case implemented. On average, one SDG Use Case is offered (see Figure 28).

The most commonly offered SDG Use Case is "Requesting proof of registration of birth" (Use Case 1), followed by Use Cases 2, 10 and 5 (see Figure 29), which were already mentioned in the introduction of this section. Except for those four, none of the other SDG Use Cases are currently implemented by the cities.
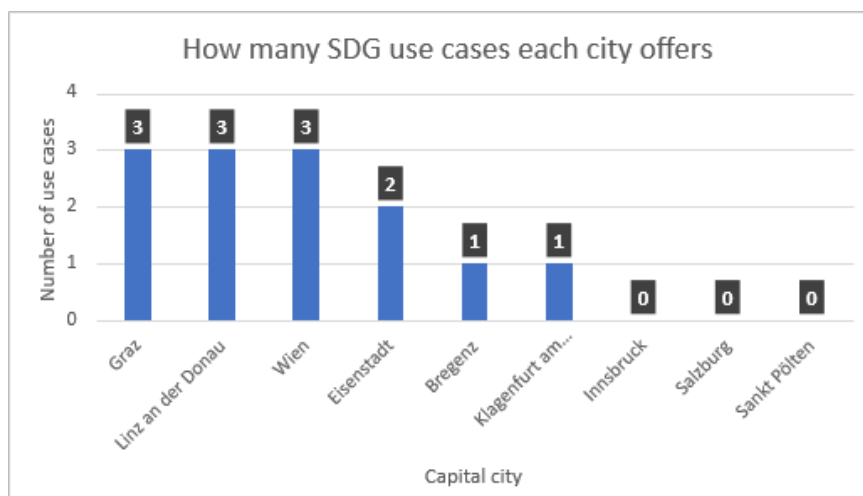

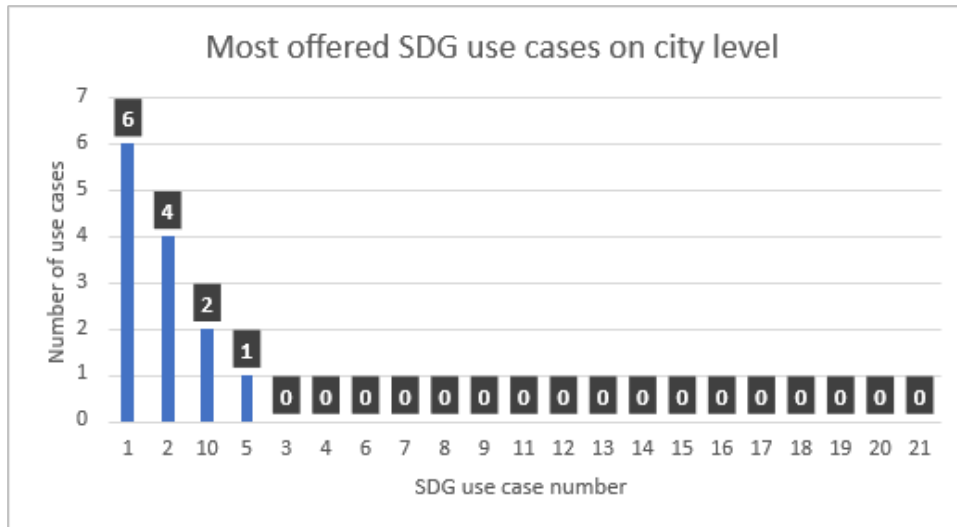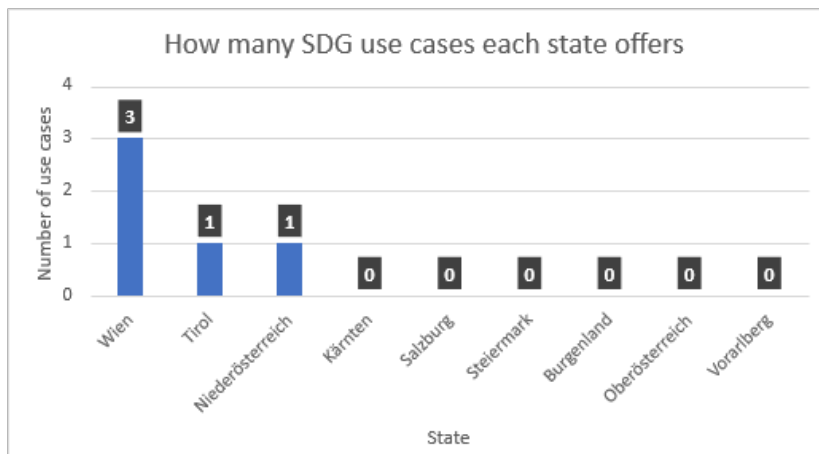Figure 28: Quantity of the SDG Use Cases of Austrian cities

Figure 29: Most offered SDG use cases in Austrian cities

State level

On state level the majority of the states, namely six (67%), do not offer an SDG Use Case on their portals, while three (33%) do (see Figure 30). The most offered SDG Use Case is "Requesting academic recognition of diplomas, certificates or other proof of studies or courses" (Use Case 5), followed by "Requesting proof of registration of birth" (Use Case 1) and "Requesting proof of registration of residence" (Use Case 2). None of the other 18 SDG Use Cases is implemented in any of the state portals (see Figure 31).

Figure 30: Quantity of the SDG Use Cases of Austrian states
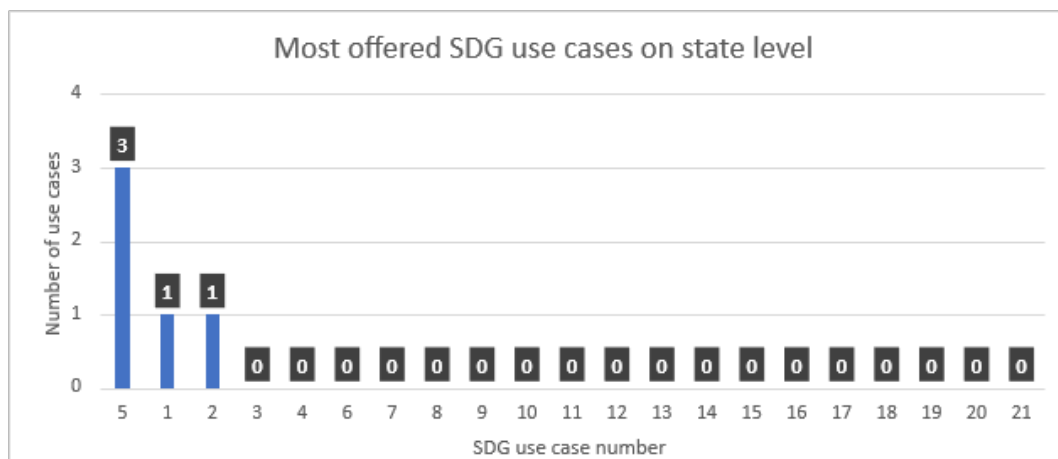
Figure 31: Most offered SDG use cases in Austrian states

Interview partners

In three cases represented by the interview partners at least one SDG use case is offered, in one case none, and for two interview partners this was not applicable.

6.3.5.3   Estonia

In Estonia, all portals studied offer at least one SDG use case. On average three SDG use cases are offered each (see Figure 32).

The most common SDG use cases in Estonia are for example, "Submitting an initial application for admission to public tertiary education institution" (Use Case 4), "Requesting academic recognition of diplomas, certificates or other proof of studies or courses" (Use Case 5), "Requesting proof of registration of birth" (Use Case 1), "Submitting an income tax declaration" (Use Case 9) and "Registering a change of address" (Use Case 10) (see Figure 33).

The SDG Use Cases not offered by any of the portals studied are "Request for determination of applicable legislation in accordance with Title II of Regulation (EC) No 883/2004 [2]" (Use Case 6), "Registration of employees with compulsory pension and insurance schemes" (Use Case 18), "Notification to the social security schemes of the end of contract with an employee, excluding procedures for the collective termination of employee contracts" (Use Case 20) and "Payment of social contributions for employees" (Use Case 21) (see Figure 33).
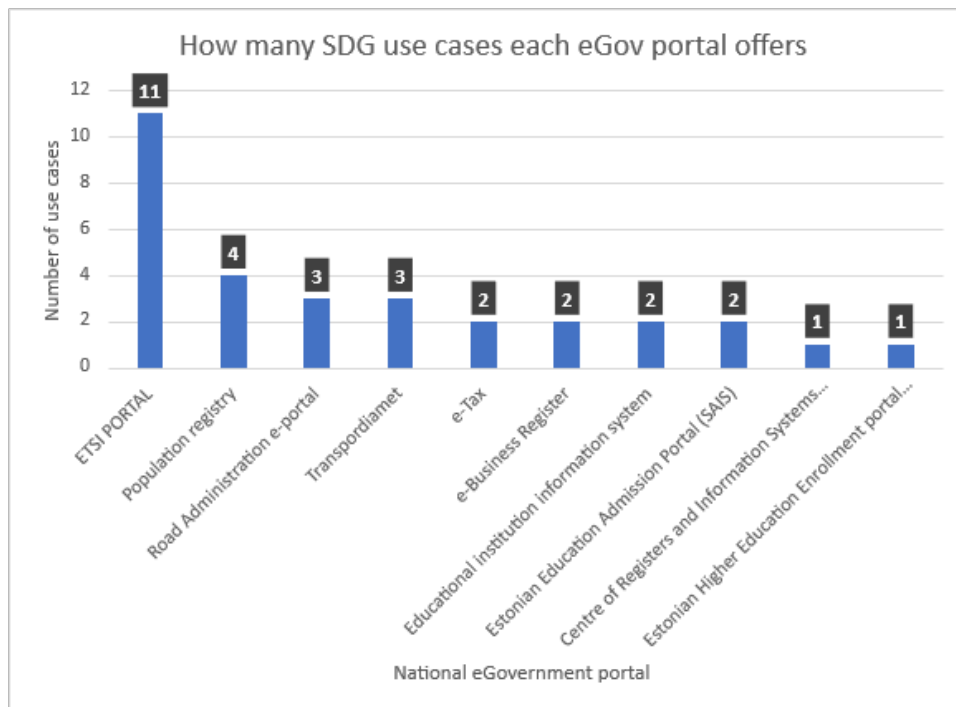

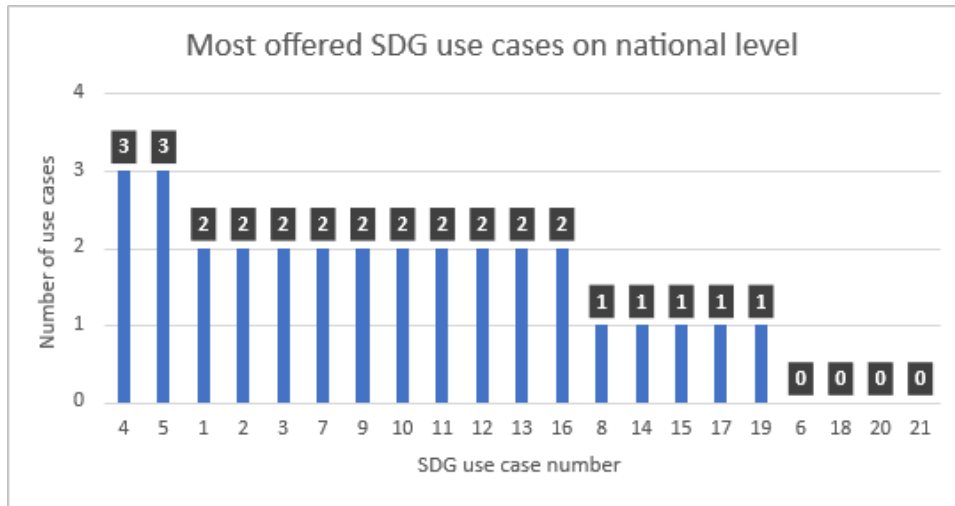Figure 32: Quantity of the SDG Use Cases of Estonian eGov portals

Figure 33: Most offered SDG use cases in Estonian eGov portals

6.3.6   Key-Takeaways

The case study carried out in three countries of the EU showed that many differences exist among Germany, Austria and Estonia concerning the availability and functionalities of governmental services, independently whether they are provided through online or mobile channels.

Germany and Austria have many things in common. For example, eID is only partly supported and most of the portals are hybrid, which we have specified as portals offering both fully electronic services and forms to be downloaded. The two countries are also comparable with regards to SDG use case implementation. Most of the studied portals and apps only offer a few SDG use cases, the most commonly used being Use Cases 1, 2, 5, 10 and 11. It was shown that many of the 21 Use Cases are currently not supported at all.

Estonia can be called "special" in many terms when comparing it to the other two countries. All portals are offered by the central government and not by regions or cities. The variety and acceptance of electronic and mobile governmental services is much more mature. An eID is supported/requested in all portals studied. Moreover, all of them offer at least one SDG use case and only four out of 21 use cases are currently not implemented in Estonia at all.

Chapter 7   Possible Relevant Business Models

This chapter focuses on the potentially relevant business models for mGov4EU. In order to depict this, the section is divided into four sections. First, there is an overview of different business model concepts and definitions. Second, two popular business model approaches are summarized. Third, an expert analysis is conducted of the mGov4EU Application and the relevance of each St. Gallens Business Model Patterns are evaluated. The aggregated results from the experts are found in the fourth sub section. The fifth subsection includes a preliminary mGov4EU Business Model Canvas draft that serves as a first insight of how it could look for the mGov4EU Mobile Application.

7.1   Business Models Concepts and Definitions

Business model, a term first used in 1957 by Bellman and Clark, has variety of definitions that capture its components and their value creation capability. Nonetheless, most definitions describe business models as concepts that describe and define how businesses function and how they create value for their stakeholders (Geissdörder et al., 2017). Osterwalder's widely known definition of a business model, states that a business model describes the rationale of how an organization creates, delivers, and captures value (Osterwalder et al., 2005). In order to achieve such results, three theoretical approaches have been developed and evolved ever since (DaSilva and Trkman, 2014; Wirtz, 2020). The first approach consisted in the use of Information technology, which then saw the business model conceptualizing approach evolve into the organizational theory approach and the strategic management approach as business models started becoming a management tool (Wirtz, 2020).

First, the information technology approach emerged with the development of tools and technologies that enable fast and efficient process documentations and analyses. In their Work, Eriksson and Penker presented the following steps for modelling businesses (Eriksson and Penker, 2000):

1. The CEO and/or responsible managers determine the available resources and business objectives.
2. The system developer designs the structure and the business process including the appropriation of the resources, thus presenting the business model in a form of simplified business processes.
3. Development of an Information system based on the business model.

Second, the organizational theory describes the business model as an abstract depiction of the company's architecture with the aim at achieving optimal results by relying on organizational regulations (Al-Debei et al., 2008). The function of the business model in this theory is no longer reduced to the first stages of system development and therefore provides a wider range of services. A better understanding of key mechanics in a business, the identification of outsourcing opportunities as well as experimenting with new business concepts are just some of the functions of business models in organizational theory (Wirtz, 2020).

Finally, the strategic management approach incorporates strategic components in the conception of business models. The strategy in this case can be defined as the factor that can shape and change current business models, in order to make the components of the business work and fit together better. This approach not only relies on resource-based and market-based views but also on the possible introduction of innovations that can also reshape the existing business model (DaSilva and Trkman, 2014; Wirtz, 2020).

7.2   Business Model Structure and Approaches

This section provides a brief presentation of the most popular business model visualization methods in research. Osterwalder and Pigneur's Business Model Canvas and the St. Gallen Business Model Navigator by Gassmann et al. are widely known models, that provide a way of structuring and visualizing business models, which in return allows an easier evaluation and modification of the existing business model (Gassmann et al., 2014; Osterwalder and Pigneur, 2009).

In an effort to provide a way to describe, visualize, asses, and change business models, Osterwalder and Pigneur developed a template containing 9 business elements, known as the Business Model Canvas. In this template, the authors placed the element of value proposition in the middle to represent the product or service being developed and/or sold. On the left side of the value proposition, businesses consider their costs, resources, partners, and key activities to properly assess the requirements of the value proposition. On the right side of the value proposition, Osterwalder and Pigneur placed the customer along with his relationship with the product and delivery channels to be an important part of business modelling. At last, the revenue of the business has to be considered in order to maintain an economic efficiency (Osterwalder and Pigneur, 2009). A graphic explanation of the Business Model Canvas can be seen in the following figure.
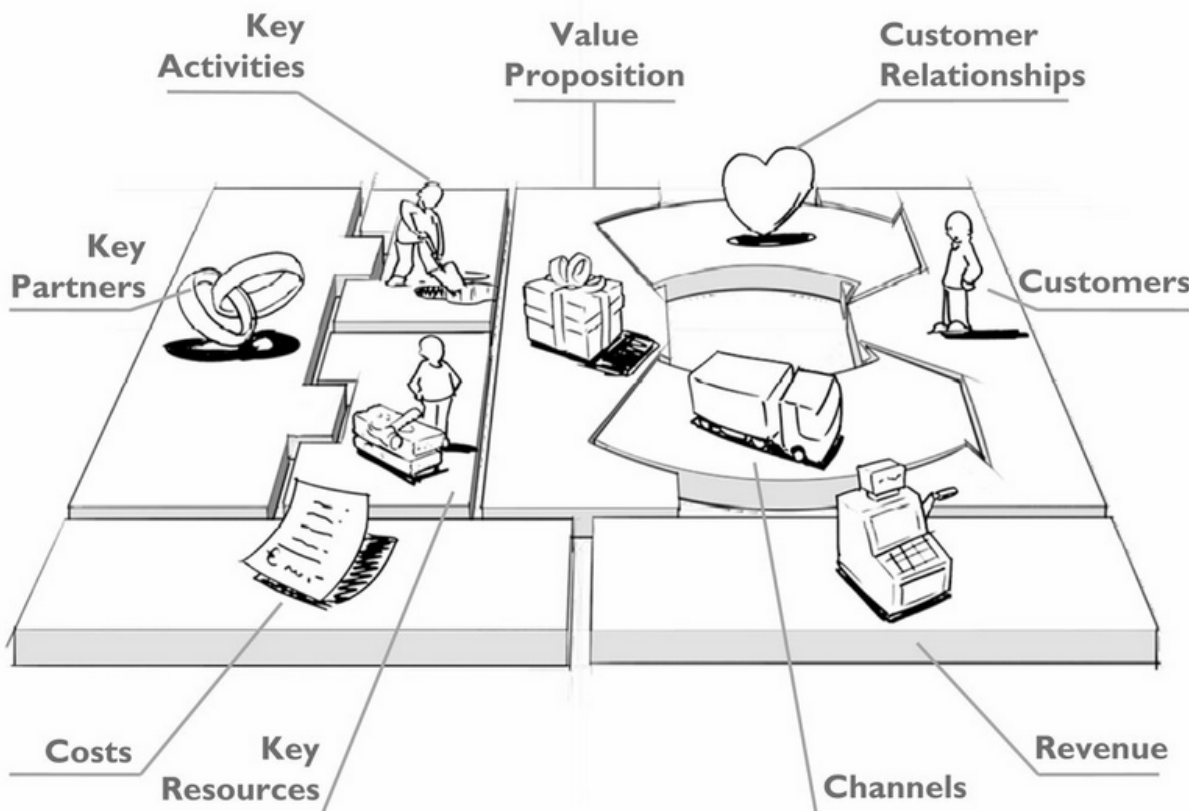

Figure 34: The Business Model Canvas by Osterwalder and Pigneur (ProjectWizards, n.d.)

The St. Gallen Business Model Navigator by Gassmann et al. argues that in order to structure and start drafting a business model, four questions need to be answered: 1. Who? 2. What? 3.How? 4.Value?.

The first question addresses the market segments or customer groups the business wants to reach. The answer to the second question is the product or service the business wants to propose to its customers and is known as the value proposition. Question three focuses on the processes and activities the business must develop and employ in order to provide the promised service/product to its target customers and create a value chain. Finally, the fourth question depicts the financial stability of the business which includes aspects like the revenue model and the cost structure (Gassmann et al., 2014). The visualization of the business model concept can be observed in Figure 35.
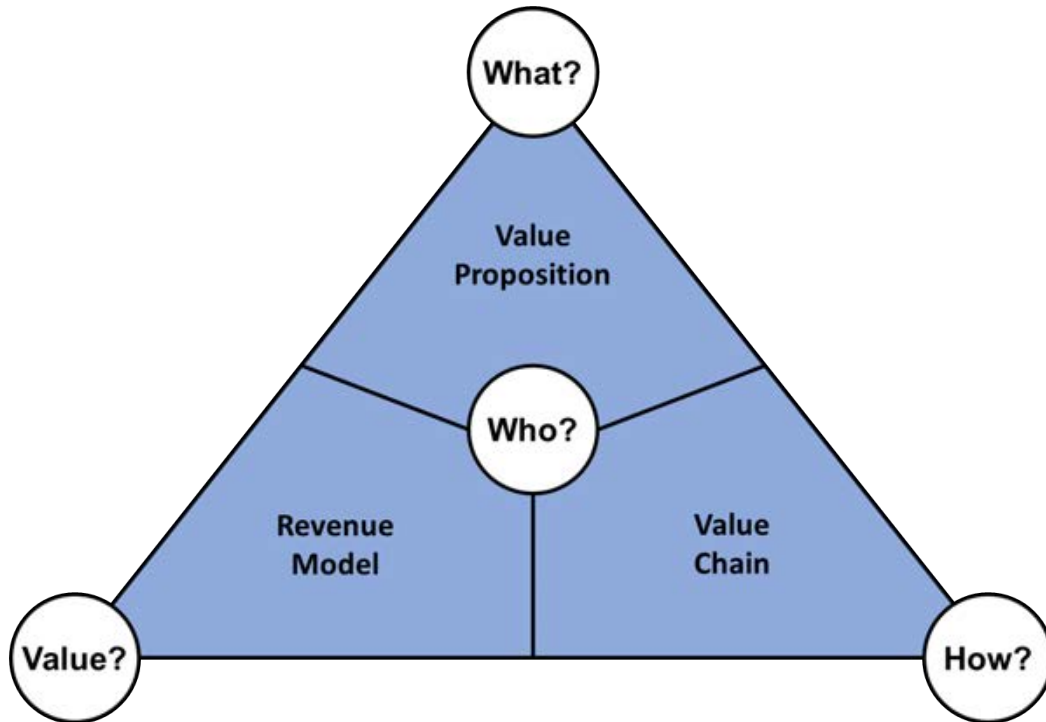
Figure 35: The Visualization of a business model

The St. Gallens Business model patterns was decided upon for various reasons. One main reason is that with St. Gallens Business Model patterns you have many patterns that could fit depending on the stakeholders. In addition, there's more flexibility with this method which is necessary for new solutions that may not have a traditional product to market business model. This method would also be very suitable for evaluating the pilots at a later stage in relation to which Business Model Patterns are most relevant.

This section will present an expert evaluation of the St. Gallen's Business Model patterns and a first draft of a potential Business Model Canvas that would be relevant for the mGov4EU Mobile Application.

7.3   Expert Evaluation of St. Gallens Business Model Patterns for mGov4EU Mobile Application

The expert evaluation was conducted in the following manner. Six experts from the mGov4EU project partners evaluated the mGov4EU Mobile Application and the relevance of each 55 Business Model Patterns. Each expert reviewed the 55 Business Model Patterns and gave it a ranking between 1 and 5 and defined as seen below.

Scale for reference	
1	Not Relevant
2	Slightly Relevant
3	Moderately Relevant
4	Relevant
5	Very Relevant

After each expert evaluated each pattern, the averages of each relevance per Business Pattern was calculated and then organized from most relevant to least relevant. In order to consider reliability, Cronbach's alpha was also calculated, which led to Good or Reliable rating of 0.828.

Please find below a general description of the mGov4EU Mobile application that was considered during the time of the evaluation of business model patterns.

7.3.1 mGov4EU Mobile Application

The expert evaluations were conducted for the mGov4EU Mobile Application. As the mGov4EU Mobile Application is in constant development, the evaluation took in consideration the status of the application in November 2021.

The Mobile Application provides Service Providers with various sources of added value in the sense of extending and optimizing existing processes or offering new components for eGov/mGov Services.

The mGov4EU Mobile Application consists of 4 systems and each system offers numerous features, all of which are provided to the Service Provider to use in their services for their end-users.

1. eID Interoperability System
The eID Interoperability system would offer service providers the ability to use an extended eIDAS framework with a mobile device for eIDAS based mobile cross-border authentication. It would also offer a wallet based cross-border authentication.

2. eSignature Interoperability System
The eSignature Interoperability system would enable the possibility to authorize a seal signature with a contact-less card or with a derived credential. In addition, it would have a eSignature metasystem for dispatching signature generation to different sub systems depending on the home country of the user. It would also make it possible to create AdES signatures.

3. SDG Interoperability System
The SDG Interoperability System would enable the Service Provider to retrieve evidence from the data provider through the SDG central nodes for user consent. It would also be possible to check authentication status verification , evidence consent management, evidence preview, evidence usage consent for further usage. In regards to the wallet system, it could store or look up evidence.

4. Digital Wallet System
The Digital Wallet System offers a credential provisioning service (e.g. for eID attributes or SDG evidence). This would enable Service providers the feature for provisioning credentials to the user digital wallet. The Wallet System offers the possibility for authentication of Citizen via the wallet, where the citizen could authenticate themselves to the Service Provider with the credentials in the Digital Wallet. Another feature included in the Digital wallet system is that it enables users to be able to present and manage credentials. Users will also be able to check their latest transactions and look up different credentials (e.g. SDG evidence).

Find a summary of the features for the systems in Table 13.

eID Interoperability System	eSignature Interoperability System	SDG Interoperability System	Digital Wallet System
eIDAS-based mobile cross border authentication	AdES Signatures	Evidence Retrieval with the User Consent	Credential Provisioning Service
Wallet based cross border authentification	Authorization of seal signature with contact-less card (e.g. German eID)	Authetifcation status verification	Authetification of Citizen via Wallet
	Authorization of seal signature with derived credential	Evidence Consent Management	Presentation of Credentials
	eSignature Meta system	Evidence Preview	Manage Credentails
		Evidence usage Consent for further Usage	Check latest Transactions
		Store Evidence in the Wallet System	Look up of Credentials
		Look up Evidence from the Wallet System	

Table 13: Summary of Features for Systems included in the mGov4EU Mobile Application

7.4 Business Model Patterns for mGov4EU Mobile Application

This section presents the most relevant business model patterns for the mGov4EU Mobile Application. In **T2.7**, there will be an extension of this section. The top five patterns will also be considered in their relevance for each of the mGov4EU pilots. After six experts evaluated each of the 55 different business model patterns according to a Likert scale of relevance to the mGov4EU Mobile application, there were five top patterns to keep in consideration with a rating between 4,666666667 and 4,166666667, which corresponds to the category "relevant" according to the Likert scale. The full results can be found in **Fehler! Verweisquelle konnte nicht gefunden werden.**. A description of the meaning based on St. Gallens (Gassmann et al., 2013) and of the relevance of each of the top five is given below.

1. Open Source

Description: In software engineering, the source code of a software product is not kept proprietary but is freely accessible for anyone. Generally, this could be applied to any technology details of any

product. Others can contribute to the product, but also use it free as a sole user. Money is typically earned with services that are complimentary to the product, such as consulting and support.

Relevance for mGov4EU: The Open Source model is clearly relevant for mGov4EU because it perfectly fits with mGov4EU's idea of providing mobile eGov services across Europe in an accessible way. mGov4EU is developing four building blocks with numerous features, all of which are provided to the Service Provider to use in their services for their end-users. These systems aim to provide reusable features, and thus those can be arbitrarily combined together. Open Source can be a good way to allow this combination and the further development of the features in order to enhance the systems according to the Service Provider requirements.

2. Open Business Model

Description: In open business models, collaboration with partners in the ecosystem becomes a central source of value creation. Companies pursuing an open business model actively search for novel ways of working together with suppliers, customers, or complementors to open and extend their business.

Relevance for mGov4EU: The Open Business Model can be a way to engage with stakeholders and to improve a system based on the experience and needs of the latter. The main stakeholders of mGov4EU are Service Providers of eGovernment or mGoverment services from the public and private sector. A selection of them was interviewed during our qualitative analysis and already provided ideas for potential collaboration opportunities. The interaction with these stakeholders will be pursued throughout the project.

3. Digitalization

Description: This pattern relies on the ability to turn existing products or services into digital variants, and thus offer advantages over tangible products, e.g., easier and faster distribution. Ideally, the digitization of a product or service is realized without losing any aspect of the value proposition that was offered to the customer before.

Relevance for mGov4EU: As Service Providers are either undergoing the transition of their services into a digital format or looking for ways to improve them to match future legal regulations, this is a fitting business model pattern. If mGov4EU Mobile Application can position itself as a tool to optimize or simplify current approaches in a digital manner, this could lead to great value for service providers.

4. E-Commerce

Description: Traditional products or services are delivered through online channels only, thus removing costs associated with running a physical branch infrastructure. Customers benefit from higher availability and convenience, while the company is able to integrate its sales and distribution with other internal processes.

Relevance for mGov4EU: E-Commerce in the context of mGov4EU refers to offering eGov and mGov services to citizens exclusively online. The case study in Chapter 6.2 showed that in most countries that's not the reality yet. In fact, most services can still be accessed "offline", meaning through personal contact at governmental bodies, municipalities etc. which is not necessarily a drawback. However, in mGov4EU we pursue the vision of making eGov and mGov services more accessible for citizens by delivering them through digital channels, which is shown in our pilots. E-Commerce could thus be a way to achieve this goal.

5. License

Description: Efforts are focused on developing intellectual property that can be licensed to other manufacturers. This model, therefore, relies not on the realization and utilization of knowledge in the form of products, but attempts to transform these intangible goods into money. This allows a company to focus on research and development. It also allows the provision of knowledge, which would otherwise be left unused and potentially be valuable to third parties.

Relevance for mGov4EU: This model could be applied to the four building blocks that are being developed in the project. Each building block could be licensed to the service provider or to the

developing company of the service. The project could in parallel focus on the further development of the building blocks or to the development of new ones.

Fehler! Verweisquelle konnte nicht gefunden werden. shows the complete results of the evaluation of the 55 St. Gallens business models and their relevance for mGov4EU. While the top 5 have already been described, the three with the lowest ranking, namely 1 = "not relevant" according to the Likert scale, were:

1. *Auction:* Auctioning means selling a product or service to the highest bidder. The final price is achieved when a particular end time of the auction is reached or when no higher offers are received. This allows the company to sell at the highest price acceptable to the customer. The customer benefits from the opportunity to influence the price of a product (Gassmann et al., 2013).

2. *Franchising:* The franchisor owns the brand name, products, and corporate identity, and these are licensed to independent franchisees who carry the risk of local operations. Revenue is generated as part of the franchisees' revenue and orders. The franchisees benefit from the usage of well known brands, know-how, and support (Gassmann et al., 2013).

3. *Pay What You Want:* The buyer pays any desired amount for a given commodity, sometimes even zero. In some cases, a minimum floor price may be set, and/or a suggested price may be indicated as guidance for the buyer. The customer is allowed to influence the price, while the seller benefits from higher numbers of attracted customers, since individuals' willingness to pay is met. Based on the existence of social norms and morals, this is only rarely exploited, which makes it suitable to attract new customers (Gassmann et al., 2013).

Those business model patterns ranked between 6 and 32 got a rating between 3,5 and 2, which corresponds to the categories "moderately relevant" and "slightly relevant". 23 out of 55 patterns have a rating below 2 and therefore are "not relevant" for the mGov4EU Mobile Application. None of the top 5 ranked patterns got a rating of 5, which would mean "very relevant".

Table 14: Results of the evaluation of the 55 St. Gallens Business Model Patterns

Rank	Overview	
1	33) Open Source	4,666666667
2	32) Open Business Model	4,333333333
3	11) Digitalization	4,166666667
4	13) E-Commerce	4,166666667
5	26) License	4,166666667
6	14) Experience Selling	3,5
7	21) Hidden Revenue	3,333333333
8	22) Ingredient Branding	3,333333333
9	47) Solution Provider	3,333333333
10	5) Barter	3,166666667
11	18) Freemium	3,166666667
12	55) White Label	3

Rank	Overview	
13	19) From Push-to-Pull	2,833333333
14	20) Guaranteed Availability	2,833333333
15	23) Integrator	2,833333333
16	24) Layer Player	2,833333333
17	29) Make More of it	2,833333333
18	10) Customer Loyalty	2,666666667
19	12) Direct Selling	2,666666667
20	2) Affiliation	2,5
21	54) User Designed	2,5
22	7) Cross Selling	2,333333333
23	15) Flat Rate	2,333333333
24	27) Lock-in	2,333333333
25	31) No Frills	2,333333333
26	35) Pay per Use	2,333333333
27	41) Revenue Sharing	2,333333333
28	37) Peer-to-Peer	2,166666667
29	45) Self-Service	2,166666667
30	48) Subscription	2,166666667
31	28) Long Tail	2
32	44) Robin Hood	2
33	34) Orchestrator	1,833333333
34	52) Two-Sided Market	1,833333333
35	1) Add-on	1,666666667
36	9) Crowd-Sourcing	1,666666667
37	25) Leverage Customer Data	1,666666667
38	38) Performance-based Contracting	1,666666667
39	50) Target the Poor	1,666666667
40	3) Aikido	1,5

Rank	Overview	
41	30) Mass Customization	1,5
42	43) Reverse Innovation	1,5
43	49) Supermarket	1,5
44	8) Crowd-Funding	1,333333333
45	39) Razor and Blade	1,333333333
46	40) Rent Instead of Buy	1,333333333
47	42) Reverse Engineering	1,333333333
48	53) Ultimate Luxury	1,333333333
49	6) Cash Machine	1,166666667
50	16) Fractionalized Ownership	1,166666667
51	46) Shop-in-Shop	1,166666667
52	51) Trash-to-Cash	1,166666667
53	4) Auction	1
54	17) Franchising	1
55	36) Pay What You Want	1

7.5   Preliminary mGov4EU Business Model Canvas

This section presents a first draft of a potential business model canvas of the mGov4EU Mobile Application (Figure 36), as provided in the first year of the project. As the project is constantly changing and adapting, it should be considered as a draft. A further and more elaborate description of this business model canvas will be provided in **Task 2.7 Sustainability and Governance.**

mGov4EU Mobile Application Business Model Canvas, version 1

Figure 36: mGov4EU Mobile Application Business Model Canvas Version 1

Chapter 8   Conclusion and Next Steps

8.1   Conclusion

This deliverable covered a wide range of topics that surround the economic and stakeholder perspective.

In Chapter 2, the Market Structure and Overview, we elaborated on the State of the Art of Mobile Government, a Market Overview, and General Market Structure. The chapter built directly off the work that was conducted in **D1.1,** specific parts of the deliverable are mentioned directly in chapter 2. The chapter takes the base of **D1.1** and expands on it in a market perspective. It gives a market overview of European eID Schemes, EU Cross Border Services for eGovernment and mGovernment, along with an overview of market trends, opportunities, and challenges. It also included a list of non-technical and technical challenges that should be considered.

In Chapter 3, it presented a Stakeholder Ecosystem, where it elaborated on the stakeholder groups and identifying which stakeholders are most relevant, their roles and relationships and identifying their values. In Chapter 4, a conceptual model was established for this deliverable and stakeholder research. The stakeholder research presented in Chapter 5 focused on the User Perspective of the Service Providers, whom are the Public Service Entities and the IT Service Providers of governmental services. A qualitative research study was conducted with Public Service Entitles and IT Service Providers in three different countries. This helped provide a wider understanding of the differences in structure, development, and mindset on key topics for these active stakeholders.

In Chapter 6, the focus was to add on to the scope of the deliverable and to provide more research and overview on the user perspective. There was an overview of which user experience and design research has been done for eGov and mGov and what could be learned. In addition, a case study was conducted where we reviewed three countries and their eGov and mGov services, along with the already implemented SDG use cases. Concluding, we provided an overview of Good Practices for User Experience and Design Research for WP2 and WP3, and the pilots should consider.

Lastly, Chapter 7 focused on the possible relevant business models for mGov4EU Mobile Application at this point in time (November 2021). As the solution is constantly in development, this was taken into consideration of the status of November 2021. This mGov4EU Mobile Application was then evaluated by 6 experts that ranked the relevance of St. Gallens 55 Business Model Patterns. Afterwards, a top five business model patterns were highlighted for the mGov4EU mobile application. In addition, the Business Model Canvas was also applied to the mGov4EU Mobile Application and a first draft of it was presented.

8.2   Next Steps

Given the timing of the project, it was decided that the Quantitative Research for Citizens (Users) will be completed in **T2.7** Sustainability and Governance. This will allow for quantitative research, e.g. surveys to End Users (citizens) or Users (Service Providers: Public Service Entitles), to be completed in a more specific context related to the mGov4EU pilots, kicking off in M18 of the project. The pilots have not officially started in year one of the project. The research would help assist in giving user-driven feedback to the pilots on their developments of what is needed for their solutions and implementations of mGov4EU. This feedback is important in supporting that the results of the project are user centric and will have user acceptance.

In addition, a future business model pattern evaluation specifically made for the pilots could also be future work in **T2.7** or in **WP5**. Lastly, the Good Practices stated in Chapter 6 could be tested with future usability or user research in **WP5**. Overall, this deliverable provided a broad spectrum of results related to the stakeholders and business models.

Chapter 9   Appendix

9.1   Theories Considered for Conceptual Framework

The following section presents an overview of the theories, adoption models, methodologies, and frameworks, that were considered for the conceptual framework at this stage.

The first group of theories consist of a multitude of adoption models that include the Theory of Reasoned Action (TRA), the Theory of Planned Behavior (TPB), The Technology Acceptance Model (TAM), the Unified theory of acceptance and use of technology (UTAUT), the Diffusion of Innovation Theory (DOI), and the Social Construction Of Technology theory (SCOT). These models and methodologies have long been used in studies that concentrated on user's behavior towards new technologies. Other adoption models have been developed specifically for the study of eGovernements and mGovernments like the E-Government Adoption Model (GAM), the E-Government Adoption and Utilization Model (GAUM) and its mGovernment format, the MGAUM.

The second group of theories includes frameworks and models that explain the effects of technological advancements and innovations on society and how society usually behaves when new kinds of innovations emerge. These theories include the Techno-Economic Paradigm (TEP), Socio-Technical Theory, the Gartner Hype Cycle, and the Technology Enactment Framework (TEF).

Theory of Reasoned Action (TRA)

The Theory of Reasoned Action (TRA) is a model developed in 1975 by Fishbein and Azjen that relies on two factor groups in order to determine the behavioral intention and actual behavior of IT users. Fishbein and Azjen defined the attitude as a result of behavioral beliefs and evaluations made by the users about the technology in question while the subjective norm consisted of other external factors (PC, 2017). A closer look at the TRA can be taken in the following figure:
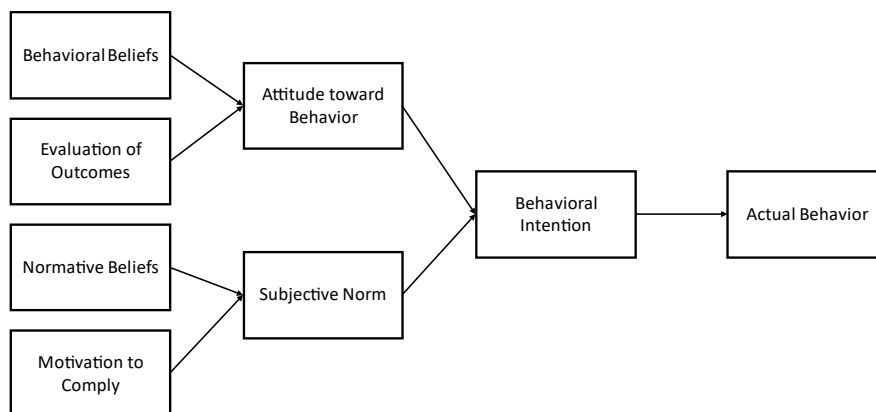
Figure 37: Visualization of the Theory of Reasoned Action by Fishbein and Azjen

Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) is a model proposed by Azjen in 1991 with the aim of extending the TRA by adding an extra factor. In addition to the attitude toward behavior and the subjective norm, Azjen added the perceived behavioral control as a factor that is determined by the availability of resources and skills. Lai explains that the perceived behavioral control factor has the potential to showcase the control the users perceive, that may restrict their behavior. A visualization of the TPB can be seen in the following figure (PC, 2017; Taherdoost, n.d.).
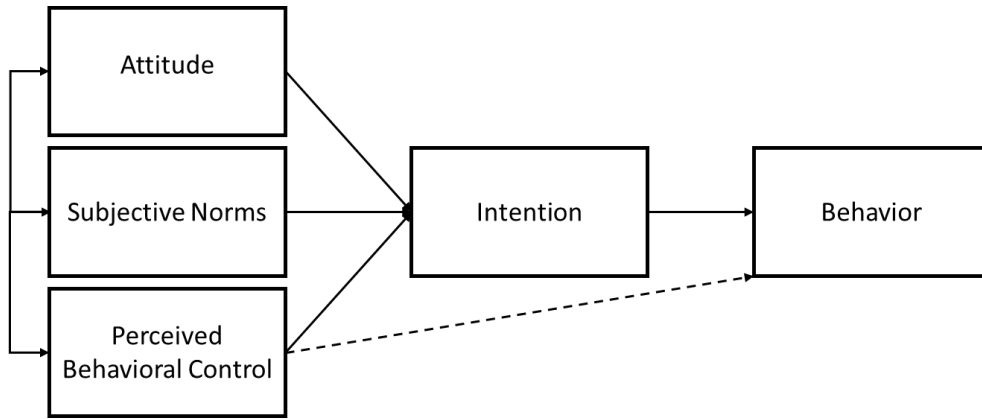
Figure 38: Visualization of the Theory of Planned Behavior by Azjen

Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a descendent from the Theory of Reasoned Action (TRA) and has been one of the most used models in the subject of technology acceptance. The TAM initially relied on three factors that explained the user's motivation to adopt a technology: perceived ease of use, perceived usefulness, and attitude toward use. Figure 3 shows the final TAM version constructed by Venkatesh and Davis in 1996 that had the attitude construct eliminated as a result of discovering that the perceived usefulness and perceived ease of use directly affect the behavioral intention. Venkatesh also experimented with the TAM and proposed the TAM2 in 2000 and the TAM 3 in 2008 that had more complex and detailed factors (PC, 2017; Taherdoost, n.d.).
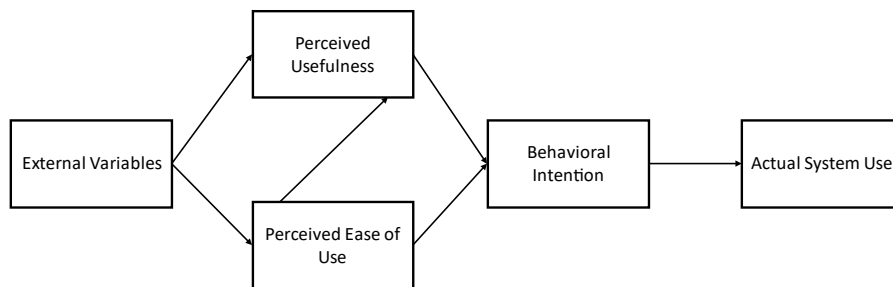

Figure 39: Visualization of the Technology Acceptance Model by Venkatesh and Davis

Unified theory of acceptance and use of technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a theory modelled by Venkatesh and Morris in 2003 after they combined TAM, TRA, a combination of TAM and the Theory of Planned Behavior (TPB), the Diffusion of Innovation, and three other theories. UTAUT relies on the Performance expectancy, effort expectancy, social influence, and facilitating conditions to determine the user's behavior towards the technology (PC, 2017; Taherdoost, n.d.). The following figure shows the additional elements that play an influential role in the UTAUT.
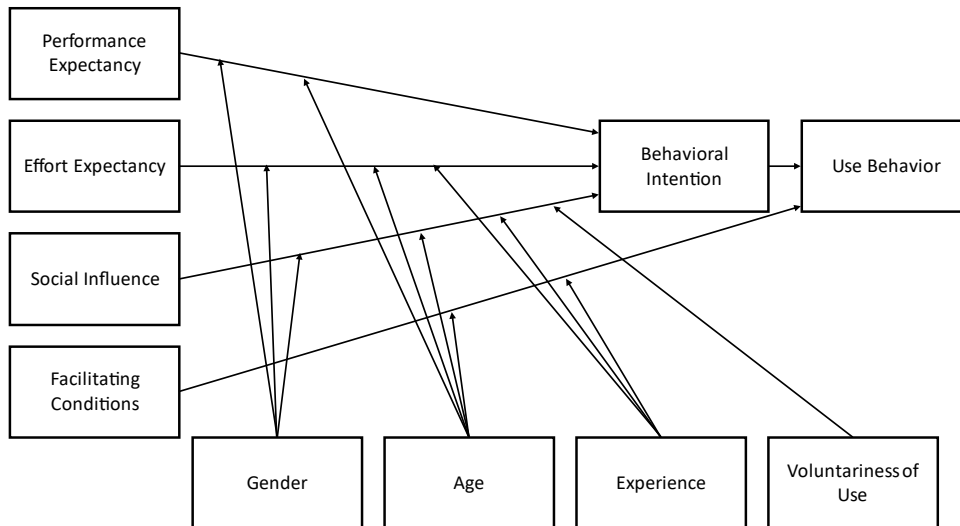
Figure 40: Visualization of the Unified Theory of Acceptance and Use of Technology by Venkatesh and Morris

Diffusion of Innovation (DOI)

Everett M. Rogers, who is "considered […] to be the father of diffusion […] research" because of his research on the Diffusion of Innovations (DOI,) utilizes four dimensions to explain how, why and in what pace innovations spread among societies (McGrath and Zell, 2001; Rogers, 2003). These dimensions consist of 1) the innovation as such, 2) the used communication channels, 3) time in which adoption occurs and 4) the social system in which the technology spreads.

Besides a wide range of topics, DOI was used to study i-voting diffusion in Estonia, relevant technological deployments in different fields (MacVaugh and Schiavone, 2010) and general acceptance of eGovernment services (Abdel-Fattah, 2014; Vassil et al., 2016). Usually, the most commonly known feature of DOI is the categorization of adopters into 1) innovators, 2) early-adopters, 3) early-majority, 4) late-majority and 5) laggards.
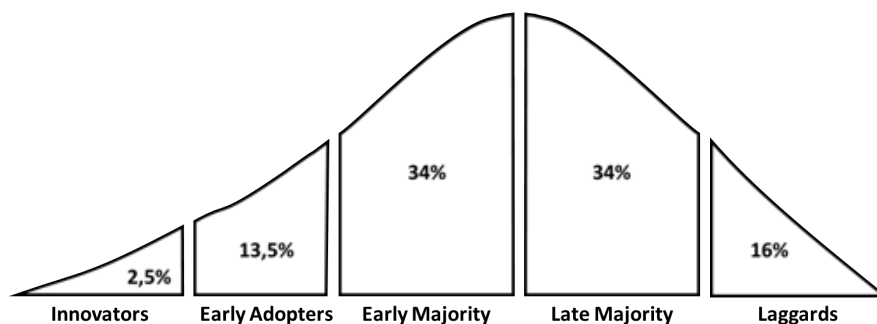

Figure 41: Visualization of the Diffusion of Innovation Theory by Rogers

Social Construction of Technology Theory (SCOT)

SCOT by Trevor Pinch and Wiebe E. Bijker is a social constructivist theory that is used in the camp of science and technology, ICT studies and technology path dependency (Fulk and Yuan, 2017; Klein and Kleinman, 2002; Pinch, 2001). As opposed to techno-determinist scholars, SCOT understands that social structures in terms of norms, values, preferences or other matters shape technological development (Cozzens, 1989). This theory argues that technology adoption is a socially-driven and collective phenomenon because technology is "a product of the social, economic, and cultural environment in which it is situated" (Humphreys, 2005). Bijker and Pinch's theory (Pinch and Bijker, 1984) mainly consists of the following elements: 1) interpretative flexibility, 2) closure and

stabilization efforts including 2a) relevant social groups and 2b) redefinition of a problem. Last, this theory deals with 3) the broader context. All of these elements are explained in the following.

1 **Interpretative Flexibility**
Different technologies have different interpretations for different groups

2 **Closure and Stabilization Efforts**
2a – Relevant Social Groups: Identifying the relevant social groups for the research
2b – Redefinition of a Problem: Adjusting the problems to the perspective of the group

3 **The broader Context**
Relating the content of a technological artefact to the wider sociopolitical milieu
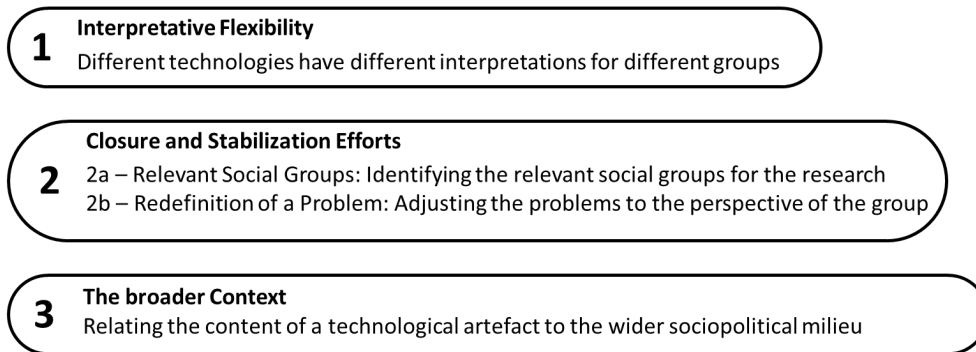
Figure 42: Visualization of the Components of the SCOT by Pinch and Bijker

E-government Adoption Model (GAM)

The e-Government Adoption Model (GAM) is a now popular model proposed by Shareef, Kumar, Kumar and Dwivedi in 2011 with the intent of creating a model that was especially oriented at the adoption of eGovernments. Their extensive research summarized the eGov adoption factors into 4 large groups: Attitude to Use, Ability to Use, Assurance to Use, Adherence to Use, and Adaptability to Use (Akhter Shareef et al., 2011). A closer look at the elements within these factor groups as well as the GAM can be taken in Figure 6.
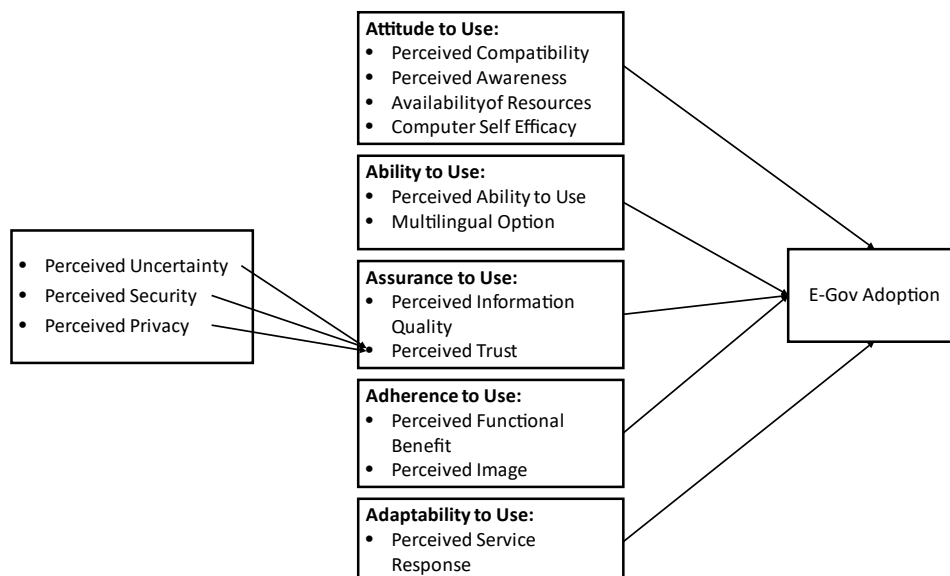

Figure 43: Visualization of the e-Government Adoption Model by Shareef et Al.

E-government Adoption and Utilization Model (GAUM)

The E-Government Adoption and Utilization Model (GAUM) is a model inspired by the GAM and has been developed as a conceptual model by Alghamdi and Beloff in 2016 as part of a User Research. Alghamdi and Beloff argue that the actual Adoption and utilization of an eGovernment service highly depends on the Intention to Use eGovernment services and the perceived E-Readiness of eGovernments (Alghamdi and Beloff, 2016). These variables then depend on various personal, motivational, technical and reliability factors that can be examined in the following figure.
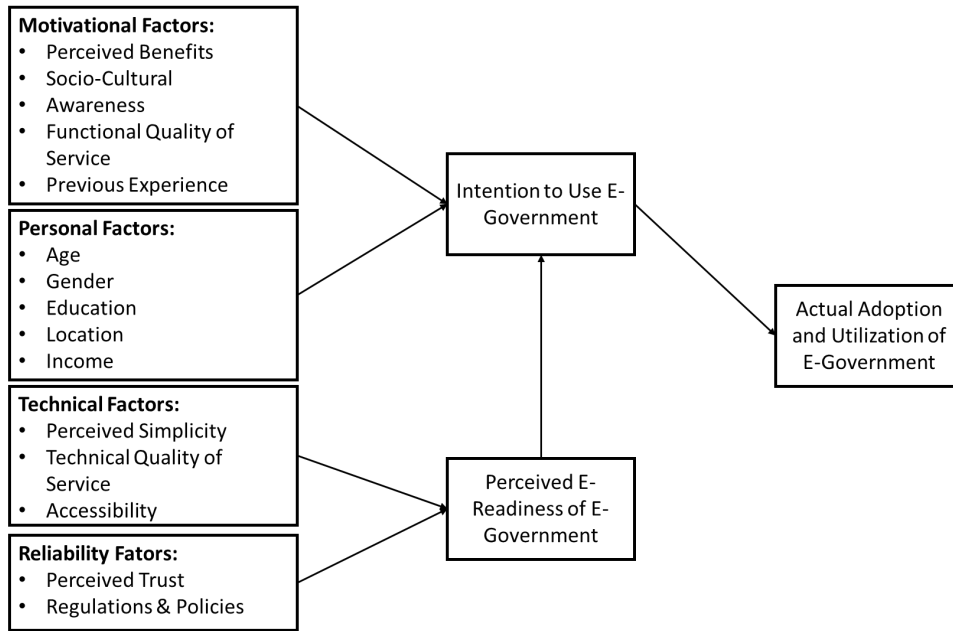
Figure 44: Visualization of the e-Government Adoption and Utilization Model by Alghamdi and Beloff

Mobile Government Adoption and Utilization Model (MGAUM):

The Mobile Government Adoption and Utilization Model (MGAUM) is a model that focuses mainly on the adoption of mobile governments services and has been developed by Alonazi, Beloff, and White in 2018 as part of a User Research conducted regarding the adoption of mobile government services in Saudi Arabia. The MGAUM relies on practical, human, and technical factors to determine the user's intention to use a mobile government service and has been inspired by TAM (Alonazi et al., 2018; Shareef et al., 2016). The following figure provides a more detailed look at the MGAUM.
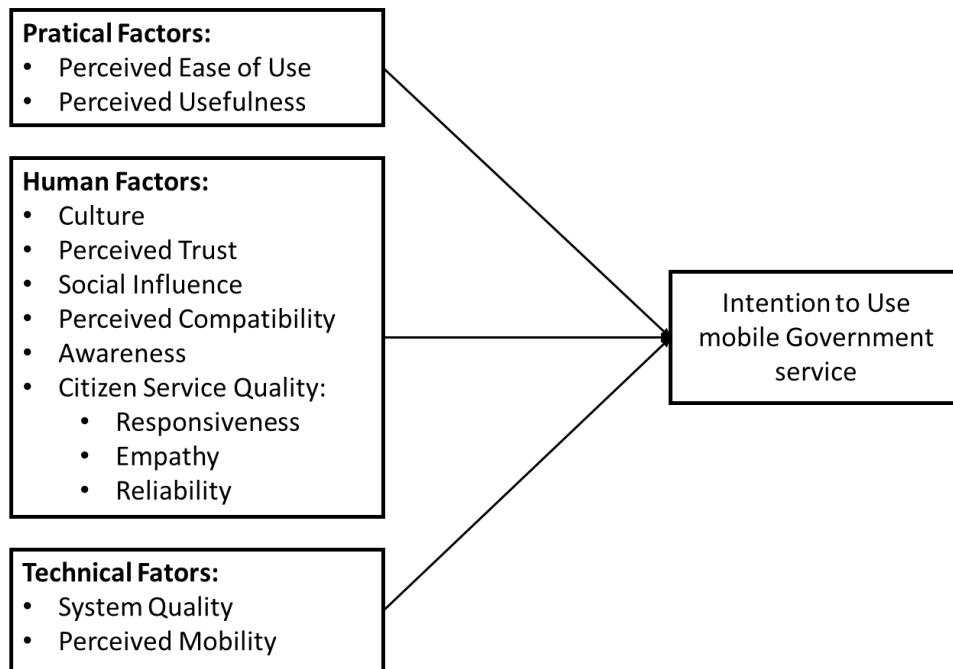

Figure 45: Visualization of the Mobile Government Adoption and Utilization Model by Alonazi, Beloff, and White

Socio-Technical Theory

The Socio-Technical Systems approach "recognizes the interaction between people and technology as a defining factor in the overall systems makeup and functionality" (Appelbaum, n.d.). The theory considers a design that is based on the combination of social and technical parts that is in an open environment. It also focuses on including a direct participation of end users in the information system design process (Scacchi, 2004). Overall, the system includes four different elements; Network of users, Developers, Information technology, and environment that the system will be used in (Scacchi, 2004).

The Techno-Economic Paradigm (TEP)

TEP by Carlota Perez "describe[s] the direction in which technological change and innovation are most likely to take place" (Drechsler et al., 2009, p. 3). TEP explains the course of technological revolutions and the shifts and changes that they bring across within society, the economy and inside of institutions (Martinez Sanchez and Perez Perez, 2003). In TEP, an illustration of two periods exists, which are called the installation period (1) and the deployment period (2). The separating phase is referred to as a turning point which usually comprises of a financial crisis.
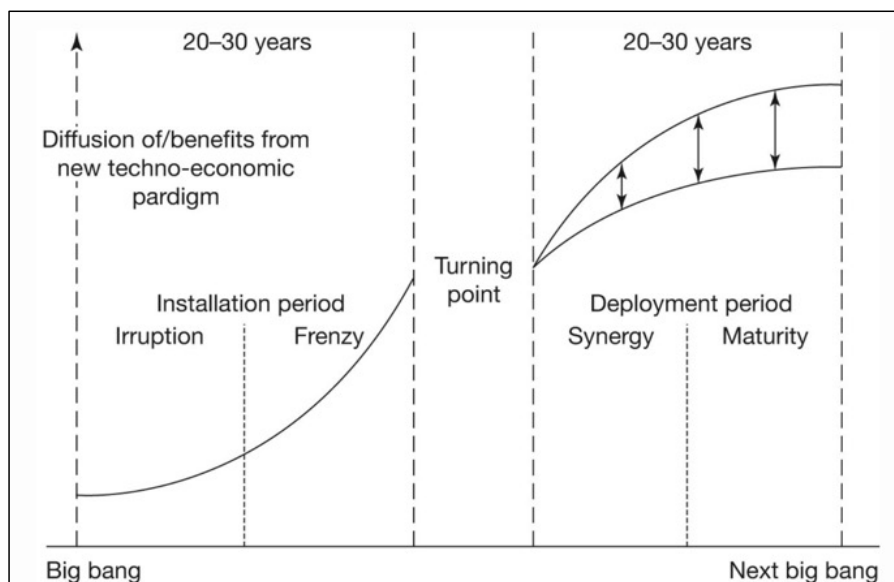

Figure 46: Visualization of two periods: the installation period (1) and the deployment period (2)

The Gartner Hype Cycle

The Gartner Hype Cycle is a model that generically explains the development of a particular technology over time (Dedehayir and Steinert, 2016). The model provides explanations on the typical stages of technology development: 1) innovation trigger, 2) peak of inflated expectations, 3) trough of disillusionment, 4) slope of enlightenment, and 5) plateau of productivity and has prior been used to assess the current status of AI and digital government technology (Fenn and Blosch, 2018; Panetta, 2018).
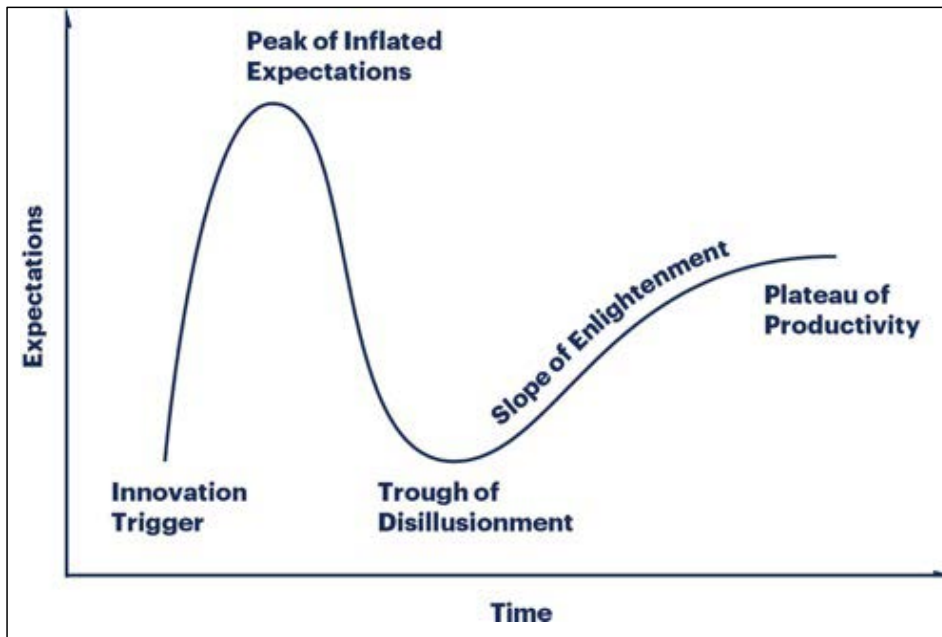
Figure 47: Visualization of the The Gartner Hype Cycle

The Technology Enactment Framework (TEF)

The Technology Enactment Framework (TEF) is Framework developed by Fountain that aims at differentiating between ICT elements and the perception and use of these elements by the users. In order to provide a complete analysis of the influence of organizational structures and arrangements on the use of technology, Fountain specified four components of the TEF: Perception, Design, Implementation, and Use. Fountain argues that the TEF presents a more complete Framework than the partial theories she encountered before (Shellong, 2007). The factors composing the TEF and their relationship can be seen in the following figure.

Review and Approach

As mentioned above, there are three basic requirements that need to be fulfilled for the mGov4EU conceptual model at this stage. First, it should be flexible and have the ability to be applied to a non-technical and technical context. This means that it should be able to be applied to the technical development of the project as well as the economic or usability aspects of the project. Second, the model should be able to be tangible. This implies that it is a model that is easy to apply to varying situations in the project's development. Third, it should be a model that takes into consideration the bigger picture and consider elements that are beyond the project. This considers external factors that are key for the project's success.

After having these requirements in mind, each method was considered. Many of the methods fit different aspects of these general requirements. However, the method that was the most fitting was the Social Construction of Technology Theory approach. Starting with this approach will fulfil the basic requirements above and also allow to easily extend or adapt this model if need be in the further development of the mGov4EU conceptual model in WP5. One way that the model could be extended, would be to apply the Diffusion of Innovation approach in the third element of the SCOT approach.

9.2   Interviewer Suggested Questions

This is the list of interview questions that was provided to interviewers for the qualitative research.

mGov4EU: Active Stakeholders' Perspective (Service Providers)
I.   Introduction and Current Status
Which **services/products** does your organization/institution/department offer to your customers/citizens?
[If relevant] What is your **role** in providing an **e-government service** and who are your partners? Are you a service provider or a customer of a service provider or both?
How are these services/products currently provided to the customers/users (**Online, Offline, Mobile**)? Are you planning to **change this?** If yes, what is the **timeline?** If no, **why not?**
If you charge for your services **who** is charged? (e.g. The Citizen or End User or Administrative Entity) How are the customers/users **paying** for these services/products? (e.g., Cash, Credit Card, Bank Transfer, Billing, PayPal etc. – multiple options possible) What is your **pricing model**? (per transaction, flat rate, cost based, value base..)
How do you currently **identify/authenticate users** to access the services? What identity solutions are your services compatible with?
[only applies to Service Providers, not municipalities etc.] Currently, **where** does your company offer these services/products? (Locally, regionally, only nationally, EU, outside EU) *[Applies to <u>ALL</u>]* Do you offer **cross-border services**? (E.g. Services that are available for foreign nationals, etc) If no, **why not?** Are you planning to **change this** (a/b)? If yes, what is the **timeline?** If no, **why not?**
Is it possible to identify/authenticate to your services with a **(foreign) eID**? Are your services compatible with **eIDAS eIDs**? If not, are there plans or why not?
How many foreign (EU) customers/users/citizens do you have? (weekly/monthly)
How do you project the demand for **cross-border services** in the **next 5 years**?
Are your services offered in a **mobile form**? Would you consider them to be **"mobile friendly"** (easy to use on a smartphone)?
What is the importance of delivering your services through the mobile channel?

	What kind of **opportunities/challenges** do you see for mobile services?
	Have you heard of the **Single Digital Gateway Regulation (SDGR)**? How do you think this regulation would impact your services? In which way? Are there any plans to make youre services SDGR compliant? If yes, what are they? How much effort do you believe it would take to implement this?
	Have you heard of the **Once Only Principle (OOP)**? How do you think the **OOP** impact your services? In which way? Are there any plans to implement the **Once Only Principle in your services**? If yes, what are they. If no, why not? How much effort do you believe it would take to implement this?

Drivers and H	II. **Drivers and Hurdles**

Identity Management

	What are the **most significant challenges** you are currently facing when it comes to identification/authentication of users?

Do you agree or disagree with the following statements?

	1 Strongly agree	2	3	4	5 Strongly disagree
We often incur problems due to **errors by the user**. E.g., incorrect user address					
We often incur problems due to **identity fraud**.					
I am **satisfied** with my current digital identity management					
My current **costs** for digital identity management are **high**					
I realize that there is **demand on the user** side for improved digital identity management					
Legal requirements (e.g. data protection) make digital identity management complicated for us.					

	Do you see a need to **change your digital identity** services? What brings you to that conclusion?
	Do you know the **Total Cost of Ownership** of your current identity management system? How is it developing? Is this cost too much?
	What would be an **appropriate remuneration** for an identity service? What would be your **willingness to pay per identification of a user**? *(Comparable to fees for Video-Ident or PayPal, Credit Cards)*
	Do you know how many **transactions fail** due to problems in your identity management?

	Are there particular **drivers/hurdles for change** (internal/external) of your identity management system?
	Which information do you need from your users (e.g., for data analysis, documentation, compliance)? Are there use cases where you only need **to check if a piece of information is fulfilled** but do not need the full information? (e.g. You check if someone is over 18, but do not need them to provide their DoB or Actual Age.)
	Do you see a need/requirement/potential in **certifying a particular attribute of users**? (Could be address, education certificates, solvency, or other aspects)
	Do you worry that changing your identity management to another system could reduce your ability to acquire **information about your users**?
	What is your opinion on **outsourcing the identity management** to an external service and/or the user being able to manage his information him/herself? Do you see it as an advantage/disadvantage for your work/service?
	What is your opinion on users being able to manage **their ID-information themselves**? Do you see it as an advantage/disadvantage for your work/service?
	Does the identity management system that you are currently using **keep you from offering services/applications/products** that you would like to offer? If yes, which services and why?
	In your opinion, what would be the **most beneficial improvement** to ID Management?
	Digital and/or mobile services [E-Gov only if relevant]
	Are there **particular drivers/hurdles** (internal/external) for the adoption of your (e.g. digital, mobile) services?
	What are the **most/least successful services** that you offer? Why do you believe that is the case?
	What kind of **technical challenges** or barriers do you have with your services?
	[If relevant] Do you know **how many people** are using your services **digital, vs mobile, vs in person**?
III. Basic Demographics	
	Approximately how many **people** are employed at your organization/institution/ department?
	[If relevant] Approximately what is the **revenue** of your organization/ institution/department? – *Alternatively*: How many interactions with customers/citizens per day/week/month?
	Please state in which **country/countries** your organization/institution/department is operating.
	In which **unit/division** and **position** are you currently working at/for?

mGov4EU

9.3 Coding Taxonomy

This is the Coding Taxonomy of what was coded in the Qualitative Research.

1. Demographics

These are basic demographics of the interviewees.

- Interviewee Position
- Country
- Type of Organization
- Services Provided
- Structure
- Services Availability
  - Online
  - Offline
  - Hybrid
  - Planned Changes

2. Regulations

This is about the awareness of SDGR and OOP and their perception about these topics.

- SDGR
  - Known
  - Unknown
  - Implementation
  - Timeline
  - Impact
- OOP
  - Known
  - Unknown
  - Implementation
  - Timeline
  - Impact
  - OZG

3. Cross-border Services

This is about the perception of Cross-border Services efforts among governmental services.

- Cross-border Services Development
  - Relevant
  - Irrelevant
  - Timeline
- Foreign Customers Currently
  - Relevant
  - Irrelevant
- Cross-border Services- Other
- Cross-border Future Impact

4. Services Availability

About the discussion of the availability of services provided by the government.

- Mobile
- Offline
- Online
- Hybrid Model
- Planned Changes

- Service Channel Usage

5. Mobile Services

Codes that are about mobile services in present and future context.

- Importance
- Opportunities
- Challenges
- Benefits
- Availability Level
  - o Pilot
  - o Mobile Configured Website
  - o Mobile Application
  - o None
  - o Planned changes

6. eID and eIDAS

Codes about eID and eIDAS in present and future contexts.

- eID Capability
  - o Yes
  - o No
- eIDAS Compatibility
  - o Yes
  - o No
- Planned Changes
- Foreign eID Compatibility
- eIDAS
- eSignature

7. Identity Management

Codes that are about Identity Management topics and the interviewees perception of various aspects in identity.

- Challenges
- Drivers
- Change(s)
  - o Most beneficial improvement
  - o No Need for change
  - o Felt Need
  - o Type of Change
- User Authentication
  - o eID
  - o User Name Password
  - o Other
- User Self Management
  - o Yes
  - o no
- Outsourcing
  - o Yes
  - o No
- Digital Wallet

8. Digital and Mobile Services

This code group is about digital and mobile services. This could be when they are talking about a specific service example that they offer digitally, or mobile. This could also be about these services in a broader context relating to challenges, drivers, hurdles, etc.

- (Un)Success
  - o Most Successful
  - o Least Successful
- Technical Challenges/Barriers
- Drivers for Adoption of Services/Products
- Hurdles for Adoption of Services/Products

9.4 Overview of SDG Use Cases

This is an overview of the SDG use cases that were mentioned in Annex 2 of (The European Parliament, 2018)

Table 15: Overview of SDG procedures/Use cases (The European Parliament, 2018)

Number	Life Event	Procedure/Use Case
1	Birth	Requesting proof of registration of birth
2	Residence	Requesting proof of registration of Residence
3	Studying	Applying for a tertiary education study financing, such as study grants and loans from a public body or institution
4	Studying	Submitting an initial application for admission to public tertiary education institution
5	Studying	Requesting academic recognition of diplomas, certificates or other proof of studies or courses
6	Working	Request for determination of applicable legislation in accordance with Title II of Regulation (EC) No 883/2004 [2]
7	Working	Notifying changes in the personal or professional circumstances of the person receiving social security benefits, relevant for such benefits
8	Working	Application for a European Health Insurance Card (EHIC)
9	Working	Submitting an income tax declaration
10	Moving	Registering a change of address

Number	Life Event	Procedure/Use Case
11	Moving	Registering a motor vehicle originating from or already registered in a Member State, in standard procedures
12	Moving	Obtaining stickers for the use of the national road infrastructure: time-based charges (vignette), distance-based charges (toll), issued by a public body or institution
13	Moving	Obtaining emission stickers issued by a public body or institution
14	Retiring	Claiming pension and pre-retirement benefits from compulsory schemes
15	Retiring	Requesting information on the data related to pension from compulsory schemes
16	Starting, running and closing a business	Notification of business activity, permission for exercising a business activity, changes of business activity and the termination of a business activity not involving insolvency or liquidation procedures, excluding the initial registration of a business activity with the business register and excluding procedures concerning the constitution of or any subsequent filing by companies or firms within the meaning of the second paragraph of Article 54 TFEU.
17	Starting, running and closing a business	Registration of an employer (a natural person) with compulsory pension and insurance schemes
18	Starting, running and closing a business	Registration of employees with compulsory pension and insurance schemes
19	Starting, running and closing a business	Submitting a corporate tax declaration

Number	Life Event	Procedure/Use Case
20	Starting, running and closing a business	Notification to the social security schemes of the end of contract with an employee, excluding procedures for the collective termination of employee contracts
21	Starting, running and closing a business	Payment of social contributions for employees

Chapter 10 Bibliography

Abdel-Fattah, M.A.-K., 2014. Factors Influencing Adoption and Diffusion of E-Government Services.

Abu Bakar, N.S., Abdul Rahman, A., Abdull Hamed, H.N., 2017. m-Government: Benefits and its Key Attributes for Personalized Services. Presented at the PACIS 2017 Proceedings. 245, pp. 3–6.

administracion, n.d. National administration apps. Natl. Adm. Apps. URL https://administracion.gob.es/pag_Home/en/atencionCiudadana/app_age.html#.YGsvSj-xW03 (accessed 4.5.21).

Akhter Shareef, M., Kumar, V., Kumar, U., Dwivedi, Y., 2011. e-Government Adoption Model (GAM): Differing service maturity levels. Gov. Inf. Q. 28.

Akkaya, C., Krcmar, H., 2018. Towards the Implementation of the EU-Wide "Once-Only Principle": Perceptions of Citizens in the DACH-Region. Presented at the 17th IFIP WG 8.5 International Conference, EGOV 2018, Krems, Austria, pp. 155–159. https://doi.org/10.1007/978-3-319-98690-6_14

Alcaraz-Quiles, F., Urquia-Grande, E., Muñoz-Colomina, C., Rautiainen, A., 2018. E-government implementation : transparency, accessibility and usability of government websites, in: International E-Government Development. pp. 291–306.

Al-Debei, M.M., El-Haddadeh, R., Avison, D., 2008. Defining the Business Model in the New World of Digital Business, in: Americas Conference on Information Systems. Presented at the AMCIS 2008 Proceedings, Kanada.

Alghamdi, S., Beloff, N., 2016. Innovative Framework for e-Government adoption in Saudi Arabia: A Study from the business sector perspective. IJACSA Int. J. Adv. Comput. Sci. Appl. 7, 655–659.

Alkaabi, S.O., Ayad, N., 2016. Factors Affecting M-Government Deployment and Adoption, in: Engineering and Technology International Journal of Information and Communication Engineering. pp. 315–320.

Alonazi, M., Beloff, N., White, M., 2018. MGAUM—Towards a Mobile Government Adoption and Utilization Model: The Case of Saudi Arabia. Int. J. Hum. Soc. Sci. 12, 459–463.

Alotaibi, R., Houghton, L., Sandhu, K., 2016. Exploring the Potential Factors Influencing the Adoption of M-Government Services in Saudi Arabia: A Qualitative Analysis, in: International Journal of Business and Management, 11.

Alssbaiheen, A., Love, S., 2016. Mobile Government in Saudi Arabia: Challenges and Opportunities. International Journal of Mobile Human Computer Interaction 8, 20–24.

Appelbaum, S.H., n.d. Socio-technical systems theory: an intervention strategy for organizational development, in: Management Decision, 35. MCB University Press, pp. 352–354.

Austrian Digital Government, n.d. MijnOverheid. Serv. Citiz. Businesses. URL https://www.nldigitalgovernment.nl/dossiers/mijnoverheid-mygovernment/ (accessed 4.5.21).

Bhattarai, R., Pappel, I., Vainsalu, H., Ben Yahia, S., Draheim, D., 2019. The Impact of the Single Digital Gateway Regulation from the Citizens' Perspective. Presented at the International Conference on Project MANagement / HCist, Elsevier, pp. 160–163.

Blackman, M., 2006. Municipalities Move to Mobile Government.

Burgstaller, L., Gaggl, B., Koch, K.-M., Leitold, H., Teufl, P., 2021. mGov4EU: D1.1 Survey of related work.

Chang, D., Li, F., Huang, L., 2020. A User-centered Evaluation and Redesign Approach for E-Government APP.

Cotterell, M., Hughes, B., 1995. Software project management. International Thomson Computer Press.

Cozzens, S., 1989. The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology by Wiebe E. Bijker, Thomas P. Hughes and Trevor Pinch. Technol. Cult. 30, 705–707.

Curinga, M., Saravanos, A., 2016. Mobile First E-Learning, in: Handbook of Research on Mobile Learning in Contemporary Classrooms.

da Silva, L.F., Freire, A.P., 2020. An Investigation on the Use of Interaction Design Patterns in Brazilian Government Mobile Information Systems, in: Brazilian Sympostum on Information Systems. Brazil, pp. 3–6.

DaSilva, C.M., Trkman, P., 2014. Business Model: What It Is and What It Is Not. Long Range Plann. 47, 379–383.

Dedehayir, O., Steinert, M., 2016. The hype cycle model: A review and future directions. Technol. Forecast. Soc. Change 108, 28–41.

Dembecka, D., Mamrot, S., 2018. The Implementation of the Once-Only Principle in a Maritime Domain. Int. Univ. Logist. Transp. Wroclaw, Logitics and Transport 40, 1–3. https://doi.org/10.26411/83-1734-2015-4-40-2-18

Digital Denmark, n.d. Digital Identity. URL https://digitaldenmark.dk/case/digital-id/ (accessed 4.5.21).

Digital Economy and Society Index, 2019. Digital Public Services. EU Comision.

eBoks, 2021. eBoks.dk. URL https://www.e-boks.com/danmark/da (accessed 4.5.21).

Eesti id, n.d.

e-estonia, n.d. e-Law. E-Law. URL https://e-estonia.com/solutions/security-and-safety/e-law/ (accessed 4.5.21a).

e-estonia, n.d. e-tax. E-Tax. URL https://e-estonia.com/solutions/business-and-finance/e-tax/ (accessed 4.5.21b).

e-estonia, n.d. i-voting. URL https://e-estonia.com/solutions/e-governance/i-voting/ (accessed 4.5.21c).

e-estonia, n.d. mobile-id. URL https://e-estonia.com/solutions/e-identity/mobile-id/ (accessed 4.5.21d).

eGovernment Benchmark 2021: Entering a new digital government era, 2021. . Capgemini Worldw. URL https://www.capgemini.com/resources/egovernment-benchmark-2021/ (accessed 12.15.21).

elegitimation, n.d. Eidentification across borders. URL https://www.elegitimation.se/en/e-identification-across-boarders (accessed 4.5.21).

Eriksson, H.-E., Penker, M., 2000. Business Modeling, in: Business Modeling with UML: Business Patterns at Work. pp. 2–10.

ESPON, 2020. Cross-border public services in Europe (Policy Brief). ESPON, Luxembourg.

ESPON, 2019. Cross-border public services in Europe. European Union.

ESPON, 2018. Cross-border Public Services (CPS). European Union.

European commission, 2020. eGovernment Benchmark 2020: eGovernment that works for the people.

European Commission, 2020. Digital Public Administration factsheet 2020 Austria. European Commission.

European Commission, n.d. Once-Only Principle. URL https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/Once+Only+Principle (accessed 4.5.21).

Falch, M., Williams, I., Tadayouni, R., 2020. Cross-border Provision of e-Government Business Registration Services, in: ITS Online Event. pp. 8–10.

Federal Ministry of digital and Economic Affairs Austria, 2017. Administration on the Net The ABC guide of eGovernment in Austria. Federal Ministry Republic of Austria Digital and Economic Affairs, Austria.

Fenn, J., Blosch, M., 2018. Understanding Gartner's Hype Cycles.

Freeman, R.E., 1984. Strategic Management: A Stakeholder Approach. Ballinger Publishing Co, Cambridge.

Fulk, J., Yuan, Y.C., 2017. Social Construction of Communication Technology. Acad. Manage. J. 5–12.

Gassmann, O., Frankenberger, K., Csik, M., 2014. The Business Model Navigator. 55 Models That Will Revolutionise Your Business.

Gassmann, O., Frankenberger, K., Csik, M., 2013. Geschäftsmodelle entwickeln: 55 innovative Konzepte mit dem St. St Galler Bus. Model Navig. Hanser Münch.

Geissdörder, M., Savaget, P., Evans, S., 2017. The Cambridge Business Model Innovation Process, in: Procedia Manufacturing 8. Presented at the 14th Global Conference on Sustainable Manufacturing, South Africa, pp. 262–269.

Goldkuhl, G., 2016. E-government design research: Towards the policy-ingrained IT artifact. Gov. Inf. Q. 33, 444–452.

government of the netherlands, n.d. DigiD. URL https://www.nldigitalgovernment.nl/dossiers/digid/ (accessed 4.5.21).

Hevner, A.R., 2004. Design Science in Information Systems Research. Manag. Inf. Syst. Q. MISQ 28, 75–105.

Hoober, S., Berkman, E., 2011. Designing mobile interfaces: patterns for interaction design.

Humphreys, L., 2005. Reframing Social Groups, Closure, and Stabilization in the Social Construction of Technology. Soc. Epistemol. 19, 231–253.

ID-Austria Mein Ich-organisiere-das- von-überall-Ausweis, 2021.

Irish Government, n.d. MyGovID. URL https://www.citizensinformation.ie/en/government_in_ireland/egovernment/mygovid.html (accessed 4.5.21).

Isagah, T., Wimmer, M.A., 2018. Addressing Requirements of M-Government Services: Empirical Study from Designers' Perspectives, in: ICEGOV '18,. Galway, Ireland. https://doi.org/10.1145/3209415.3209469

Isagah, T., Wimmer, M.A., 2017. Mobile Government Applications: Challenges and Needs for a Comprehensive Design Approach, in: ICEGOV. Presented at the ICEGOV'17, New Delhi, India, pp. 423–432.

Kalvet, T., Toots, M., Van Veenstra, A.F., Krimmer, R., 2018. Cross-border e-Government Services in Europe: Expected Benefits, Barriers and Drivers of the Once-Only Principle. Presented at the ICEGOV '18: Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance, New YorkNYUnited States, pp. 70–72.

Klein, H.K., Kleinman, D.L., 2002. The Social Construction of Technology: Structural Considerations. Sci. Technol. Hum. Values 27, 28–35.

Kö, A., Molnar, T., Matyus, B., 2018. A User-centred Design Approach for Mobile-Government Systems for the Elderly. Hungary.

Krimmer, R., Kalvet, T., Toots, M., Cepilovs, A., Tambouris, E., 2017. Exploring and Demonstrating the Once-Only Principle: A European Perspective. Presented at the dg.o '17: 18th Annual International Conference on Digital Government Research, Staten Island NY USA.

Kubach, M., Roßnagel, H., Sellung, R., 2013. Service providers' requirements for eID solutions: Empirical evidence from the leisure sector, in: Hühnlein, D., Roßnagel, H. (Eds.), Open Identity Summit 2013 - Lecture Notes in Informatics (LNI) - Proceedings. Bonn, pp. 69–81.

Kubach, M., Sellung, R., 2021. On the Market for Self-Sovereign Identity: Structure and Stakeholders, in: Open Identity Sumit 2021. Presented at the Open Identity Summit, Bonn, pp. 143–154.

Kumar, M., Sinha, O.P., 2007. M-Government – Mobile Technology for e-Government. Department of MCA, Sambhram Academy of Management Studies.

Kureerung, P., Ramingwong, L., 2019a. Factors Supporting User Interface Design of Mobile Government Application, in: ICISS 2019. Tokyo, Japan.

Kureerung, P., Ramingwong, L., 2019b. A Framework for Usability Design to Promote Awareness of Information Disseminated via Mobile Government Applications. Thailand.

Lamming, M., Newman, W., 1995. Interactive system design.

Latvian Government, n.d. Latvian digital services. URL https://latvija.lv/EN (accessed 4.5.21).

Lönn, C.-M., Uppström, E., Nilsson, A., 2016. Designing an M-Government Solution: Enabling Collaboration through Citizen Sourcing, in: ECIS 2016. Turkey, p. 68.

MacVaugh, J., Schiavone, F., 2010. Emerald Article: Limits to the diffusion of innovation: A literature review and integrative model. Eur. J. Innov. Manag. 33, 197–221.

Maky, H.A., Shafiz Affendi Mohd, Y., Wan Rozaini Sheik, O., 2016. SCOT Theory: Theory for Engaging the Citizen's Self-Knowledge in the Decision Making of E-Government. J. Telecommun. Electron. Comput. Eng. 8, 177–181.

Martinez Sanchez, A., Perez Perez, M., 2003. Cooperation and the Ability to Minimize the Time and Cost of New Product Development within the Spanish Automotive Supplier Industry. J. Prod. Innov. Manag. 20, 57–69. https://doi.org/10.1111/1540-5885.201005

Martins, J., Veiga, L., 2018. Electronic Government and the Ease of Doing Business. Presented at the ICEGOV '18: 11th International Conference on Theory and Practice of Electronic Governance, Galway, Ireland, pp. 1–3.

McGrath, C., Zell, D., 2001. The Future of Innovation Diffusion Research and Its Implications for Management. J. Manag. Inq. 10, 386_391.

Müller, P.A., Gil-Garcia, J.R., Tirelli, C., 2018. The Impact of Political, Technological and Social Variables on the Development of Local E-Government: Lessons from Brazil. Presented at the Proceedings of the 11th International Conference on Theory and Practice of Electronic Governance., Galway, Ireland, pp. 290–295. https://doi.org/DOI: 10.1145/3209415.3209440

Munyoka, W., Manzira, M.F., 2014. From E-Government to M-Government – Challenges Faced by Sub-Saharan Africa, in: Proceedings of the International Conference on Computing Technology and Information Management. Dubai, pp. 88–91.

Myers, M.D., 2009. Qualitative research in business and management. Sage Publications Ltd, London.

Myers, M.D., Newman, M., 2007. The qualitative interview in IS research: Examining the craft. Inf. Organ. 17, 2–26. https://doi.org/10.1016/j.infoandorg.2006.11.001

National Interoperability Framework Observatory, 2020. Digital Public Administration factsheets 2020.

NemID und digital post in Dänemark, 2018.

Noprisson, H., Husin, N., Utami, M., Rahayu, P., Giri Sucahyo, Y., Indra Sensuse, D., n.d. The Use of a Mixed Method Approach to Evaluate m-Government Implementation, in: 2016 International Conference on Information Technology Systems and Innovation. Bali.

Nor Laila, N., Afdallyna Fathiyah, H., Wan Adillah Wan, A., Fauzi Mohd, S., 2016. Towards the Conceptualization of Citizen User Experience: Citizens' Preference for Emotional Design in E-Government Portal, in: 4th International Conference on User Science and Engineering. pp. 69–74.

Ntaliani, M., Costopoulou, K., Karetsos, S., 2008. Mobile Government: A challenge for agriculture. Gov. Inf. Q. 25, 699–716.

Ogunleye, O.S., Van Belle, J.P., 2014. Exploring the Success, Failure and Factors Influencing M-Government Implementation in Developing Countries. Presented at the Exploring the Success, Failure and Factors Influencing M-Government Implementation in Developing Countries, p. 3.

Osterwalder, A., Pigneur, Y., 2009. Business Model Generation. Amsterdam.

Osterwalder, A., Pigneur, Y., Tucci, C.L., 2005. Clarifying business models: Origins, present, and future of the concept. Commun. Assoc. Inf. Syst. 16, 1.

Panetta, K., 2018. 5 Trends Drive the Gartner Hype Cycle for Emerging Technologies, 2020 [WWW Document]. Gartner. URL https://www.gartner.com/smarterwithgartner/5-trends-drive-the-gartner-hype-cycle-for-emerging-technologies-2020/

PC, L., 2017. The Literature Review of Technology Adoption Models and Theories for the Novelty Technology. JISTEM - J. Inf. Syst. Technol. Manag. 14, 21–38.

Pinch, T., Bijker, W., 1984. The social construction of technological systems: New directions in the sociology and history of technology.

Pinch, T.J., 2001. Why you go to a music store to buy a synthesizer: Path dependence and the social construction of technology. Path Depend. Creat. 381–400.

portal administracion, n.d. electronic notifications app. URL https://administracionelectronica.gob.es/pae_Home/en/pae_Estrategias/pae_Movilidad_Inic io/pae-Aplicacion-movil-Notificaciones-electronicas.html?idioma=en#.YGswNj-xW01 (accessed 4.5.21).

Pouloudi, A., 1997. Aspects of the stakeholder concept and their implications for information systems development. Eur. J. Inf. Syst. 1–14.

Pouloudi, A., Whitley, E.A., 1997. Stakeholder identification in inter-organizational systems: gaining insights for drug use management systems. Eur. J. Inf. Syst. 6, 1–14.

ProjectWizards, n.d. The Business Model Canvas. URL https://www.projectwizards.net/en/blog/2019/09/business-model-canvas (accessed 6.17.21).

Rakotonirina, V., Raoelson, H., 2018. E-government: Factor of public administration efficiency and effectiveness. Case of the Ministry of Higher Education and Scientific Research in Madagascar, in: ICEGOV '18,. Galway, Ireland, pp. 166–170. https://doi.org/10.1145/3209415.3209432

Rogers, Everett.M., 2003. Diffusion of Innovations, 5th ed. Free Press, New York.

Rosenbaum, J., Zepic, R., Schreieck, M., Wiesche, M., Krcmar, H., n.d. Barriers to Mobile Government Adoption: An Exploratory Case Study of an Information Platform for Refugees in Germany. Technical University of Munich, München.

Scacchi, W., 2004. Socio-Technical Design, in: The Encyclopedia of Human-Computer Interaction. Berkshire Publishing Group, pp. 2–4.

Shareef, M.A., Dwivedi, Y.K., Laumer, S., Archer, N., 2016. Citizens' Adoption Behavior of Mobile Government (mGov): A Cross-Cultural Study, in: Information Systems Management, 3.

Sharma, S.K., Al-Badi, A., P.Rana, N., Al-Azizi, L., 2018. Mobile Applications in Government Services (mG-App) from User's Perspectives: A Predictive Modelling Approach, in: Government Information Quarterly. Swansea, pp. 7–15.

Sharp, H., Finkelstein, A., Galal, G., 1999. Stakeholder identification in the requirements engineering process, in: Proceedings. Tenth International Workshop on Database and Expert Systems Applications. DEXA 99. pp. 387--391. https://doi.org/10.1109/DEXA.1999.795198

Shellong, A., 2007. Extending the Technology Enactment Framework. Harvard University.

Sideridis, A., Pimenidis, E., Costopoulou, K., Yialouris, C., Ntaliani, M., Savvas, I., Maliappis, M., Karetsos, S., Tsiafoulis, S., Protopappas, L., Chatziandreou, A., 2017. Cross-Border e-Government Authentication Services, in: Proceedings of the 8th International Conference on Information and Communication Technologies in Agricultur. Greece, pp. 850–854.

Sillitti, A., Succi, G., 2005. Requirements engineering for agile methods, in: Engineering and Managing Software Requirements. Springer, pp. 309–326.

Sivamalai, L., 2013. Using the Lens of "Social Construction of Technology" to Understand the Design and Implementation of Aadhaar (UID) Project. Presented at the InternationalWorking Conference on Transfer and Diffusion of IT (TDIT), Bangalore, India.

Susanto, T.D., Diani, M.M., Hafidz, I., 2017. User Acceptance of e-Government Citizen Report System (a Case Study of City113 App), in: 4th Information Systems International Conference 2017. Bali, Indonesia, pp. 560–568.

Szabó, B., 2018. GOOD EXAMPLES OF M-GOVERNMENT IN HUNGARY⬜.

Taherdoost, H., n.d. A review of technology acceptance and adoption models and theories, in: INTER-ENG 2017. Presented at the 11th International Conference Interdisciplinarity in Engineering, 22, Romania, pp. 960–967.

Talukder, S., Chiong, R., Corbitt, B., Bao, Y., 2020. Critical Factors Influencing the Intention to Adopt m-Government Services by the Elderly, in: Journal of Global Information Management, 4. pp. 74–78.

The European Commission, 2021. Digital Economy and Society Index (DESI) 2021.

The European Parliament, 2018. establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services and amending Regulation (EU) No 1024/2012.

Tinholt, D., Niels, V. der L., Sem, E., Groeneveld, A., Cattaneo, G., 2019. eGovernment Benchmark 2019: Empowering Europeans through trusted digital public services. EU Comision.

Trimi, S., Sheng, H., 2008. Emerging trends in M-government. Commun. ACM 51, 53–58.

Tseng, P.T., Yen, D.C., Hung, Y.C., Wang, N.C., 2008. To explore managerial issues and their implications on e-Government deployment in the public sector: Lessons from Taiwan's Bureau of Foreign Trade. Gov. Inf. Q. 25, 734–756.

Vassil, K., Solvak, M., Vinkel, P., H.Trechsel, A., Alvarez, R.M., 2016. The diffusion of internet voting. Usage patterns of internet voting in Estonia between 2005 and 2015. Gov. Inf. Q. 33, 353–359.

W3C, n.d. Web Content Accessibility Guidelines (WCAG).

W3C, n.d. Authoring Tool Accessibility Guidelines (ATAG).

W3C, n.d. User Agent Accessibility Guidelines (UAAG) Overview.

Wang, C., 2014. Antecedents and consequences of perceived value in Mobile Government continuance use: An empirical research in China. Comput. Hum. Behav. 34, 140–147.

Welby, B., 2019. The impact of digital government on citizen wellbeing. OECD: Organisation for Economic Co-operation and Development.

Williams, I., Falch, M., Tadayouni, R., 2018. Internationalization of e-Government Services.

Wirtz, B.W., 2020. The Business Model Concept, in: Business Model Management. pp. 7–14.

Wirtz, B.W., Birkmeyer, S., Langer, P.F., 2019. Citizens and mobile government: an empirical analysis of the antecedents and consequences of mobile government usage. Int. Rev. Adm. Sci.

Wroblewski, L., 2011. Mobile First.

Xia, V., 2017. What is Mobile First Design? Why It's Important & How To Make It? URL https://medium.com/@Vincentxia77/what-is-mobile-first-design-why-its-important-how-to-make-it-7d3cf2e29d00 (accessed 4.5.21).

Zibuschka, J., Roßnagel, H., 2012. Stakeholder Economics of Identity Management Infrastructures for the Web, in: Proceedings of the 17th Nordic Workshop on Secure IT Systems (NordSec 2012). Presented at the 17th Nordic Workshop on Secure IT Systems (NordSec 2012), Karlskrone, Sweden.