AALTO UNIVERSITY
School of Science
Master's Programme in Industrial Engineering and Management

Juho Rinne

# EU's Single Digital Gateway and its implementation in Finnish eGovernment: A case study

Master's Thesis

Espoo, Finland, 27.05.2019

Advisors: Professor Kari Smolander, Professor Timo Seppälä

Supervisor: Professor Timo Seppälä

Aalto University
School of Science

**Master's thesis abstract**

**Author:** Juho Rinne

**Title:** EU's Single Digital Gateway and its implementation in Finnish eGovernment: A case study

**Degree Programme:** Master's Programme in Industrial Engineering and Management

**Supervisor:** Professor Timo Seppälä

**Advisors:** Professor Kari Smolander, Professor Timo Seppälä

| | |
|---|---|
| **Major:** Operations and Service Management | **Code:** SCI3049 |
| **Date:** 27.05.2019 **Pages:** 106 + 4 | **Language:** English |

Electronic government systems are evolving towards platform-like public service single point of contacts, where citizens and businesses can complete most public administration procedures fully online. However, this progress has been slow since digitalization of the public sector is not only a technical but also a legal, semantic and organizational challenge and it requires extensive reorganization of government. When creating a governmental system of systems across the public sector, technical, legal, semantic and organizational interoperability is needed.

This thesis compares electronic government with digital platforms and investigates what resources in electronic government environments resemble digital platforms' boundary resources. The aim is to identify what kinds of resources governmental platform owners should provide to public service providers for expediting the development, adoption, and growth of governmental platforms. A case study on EU's Single Digital Gateway regulation was conducted. The objective of the regulation is to create an EU-wide public service portal that helps citizens and business use their right to free movement within the union. The Finnish public administration platform Suomi.fi and the labor market platform Työmarkkinatori will be connected to the portal and are examined as subunits in the case study. Data collection consisted of qualitative semi- or unstructured in-depth interviews with Finnish electronic government specialists involved in the case.

The findings of the study indicate that electronic governments face a similar paradox of control as digital infrastructures and digital platforms. The main boundary resources that are paramount for an interoperable cross-border electronic government platform are high-level identification tools, secure data exchange tools, secure messaging tools, interoperability components and solutions, regulatory documents, transparency resources, and instructions and documentation. To accelerate electronic government development, the platform owners should enhance the communication with the third-party service providers, give sufficient flexibility to third parties in their development, set realistic schedules, concentrate on overcoming legal, organizational and semantic interoperability challenges, and try offer incentives for actors on the platform.

**Keywords:** digital infrastructure, digital platform, boundary resources, electronic government

**Författare:** Juho Rinne

**Titel:** EU:s Gemensamma Digitala Ingång och dess genomförande i finsk elektronisk förvaltning: En fallstudie

**Utbildningsprogram:** Master's Programme in Industrial Engineering and Management

**Övervakare:** Professor Timo Seppälä

**Handledare:** Professor Kari Smolander, Professor Timo Seppälä

**Huvud- eller biämne:** Operations and Service Management **Kod:** SCI3049

**Datum:** 27.05.2019 **Sidantal:** 106 + 4 **Språk:** Engelska

Elektroniska förvaltningssystem utvecklas mot plattformliknande kontaktpunkter för offentliga tjänster, där medborgare och företag kan fullgöra de flesta offentliga förvaltningsförfarandena på nätet. Denna utveckling har dock varit långsamt, eftersom digitaliseringen av den offentliga sektorn inte bara är en teknisk utan också en juridisk, semantisk och organisatorisk utmaning och kräver en omfattande omorganisation av förvaltningen. När man skapar ett statligt system av system över hela offentliga sektorn behövs teknisk, juridisk, semantisk och organisatorisk interoperabilitet.

Avhandlingen jämför elektronisk förvaltning med digitala plattformar och undersöker vilka resurser i elektronisk förvaltning liknar de digitala plattformarnas gränsresurser. Syftet är att identifiera vilka typer av resurser statliga plattformsägare bör tillhandahålla offentliga tjänsteleverantörer för att påskynda utveckling, adoption och tillväxt av statliga plattformar. En fallstudie genomfördes om EU:s förordning om inrättande av en gemensam digital ingång. Syftet med förordningen är att skapa en EU-omfattande portal för offentliga tjänster som hjälper medborgare och företag att använda sin rätt till fri rörlighet inom unionen. Den finska offentliga förvaltningsplattformen Suomi.fi och arbetsmarknadsplattformen Työmarkkinatori kommer att anslutas till portalen och granskas som enheter i fallstudien. Datainsamling bestod av kvalitativa halv- eller ostrukturerade djupintervjuer med finska elektronisk förvaltningsspecialister.

Undersökningsresultaten visar att elektronisk förvaltning står inför en liknande paradox av kontroll som digitala infrastrukturer och digitala plattformar. De viktigaste gränsresurserna som är avgörande för en interoperabel gränsöverskridande elektronisk förvaltningsplattform är identifieringsverktyg på hög nivå, säkra verktyg för datautbyte, säkra kommunikationskanaler, komponenter och lösningar för interoperabilitet, förordningsdokument, transparensresurser samt instruktioner och dokumentation. För att påskynda den elektroniska förvaltningsutvecklingen borde plattformsägare förbättra kommunikationen med tredjepartsleverantörer, ge tillräcklig flexibilitet till tredje parter i deras utveckling, fastställa realistiska tidtabeller, koncentrera sig på att övervinna juridiska, organisatoriska och semantiska interoperabilitetsutmaningar och försöka erbjuda incitament för aktörer på plattformen.

**Nyckelord:** digitala infrastrukturer, digitala plattformer, elektronisk förvaltning, gränsresurser

## Acknowledgements

First of all, I want to thank my advisor Professor Kari Smolander for giving me the opportunity to work as a research assistant and to write this thesis in the DINE research group. Special thanks should be given to both Smolander and my supervisor Professor of Practice Timo Seppälä for giving me invaluable help and guidance throughout the writing process. I also want to thank Kimmo Karhu for his advice at the beginning of the project that helped me get started.

I want to thank the people at the Finnish Population Register Center for suggesting I would study the Single Digital Gateway regulation. Thanks to everyone who took the time to meet me for an interview and contributed to this research.

To my fellow workers at the Department of Computer Science: thanks for all the fun we have had in the last few years.

I wish to thank my family for supporting and encouraging me throughout my studies. And lastly, thank you Emma, for all your love and support.

Espoo, 27 May 2019

Juho Rinne

## Table of contents

## Table of tables



## Table of figures

## List of abbreviations and acronyms

| | |
|---|---|
| API | Application Programming Interface |
| BR | Boundary Resource |
| CEF | Connecting Europe Facility |
| CPSV-AP | Core Public Service Vocabulary Application Profile |
| DI | Digital Infrastructure |
| EC | European Commission |
| EG | Electronic Government |
| eIDAS | Electronic Identification, Authentication and trust Services |
| EU | European Union |
| ICT | Information and Communications Technology |
| IMI | Internal Market Information system |
| IPR | Intellectual Property Rights |
| ISA | Interoperability Solutions for public Administrations |
| IT | Information Technology |
| MS | Member State |
| POC | Point Of Contact |
| PRC | Population Register Center |
| RQ | Research Question |
| SDG | Single Digital Gateway |
| SDK | Software Development Kit |
| TMT | Työmarkkinatori |
| TOOP | The Once Only Principle |

# 1 Introduction

Using the free movement right within the European Union as an EU citizen is currently considered too complicated because the public administration information and services needed when moving abroad are often inaccessible and scattered around different websites. On 2 October 2018, the European Parliament signed an act for establishing a Single Digital Gateway for the union, which aims to ease the unavoidable bureaucratic processes when relocating to another EU member state. The regulation requests all member states to offer certain (1) information about national rights, obligations and rules, (2) public administration procedures, and (3) assistance and problem-solving services online. These contents will be provided through EU's Your Europe portal, which will function as the gateway. Each Member State is obliged to offer links in the portal that guides the users to national websites containing the aforementioned requirements.

In 2017, the government of Finland finished a program called The National Architecture for Digital Services that resulted in a handful of Suomi.fi services. The aim of the program was to create a common platform for digital public services provided by both public and private sector organizations. Suomi.fi intends to become a one-stop shop for finding information and services and to interact with Finnish authorities. The future development of the Finnish digital infrastructure should consider the EU's regulations and aim to fulfill the requirements not yet fulfilled by the current infrastructure.

As a part of the Finnish government's efforts of improving the nation's employment services, the Ministry of Economic Affairs is developing a digital labor market platform called Työmarkkinatori. The platform aims to become a nation-wide labor market ecosystem and meeting place for both public and private sector employers and job seekers. Työmarkkinatori will also eventually be connected to the Single Digital Gateway, as work-life information and procedures are requested to be included in the portal.

Digital platform business models have proven to be advantageous and efficient during the past few years, and platforms are now emerging in various areas and the government is no exception. Governments are now striving to create platform-like single point of

contacts for digital public services. The Single Digital Gateway, for example, is aiming at becoming a huge single point of contact for public services in the entire European Union. Both Suomi.fi and Työmarkkinatori will be small parts of the envisaged gateway. Connecting countless public sector services from 28 member states is no easy task. What can governmental bodies learn from the successful free market digital platforms in their attempts of creating governmental platform ecosystems?

## 1.1 Research problem, objectives and scope

According to scholars in computer science, political science, business administration and many other fields, the benefits of establishing electronic government are apparent and governments should aim at digitizing their services and allow transactions between citizens/businesses and public administration to be conducted electronically (Heeks and Bailur, 2007; Scholl, 2017; Gil-Garcia, Dawes and Pardo, 2018; Wirtz and Daiser, 2018). However, adopting electronic government is challenging (dos Santos and Reinhard, 2012; Wirtz and Daiser, 2018). Wide-ranging and functional electronic government requires integration of and interoperability between various public administration systems and there are countless barriers in establishing this (Pardo, Nam and Burke, 2012). The adoption is not merely a technical task, since also regulatory issues arise when integrating systems, processes, and transactions from different fields of public administration. The implementation of electronic government is a technical, political, economic, social and organizational challenge (dos Santos and Reinhard, 2012).

In the digital platform world, researchers have discussed platform boundary resources that platform owners provide for third parties when developing content to platforms (Ghazawneh and Henfridsson, 2013; Seppälä, Juhanko and Korhonen, 2015; Karhu, Gustafsson and Lyytinen, 2018). The central purpose of boundary resources is to lower the barriers of using the platform, alleviate the development process and to make the job of third-party application developers as easy as possible. Similar resources should be provided to public organizations when creating platform-like electronic government systems. According to some scholars governments are evolving towards platforms (O'Reilly, 2010; Accenture, 2018). Platform researchers have mainly focused on the economic and technical aspects of platforms, but platforms or platform-like systems have

now started to emerge in governmental environments too, which is why more research on governmental digital platforms should be conducted.

The objective of this thesis is to identify what can be learnt from the literature on platform boundary resources for helping and encouraging public administrations to join electronic government systems or platforms. One objective is to assess how the boundary resource models fit the context of electronic government. The aim is also to detect how some of these resources might appear and work on the operational level of an electronic government initiative. An objective is to identify methods, techniques and/or approaches that could alleviate electronic government adoption. Helbig, Gil-García and Ferro (2008) did a study regarding electronic government and the digital divide, where they attempted "to explore the theoretical and practical intersections of these areas of study to show how they run parallel to each other and also how they complement and possibly enrich the explanatory potential of E-Government research". This thesis aims to explore the theoretical and practical intersections between boundary resources in digital platforms and similar resources in electronic government and possibly enrich electronic government research.

The scope of this study will consider only the parts of a governmental platform, portal or system that function in the same way as boundary resources do in regular digital platforms. Technical details of the plausible boundary resources of an electronic government platform will not be analyzed, the aim is to identify and classify them. The study is limited to one electronic government case. Analysis of two embedded subunits will is also be carried out.

## 1.2 Research questions

A conceptual framework for this research was drawn from three research fields: digital platforms, digital infrastructures, and electronic government. The conceptual framework is discussed in detail at the end of chapter 2.5. The working hypothesis of the thesis is that interoperable electronic government initiatives have resources resembling platform boundary resources. The hypothesis and the framework function as a basis for this exploratory qualitative research.

To help reach the objectives outlined in the previous chapter, the following research questions were drafted:

**RQ1. What kinds of resources that resemble platform boundary resources exist in electronic government?**

**RQ2. What factors support or hinder the development of electronic government?**

This study is conducted in the Finnish electronic government context. Therefore, the research questions are directed to electronic government specialists in Finland. The EU-wide initiative called Single Digital Gateway will be analyzed from the perspective of Finnish electronic government officials.

Two studies gave inspiration for these specific questions. A study by Bianco et al. (2014), where the role of boundary resources in software ecosystems was discussed, set the following RQ: "What different kinds of platform boundary resources exist in software ecosystems?". A study by Myllärniemi et al. (2018) that was about the factors supporting the adoption and use of software frameworks included this RQ: "How do platform boundary resources support or hinder the adoption and continuous use of a framework?". Both articles had an influence on the conceptual framework developed for this thesis. The supposition is that there exist resources in electronic government that are similar to boundary resources found in digital platforms and software frameworks/ecosystems discussed in platform boundary resource research.

RQ1. will be answered mainly by doing desktop and secondary research. Insights gained from interviews with experts will enrich the answer for RQ1, as well as give a hint of how the plausible resources work on the operational level and support the implementation and adoption of electronic government. The data collected from the interviews should address RQ2. The interviewed specialists are expected to give insights on how the resources appear on the operational level and what factors are supporting or hindering the development of electronic government. Detailed data collection and analysis are discussed in chapters 3.3 and 3.4.

## 1.3 Structure of the thesis

This thesis consists of six chapters. After the introduction, chapter 2 pieces together literature from research on digital infrastructures, digital platforms, and electronic government. In chapter 3, the research methodology is outlined. Chapter 4 introduces the case and all three units of analysis: EU's Single Digital Gateway regulation, the Finnish National Architecture for Digital Services program and its Suomi.fi services, and a Finnish labor market platform called Työmarkkinatori. The findings of the study are presented in chapter 5. Finally, the discussion and conclusions of the thesis are summed up in chapter 6.

# 2 Literature review

Literature from three research topics is reviewed: digital infrastructure, digital platforms, and electronic government. Each topic is associated with the studied case. Research on digital infrastructure and platforms stems from several disciplines, inter alia information systems, strategic management, and economics. Defining the difference between digital infrastructure and platforms has been one objective of scholars during the past years. This chapter aims at making a distinction between them. A summary of the review with some discussion about the relationship between digital infrastructure, platforms and government are presented at the end of this chapter.

## 2.1 Introduction to the literature review

The first phase of the research was about gaining knowledge of the fields mentioned above. While studying the literature I aimed at making connections between the fields and identifying similarities in them. The goal was to distinguish features of digital platforms that are applicable to electronic government.

Broadly speaking, the gathering of appropriate literature for this thesis was done in three rounds. I began searching articles on Google Scholar using different combinations of keywords, e.g. “digital infrastructure”, “digital platform”, “electronic government” and “boundary resources”. In the first round, I opened and skimmed through the abstracts of interesting articles I came across. In the second round, the articles that seemed useful for this thesis were saved to my personal Mendeley database for later use and reading. Lastly, the articles discussed and referred to in the thesis were filtered from the ones I had saved in Mendeley. A few iterations were also made in the process, as for example, interesting articles were found from the bibliography of other useful articles and new keywords for searching were identified.

## 2.2 Digital Infrastructure

Digital infrastructure (DI) may be defined as the collection of sociotechnical components, networks, systems and processes that contribute to the functioning of an ICT system (Henfridsson and Bygstad, 2013). These systems are described as "shared, unbounded, heterogeneous, open and evolving" (Hanseth and Lyytinen, 2010). Digital infrastructure can cover various settings, levels of analysis, and technologies. The infrastructure can be adjusted to serve merely a group or organization, but also whole industries or societies (Tilson, Lyytinen and Sørensen, 2010). One of the most apparent examples of digital infrastructure is the Internet (Monteiro, 1998).

Digital infrastructure differs from other types of infrastructure in that DI is capable of collecting, storing and transferring data across numerous systems and devices (Constantinides, Henfridsson and Parker, 2018). Unlike traditional infrastructures where the technical variables like pipes in a sewage system or power lines in an electricity network prevent them from evolving rapidly, digital infrastructures are extremely scalable. Their core components can be replaced or upgraded relatively easily. As Tilson et al. (2010) write "new combinations of services and capabilities can be produced at unprecedented speed". Digital infrastructures are more scalable and flexible than traditional infrastructures and allow the transfer of versatile content. (Tilson, Lyytinen and Sørensen, 2010)

Henfridsson and Bygstad (2013) discuss the generative mechanisms of digital infrastructure. *Adoption*, *innovation,* and *scaling* are the three self-reinforcing mechanisms of DIs that function as causal powers in their evolution. As more services are offered through the infrastructure more users will be attracted to it, and more users using the infrastructure will lead to more resources being invested in it (adoption). The flexibility of a DI's technical environment creates a space for innovation that encourages stakeholders to recombine the social and technical elements provided through the infrastructure for creating new services, which will result in an advanced DI (innovation). Useful digital infrastructure will attract partners who might have integrable solutions to the infrastructure, and new solutions give the infrastructure an increased reach (scaling). (Henfridsson and Bygstad, 2013)

Tilson et al. (2011) point out that digital infrastructures have paradoxes of change and control. Being scalable and flexible in their nature, digital infrastructures change and evolve in a fast manner. The authors state that generativity can be observed in DI's. New sociotechnical relationships emerge all the time in digital infrastructure. *The paradox of change* refers to how DIs should be both stable and flexible at the same time. DI should be stable and familiar environments to ensure the easy addition of new artifacts, processes, and actors to the system. At the same time, DI should be flexible to allow free evolving and limitless growth for reaching its full potential. *The paradox of control* refers to how DIs should have both centralized and distributed control. The control over DI should be centralized so that the infrastructure does not deviate from its planned course. However, the control over DI should also be distributed by giving actors individual autonomy, so that new control points can be established and services expanded or changed without the bureaucratic hassle. (Tilson, Sørensen and Lyytinen, 2011)

As stated earlier, digital infrastructures are heterogeneous systems compiled of social and technical elements that are created for groups of all sizes to orchestrate their needs concerning services and content (Constantinides, Henfridsson and Parker, 2018). Today these socio-technical systems are viewed as the foundation on where digital platforms emerge. According to Constantinides et al. (2018), digital platforms are created and cultivated on top of digital infrastructure and that platforms are subparts of infrastructure. "Digital infrastructures provide the necessary computing and networking resources" for digital platforms to function. (Constantinides, Henfridsson and Parker, 2018)

## 2.3 Digital Platforms

Platforms can broadly be defined as systems of systems that connect several parties together over organizational boundaries to practice value-adding activities (Mattila, Seppälä and Holmström, 2016). There are two theoretical perspectives to platforms, non-digital platforms studied in the fields of strategic management and economics refer to two- or multi-sided markets (or platforms) while engineers view platforms as technological architectures (Gawer, 2014). In a two-sided market, there are two distinct groups that interact with each other through platforms or other intermediaries (King, 2013). In the economic view, the platforms essentially exist for facilitating transactions

between supply and demand (Gawer and Evans, 2016). Platforms aim at connecting as many people within and across the groups as possible. How big the benefit of joining the platform depends on the size of the other group on the platform (Armstrong, 2006). For example, a newspaper is one form of a platform where the newspaper (platform owner) connects advertisers (supply) with readers (demand) (Choudary, Van Alstyne and Parker, 2016). The benefit of buying ad space on the paper depends directly on the number of readers. Platforms in the technical view are ultimately "extensible codebases to which complementary third-party modules can be added" (De Reuver, Sørensen and Basole, 2018). Parker et al. (2016) define them as collections of digital resources that support value-creating activities between consumers and producers.

So-called platformization is a rising trend in various industries (Kazan et al., 2018). An increasing number of companies are exploring platform-based business models and seeking to create platforms for their digital goods and services (Gawer and Evans, 2016). The platformization is expected to replace traditional firms and business sectors with new ones and change entire industries by reshaping our understanding of competition and the way we work (De Reuver, Sørensen and Basole, 2018).

A recent study by Kazan et al. (2018) suggested that there are two strategic dimensions to digital platforms' architectures, one for creating and the other for delivering value. The value creation dimension of the strategic architecture refers to the technical foundation that the platform offers to third parties for developing their applications on while the value delivery architecture refers to the technological backbones such as the Internet that constitute the digital infrastructure behind the platform. (Kazan et al., 2018)

A similar paradox of control appears in digital platforms as in DIs. When constructing platforms, managers are likely to face a trade-off decision when choosing between centralized and decentralized platform control. Choosing a platform design with central control is certainly better when building and trying to popularize a platform, but most companies rather avoid integrating to systems that are controlled by another company. Companies prefer systems they themselves control to circumvent becoming dependent on a system provider, even if their own systems would be poorer in quality than some provider's system. Decentralized platform control would increase the likelihood of network effects in the environment, which is why centralized control should be avoided.

As new technologies like blockchain emerge, decentralized platform control might become implementable without the drawbacks. (Mattila, Seppälä and Holmström, 2016)

On the other side of the coin, Seppälä and Mattila (2016) argue that giving systems too much freedom to evolve on their own might preclude them from being integrated to a platform in the form of a network of systems, and allow interoperability between the systems in the future. Letting systems evolve disconnected from each other could result in dissimilar systems that are difficult to merge. To keep the option of a network of systems alive, the control over the systems should be kept at a high enough level, so that the systems do not deviate apart. The systems need to be developed on a common platform, but no one seems to be taking the initiative of creating such a platform. The authors present three different ways that a platform for a network of systems could arise in the context of interoperability within the EU, which is an objective of the union. The first option is to let some market-driven company take the role of a platform mediator that creates the basis for the network. Another option is that the government takes a role as an encourager for private companies to develop a platform through regulations. The last option would be that the government itself becomes the platform mediator. (Seppälä and Mattila, 2016)

When a platform attracts numeral businesses and grows a network around it, a more fitting concept to consider might be a platform ecosystem. A platform ecosystem, also known as a digital or software ecosystem could be defined as a group of companies that share an interest in the prosperity of digital technologies, as a platform, and aim at using its potential for materializing their products or services. All companies in the ecosystem contribute to the growth and survival of the technology by reinforcing the network effects with their involvement and by sharing their intellectual capacity for improving the technology. (Yoo, Henfridsson and Lyytinen, 2010; Selander et al., 2013; Bazarhanova and Yli-huumo, 2019)

Two relevant characteristics of digital platforms are that they generate *network effects* (or network externalities) and offer *boundary resources* (Seppälä, Juhanko and Korhonen, 2015). As pointed out in chapter 2.2, digital platforms appear in DIs and they utilize the social and technical resources the infrastructure offers. However, digital platforms do not hold these resources as key assets like DIs do (Constantinides, Henfridsson and Parker,

2018). The applications created by third parties are the complementary assets of a digital platform (Ghazawneh and Henfridsson, 2010). The value generated by platforms comes from the interactions it enables between different stakeholders, and the more interactions there are on the platform, the greater the network effects are. Actors on the platform seek to take advantage of network effects in the environment and reach as many individuals on the other side of the two- or multisided-market in context (Seppälä, Juhanko and Korhonen, 2015). Each new user of a platform increases the network effects as well as the platform's value (Constantinides, Henfridsson and Parker, 2018). The network effects can be either direct or indirect. Direct network effects depend on the number of users in the same user group while indirect network effects depend on the number of users in a different user group (De Reuver, Sørensen and Basole, 2018). To be able to harness network effects to a high extent on a platform, joining the platform should be as simple as possible, both on the supply- and demand-side. Hence, platforms offer boundary resources for making the development of applications on the platform an easier process.

### 2.3.1 Platform boundary resources

In platform business models, the platform owner's focus should be more on improving the resources supporting the third parties using the platform than on developing their own applications (Ghazawneh and Henfridsson, 2013). The resources supporting external complementors are called platform boundary resources. Ghazawneh and Henfridsson (2013) define them more precisely as "software tools and regulations that serve as the interface for the arm's-length relationship between the platform owner and the application developer". With the help of proper boundary resources, application developers should by themselves manage to conduct all necessary activities for creating and maintaining an application on a platform (Myllärniemi et al., 2018). The boundary resources essentially help third parties to contribute with improvements or new complements (digital and intangible resources like applications or physical devices) to the platform (De Reuver, Sørensen and Basole, 2018; Karhu, Gustafsson and Lyytinen, 2018).

Most previous studies state that there are two types of boundary resources: *technical* and *social* boundary resources (Yoo, Henfridsson and Lyytinen, 2010; Ghazawneh, 2012). The technical boundary resources refer to technical tools used by developers when creating content for the platform and connecting to the platform. Examples of technical

boundary resources are APIs (Application Programming Interface), SDKs (Software Development Kit) and other development tools. Social boundary resources refer to cooperative, legal, administrative and operational provisions that can be in the form of contracts between stakeholders, IPR agreements, code documentation, open-source licenses and forums (Bianco et al., 2014; Seppälä, Juhanko and Korhonen, 2015; Karhu, Gustafsson and Lyytinen, 2018).

Seppälä, Juhanko and Korhonen (2015) studied platforms from a business perspective and identified eight categories of social and technical boundary resources between platform owners and third parties. The categories are listed in Table 1.

Table 1. Social and technical boundary resources (Seppälä, Juhanko and Korhonen, 2015)

| **Social Boundary Resources** | **Technical Boundary Resources** |
|---|---|
| Agreeing on rights | Software Development Kits |
| Agreeing on IPR | Application Programming Interfaces |
| Common earnings logic | Functional scripts |
| Open data (for 3rd parties) | |
| Instructions and documentation | |

However, drawing a clear distinction between technical and social boundary resources is becoming ever more difficult (Lauslahti et al., 2018). E.g. smart contracts discussed by Lauslahti et al. (2018) indicate that social boundary resources are evolving towards a technical direction. Technical boundary resources are characterized as technical enablers, but since new social boundary resources like smart contracts are also considered as technical enablers, the classification of BR types becomes intricate. (Lauslahti et al., 2018)

Bianco et al. (2014) suggest that technical boundary resources could further be split in two: (1) application boundary resources and (2) development boundary resources, totaling in three types of boundary resources with social boundary resources being the third type. Application boundary resources are the ones that enable the developer to interact with the platform, e.g. APIs. Development boundary resources, on the other hand, are those that help the developer develop an application for the platform, e.g. SDKs. The

authors also suggest that boundary resource classes are not mutually exclusive. While application boundary resources like APIs are mainly for allowing developers to connect with an interface, the APIs also include methods that developers might use while developing their applications, which makes them development BRs as well. According to the researchers, the social boundary resources should "transfer the knowledge of creating software and to act as a means of interaction between the keystone player and developers". Since comments in source code often transfer knowledge of creating software to the developer, and methods in APIs and SDKs usually have semantic cues in their names, the authors believe that the technical boundary resources can also be viewed as social boundary resources. Therefore, Bianco et al. proposed an onion model for boundary resources (Figure 1). All boundary resources have some social component in them. (Bianco et al., 2014)

Boundary resources are not only designed for helping third parties to create complementary assets but also for controlling the platform and the ecosystem that evolves around it (Ghazawneh and Henfridsson, 2010). Like the paradox of control in both digital infrastructures and digital platforms, the same dilemma has been discussed regarding the design of boundary resources, since one wants to maintain as much control over the platform as possible but still give developers freedom and stimulate them to create content on the platform (Ghazawneh and Henfridsson, 2013). The platform BRs can be used for balancing the control. This type of tradeoff between retaining vs. relinquishing control over a platform (Benlian, Hilkert and Hess, 2015), or granting access vs. devolving control in a platform (Boudreau, 2010) is what the concept of platform openness is about. Platform openness refers to the opening or removing of restrictions on the use,

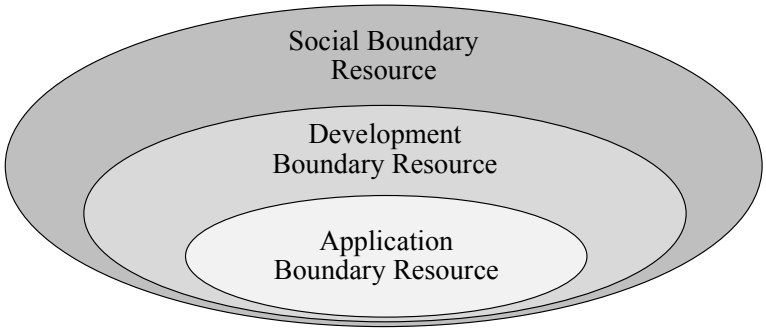


Figure 1. The onion model of boundary resource classes (Bianco et al., 2014)

development, and commercialization of the platform technologies (Boudreau, 2010; Karhu, Gustafsson and Lyytinen, 2018). De Reuver et al. (2017) state that platform openness does not only relate to these organizational arrangements but also to "the extent to which the boundary resources support the development of complements".

Karhu et al. (2018) conceptualized these two forms of platform openness as (1) access openness and (2) resource openness. Access openness is about granting access to the external complementors by providing them (boundary) resources for participating and conducting business on the platform. Access here refers to the access to participate. Resource openness, on the other hand, refers to revealing the intellectual property of the platform owner's resources. Having the platform as open-source software would be one form of resource openness. (Karhu, Gustafsson and Lyytinen, 2018)

Ghazawneh and Henfridsson (2013) presented the boundary resources model that visualize the role of boundary resources between platform owners and third party developers. As seen in Figure 2, the platform owner designs boundary resources while the application developers make use of them. Figure 2 also indicates that the boundary resources are *resourcing* and *securing* the platform. These two functions help in balancing the control of the platform. The authors of the model refer to resourcing as "the process

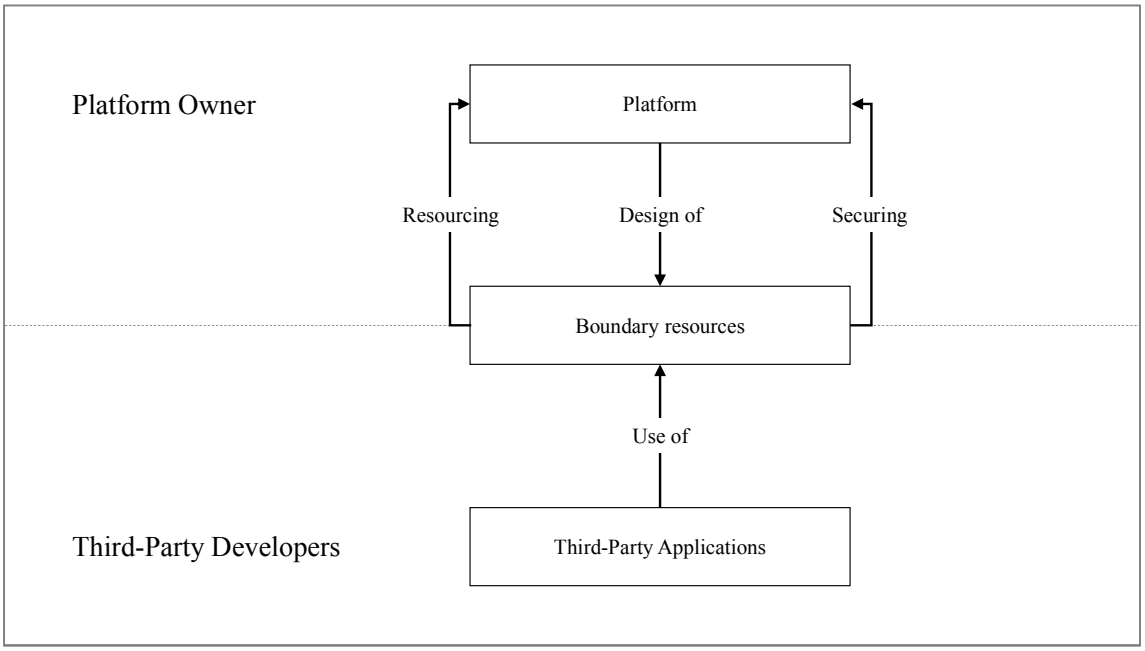


Figure 2. The boundary resource model (Ghazawneh and Henfridsson, 2013)

by which the scope and diversity of the platform is enhanced". With the resourcing, platform owners aim at expanding their ecosystems by attracting new actors by, for example, integrating a new feature (a boundary resource) to the platform. As stated earlier, boundary resources are also used for control, which is what securing resources in the boundary resources model refer to. As the authors put it, "securing denotes the process by which the control of a platform and its related services is increased". The securing boundary resources are created for e.g. minimizing the risk of some developers damaging the platform. (Ghazawneh and Henfridsson, 2013)

Ghazawneh and Henfridsson (2013) also identified four variants of resourcing and securing actions taken by platform stakeholders: self-resourcing, diversity resourcing, regulation-based securing, and sovereignty securing. With self-resourcing, the authors refer to situations where third parties develop resources themselves as a response to the limitations of the platform's BR offering. The third parties' own initiatives can help in expanding the platforms since other third parties on the platform can potentially use the products of their endeavors or it can spark a response in the platform owners to deal with the limitations of their BRs. The self-resourcing can happen in platforms that e.g. focus too much on securing and force the third parties to create their own workarounds. As a response to the self-resourcing actions made by third parties, platform owners can attempt to create and provide diversity resourcing boundary resources. In the diversity resourcing act platform owners deliberately aim at diversifying the platform and stimulating third-party developers to create various applications and enter new areas. Diversity resourcing BRs are intended to expand the scope of the platform ecosystem. Regulation-based securing refers to the act of securing the platform through administrative legislation. If platform owners feel the need to increase their control they can always choose to make non-technical restrictions, e.g. setting regulatory measures for the development. The last variant, sovereignty securing, refers to actions taken by platform owners for maintaining or achieving undivided control over the platform and its evolution. Both technical and social boundary resources can be used for achieving sovereignty. (Ghazawneh and Henfridsson, 2013)

The boundary resource model helps in understanding the role of platform boundary resources' design and use in third-party development. As Ghazawneh and Henfridsson (2013) point out, the model resembles process theory, meaning that the absence of necessary conditions might prevent desired outcomes from happening. The boundary resources are created for a reason, but designing boundary resources will not always guarantee that third parties will use them. Not developing boundary resources at all, however, will certainly mean that nothing will be created on the platform. The emergence of boundary resources can be both reactive or proactive, sometimes the owners come up with solutions and other times it is initiated from developers' use of the resources. (Ghazawneh and Henfridsson, 2013)

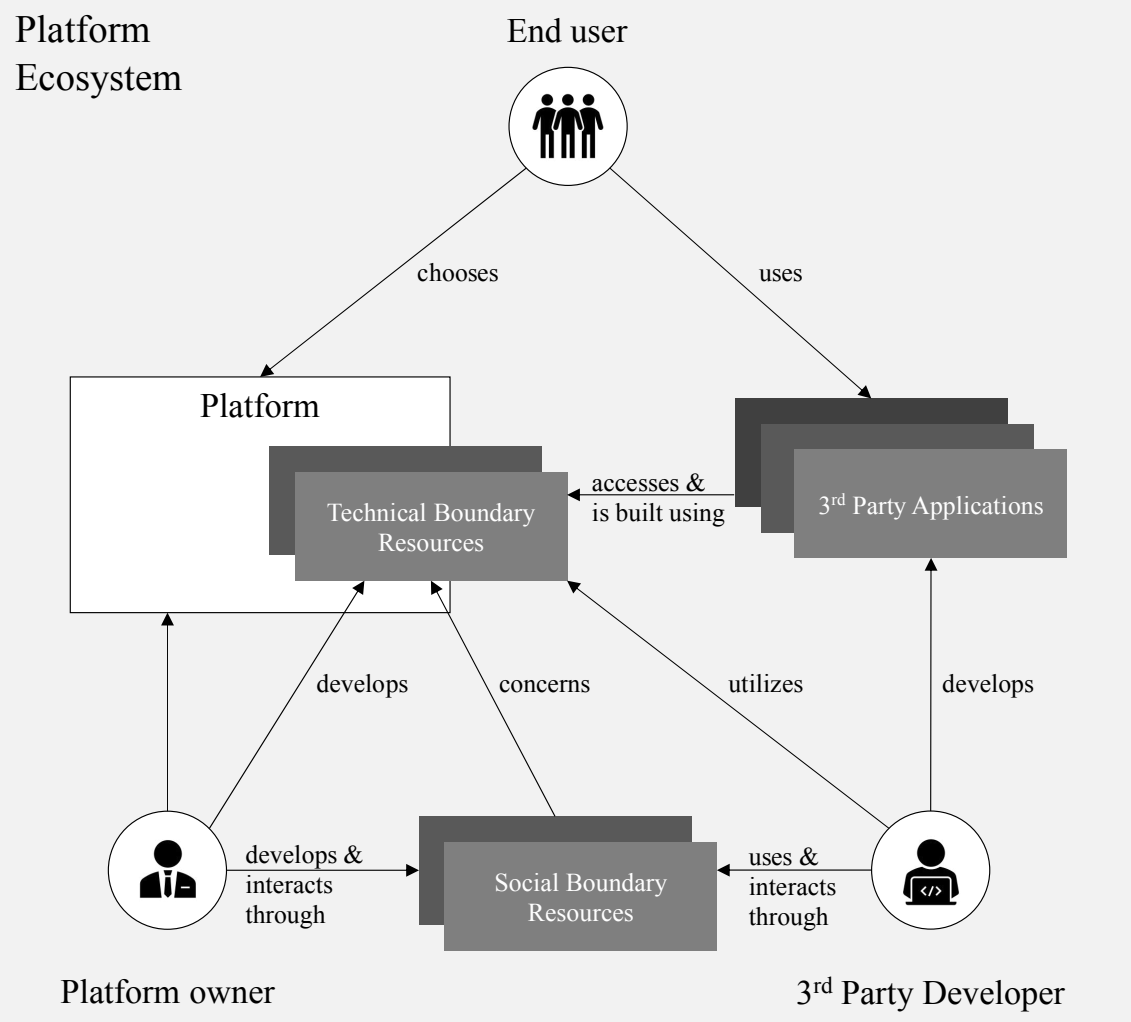


Figure 3. Boundary resources in a platform ecosystem (Bianco et al, 2014; Myllärniemi et al., 2018)

Bianco et al. (2014) illustrate the role of boundary resources in platform ecosystems. The model is also adapted by Myllärniemi et al. (2018) (Figure 3).

Boundary resources are important elements in a successful platform ecosystem. The success of a platform and its ecosystems depends on the diversity and quality of its applications and for acquiring this, platform owners ought to attract third parties with boundary resources that makes the application development effortless

## 2.4 eGovernment

The definition of electronic government has slowly taken shape along the evolution of information and communication technologies (ICT) (Scholl, 2017). Most scholars in the past two decades have defined electronic government roughly as the use of ICT in all levels of government for improving information and service delivery (Howard, 2001; Gottschalk, 2008; Sandoval-Almazán and Gil-Garcia, 2008; Teo, Srivastava and Jiang, 2008; Pardo, Nam and Burke, 2012). A recent study by Gil-Garcia, Dawes and Pardo (2018) aligns the definition of electronic government (digital government in the article) with UNESCO's definition of e-governance from 2011: "*the public sector's use of information and communication technologies (ICTs) with the aim of improving information and service delivery, encouraging citizen participation in the decision-making process and making government more accountable, transparent, and effective*". Electronic government is yet to be a well-defined term and it has a wide range of alternative terms that have become synonymous, e.g. digital government, e-gov, eGovernment, internet government, online government, and connected government. The European Union use the word eGovernment (EG) most frequently on their websites and in their documents, which is the alternative used in this thesis (Davies, 2015; European Commission, 2016).

eGovernment has been studied in different disciplines, e.g. computer science, political science, information science, information systems, business administration and public administration, which means an interdisciplinary body of knowledge has been accumulated and there are varying perspectives, methodologies and themes in the literature (Heeks and Bailur, 2007; Scholl, 2017; Gil-Garcia, Dawes and Pardo, 2018; Wirtz and Daiser, 2018). EG's anticipated benefits and its often realized shortcomings

are key reasons why the topic has aroused interest in academics and practitioners across disciplines (Wirtz and Daiser, 2018). In domains like computer science and information systems, eGovernment research mainly concentrates in information and service delivery using ICT, but the context of eGovernment is broader than that and encompasses also the whole transformation of government and the conception of new democratic opportunities (Helbig, Gil-García and Ferro, 2008).

E-governance is a term often supposed as the same as eGovernment, but the two have a difference. E-governance is considered as a broader term that includes all relationships and networks related to ICT one can find within a government or any other organization (the term is not restricted to governmental environments), whereas eGovernment is a narrower term that refers to electronic services that a government provide for its citizens or businesses (Marche and McNiven, 2003). I will use this demarcation of eGovernment in this thesis. This review will mainly concern the literature regarding the adoption and development of governmental electronic services.

### 2.4.1 Benefits

Scholars see a wide range of benefits in EG. The use of ICT offers the possibility of a more efficient, transparent and effective government (Gil-Garcia, Dawes and Pardo, 2018). With the help of ICT, governments are expected to increase the efficiency and effectiveness of the interaction not only between authorities and citizens or businesses (G2C and G2B), but between government and its employees (G2E) and between different public administrations and governments (G2G) (Carter and Bélanger, 2005). Increased quality of services, financial savings and improved effectiveness of internal government activities is realizable with successful eGovernment projects (Pardo and Tayi, 2007). eGovernment is regarded as a tool for raising public participation and engagement in government (Sahraoui, 2007). EG is also hoped to improve the relationship between government and the public, which according to some studies has declined dramatically over recent decades (Janssen et al., 2018). All in all, eGovernment initiatives are anticipated to raise the level of government performance (Klischewski and Lessa, 2015).

### 2.4.2 Challenges

Creating useful eGovernment is challenging. Some estimates say that EG projects might have a failure rate as high as 85% (Heeks, 2008; Helbig, Gil-García and Ferro, 2008). In

their meta-analysis of empirical EG research, Wirtz and Daiser (2018) found several conceptual and empirical articles suggesting that there are major issues with developing EG, such as EG diffusion and service quality. According to dos Santos and Reinhard (2012), forming an integrated, interoperable technological infrastructure out of fragmented and dispersed systems within a nation, that would provide electronic services of high quality to its citizens, is one of the biggest challenges of EG. Integration of governmental systems would not only encompass data exchange but the integration of processes and transactions too, which makes the implementation of EG not only a technical but also a political, economic, social and organizational challenge. Savoldelli, Codagnone and Misuraca (2014) claim that the deployment of EG has for a long time concentrated mainly on technical and operational matters and that political and institutional issues gained attention later. The authors state that the political and institutional barriers are in fact the main factors slowing down EG adoption and focusing more on them might favor the adoption of EG. Helbig, Gil-García and Ferro (2008) argue that the digital divide is a problem related to EG since many people still have problems with access and use of digital services. As pointed out earlier, the trust in government among the public could be stronger, which is why proving the trustworthiness of EG is of high importance and another challenge, if a government expects citizens to use its electronic services (Janssen et al., 2018).

### 2.4.3 Evolution

Howard (2001) anticipated that eventually most transactions between citizens and public administrations will be done electronically and the way things get done, which is seemingly now taking place. To increase the findability of information and services online, all content should be reachable through an acknowledged common portal or gateway. A portal providing a one-stop-shop or single point of contact (POC) for citizens and businesses to handle their affairs with public administrations is believed to be the ideal set-up for EG. (Sahraoui, 2007; Scholl and Klischewski, 2007; dos Santos and Reinhard, 2012; Sandoval-Almazan and Gil-Garcia, 2012; European Commission, 2017). Sandoval-Almazan and Gil-Garcia (2012) believe that a government portal could also be the central technical component for interaction, participation, and collaboration within government networks and non-government actors.

EG researchers have come up with various EG stage models with differing perspectives. Most stage or maturity models developed by scholars suggest that EGs begin by being a basic information display, but grow more complex, sophisticated and interactive over time (Chen et al., 2007). Chen et al. (2007) presented a model originally developed by Layne and Lee (2001) with four stages or dimensions of EG integration or development: (1) catalogue with online presence and downloadable forms, (2) transaction with services, forms online and a working database supporting online transactions, (3) vertical integration with local systems linked to higher level systems and within similar functionalities, and (4) horizontal integration with systems integrated across different functions and real one-stop shopping for citizens. Gottschalk (2008) constructed a model for maturity levels for interoperability in digital government (EG) including five levels: (1) computer interoperability where technical and semantic issues are solved, (2) process interoperability where work processes are linked, (3) knowledge interoperability where knowledge is shared, (4) value interoperability where benefits are shared, and (5) goal interoperability where goals are aligned. Sandoval-Almazan and Gil-Garcia (2012) devised a model that includes five different functions government portals can have: (1) information display, (2) provision of services, (3) tools for interaction, (4) channels for participation, and (5) opportunities for collaboration. Lee and Kwak (2012) proposed an open government maturity model with five levels of social media utilization in EG: (1) 'initial conditions' where social media is never or seldom used, (2) 'data transparency' where social media is used for increasing data transparency, (3) 'open participation' where the focus is on increasing the public's participation in government work by using social media, (4) 'open collaboration' where collaboration among government agencies, the public and the private sector is promoted, and (5) 'ubiquitous engagement' where the transparency, participation, and collaboration is increased and ubiquitous and continuous engagement is realized. All in all, the research and the models indicate that EG follows regular patterns of growth and evolves toward more complexity and specialization while increasing the interoperability and supporting the transformation of government (Janowski, 2015). As EG evolves, the technical and managerial complexity increases, which means the challenges and risks become larger too.

The evolution of digital systems in other heavily regulated fields has also been towards platform-like environments, with increasing integration of and interoperability between

different organizations' systems. Mattila, Seppälä and Lähteenmäki (2018) show how the financial sector and banking services are undergoing a similar transformation as governments. The authors suggest that this transformation will affect other institutions and guide e.g. public registry holders to move towards platform based strategies.

Researchers have identified three generations of EG, that describe more general and extensive maturity levels (generations) for EG than the maturity and stage models discussed above. The first generation of the World Wide Web or Web 1.0 is the era when the web was a simple information database, with a collection of websites providing information for its users without any interactive content. The corresponding Government 1.0 generation is similar, as in that type of EG the information flows only in one direction, from the government to citizens (Chun et al., 2010). In the first generation, there was no interaction with the public. Hence, some suggested that governments should be open, or so-called Government 2.0s, that refers to usage of Web 2.0 (also called as Participative or Social Web) technologies in governments (Chun et al., 2010; Dixon, 2010). Web 2.0 technologies are social media like blogs, wikis and social networking hubs, where users are involved in the content creation (Chun et al., 2010). Web 2.0 introduced more interactive and dynamic websites, platforms and services of various kinds, which changed the user-computer interaction from a one-way monologue to a dialogue. The idea with Government 2.0 or an open government is that there are transparency, participation, and collaboration in the government and give regular citizens outside public administrations a chance to contribute in the development of a better government (Lee and Kwak, 2012). The Government 2.0 concept is however no longer up to date as it does not match with the newest inventions and innovations in ICT. During the past few years, scholars have been trying to define the upcoming successor to the second generation, Government 3.0, and identify its characteristics.

### 2.4.4 Government 3.0

Web 3.0 has been discussed for some years now and along with it came the Government 3.0 concept. There is no accurate definition for Web 3.0 nor Government 3.0 yet. Yli-Huumo et al. (2018) found that the definitions from the current literature are loose, but seem to have two main perspectives. One perspective refers to the use of new Web 3.0 technologies in governments, such as artificial intelligence, blockchain, and Internet of

Things. The other perspective points to the reorganization of government on several levels, which refers to creating the next generation of infrastructure, organizational structure, processes, and services. The authors categorized the characteristic themes of Government 3.0 concept based on existing literature. The categories are as follows: (1) openness and transparency of government, (2) sharing of data, (3) increased communications and collaborations G2C, G2B, and G2G, (4) reorganization of government through integration and interoperability, and (5) Use of new technologies. What the Government 3.0 concept should do is to further improve the openness/transparency, sharing, communication and cooperation in governments and incorporate citizens and private businesses in the development. Yli-Huumo et al. (2018) also suggested two additional themes to the Government 3.0 paradigm that were identified from research on the Finnish National Architecture for Digital Services program: "cross-border G2G integration" and "increased private development innovations on public services".

One goal of the Finnish National Architecture for Digital Services program was to establish a connection between the Finnish and Estonian government platforms. Since 7 February 2018, the two were connected and cross-border information sharing between the Finnish and Estonian systems was opened. This was one of the first cross-border governmental information sharing systems in the world (Yli-Huumo et al., 2018). There have also been ambitions for cross-border interoperability on the EU level with the Single Digital Gateway regulation and the Once Only Principle, which will be discussed in detail in Chapter 4. Cross-border G2G integration seems to interest several groups, hence it should be involved in the idea of a Government 3.0.

Another identified theme in their studied case was that the public sector is attempting to attract private sector organizations to use the public sector's services when innovating new services. Yli-Huumo et al. (2018) formulated this theme as "increased private development innovations on public services". Involving private companies in the development of a better government should be emphasized and included in the Government 3.0 concept.

### 2.4.5 Interoperability and integration

To attain extensive eGovernment, one main necessity is interoperability between public sector organizations (Pardo, Nam and Burke, 2012). However, employing interoperability might be one of the biggest challenges in EG (Goldkuhl, 2008). Interoperability essentially refers to the ability of two or more systems to interact and exchange data with one another. Dos Santos and Reinhard (2012) define interoperability as the "ability of a system or process to use information and/or functionality of another system or process through the adherence to common standards". According to Pardo, Nam and Burke (2012), EG interoperability is recognized as "the set of policy, management, and technology capabilities necessary for these networks of organizations to achieve information sharing". As Gottschalk's (2008) model discussed previously in this chapter denotes, there are different levels of interoperability in governments, from low to high levels of complexity, and that interoperability does not only involve technical interoperability. EG interoperability is not to be confused with EG integration, even though the concepts are closely linked. Goldkuhl (2008) consider integration as a more abstract concept that is about connecting parts and forming a coherent whole, for example integrating several information systems into one system. The integrated parts would still be separate entities but function together. Interoperability then again is more about data exchange between systems, and when systems interoperate, they remain as separate systems. EG integration is about forming a unit of government entities by merging processes and sharing information (Scholl et al., 2012). EG integration seeks to centralize government services and make a cohesive and seamless whole out of them (Lam, 2005). EG integration can, for example, result in a government web-portal where citizens and business can complete transactions with government agencies without having to visit physical locations (Ebrahim and Irani, 2005). Integration and interoperability often go hand in hand in EG projects and usually one cannot be established without the other (Scholl et al., 2012).

EG adoption in public sector organizations face barriers in both EG interoperability and EG integration aspects. Lam (2005) identified four themes for EG integration barriers: strategy, technology, policy, and organization barriers. Dos Santos and Reinhard (2012) discuss barriers to interoperability and classify them as political, organizational, economic or technological. From EG literature, Scholl and Klischewski (2007) found

nine constraints influencing both EG integration and interoperability: constitutional/legal, jurisdictional, collaborative, organizational, informational, managerial, cost, technological, and performance constraints. In essence, the adoption of EG is far broader than a technical challenge. For EG to work, a thorough transformation of government is needed. To boost EG adoption, managers should put their efforts in overcoming these barriers and eliminating the constraints. One objective of this thesis is to identify methods, techniques and/or approaches that could lower the EG adoption barriers.

## 2.5 Connections between the research topics

Digital infrastructures, digital platforms, and electronic government are all more or less associated with one another. Digital platforms are built on digital infrastructures that provide the necessary ICT technologies. Electronic government has its technical cornerstones in digital infrastructures. Government as a platform is an idea that has gained interest in scholars and some believe that governments will face platformization (O'Reilly, 2010; Linders, 2012; Accenture, 2018). The characteristics of the upcoming Government 3.0 generation discussed in chapter 2.4 are similar to platforms' characteristics (Yli-Huumo et al., 2018).

Constantinides, Henfridsson and Parker (2018) claim that infrastructures are undergoing a process of platformization, since their architecture and control points are becoming more transparent and open because of digitization. Platforms, on the other hand, are undergoing infrastructuring, because they are expanding their reach and scope into supply chain management and becoming more physical. The authors suggest that digital infrastructures and digital platforms are evolving side by side and that they should be studied concomitantly in future research. As discussed in the review, both infrastructures and platforms have a paradox of control. Managers want to have control over their infrastructures and platforms, to prevent them from evolving to something undesired. At the same time, they should allow as much freedom as possible in these environments to foster innovation and untrammeled growth. Similar issues exist in EG integration projects. Public sector organizations often have differing systems, processes, and customs, and to get them to follow the same set of rules can be difficult. However, making

a coherent whole out of diverse systems is equally difficult. Managing and developing infrastructures, platforms and electronic government is quite troublesome.

Government as a platform is a concept coined by O'Reilly (2010). The author suggested that governments should adopt platform-based business models and gain the benefits platforms can offer. The effectiveness of platform-based business models today is undeniable, which is why governments should seek to create platforms too. The author lists seven lessons learned from the platform world that governments should take when trying to harness the power of technology and reorganizing the government: (1) open standards spark innovation and growth, (2) build a simple system and let it evolve, (3) design for participation, (4) learn from your "hackers", (5) data mining allows you to harness implicit participation, (6) lower the barriers to experimentation, and (7) lead by example. O'Reilly ends the article by giving concrete instructions on practical steps government agencies should take, when platformitizing government. A recent consultancy report proposes that governments are evolving to platforms and that this is a natural part of their progression (Accenture, 2018). The power of government as a platform is that governments would gain data currency, the user experience would be streamlined with a single point of contact, governments could enjoy network effects, and skills and ideas would be shared over the network without any ownership. It appears as if using at least some elements of platforms in EG would be fruitful for both citizens and authorities.

Wirtz and Daiser (2018) state that EG research has been directed towards an open-ended environment, because there are ongoing advancements in ICT that has made the EG a dynamic field and the implementation of EG have continuing difficulties. In their meta-analysis of empirical EG research, they found several topics and approaches to EG. Their implications for future research state that there exists only little quantitative empirical EG research of intergovernmental aspects, and that there is plenty of potential in carrying out investigations from both user and provider perspectives. Criado (2012) studied interoperability of EG in the European Union and suggested that research on intergovernmental interoperability and integration should be done to further develop this area of investigation. The variation between systems that are to be integrated should be examined, for finding out more about the benefits and challenges that lie in intergovernmental EG collaboration.

In this thesis, I aim at identifying and classifying resources provided by leading parties in an EG project that resemble platform boundary resources. Resources provided by EG system owners that help public sector bodies in EG adoption and also resources that maintain the government's control over the EG. As a conceptual framework, I use an adapted version of the boundary resource model shown in Figure 4. According to Figure 3, digital platforms have three groups of actors called platform owners, third-party developers and end users. Similarly, these three groups also exist in electronic governments but are comprised of different bodies. In the governmental setting the platform owner is (usually) the government itself or some governmental body, the third-party developers can be any organization, public or private, that are somehow involved with public sector services, for example, municipalities, healthcare centers or a transport safety agency, and the end users are citizens or businesses. In addition, the description of the relationship between the end user and the platform in Figure 3 is not fitting for the conceptual framework in the governmental context. A citizen or business representative does not choose what governmental platform they visit. A more suitable description for the relationship would be that the platform and its owners serve the user. In this conceptual framework, the supposition is that there is no competition between governmental platforms and that there are no third-party actors developing alternative platforms for doing public administration procedures online.

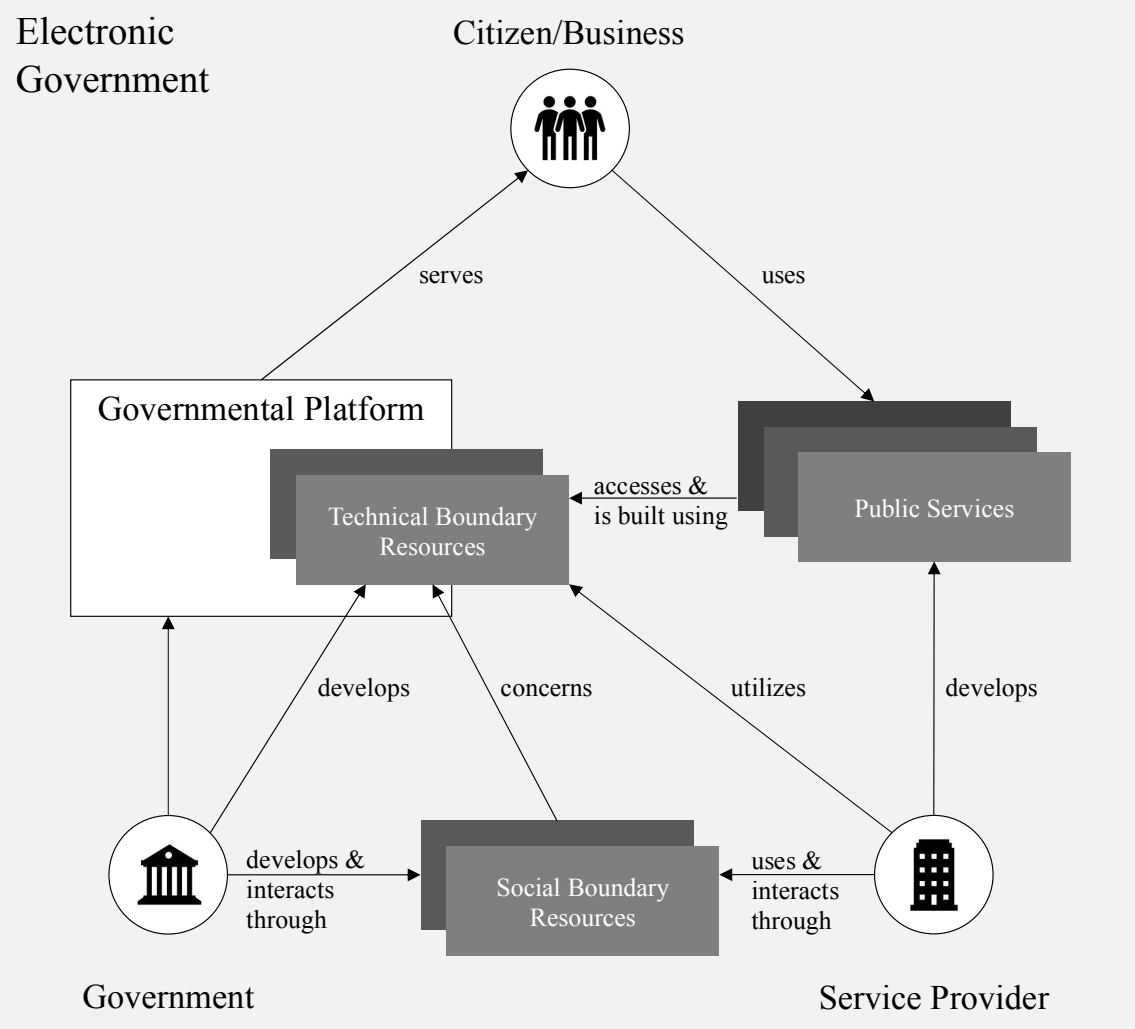


Figure 4. Boundary resources in electronic government, based on Myllärniemi et al. (2018) and Bianco et al. (2014)

# 3 Research methodology

This chapter presents the study's research methodology. The research process is described in chapter 3.1. Chapter 3.2 presents the case study design. Chapters 3.3 and 3.4 explain how the primary and secondary research data was collected and analyzed.

The empirical part of this research is an explorative and qualitative case study of electronic government environments and their resources that resemble digital platform's boundary resources. The objective is to identify what kind of boundary resources exist in electronic government and what factors either support or hinder the development and adoption of EG. Qualitative research methods were considered the most appropriate for answering the chosen research questions. Qualitative data collection methods include, e.g. studying archives, conducting interviews and/or questionnaires, and making observations (Eisenhardt, 1989). In-depth interviews with Finnish EG specialist was expected to give the widest outlook of the boundary resource in a governmental platform setting. To support the interviews, thorough desktop research was also conducted. Because of the novelty of the research subject, a case study was seen as the best fit (Eisenhardt, 1989).

## 3.1 Research process

In this research, I roughly followed the eight steps of the case study method defined by Eisenhardt (1989). I started by formulating initial research questions to give the work some direction. Unlike Eisenhardt's suggested order of activities, the case was chosen prior to defining the questions. Secondly, qualitative data collection methods were selected, since they were considered most suitable for the case in question. The next step was to 'enter the field'. The author spent 11 months in total getting familiar with electronic government and the EU regulation (discussed in chapter 4), accumulating knowledge about the subject throughout the period. Flexible and opportunistic data collection methods were customary and this resulted in an iterative cycle of redefining the research questions. This forced me to shift the focus of the thesis a few times. The last

steps included analyzing the collected qualitative data, finding results in the data and finally comparing them to the literature and reaching a closure.

The research process can be divided into four main phases:

1. Exploring the research of digital infrastructures, digital platforms, and electronic government and making a synthesis of existing literature (reviewed in chapter 2).
2. Desktop and secondary research of EU's Single Digital Gateway, the Finnish eGovernment platform Suomi.fi and the Finnish labor market platform Työmarkkinatori.
3. Primary research by doing qualitative interviews with Finnish EG specialists involved with the studied cases.
4. Analysis of gathered data.

The first phase of the research was about gaining knowledge of the fields mentioned above. While studying the literature I aimed at making connections between the fields and identifying similarities in them. The goal was to distinguish features of digital platforms that are applicable to electronic government. The second phase was about detecting signs of platform boundary resources in electronic government through an exploratory case study. An empirical investigation was conducted for identifying resources comparable with platform boundary resources that are noticeable in the setting of an intergovernmental digital system. Thirdly, interviews with people involved with EG in Finland was conducted, for acquiring some primary research data. The goal was to get some inside perspective of EG development. The last phase was to analyze the collected data and making a synthesis out of it.

With the flexible and opportunistic research approach taken, a few iterations over the three first phases was inevitable. For example, the initial plan was to only study one subunit of the SDG case in the Finnish EG, Suomi.fi, but after conducting the fourth interview I was introduced to the labor market platform Työmarkkinatori and decided to examine it as a second subunit. Before conducting the last two interviews and starting the data analysis, I returned to do desktop research on the second subunit. Also, the initial research questions only concerned the topic of the final RQ1. Since all interviewees shared insights into how EG development and adoption usually proceed and what factors

influence it, I decided to include a second research question (RQ2) to the study. However, the research phases and process remained the same in the big picture.

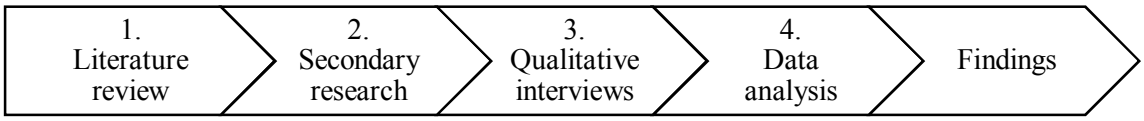


Figure 5. Research process

## 3.2 Case study design

The case in question is the European Union's regulation for establishing a digital portal to provide access to information, procedures, and assistance and problem-solving services from all EU member states to all EU citizens and businesses (European Commission, 2018b). A detailed presentation of the case is in chapter 4. In this qualitative research, I follow an exploratory embedded case study design proposed by Yin (2009), also discussed by Eisenhardt (1989). Yin states that exploratory case studies are used for defining questions and hypotheses for developing consecutive studies. Since exploratory case studies have an intuitive approach, they are well suited for studying phenomena that are not yet recognized (Streb, 2012). Therefore, an exploratory case study design is applicable to the topic of boundary resources in governmental digital platforms. Eisenhardt's process of inducting theory using case studies is also considered (Eisenhardt, 1989). According to Eisenhardt, the proposed research approach is particularly appropriate in new topic areas (1989). Little to no research on governmental boundary resources have been conducted.

The study has an embedded single-case design, with three units of analysis. The first unit of analysis is the union and their Single Digital Gateway (SDG) regulation and the two subunits are the Finnish eGovernment platform/portal called Suomi.fi and the Finnish Työmarkkinatori (TMT), a platform for connecting both private and public employers with potential employees. Both of them are to be connected to the EU-wide portal. Diving into an embedded subunit of the SDG-regulation, instead of only taking a holistic approach to the case, gives a closer look to the phenomena on an operational level (Yin, 2009, p. 50). Both of the studied subunits can also be considered as independent platform

ecosystems. Studying the boundary resources of each unit of analysis separately gives different perspectives to boundary resources in governmental settings, which enrich the answers to both research questions.

It is worth noting that single case studies are more vulnerable than multiple case studies since multiple case studies provide greater analytical benefits than single case studies. Multiple case designs should always be preferred over single-case designs since there is always a risk that some single case is unique and distinctive from other cases. Two embedded subunits in the analysis will still give a richer view of the phenomena. (Yin, 2009, p. 60)

The approach to the case design is flexible and adaptive. I chose to stay open to modifications in the case design throughout the research process. New information acquired in the data collection phase might require changes in the design (Yin, 2009, p. 62). Deciding to take Työmarkkinatori as a second subunit in the analysis is an example of this. Flexible and opportunistic data collection methods were used and iterative cycles were done in the theory-building part (Eisenhardt, 1989).

A weakness of case studies is that they may generate narrow and idiosyncratic results (Eisenhardt, 1989). Hamel, Dufour and Dominic (1993) point out that the subjectivity of the researcher and others involved in the case might cause a lack of rigor in the collection, construction and analysis of the empirical material. The case study results may not be generalizable. For this reason, the main goal of this study is not to generate generalizable theory but to raise problems and devise definitions related to the topic. One aim case studies can have is to provide descriptions, which is the aim of this study (Eisenhardt, 1989).

## 3.3 Data collection

Case studies often combine different data collection methods, e.g. archives, interviews, questionnaires and observations (Eisenhardt, 1989). The data in case study research can be either qualitative, quantitative or both, but for this specific case, no value in gathering quantitative data was seen. Data and knowledge were acquired by reading literature, available documents related to the regulation, observing the progress of the project and

interviewing EG specialists in the field. When conducting case study research, it is not recommended to rely on individual sources of evidence (Yin, 2009, p. 114). Therefore, I aimed at finding multiple sources of evidence. The goal was to convergence the collected evidence through triangulation to form a more convincing conclusion. Both secondary and primary research data was collected.

The data collection had two main parts:

1. Secondary data collection by reviewing i.a. academic papers, governmental documents, news articles and websites
2. Primary data collection through qualitative interviews with Finnish experts involved with the studied case

All the collected secondary data were saved in a case study database. I highlighted important information in the archive documents and starred the most important documents. All websites that contained essential information about the EG projects were bookmarked and frequently visited. I used MS Word for storing field notes. In the primary data collection, I conducted semi-structured or unstructured in-depth interviews favoring open-ended over closed-ended questions. In total, six interviews were conducted between August 2018 and April 2019. All interviews were recorded and transcribed to text. The interviews are listed in Table 2. I also joined Työmarkkinatori's joint development environment described in chapter 4.3.1.3 to get inside perspective to the resource.

As a case study database, I used a laptop computer, where all files were stored both locally and in the cloud. I used Microsoft OneDrive for storing the field notes, interview transcripts, the thesis document, and other related material. Mendeley Desktop was used for storing all the academic literature as well as the documents, news articles and other files related to the EU regulation and other EG initiatives.

Table 2. Interviews

| # | Date | Main Topic | Organizational type | Role in organization | min |
|---|---|---|---|---|---|
| 1 | 8.8.2018 | Interoperability solutions | Developer of interoperability solutions | Technical manager | 46 |
| 2 | 15.8.2018 | Electronic identification | Ministry | Development manager | 39 |
| 3 | 13.9.2018 | Implementation of SDG in Finland | Ministry | Specialist | 69 |
| 4 | 5.3.2019 | Implementation of SDG in Finland | Governmental center of development and administration | Finnish National Coordinator of the SDG | 59 |
| 5 | 28.3.2019 | Implementation of TMT | Governmental center of development and administration | Business owner | 61 |
| 6 | 1.4.2019 | Implementation of TMT | Governmental center of development and administration | Business owner | 54 |

## 3.4 Data analysis

In the analysis of the interview transcripts, I used two of the three basic types of coding in grounded theory research: open and axial coding (Corbin and Strauss, 1990; Bohm, 2004; Saldaña, 2016). ATLAS.ti coding software was used in the analysis. Before starting the open coding, I created preliminary codes that I expected or knew to be found in the transcripts. When doing the open coding I labeled relevant words, phrases, sentences and sections. While carrying out the first round of the analysis, new concepts were identified in the data and new codes were created. Before moving on the second round and the axial coding, I re-read the transcripts, modified some of the created codes, and composed some new ones. After the open coding phase, I had 203 codes in the interview data. In the axial coding part, I began by picking the most important codes. I identified patterns and similarities in them and developed some themes and categories for the codes. In total,

twelve themes were identified in the codes. I then boiled down the twelve themes to six main categories. The relevant categories were named:

1. Administrative and legal challenges (27 codes)
2. Ambitious goals (15 codes)
3. Communication between implementers and legislators (20 codes)
4. Cross-border identification (25 codes)
5. Interoperability (15 codes)
6. Level of detail in regulations (13 codes)

The categories and the relevant codes in them are presented in chapters 5.1 and 5.2.

In the data collection, I aimed at using multiple sources of evidence as suggested by Yin (2009). I searched the web extensively for secondary research data related to all three studied EG environments, I interviewed people involved with all three different EG environments, participated in an EG conference in September 2018 and have been observing the overall EG situation in Finland for the past two years. In the final phase of the data analysis, I conducted data triangulation on all gathered evidence to make the most convincing conclusions possible. In data triangulation, the researcher uses data from multiple sources of evidence to corroborate the same fact or phenomena (Yin, 2009). Analyzing three instances of EG gives multiple measures of the same phenomena, which increases the reliability of the study. Case studies using multiple sources of evidence are generally rated higher than case studies relying on single sources of information (Yin, 2009).

# 4 Case study

The structure of this chapter is as follows. The main unit of analysis in this case study is the European Union's Single Digital Gateway, which will be discussed first in chapter 4.1. The subchapter starts with the origin of the regulation after which the core functionality of the SDG and the boundary resources supporting its development are outlined. Subunits in this case study analysis are the Finnish eGovernment platform called Suomi.fi and a Finnish labor market platform called Työmarkkinatori. Both of these digital environments are to be connected to the SDG. The origin, core functionality and boundary resources supporting the creation of Suomi.fi and TMT are discussed in chapter 4.2 and chapter 4.3.

## 4.1 Single Digital Gateway

### 4.1.1 EU's Single Market

In the Treaty of Lisbon, signed by the European Union on 13 December 2007, one of the main goals set for the union was to "promote economic, social and territorial cohesion and solidarity among member states" ('Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community', 2017). 'Freedom' was listed among EU's core values in the treaty, which meant among other things that citizens should have the right to move and reside freely anywhere in the union. To increase the freedom of EU citizens and to reach the goal of a truly united union, the EU has been striving to create a European Single Market. A single market is defined as an intergovernmental agreement where most trade barriers have been removed (Fligstein and Mara-Drita, 1996). The main aim of the European Single Market is to allow free movement of goods, service, people and capital, occasionally referred to as the "four freedoms" (Barnard, 2013), within the European Union. An effective single market is assumed to spark competition and trade, cut down prices, increase quality and improve efficiency (Davies, 2015). The single market has been considered as the economic engine of the union. The Commission states that the European Single Market is one of EU's

greatest achievements, which has amplified the economic growth and made life easier for both consumers and businesses. The single market continues to develop towards its full potential.

With the advancement of digital infrastructures and electronic services, new opportunities for increasing the interaction between member states has risen and along them comes new challenges. The full potential of digital tools has not yet been utilized in e.g. the governmental activities of the EU. With the help of new technologies and better management, it is believed that the interconnectivity between the member states could be even further increased.

### 4.1.2 Digital Single Market

In 2015, Juncker's EU Commission announced the Digital Single Market Strategy that supported the formation of a European Single Market in digital environments (European Commission, 2015). The goal is to remove the digital trade barriers or other digital obstacles citizens and businesses might face when surfing online in the union. The union wants to ensure access to online goods and services for all EU's citizens and businesses, regardless of their nationality or current place of residence.

The strategy has three pillars:

1. Better access to online goods and services around Europe
2. Creating good conditions for digital networks and services to thrive
3. Increasing the growth of the European Digital Economy

A connected Digital Single Market is expected to boost Europe's economic growth, creating new jobs especially for younger generations (European Commission, 2015). Creating a Digital Single Market has been declared as one of the union's highest priorities (Juncker, 2014).

One component of the Digital Single Market is eGovernment. Public services are being digitized alongside technological progress, and this is changing the way citizens and businesses interact with governmental institutions. More and more of the contact between citizens and governments is moved to online locations as time goes by. However, when dealing with public administrations online, especially abroad, citizens and businesses face

difficulties (Duke, 2018). EU leaders believe the online interaction between the government and citizens should be smoother than it currently is. "Online public services are crucial to increasing the cost-efficiency", which is why the Commission wants public services to be digitized and made user-friendly for citizens and businesses (European Commission, 2015).

In connection with the Digital Single Market Strategy, the union has developed the E-Government Action Plan 2016-2020. As stated in the plan, "the digital transformation of government is a key element to the success of the Single Market" (European Commission, 2016). The union is attempting to accelerate the digital transformation of government with the plan. The vision is to have public administrations in the union that are providing digital services that are borderless and user-friendly. Opening the services between public administrations to work within and across borders is expected to increase efficiency and help the free movement of citizens and businesses. One of the actions in the plan is to create a Single Digital Gateway. Some other actions in the plan are complementary with the SDG and will contribute to the success of it, which means that the SDG will have to be developed in parallel with a few other initiatives. Establishing it unaccompanied would not give the desired results. The SDG regulation is presented in the next chapter. The eIDAS regulation and the Once-Only-Principle that are supporting the SDG are described in the subchapters following the next chapter.

### 4.1.3 The Single Digital Gateway regulation

In 2013, the Internal Market and Consumer Protection (IMCO) committee conducted a study where features and added value of a European single point of contact were discussed. The objective of a single point of contact is that users could access an extensive range of information and services through a single platform or portal. It could be compared to a governmental shopping mall where citizens can find a variety of goods and services in one centralized space. In the study, the early recommendation of creating a Single Digital Gateway for the EU was made, which would function as the single point of contact. Since then, the gateway has been enforced various times. On 2 October 2018, the act was finally signed by the Commission (European Commission, 2018b).

*Case study*

The regulation has three main objectives (European Commission, 2018b):

1. To minimize the amount of paperwork needed when exercising internal market rights as a citizen or business.
2. To eliminate discrimination and offer equal opportunities to each EU citizen.
3. To guarantee a functioning internal market.

Using the right to free movement in the EU as a citizen or a business should be far less problematic than it has been. The barriers to accessing information and services are causing large costs for citizens and businesses. Estimations say the costs of finding information for cross-border activities could be as high as 57,2 billion euros per year (Duke, 2018). It is believed that a Single Digital Gateway for all EU member states could significantly alleviate the processes and minimize costs. It is estimated that in total, businesses in the union could save 11 billion euros and EU citizens could save 855 000 hours per year with the gateway (European Commission, 2017).

When going abroad to study, work or travel one might need to find information about the nation's rules or problem-solving and assistance services. As the studies have shown, people and businesses face obstacles while trying to find the information online (Duke, 2018). The information and services are scattered around different websites, which can cause a time-consuming process for the user. The IMCO study from 2013 found that there are 44 different contact points (websites) on the union level and 22-61 contact points on national levels (European Commission, 2013). What the Single Digital Gateway would do is gather all the information and services, meaning web links to the pages where one can find the information or service, on to one platform or portal. EU already has a portal called Your Europe that partly does this, but is quite undersupplied. According to the IMCO study, the awareness of the existence of services for cross-border activities is low. Citizens and businesses do not know where to turn when they want to go abroad to study, work or travel (European Commission, 2013).

*Case study*

The Single Digital Gateway should help make the most out of the Single Market and change the way users experience the Single Market. The gateway's core purpose is to allow access to the following from any EU member state through one platform or portal (European Commission, 2018b):

1. Information about national rights, obligations and rules
2. Public administration procedures
3. Assistance and problem-solving services.

The gateway will manage the "front office" of public administrations, meaning that there will be no technical integration between member states' administrative procedures. However, for being able to complete public administration procedures in a member state other than the citizen's home country, some level of interoperability between the public administrations in different member states is needed. Citizens and business representatives should have the opportunity to authenticate themselves when completing procedures using their personal identification number and request that some data or documents already submitted to some governmental body can be exchanged between administrations if need be, and in these cases interoperability is needed. The gateway's core purpose is to connect users and administrations, by ensuring access to any information, procedure or service for any citizen or business across member states' borders. How and where each member state provides the content is up to them, as long as the desired contents are found online. The union and the gateway will ensure that the content is delivered to businesses and citizens. (European Commission, 2018b)

What specific content is demanded in the Gateway is listed in the regulation's Annexes. Annex I lists the relevant areas of information for citizens and businesses utilizing their Single Market rights, Annex II lists procedures and Annex III assistance and problem-solving services. The areas of information in Annex I is listed in Table 3. The 21 requested public administration procedures in the regulation are organized around certain life events: (1) birth, (2) residence, (3) studying, (4) working, (5) moving, (6) retiring, (7) starting, running and closing a business. The complete Annex II is presented in APPENDIX II of this thesis. The listed assistance and problem-solving services in SDG's Annex III are: (1) Points of single contact, (2) Product Contact Points (2), Product Contact Points for Construction, (4) National assistance centres for professional qualifications, (5)

National contact points for cross-border healthcare, (6) European network of employment services (EURES), (7) Online dispute resolution (ODR). (European Commission, 2018b)

Table 3. Information about rights, obligations and rules for citizens and businesses

| **Area of information for citizens** | **Area of information for businesses** |
|---|---|
| Travel within the Union | Starting, running and closing a business |
| Work and retirement within the Union | Staff |
| Vehicles in the Union | Taxes |
| Residence in another Member State | Goods |
| Education or traineeship in another Member State | Services |
| Healthcare | Funding a business |
| Cross-border family rights, obligations and rules | Public contracts |
| Consumers in cross- border situations | Health and safety at work |

The Single Digital Gateway will be built upon EU's already existing Your Europe –portal. This portal is designed to help EU citizens and businesses when studying, working, travelling or doing business abroad in another member states. The portal focuses on real-life cross-border situations and aims at providing the help and information one might need when finding oneself in such a situation. Essentially the current Your Europe portal is a primal version of what the SDG is expected to be. Your Europe covers at present much of the objectives of the SDG regulation. The regulation will aim to upgrade Your Europe and make it more reachable and effective. The current awareness of Your Europe is low among citizens and businesses. Having a portal like Your Europe becomes pointless if end-users do not know what it is or cannot find it. The portal is expected to be improved and brought forward to the public with the regulation. Your Europe can be viewed as a good starting point for a Single Digital Gateway (Duke, 2018).

#### 4.1.3.1 eIDAS regulation

The Electronic Identification, Authentication and trust Services regulation, or eIDAS for short, lays a set of standards in the union for electronic identification for electronic transactions. The union wishes member states would use the same identification tools to alleviate cross border activity and make Europe's internal market accessible for everyone. Since the Single Digital Gateway will guide users to some services that require identification of the user, the success of the SDG regulation is directly linked with

eIDAS's success. If some citizen or business cannot reach a service because they cannot authenticate him- or herself, the Gateway would not differ much from the existing Your Europe –portal. A requirement for the procedures' cross border functionality is that the identification is done with a high assurance level. According to the eIDAS regulation, identification tools can be divided into three assurance levels: low, substantial or high. The eIDAS regulation will require high-level authentication across member states' borders, which goes hand in hand with the SDG regulation. According to the regulation, by 29 September 2018, all public administrations in the union providing digital services should have recognized eIDAS notified identification tools. This, however, has not been achieved in Finland and some other member states. (European Commission, 2014, 2018b; Eichholtzer, 2019)

#### 4.1.3.2 The Once-Only Principle

Once every country in the union have their digital government platforms up and running, the challenge is to make the systems from different member states responsive to each other. In the long run, the union is trying to achieve cross-border interoperability between member states' governments. The Once-Only principle (TOOP or OOP) has the idea that after some information is requested by a citizen, say their education, it should not have to be asked again later by the same or any another public administration. The ultimate goal is to have all public administration databases connected in this TOOP architecture. In the European Single Market, this would mean that the information could be transferred across borders so that public administrations from other member states also access the information. In other words, the information about some citizen's education should be accessible by other EU nations' governments too. (European Commission, 2016)

### 4.1.4 Boundary resources in the Single Digital Gateway

This chapter presents resources that could be referred to as boundary resources in the Single Digital Gateway context. An important aspect to bear in mind is that the SDG is at the time of writing in an initial stage, meaning that some potential boundary resources might have not been created just yet.

The SDG regulation will enhance the already existing Your Europe -portal, that will eventually resemble conventional digital platforms found in the private markets. To

illustrate how the portal is similar to digital platforms, I use the conceptual framework presented in Chapter 2.5 (Figure 4) that is based on Myllärniemi et al.'s (2018) and Bianco et al.'s (2014) boundary resource models (Figure 3) shown in Chapter 2.3.1. The SDG platform environment is depicted in Figure 6. Digital platforms consist of three groups of actors, the platform owners, the third-party developers and the users of the platform, as shown in Figure 3. In Your Europe -portal, there are signs of these three groups too, but the actors mainly come from the public sector, not the private. The platform owner in the case of SDG would be the European Commission. The third-party developers are the member states and public administrations within these countries. Users of Your Europe are not only the citizens but also businesses or representatives of businesses. The initial

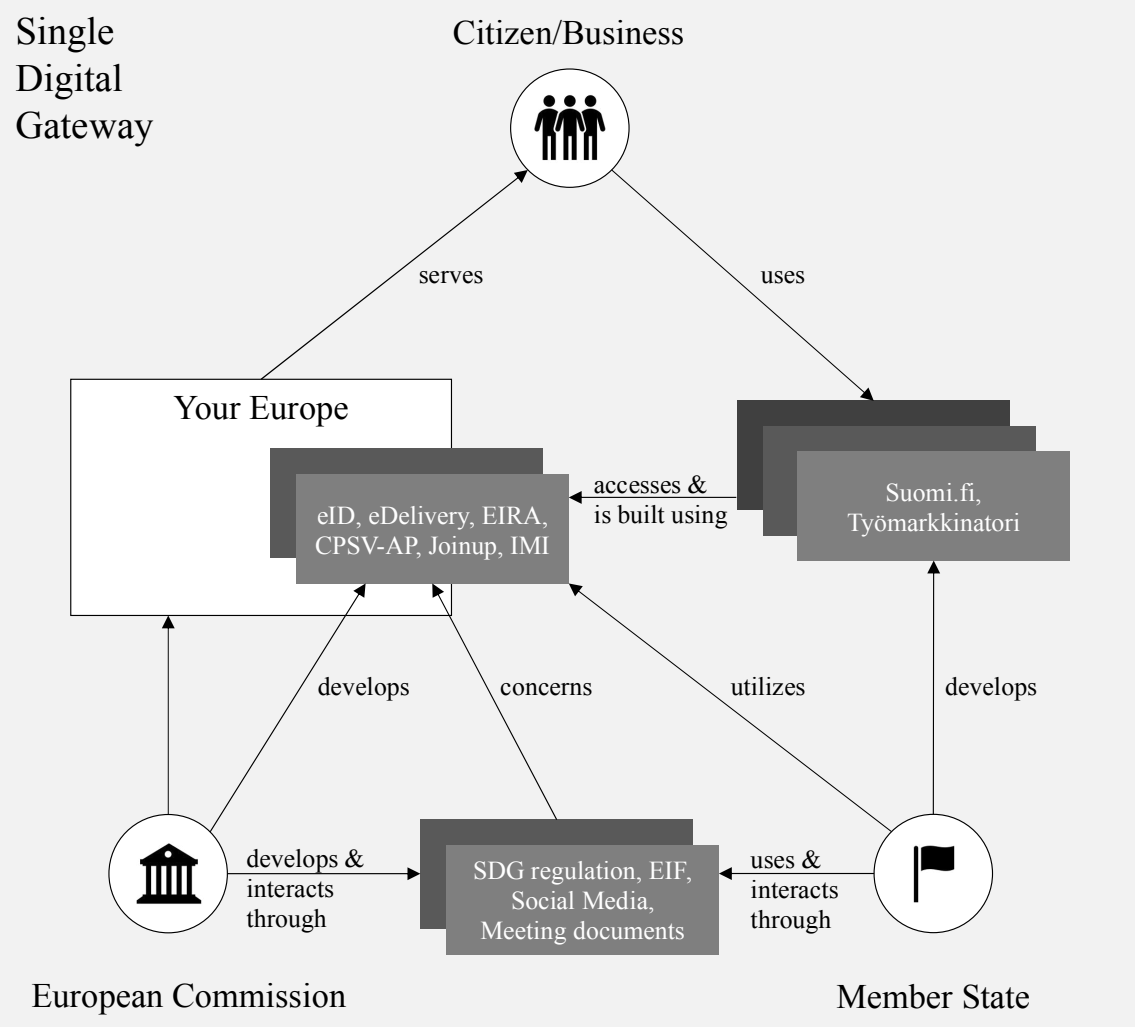


Figure 6. SDG Platform Ecosystem, based on Myllärniemi et al. (2018) and Bianco et al. (2014)

supposition of this study was that some sort of social and technical boundary resources that help the member states and the public authorities in them create contents for Your Europe should exist.

On 21 November 2018, the European Parliament and Council made a publication of the regulation (EU) 2018/1724 on "establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services" in the Official Journal of the European Union (European Commission, 2018b). In any governmental initiative, be it a healthcare reform or the implementation of electronic government, some sort of regulatory document is required that gives guidelines on how the initiative is to be achieved. Like in most government projects, SDG's regulatory document contains the main instructions for implementing the Single Digital Gateway across the union. This being the case, perhaps the most important boundary resources in this project is the document itself.

However, the document describes the elements and functionality of the Gateway only on an overall level and does not give the developers and/or service designers concrete step-by-step instructions on how to fully implement it. The commission deliberately gave the member states the freedom to make their own national portals or platforms that can be connected to the gateway, which is presumably one of the reasons why there are not detailed instructions for most parts of the gateway in the document. Nevertheless, complementary boundary resources that support and encourage member states to create the desired contents and connect their national solutions to the EU-wide portal undoubtedly accelerates the process of creating a single point of contact to all EU citizens. Some boundary resources the European Commission is providing to its member states for supporting the creation of the Single Digital Gateway in each EU country will be presented in the subchapters below.

#### 4.1.4.1 CEF Digital

The Connecting Europe Facility program, CEF for short, is a funding instrument by the union that is among other things used for promoting and supporting the creation of European digital services. The program's 'CEF Digital' entity is providing what they call digital building blocks for public administrations as well as private actors across the union to facilitate the delivery of digital services to EU citizens. These building blocks are

apparent boundary resources for creating cross-border digital services in the union, since they "consist of technical specifications, sample software and supporting services, and aim to ensure interoperability between the existing information and communication technology (ICT) systems in different member states" (European Commission, 2018b). Building blocks CEF Digital is providing are called eDelivery, eID, eInvoicing, eSignature, eTranslation, and eArchiving. According to the SDG regulation document, eDelivery and eID should be used in the technical system of the SDG (European Commission, 2018b). (CEF Digital, no date)

*eID identification*

A prerequisite for completing most of the 21 procedures in the SDG regulation is that citizens can electronically authenticate themselves anywhere in the union. Hence, eID identification will be a cornerstone in the functionality of the SDG and the services found through the portal. The eID building block on CEF Digital is one of the most important resources for the SDG. CEF Digital's website includes detailed and systematic instructions for employing the eID identification tool.

*eDelivery*

The building block can be used for secure and reliable exchange of documents and data across different sectors of public administrations both inside and over national borders. For some of the 21 SDG procedures to be completed, certain documents or data have to be delivered from one administration to another. If public administration organizations have common technical specifications, interoperability is easily achievable and the exchange of the documents and data become effortless. The eDelivery solution can be used for creating common technical specifications. CEF Digital's website includes detailed and systematic instructions for setting up eDelivery in a government organization.

#### 4.1.4.2 ISA$^2$

ISA$^2$ is another program supporting the creation of digital public administration services in the EU. The program is running from 1 January 2016 to 31 December 2020 and is a successor to the first ISA program that ran 2010-2015. The name of the program is derived from 'interoperability solutions for public administrations, businesses and

citizens'. The purpose of the program is to create digital interoperability solutions or components that can be used in public administrations in the EU. In practice, the program is reinforcing 54 actions that focus on developing tools, services, and frameworks regarding interoperability. For example, one of the actions is called '2017.05 Interoperability requirements for the Single Digital Gateway implementation', which aim at constructing the technical basis for a common architecture for the SDG. The action's purpose is to develop the necessary support IT tools for the Single Digital Gateway for increasing the interconnectivity between member state level IT tools and EU level IT tools, and help improve the future gateway while it is being developed. (European Commission, 2018a, no date)

Some of ISA$^2$'s actions have already resulted in operable solutions. Below are some solutions that could potentially be useful for the Single Digital Gateway.

*EIRA*

The European Interoperability Reference Architecture (EIRA) is an ISA$^2$ solution that is meant for public administrations who are about to develop cross-border public services. What EIRA does is that it classifies and organizes interoperability building blocks used in public services under one roof. The goal of EIRA is to encourage reuse of already existing interoperability solutions and help public administrations keep costs down when creating eGovernment systems.

*Core Public Service Vocabulary Application Profile (CPSV-AP)*

The CPSV-AP is a common data model for describing public services online. The solution is meant for public administrations about to create an online catalogue or portal of their public services. The CPSV-AP model suggests describing these services in a standardized and semantic way so that they are well structured and machine-readable. The intention of CPSV-AP is that the descriptions from various different administrations would have a uniform format so that portals such as the SDG would provide the information on services in a consistent and user-friendly way. The information on the services would also be grouped logically around specific business or life events. The solution offers a toolbox that public administrations can use when creating or exchanging CPSV-AP-based descriptions of public services.

*Case study*

*Joinup*

Joinup is an ISA$^2$ solution built for sharing and reusing interoperability solutions. It is a collaborative platform that encourages public administrations to cooperate. The platform has gathered almost 2,800 solutions for interoperability and has 13,000 eGovernment professionals registered to the site.

*The New European Interoperability Framework*

In addition to the actions and solutions, the ISA$^2$ program promotes and maintains a European Interoperability Framework (EIF). This framework gives concrete recommendations, common principles and models as guidelines for public administrations around Europe planning to develop interoperable public services and wanting to establish cross-organizational relationships. EIF distinguishes four layers of interoperability in digital public services: legal, organizational, semantic and technical. The framework aims to help in each of these layers of interoperability. The key goal of the framework is to promote electronic communicating between public administrations, not only nationally but internationally too, and contribute to the making of a digital single market. (Vann and Atherton, 2017)

#### 4.1.4.3 IMI

Internal Market Information System (IMI) is an online tool used for the secure exchange of information between different public authorities. This communication tool is designed to help EU countries share information with each other. IMI's key goal is to improve the performance of the EU's internal market by facilitating the administrative cooperation between member states. The system is available in all official union languages to avoid language barrier complications. The first information exchange over the system took place in 2008. Today, there a more than 8,200 registered authorities with over 18,000 registered users on IMI. The SDG regulation states that the IMI system should be used when verification of evidence is needed from another Member State. The regulation also promotes the use of IMI for administrative cooperation. (European Commission, 2012, 2018b)

#### 4.1.4.4 Other resources

The YouTube channel 'EU Growth' uploaded a video called 'Building the single digital gateway together' on 10 December 2018 (EU Growth, 2018). The video is an explanatory and instructional video about the SDG. It explains comprehensively what the SDG is about and it mentions the important fact that this regulation is for all public administrations around Europe, not only the national coordinators of the SDG. The video could be viewed as a boundary resource. Other videos on the channel are related to digitalization of the public sector too. Other YouTube channels the union uses for communication are called 'European Commission', 'European Parliament', 'Council of the EU' among others. To conclude, the Commission is seemingly using social media as boundary resources too.

The SDG national coordinator meetings where all member states get the chance to influence the SDG by bringing national concerns about the portal to on the table, generate valuable minutes that can be used for the further development of Your Europe. Therefore, these meetings could be viewed as boundary resources in the case of electronic government.

#### 4.1.4.5 Summary of boundary resources in SDG

In the case of the Single Digital Gateway, both social and technical boundary resources for the member states are provided. The focus seems to be more on social than technical resources. Following Bianco et al.'s (2014) onion model for boundary resources in digital platforms presented in chapter 2.3.1 (Figure 1), all the resources found for the SDG are also believed to have at least some social component in them. That being said, all the resources listed in the previous subchapters are considered as social boundary resources. According to the onion model, the technical boundary resources can be split into two: application and development BRs. The resources that enable the developer to interact with the platform are application BRs, and in the SDG case, eID is an example of a boundary resource that requires interaction with the platform. Development BRs, on the other hand, are resources used in the development of services but do not require interaction with the platform. In the SDG, technical solutions or components found on e.g. Joinup are considered as development BRs but not application BRs. All SDG BRs are listed in Table 4.

Table 4. Boundary resources in SDG

| **Boundary resource** | **Application BR** | **Development BR** | **Social BR** |
|---|---|---|---|
| SDG regulation | | | x |
| eIDAS identification | x | x | x |
| eDelivery | x | x | x |
| EIRA | | x | x |
| CPSV-AP | | x | x |
| Joinup | | x | x |
| EIF | | | x |
| IMI | x | x | x |
| Social Media | | | x |
| Meeting documents | | | x |

## 4.2 Suomi.fi

The first subunit in this case study analysis is the Finnish eGovernment platform called Suomi.fi.

The National Architecture for Digital Services Program, known as KaPA (Kansallinen Palveluarkkitehtuuri) program in Finnish, was run in Finland in 2014-2017 with a € 100 million budget, which aim was to create governmental electronic services for citizens and businesses. The program was successful and ended in time and under budget. (Finnish Government, 2017)

The intention was to create a digital infrastructure facilitating information transfer between administrations in the country. In addition, transactions by citizens, businesses and other organizations with the Finnish authorities were hoped to be alleviated with the creation of the digital infrastructure and the e-services. The program was also expected to promote openness in public administration, raise cost-efficiency with online services and support the national economy by creating new opportunities for private sector businesses. (Ministry of Finance, 2017)

On 15 July 2016, the Electronic Transaction Act or so-called KaPA law entered force, which accelerated the deployment of the e-services among governmental organizations (Ministry of Finance, 2016). The deployment and development of the services have not however stopped after the program ended. The Finnish Population Registration Centre, which has overseen the development of the services, has created roadmaps for the future development of Suomi.fi services (Population Register Centre, 2019).

The services the program yielded were developed on the Suomi.fi domain, which existed already prior to the KaPA program. The previous Suomi.fi pages contained some information and forms about procedures with public administration solely for citizens. Businesses visited a separate site called yrityssuomi.fi for their transactions with the government and when searching for relevant information. One of KaPA program's objectives was to merge the two sites on the same Suomi.fi domain. Also, asiointitili.suomi.fi, a third website and platform for communicating with authorities was amalgamated with the new suomi.fi. The program is aiming to create a one-stop-shop for

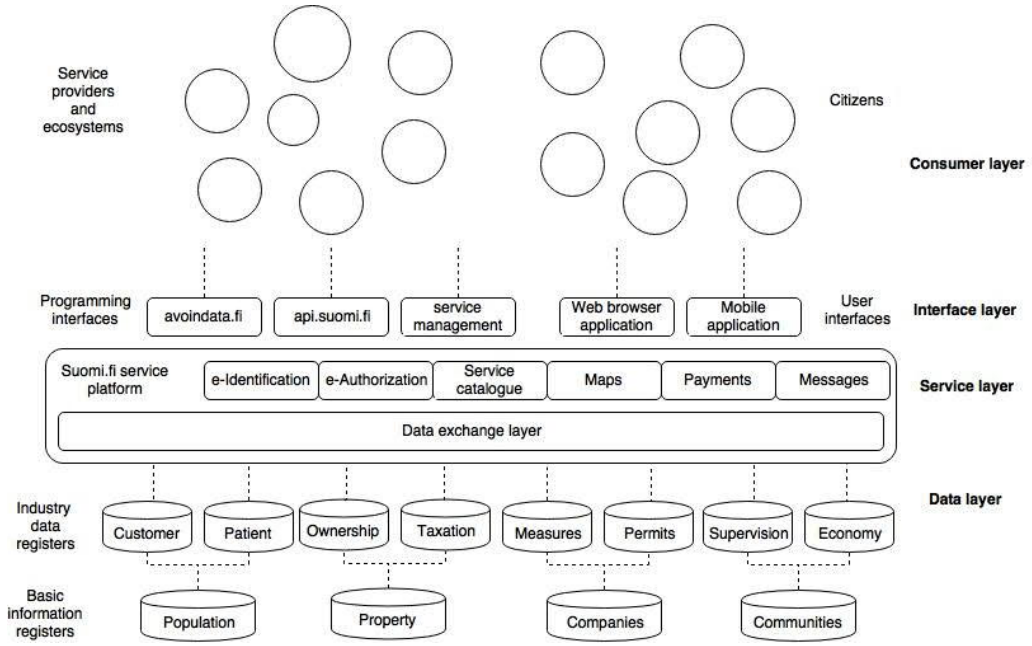


Figure 7. Suomi.fi architecture (Yli-Huumo et al., 2018)

citizens and businesses to transact with the Finnish government. (Ministry of Justice, 2016)

The overall architecture of the new digital infrastructure is displayed in Figure 7. Yli-Huumo et al. (2018) pictured Suomi.fi to have four layers as visualized in the figure: a consumer, interface, service, and data layer.

### 4.2.1 Suomi.fi services

The concrete results of the KaPA program were digital services called Suomi.fi services. Suomi.fi is the name and domain of the website or platform for the digital infrastructure and the access point to the services for citizens and businesses. The essential services on the site are briefly outlined below.

#### 4.2.1.1 e-Identification

The service enables secure electronic identification of Finnish and EU citizens. It uses a few different identification media, such as bank identification and mobile certificates. These identification tools have a substantial assurance level in the eIDAS scale (low, substantial, high). The service is intended for governmental authorities, agencies and institutions, courts and other judicial bodies. Public sector organizations that require

strong authentication are obliged to use the service. In principle, it will not be available for private sector organizations, with exceptions when one is providing services for the public sector. (esuomi.fi, no date)

#### 4.2.1.2 e-Authorization

e-Authorization can be used to reliably verify whether a person or company representative has authorization and the right to use services on the behalf of another person or organization in any time or place. Any organization is allowed to utilize Suomi.fi e-Authorization as long as the organization has the right to handle the unique identifier of its customers, such as the personal identification number or company y-identifier. (esuomi.fi, no date)

#### 4.2.1.3 Service Catalogue

The Finnish Service Catalogue is a centralized data repository of public sector services, where organizations have the right or obligation to provide information on the services and service channels they offer. The target groups of the services may be individuals, companies or authorities. The catalogue essentially gathers all relevant information on public administration in one place. (esuomi.fi, no date)

#### 4.2.1.4 Web Service

The Suomi.fi Web Service gives public administration customers access to services and personal information easily in one place. It also provides information on how to manage different life situations and information about services related to those situations. (esuomi.fi, no date)

#### 4.2.1.5 Messages

The service enables digital communication between citizens or organizations and authorities. The end-user still gets to choose whether they want their messages electronically or as a traditional letter. (esuomi.fi, no date)

#### 4.2.1.6 Data Exchange Layer

The Suomi.fi Data Exchange Layer provides a standardized way of transferring data between organizations, enabling the creation of secure service packages for citizens,

businesses, and authorities. This Suomi.fi service could be compared to an innovation platform presented by Gawer and Evans (2016), that consists of technological building blocks and databases that can be used for developing complementary EG services. Any organization has the right to use the service for data exchange. The service was built using Estonia's X-road data exchange framework, which was originally used in a similar service in Estonia called X-tee. Since 7 February 2018 the Data Exchange Layer and X-tee have been connected and cross-border information sharing between the Finnish and Estonian administrations has been possible (Population Register Centre, 2018). This is one of the first cross-border governmental information sharing systems in the world (Yli-Huumo et al., 2018). (esuomi.fi, no date)

Table 5. Essential Suomi.fi services

| **Service** | **Description** |
|---|---|
| e-Identification | A single sign-on electronic identification system for end-users of digital services. |
| e-Authorization | Verification of a person's or organization's right to use digital services on behalf of someone else |
| Service catalogue | Organizations can provide users necessary information about their services and service channels |
| Web Service | The user interface for the services |
| Messages | Digital communication with authorities |
| Data Exchange Layer | Channel for data transfer between organizations |

In addition to these, Suomi.fi provides a Maps and Payments service for public sector organizations. Most services are available for both public and private sector organizations. Many public-sector organizations are obliged to use some of the services by the KaPA act, e.g. municipalities must write descriptions of their public services in the service catalogue and the identification service must be utilized. The law accelerated the deployment significantly. (esuomi.fi, no date)

### 4.2.2 Boundary resources in Suomi.fi

This chapter presents resources that could be referred to as boundary resources in the Suomi.fi context.

*Case study*

One objective of the National Architecture for Digital Services program in Finland was to bring all online public services and information about public services in general to a one-stop-shop. The program prompted the website Suomi.fi. The Population Register Center (PRC) was chosen to operatively manage the site and its services throughout the program (2014-2017) and still does in 2019. Again, to illustrate how Suomi.fi is similar to digital platforms, I use the model (Figure 3) shown in Chapter 2.3.1. In the adapted model (Figure 8), the platform owner of Suomi.fi is the Population Register Center (PRC) that is responsible for the development and maintenance of the website. The corresponding third-party developers are public administrations or occasionally private

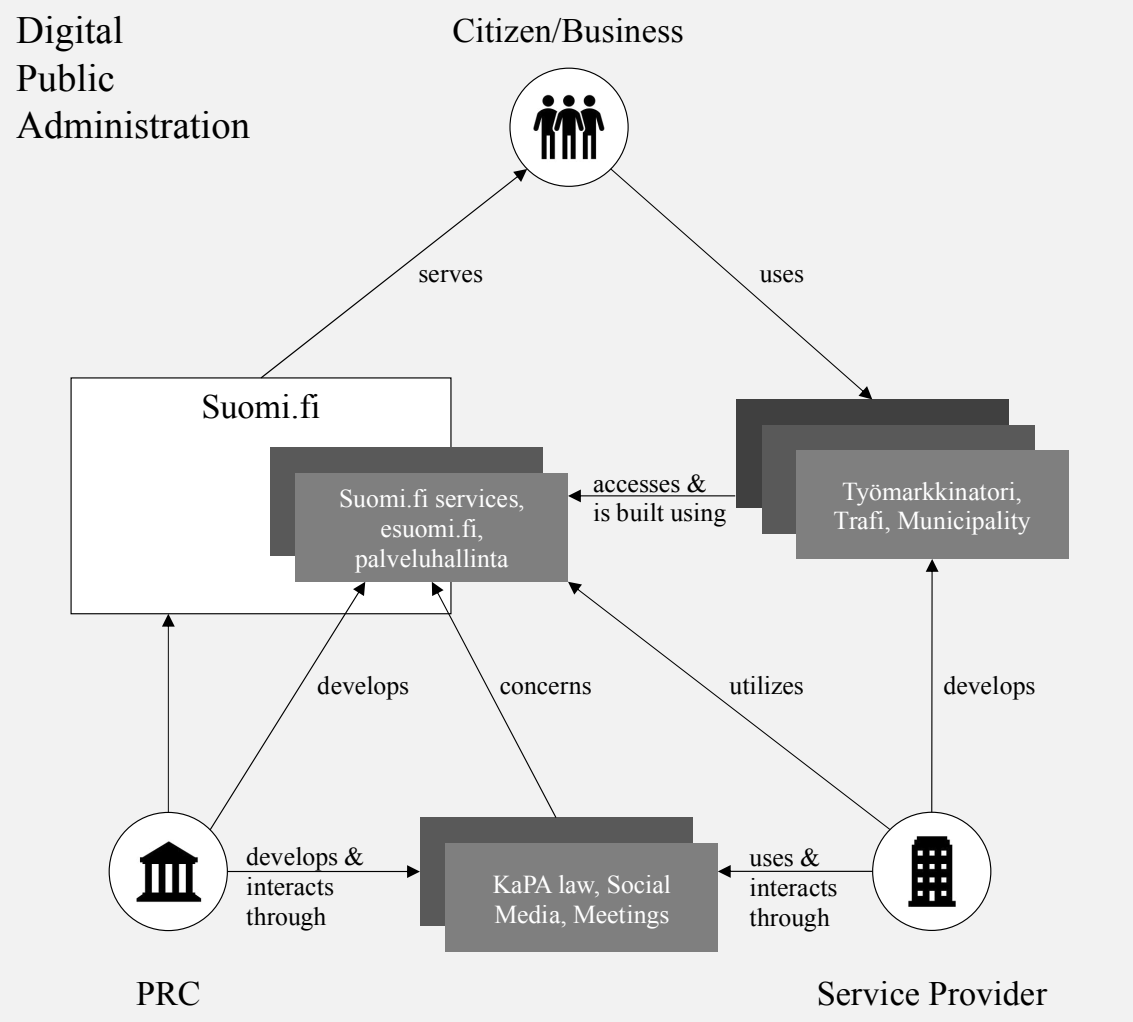


Figure 8. Suomi.fi Platform Ecosystem, based on Myllärniemi et al. (2018) and Bianco et al. (2014)

sector companies that are involved in the creation and provision of online and offline public services. The users of the platform are citizens and businesses.

The Electronic Transactions Act (KaPA Act), discussed in chapter 4.2, came into force on 15 July 2016. The law laid down use obligations and rights of Suomi.fi services. The law document itself declares what kind of digital services each type of organization is either obliged or have the right to use. For example, most public administrations are obliged to use the Messages and e-Identification services in their public services. The law also mentions who are responsible for creating what, for example, PRC was ordered to manage the Suomi.fi services. In this sense, the regulatory document function as a boundary resource in this case too, as in the SDG. However, the law document alone does not comprehensibly guide e.g. municipalities to fulfill the requirements in the law. Other resources that accelerate the adoption of Suomi.fi and its services are provided elsewhere.

#### 4.2.2.1 Suomi.fi services

To get public service providers to join the Suomi.fi platform, PRC offers digital services at arm's length to administrations and private companies who can or must use them in their service procedures. Therefore, all Suomi.fi services can be seen as boundary resources to the public administrations (sometimes private companies) providing services to citizens and businesses. For example, the labor market platform TMT uses Suomi.fi e-Identification for authenticating its users, organizations developing public services can use the Data Exchange Layer for accessing information from other organization's databases, and public service providers can use the Messages service for communicating with citizens or business representatives.

#### 4.2.2.2 palveluhallinta.suomi.fi

The site palveluhallinta.suomi.fi provides extensive information and support for the adoption and management of the Suomi.fi services. The site is a self-service Suomi.fi service management portal. It includes detailed and systematic instructions for setting up most Suomi.fi services, like e-Identification and the Service Catalogue. The user organizations can also use the site's assistance and problem-solving services. Additionally, anyone can access statistical use data and reports of the Suomi.fi services. However, instructions for adoption and use of some of the services are not covered on

palveluhallinta.suomi.fi, since some of the information is still on esuomi.fi that was a predecessor to palveluhallinta.suomi.fi.

#### 4.2.2.3 esuomi.fi

Information and support for the adoption and management of e.g. the Data Exchange Layer and e-Authorization services can be found on esuomi.fi. An organization willing to utilize these services can find the application forms there. Like palveluhallinta.suomi.fi, esuomi.fi too still contains extensive information on the Suomi.fi services, but most of the administrative procedures have been moved over to palveluhallinta.suomi.fi. As the site itself declares, esuomi.fi is a communication channel for national architecture for digital services.

#### 4.2.2.4 Other resources

Suomi.fi has an online presence that supports the public administration's accession of the e-services. A youtube channel called 'suomifi' has informational videos of the services. Other social media like Twitter is used for communication too.

PRC organizes Suomi.fi info events in which anyone interested in the services is welcome to participate. Educational events were also held where the service adopting organizations were helped and trained to use the services.

All Suomi.fi services have been published as open source (Population Register Centre - GitHub, no date). This transparency function as social boundary resource. (esuomi.fi, no date)

#### 4.2.2.5 Summary of boundary resources in Suomi.fi

Both social and technical boundary resources can be identified in the Suomi.fi ecosystem. Still following the onion model for boundary resources (chapter 2.3.1, Figure 1), all resources mentioned above are regarded as social boundary resources. Technical resources provided on Suomi.fi are the Suomi.fi services and APIs supporting the services.

Table 6. Boundary resources in Suomi.fi

| **Boundary resource** | **Application BR** | **Development BR** | **Social BR** |
|---|---|---|---|
| KaPA law | | | x |
| Suomi.fi services | x | x | x |
| palveluhallinta.suomi.fi | x | x | x |
| esuomi.fi | x | x | x |
| Open source code | | x | x |
| Social Media | | | x |
| Meetings | | | x |

## 4.3 Labor market platform

The second subunit in this case study analysis is a Finnish labor market platform called Työmarkkinatori.

One of the Finnish government's key projects during Juha Sipilä's period of service as prime minister (2015-2019) was the development of employment services. The Ministry of Economic Affairs together with its subsidiary KEHA (Employment and Development and Administrative Services Centre), launched a project called TE-digi in 2016 for reforming the government's labor and business services. As a part of the TE-digi project, KEHA is now developing a digital platform for the Finnish labor market called Työmarkkinatori (TMT) that is supposed to support the search for employment, strengthen the dialogue and cooperation of public employment services, and ultimately help raise the Finnish employment rate. As stated on TMT's website, by 2021, TMT will be a digital platform that:

- connects private and public service providers on to a common platform
- enables better matching of job seekers, entrepreneurs and employers, students, educational institutions, employment agents and recruitment companies
- works as a meeting place and source of information for job search and recruitment
- enables the development of new services for job seekers and employers

(KEHA-keskus, no date)

The platform will have two distinct parts, one is for the free labor market where employers and employees are matched with one another and the other is for work-related administrative procedures. The administrative procedures are separable from the rest of the site and do not fill the digital platform characteristics in the same way as the labor market part of the site does. Therefore, the administrative part of TMT will not be analyzed in this thesis. The core purpose of the free labor market side of the platform is to match as many potential employees with as many potential employers. The platform will also contain other services that support this main objective. Job seekers will not only find direct employers through the site but also e.g. institutions providing educational services, recruitment companies, and billing service companies that indirectly helps job

seekers land a job. Since the third parties of the platform are not merely employers, this group of companies or organizations are referred to as partners.

The central module of TMT is a search engine called 'Job Board' for searching job advertisements and respectively job candidates. Both a job applicant and an employer can thus use the search engine. Job applicants can create profiles with their curriculum vitae that will help them find suitable employers through the platform. Likewise, employers can publish job advertisements with which they can find potential candidates on the platform. In practice, company representatives are authorized to act on behalf of the company using Suomi.fi e-Authorization. The representatives use Suomi.fi identification to login and then publish and manage job advertisements.

TMT is developed in close collaboration with its end users. TMT involves private actors and other third parties in the development of the platform. The owners of TMT want to create an as user-friendly service as possible with a user-centered design, and they consider that involving end users in the creation of it will help them achieve this goal. KEHA center maintains an online joint development environment where partners or collaborators can partake in the discussion about the platform and the development of it. Anyone interested in contributing to the platform can apply to join the joint development community. The collaboration is not done exclusively online since the partners and owners together schedule TMT workshops and other face-to-face meetings around Finland. According to TMT's website, during the year 2017, the owners of TMT met around 2000 partners and customers of the platform.

In addition to the matching of job seekers and employers, TMT also encourages users of the platform to consider self-employment alternatives. By using TMT, job seekers can also find various short-term employment opportunities. The website lists, for example, billing services like Eezy Osuuskunta or Ukko.fi where self-employed people can send invoices for their work. The unemployed can find useful information about their rights and unemployment security.

The basic principle of TMT is to exploit the advantages digital platforms can offer to markets. For example, KEHA-center is looking to achieve network effects in the Finnish labor market with TMT. TMT aims to become a labor market platform ecosystem that creates a multisided-market, where public, private and third sector organizations can

benefit from a large group of job seekers, and the job seekers or citizens in general can reach countless work-related services from a one-stop-shop. TMT differentiates from other labor platforms in that it is an ecosystem owned by the government and it combines both public and private sector labor services, which other private labor market sites like Oikotie.fi might not necessarily do. (KEHA-keskus, no date)

### 4.3.1 Boundary resources in the labor market platform

This chapter presents resources that could be referred to as boundary resources in the Työmarkkinatori context. An important aspect to bear in mind is that Työmarkkinatori is at the time of writing in an initial stage, meaning that some potential boundary resources might have not been created just yet.

Eventually, the online labor market platform called Työmarkkinatori will be a single point of contact to all work-related services and information in Finland. In the Myllärniemi et al. (2018) and Bianco et al. (2014) inspired model (Figure 9), the platform owner of TMT is the Development and Administrative Services Center (KEHA) together with its parent organization The Ministry of Economic Affairs. The third-party developers are so-called partners that are not only employing organizations but also employment agents, organizations providing educational services, billing services, etc. The users of the platform are job seekers. In contrast to the SDG and Suomi.fi, the relationship between the platform and the user in this context is the same as in platform ecosystems. Unlike most other public sector platforms, TMT is to some extent competing against other labor market platforms. The user selects TMT out of several alternative labor market platforms. Stakeholders of TMT are not obliged to join the platform and using TMT is voluntary for job seekers and employers, which makes TMT quite exceptional for a public sector platform. The conceivable advantage TMT has over other labor market platforms is that it can potentially get a wide-range of employers from both the private and public sector on the same platform, which is not as achievable with free market platforms. Also, TMT is a free of charge service for the employers and posting job advertisements is complimentary, which makes it differ from other labor market platforms.

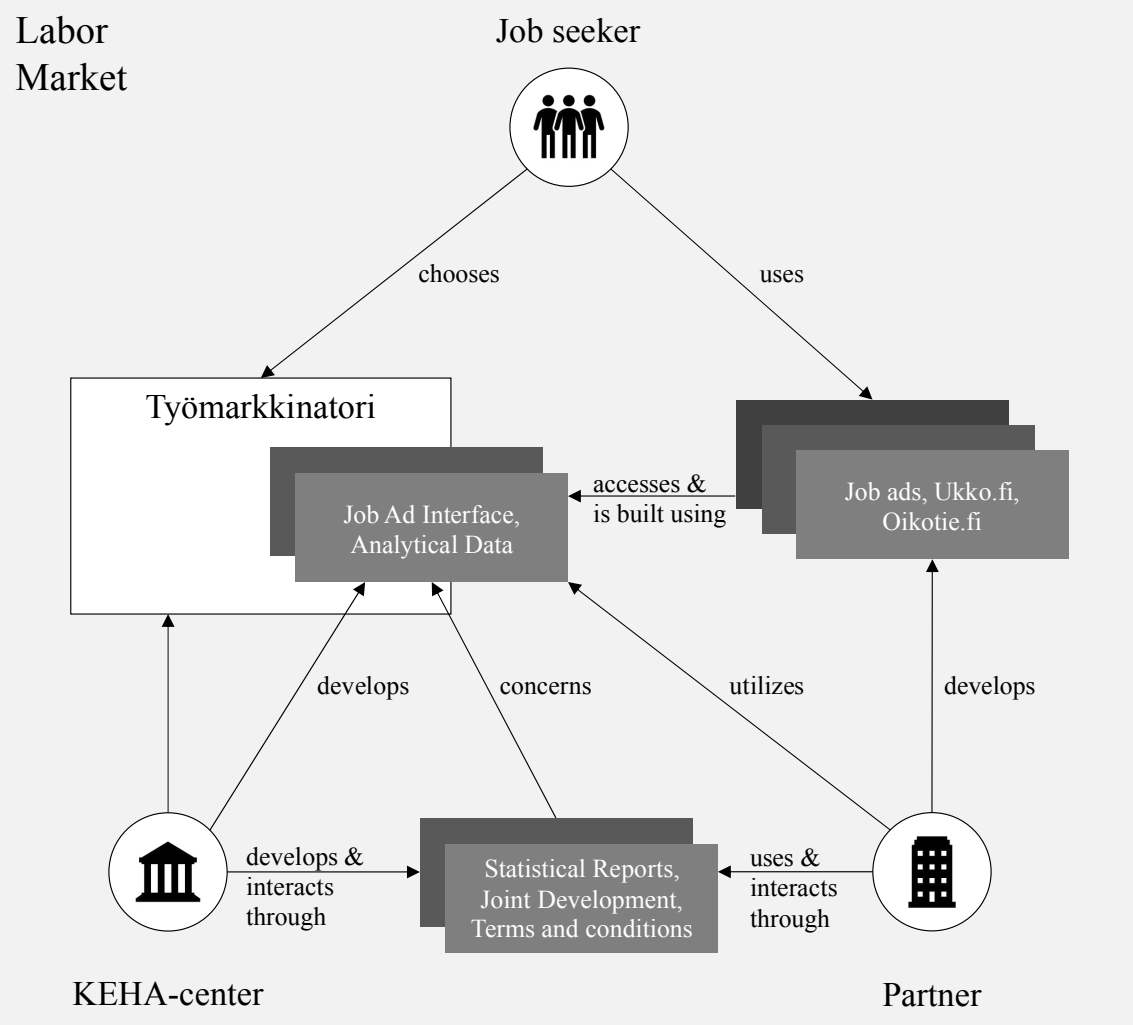


Figure 9. TMT Platform Ecosystem, based on Myllärniemi et al. (2018) and Bianco et al. (2014)

The platform has two parts, one is for the free labor market where employers and employees are matched with one another and the other is for work-related administrative procedures. In this analysis, I will focus on the free labor market part of the ecosystem. As there are not that many laws and/or regulations for job advertising that would steer the development of TMT, there is no regulative document that functions as one of the main boundary resources, like in the Suomi.fi and SDG case. The service designers and developers have rather free hands in the creation of TMT. TMT originated from 'TE-digi', a project initiated by the Finnish government for improving employment services in the country. The administrative procedures of TMT are regulated to some extent, and that side of TMT will have a regulatory document as a boundary resource. However, the

important information about joining and using TMT for the partners is not in any regulatory documents.

#### 4.3.1.1 Interface for importing job advertisements

Employers are provided with an interface through which they can import their job advertisements on TMT. Owners of TMT aim at utilizing REST API interfaces on the platform. They want to give the third-parties of the platform the possibility of managing their own content on the platform at arm's length.

#### 4.3.1.2 Statistical reports and analytical tools

TMT will offer personalized statistical data reports and analytical tools to its partners. The idea is that TMT wants to help their partners improve their own content on the platform by analyzing user behavior on their own.

#### 4.3.1.3 Joint development

Cooperation with third-parties has been important for KEHA-center throughout the project. KEHA wants to make an as user-centric platform as possible and they see that involving the eventual users of the platform in development is key for achieving this. TMT has a joint development workspace that anyone who is willing to participate in the development of TMT can join. In the workspace, the platform owners together with partners of the platform prepare tasks and events related to cooperation and development. People discuss and share information and materials in the workspace. The purpose of the workspace is to give users the opportunity to share insight into how they want TMT to function. In this manner, the final platform would truly address customer needs.

#### 4.3.1.4 General terms and conditions of use

When signing up for the service, strong authentication is required from the partners. Each person willing to use TMT on the behalf of a partner organization must authenticate themselves with their personal IDs using Suomi.fi e-Identification. After authentication, the partners are asked to accept the general terms and conditions of use and fill the information needed for processing their application, which is then accepted by the administrator. This process principally signs an agreement between the third-party

developers and platform owner in the case of TMT. The general terms and conditions of use document is a boundary resource.

#### 4.3.1.5 Summary of boundary resources in TMT

Both social and technical boundary resources can be distinguished from TMT too. In the onion model, all resources mentioned above are regarded as social boundary resources. Technical resources provided on TMT are the job ad interface and the technical tools to support the user behavior analysis.

Table 7. Boundary resources in TMT

| **Boundary resource** | **Application BR** | **Development BR** | **Social BR** |
|---|---|---|---|
| Job Ad Interface | x | x | x |
| Statistical reports | | | x |
| Analytical data | | x | x |
| Joint development | | | x |
| Meetings | | | x |
| Terms and conditions | | | x |

# 5 Findings

This chapter delineates the findings of this case study. Three platform-like eGovernment environments were analyzed in the study, the European Union's Single Digital Gateway, a website called Suomi.fi where citizens and businesses can find Finnish public administration information and services, and a labor market platform in Finland called Työmarkkinatori. eGovernment resources resembling boundary resources in digital platforms were identified through desktop research and qualitative unstructured interviews with EG specialists. The identified boundary resources in all three electronic government environments were already outlined in chapter 4 at the end of each subchapter and RQ1 was partly answered. However, the research question also asks what kinds of BRs exist in EG settings. This is addressed in chapter 6. Firstly, I will present insights on how some of the SDG boundary resources appear and function on an operational level in the Finnish EG context in chapter 5.1. Secondly, supporting and hindering factors Finnish EG specialists have noticed in EG development and adoption are presented in chapter 5.2. These two subchapters together address RQ2. Finally, I classify boundary resources in an EG setting considering the supporting findings in chapters 5.1 and 5.2. The conclusive answer to RQ1 is presented in the Discussion and Conclusions section of this thesis. The findings from the interviews are discussed next.

## 5.1 Outlook of boundary resources on the operational level

The conducted interviews yielded insights on how some SDG boundary resources appear and function in Finland. The following subchapters present what some of the interviewees had to say about them. I interviewed people responsible for implementing the SDG regulation in Finland and people involved with Suomi.fi and TMT. Your Europe will eventually be an enormous collection of online service catalogues or platforms like TMT and Suomi.fi. TMT and at least parts of Suomi.fi will eventually be connected to the Single Digital Gateway.

### 5.1.1 eIDAS identification

As stated in chapter 4.1.3.1, cross-border identification is the most important boundary resource for member states to put into service. High-level identification of a citizen or business is a prerequisite for doing cross-border public service transactions. One does not come without the other. Reaching information about governments in Europe through Your Europe do not require authentication of the user (citizen or business), but for being able to complete the procedures listed in SDG regulation's ANNEX II (see APPENDIX II), electronic identification of any EU citizens is a must. When discussing eIDAS and the SDG procedures Development manager (I#2) said as follows:

> "These cannot be taken forward separately",
> "There is really no other tool available that the Commission offers. Going forcibly in parallel. Forced marriage. There is no other solution in Europe, I haven't even heard that someone would dream about anything else. It's a must-have solution with eIDAS."
> Development manager (I#2)

The only way to get SDG working is with eIDAS. National Coordinator (I#4) stated this about eIDAS:

> "The role of eIDAS should have been confirmed first because it has a central role in whether or not the business services will work and only then start to discuss the once only principle"
> National Coordinator (I#4)

The interviewee referred to the relatively poor state of eIDAS in Finland as well as in other countries in the EU. Before dreaming of the once only principle and an interoperable public sector in the entire union, a functioning cross-border identification tool should be successfully established. Specialist (I#3) also pointed out the following:

> "The electronic transaction is by far the most challenging task"
> Specialist (I#3)

Why is this challenging? In the Finnish EG environment, the eID identification's integration does not seem to be as easy as CEF Digital might suggest on their website. According to the interviewees, there are several issues related to this. There have been

attempts to create EU-wide identification systems before, but without success. Authorities have also been discussing a Nordic or Baltic ID standard as a first step, but that too has not lead to any solutions.

> "There have been these dreams from time to time in the history of the EU of making a European identity and it has always been shot down"
> Development manager (I#2)

One factor making it challenging is that countries in the union have differing ID number systems, which can be quite difficult to connect and manage in an EU-wide identification system.

> "Finland has a personal identity number and then in Estonia, there is a different looking ID and of course, these tags won't work across national borders. An international identifier for identifying individuals is needed"
> Technical manager (I#1)

Another issue is that authorities in Finland that own the public sector services has the right to decide if they adopt eIDAS identification. EU compels member states to start using eIDAS but the Finnish government cannot force the authorities to do so by law.

> "The eIDAS regulation obliges the member states, but in practice, the decision to take eIDAS identification in use is made by the authority that owns the service"
> Specialist (I#3)

This has resulted in that there are few if any identification tools that have been eIDAS notified in Finland.

> "At least for the time being, we have not come to the knowledge that any owner of identification tools in Finland would have notified them"
> Development manager (I#2)

### 5.1.2 eDelivery

When developing the Suomi.fi Data Exchange Layer service, the Finnish authorities created and used their own solution for data exchange even though CEF Digital provides the eDelivery building block created for the same cause. Finland used the Estonian X-road technology as a basis for the Data Exchange Layer. X-road is an open source

technology that has been adopted for data exchange in several countries (NIIS, no date). The technology could be seen as a contender for EU's eDelivery. For example, Finland and Estonia have launched a cross-border Data Exchange Layer that principally meets the once only principle between the countries' public administrations, which has not been achieved with eDelivery yet. It seems that the eDelivery boundary resource does not appear that useful for some EU countries since they have decided to use X-road instead. One of the reasons why X-road might be so popular is because of the open source.

> "I do not personally believe that it would be so widespread if it were not open source"
> Technical manager (I#1)

X-road and eDelivery technologies are technically alike.

> "What I got to know about its [eDelivery] architecture, it seems like its approach is very similar to what X-road's is that it is too a distributed system based on SOAP messaging"
> Technical manager (I#1)

Knowing that X-road is similar to eDelivery, some people behind X-road attempted to lobby their solution for the EU. However, this attempt did not lead to any engagements from either side.

> "We previously attempted to lobby X-road in that direction [EU], but for a reason or another it did not lead to any concrete actions",
> "One EU representative exchanged a few messages via LinkedIn. He was mostly interested in the status of X-road at the time."
> Technical manager (I#1)

Since Finland and Estonia has established a working solution for data exchange between authorities, they will refuse to replace X-road with eDelivery. EU's policy, however, is that eDelivery will be used for data exchange since they have invested money and resource in creating it.

> "The EU policy is that eDelivery would be used"
> Technical manager (I#1)

*Findings*

Connecting various data exchange system for the SDG will certainly be challenging. When there are EG systems in the EU using different technologies, it seems like the solution will be to use some customized linking components or adapter services to enable data flow between them.

> "Some kind of adapter between X-road and eDelivery, as those technologies and protocols are pretty similar, it should be possible"
> Technical manager (I#1)

### 5.1.3 CPSV-AP

The CPSV-AP data model has been used in Finland. The national Suomi.fi Service Catalogue follows the consistent way to describe service and service channel information suggested in CPSV-AP. It was also used in the cooperation between Finland and Estonia when a cross-border service catalogue was created. Specialist (I#3) too mentioned that Finland has been using the model.

> "We have nationally utilized these wordings and these classifications so I know they are very happy at least in the commission"
> Specialist (I#3)

### 5.1.4 IMI

The Internal Market Information System has proven useful in Finland in some areas.

> "It [IMI] is used in many different internal market areas of legislation and in some areas it works well"
> Specialist (I#3)

However, in some areas, the system does not appear useful and there seem to be people who are unaware of it or prefer to use other channels for communicating with authorities from other member states.

> "They do not necessarily know about their obligation to use it",
> "Email or phone is sort-of easier to use"
> Specialist (I#3)

### 5.1.5 ISA$^2$

According to Specialist (I#3), Finnish EG specialists are aware of the ISA$^2$ building blocks and they have been presented to them, but adoption of them have been poor.

> "They have been poorly adopted"
> Specialist (I#3)

### 5.1.6 Summary

The overall impression from the interviews was that the boundary resources that support member states to create what EU is demanding in the electronic government setting are quite unutilized in Finland. In this initial stage of the Single Digital Gateway, it seems that many of the leading EG authorities that are responsible for implementing the SDG in Finland have not been acquainted with EU's boundary resources. The whole implementation of an interoperable EU-wide public sector seems quite unachievable at least in the set schedules. No clear strategies for the implementation of SDG exist in Finland. eIDAS has not been established either, which is the foundation of the gateway.

## 5.2 Factors supporting and hindering the development of eGovernment

Each interviewee had opinions on factors that influence the adoption and development of electronic government. This subject was thoroughly discussed in all interviews. Both positive supporting factors and negative hindering factors were uncovered in the discussions and these factors were not necessarily related to boundary resources. When analyzing and coding the data, themes and categories were identified. Some themes matched with the topics found in the existing eGovernment literature. The discovered themes are discussed in the following subchapters.

### 5.2.1 Overlapping regulations

Overlapping or contradicting regulations and laws within nations and the EU seem to be a common occurrence. Many public organizations are often simultaneously creating the same thing or reinventing the wheel when functioning solutions already exist.

> "You often find that the same thing is planned in different ministries without discussing it at all"
> Business owner (I#5)
> "These overlaps in different regulations are at least influential factors"
> National Coordinator (I#4)

For example, most of the assistance and problem-solving services meant for the SDG already exist.

> "Assistance and problem-solving services already exist because they come from other EU regulations"
> Specialist (I#3)

Having to ask member states to create assistance and problem-solving services several times tells something about the attitude member states have for EU regulations and the attitude public administrations have for digital government initiatives in general.

### 5.2.2 Ambitious goals

A reoccurring theme in the interviews was that EG projects often have too ambitious schedules. The timetable is usually one of the biggest challenges and it often steers the implementers to make hasty solutions. The SDG has put a four-year time limit for creating the cross-border procedures and two years for filling the information about rights and services on Your Europe. The once only principle should be implemented five years after the regulation comes to force at the latest. Most interviewees announced their concerns of the SDG timetable and EG timetables in general.

> "Two years seems like a quite short period of time when even ten years seems to be too short"
> Specialist (I#3)
> "It is an ambitious schedule that 2020, cannot help but be staggered"
> Development manager (I#2)
> "If this is to be done at the EU level then 2025 will come quite quickly"
> National Coordinator (I#4)

> "What I've noticed after closely following the tempo in public administration in different countries, even if projects would be considered fast we easily speak in years"
> Technical manager (I#1)
> "Often unrealistic [schedules]"
> Business owner (I#5)

Creating national EG platforms or ecosystems takes a long time and has many obstacles. International platforms/portals are even more challenging. When public administrations complete these EG projects in a hurry, the result often becomes poor.

> "It does not always produce a customer-friendly result, especially in the time frames that are given"
> Business owner (I#5)

eIDAS identification is one of the most important tools to employ around Europe if a working SDG is to be established. Development manager (I#2), involved in the eIDAS integration in Finland, had serious doubts about getting eIDAS functioning within the period set by the Commission.

> "Some countries are ready to do so but for example in Finland, I do not dare to promise that our PRC would notify the ID card within the next six years"
> Development manager (I#2)

### 5.2.3 Communication between service implementers and legislators

The level of communication between the legislators and the people who ultimately implement the law in practice influence the development of EG. One of the problems in EG projects is that the legislators give service designers and developers detailed instructions on how to create online services without having the IT experience or expertise.

> "One of the biggest problems is that the legislators and IT people do not discuss"
> National Coordinator (I#4)
> "It [the communication] could be more effective"
> Business owner (I#6)

> "Legislators write a law and then we basically get a government proposal in our hands that we start to look at and be like, oh well, what is this and how should this be done"
> "Written into the law, and then it drops to implementation and then implementers wonder how to do it"
> Business owner (I#5)

One solution to this issue could be that the implementers of the service would be involved in the legislative process.

> "They [the implementers] should be at the same table when the law is set"
> National Coordinator (I#4)
> "You should be able to take something like demos to see how something could be taken forward because it always opens up a bit more when you're able to show what it could actually be"
> Business owner (I#6)
> "It would be best to be able to discuss in advance with the Commission about the proposal to be given, but it is hardly ever possible"
> Specialist (I#3)

### 5.2.4 Level of detail in regulations

The more open the regulations are in detail the better the outcomes usually are. The regulatory document should not be too specific or the implementation becomes difficult and generates bad results. Often when the regulation is too specific, the implementers realize along the way that there are better approaches to developing the service.

> "We have no choice but to make a really complex process into our system when we could have said many times that this could have been technically accomplished in this way"
> "We could do it like by means of information technology but now the law controls our process"
> National Coordinator (I#4)

> "Yes definitely, to avoid too tight legislation and not tie the hands of implementers"
> Business owner (I#6)

Giving the developers leeway in service implementation seem to yield much better results.

> "I have seen for the first time in the last year that more is done together, that one of the laws had a very elementary first version that basically gave us [implementers] the opportunity to influence the content for the first time. That was, in my opinion, a good thing"
> Business owner (I#5)

For example, the free market side of TMT did not have some detailed regulation steering its direction and gave developers the freedom to create what they thought best. This appeared to have worked well since TMT is in a promising state.

> "It is nice that there is a more free development sphere in the TMT ecosystem"
> Business owner (I#5)

### 5.2.5 Administrative and regulatory challenges

The technical capabilities exist for creating interoperable EG systems and setting one up is not technically difficult. However, the administrative challenges are slowing down the adoption and development EG. Bureaucratic processes often take a longer time than the technical configuration. The issues in legal and organizational interoperability make the bureaucratic processes slow.

> "Technology is not the biggest problem why something is not working but maybe it's more because of the way of working and lack of knowledge and so on"
> Specialist (I#3)
> "Legislative problems, not technical problems"
> Development manager (I#2)
> "The biggest challenge is not getting the information to technically move in a sufficiently secure way, but to also get it moving administratively easy enough"
> Technical manager (I#1)

*Findings*

> "The legislation related to the processing of personal data in Estonia is a bit different from what it is in Finland. Adjusting this can be difficult"
> Development manager (I#2)

For example, several public sector actors were interested and tested the test environment of the Estonian and Finnish X-road and Data Exchange Layer cooperation. However, no one utilized it when it launched to production. The legislative interoperability was the issue.

> "The production environment has not yet progressed and this is more because of this administrative aspect, which is really unfortunate because the technical readiness is there"
> Technical manager (I#1).

Development manager (I#2) declared too that technically connecting the Suomi.fi Data Exchange Layer and the Estonian X Tee was not an issue, but legally it is.

> "Of course, it is no easier in legal terms, but technically yes as we both have X-road environments"
> Development manager (I#2)

Development manager (I#2) also shared the opinion that governments should stop requiring point-to-point data exchange contracts between all public authorities separately.

> "That there must always be a data license between two authorities so that they can exchange information is not up-to-date"
> Development manager (I#2)

When a public service does not require the movement of confidential data, it is much simpler to implement since the administrative and regulatory challenges are minimal. If some service requires the transfer of confidential information, government officials usually end up choosing the strictest policies for the services to avoid any risk of leaking personal data of citizens. When a strict policy is chosen, there is often no other choice than to create a complex solution that might not be user-friendly.

> "It [TMT] has also a channel to administrative procedures so there exist strong data protection and security issues"
> Business owner (I#6)
> "The personal data of the unemployed is extremely confidential information",
> "If there are doubts about how the thing should be done, people often end up using the strictest policies"
> Business owner (I#5)

The free labor market side of TMT does not require the transfer of confidential information. This means that there are not too many administrative or regulatory obstacles to overcome and the platform can grow freely.

> "There is not so much legislation on job advertising",
> "TMT does not have as many legislative or regulatory obstacles to its development as it may be otherwise in the governmental environment"
> Business owner (I#5)
> "Governmental services [of TMT] are strictly regulated by law, but on the other hand we are also making this free market service to which all actors are invited which gives us freer hands to implement"
> Business owner (I#6)

The less regulated the governmental platform is the more flexibility it has and gives the ecosystem unrestrained growth opportunities. As Technical manager (I#1) pointed out, we should strive at finding a balance between regulatory control and sufficient flexibility in EG projects.

> "Some golden mean with sufficient flexibility but there are still controls",
> "Flexible enough so that they could be completed relatively fast as well as in a reliable way"
> Technical manager (I#1)

### 5.2.6 Summary

Evidently, the more complex the EG environment is wanted to be the more difficult it is to create and more hindering factors emerge. Actors involved in the creation of EG can attempt to diminish the hindering factors by reinforcing supporting factors. The

supporting factors could counteract the hindering factors as shown in Table 8. For example, setting realistic goals and laying laws or regulations that are consistent with previous laws and/or regulations sets a better starting point than making repeatedly inconsistent decisions regarding EG and setting too ambitious goals. Also, by having effective communication between all actors involved with an EG project usually generates better results. Excessive interoperability between systems in an EG environment poses various challenges. Administrative interoperability is much more difficult to implement than technical interoperability. When creating an EG system of systems, the legislative and administrative challenges are far greater than the technical challenges.

Table 8. Supporting and hindering factors in EG development

| **Supporting factor** | | **Hindering factor** |
|---|---|---|
| Consistent decisions | vs. | Inconsistent decisions |
| Realistic goals | vs. | Unrealistic schedules |
| Effective communication | vs. | Lack of communication |
| Minimum regulative control | vs. | Technically detailed regulation |
| Low level of interoperability | vs. | Interoperability on several layers |
| No confidential information involved | vs. | Confidential information involved |

# 6 Discussion and Conclusions

## 6.1 Boundary resources in eGovernment

Like digital platforms in the free markets, EG platforms too have technical and social boundary resources that support the third parties' development of content to the platform. The boundary resources help the governmental body owning the platform create an arm's length relationships with the public (sometimes private) sector service providers using the platform as third-party developers. Based on the findings, the conceptual framework and hypothesis presented in Chapter 2.5 (Figure 4) can be considered valid in an EG setting.

Figure 2 presented in chapter 2.3.1, suggest that platform boundary resources have two purposes; they are resourcing and securing the platform (Ghazawneh and Henfridsson, 2013). With resourcing BRs, platforms attract third-party developers to create applications on the platform. At the same time, BRs can help in securing the platform by steering the third parties' development. These securing BRs make sure that the platform does not evolve to something unwanted by giving the platform owners more control. In essence, boundary resources are used for both enlarging the platform and managing control. As discussed in the literature review, digital platforms and infrastructures face paradoxes of change and control (Tilson, Sørensen and Lyytinen, 2011; Ghazawneh and Henfridsson, 2013; Lauslahti et al., 2018). Platform or infrastructure owners should give third parties as much freedom on the platform as possible so that the platform can grow, but at the same time make sure that the platform is under control.

This paradox of control is noticeable in eGovernment too. In the EG setting, the political power usually steers the control in the form of a law or regulation. As discussed in the previous chapters, a regulation should not be too specific so that the EG system can be developed with sufficient flexibility. If the legislators try to have too much control over the platform by setting strict policies, it will generally not result in very usable products. However, the government cannot give third parties on the platform too much freedom

either, since too much third-party freedom does not create a coherent whole of the platform. As mentioned in chapter 5.2.5, a golden mean with some regulatory control and suffice flexibility is the key to success. The identified boundary resources in the case discussed in chapter 4 seem to have the same core functions as regular digital platform's boundary resources have; they are resourcing and/or securing the platform.

Another feature related to the paradox of control in digital platforms and its boundary resources is platform openness. As stated in the literature review (chapter 2.3.1), platform openness refers to the opening or removing of restrictions on the use, development, and commercialization of the platform technologies (Boudreau, 2010; Karhu, Gustafsson and Lyytinen, 2018). In addition to the resourcing and securing purposes, boundary resources can also have a function of increasing the transparency of the platform. As discussed in the literature review, platforms can have two types of openness: access and resource openness (Karhu, Gustafsson and Lyytinen, 2018). Access openness refers to the easiness of joining and participating on the platform as a third party developer. Resource openness refers to the transparency of the platform's codebase, intellectual property and use data. The boundary resources in eGovernment settings are also used for increasing government transparency.

The functions of each presented boundary resource in the SDG, Suomi.fi and TMT environments are listed in Table 9, Table 10, and Table 11.

Table 9. SDG boundary resources' functions

| Boundary resource | Functions |
|---|---|
| SDG regulation | **Securing.** The regulation document is the fundamental documentation for implementing the SDG that sets some controls on the development. |
| eIDAS identification | **Securing.** The EU requires that eIDAS identification is used in cross-border activities.<br>**Access openness.** Identification enables cross-border procedures. |
| eDelivery | **Securing.** The EU promotes eDelivery as a data exchange technology for member states.<br>**Access openness.** Enables data exchange through the platform. |
| EIRA | **Resourcing.** EIRA encourages public administrations to reuse existing interoperability solutions and help them keep costs down.<br>**Resource openness.** EU shares solutions with public administrations. |
| CPSV-AP | **Securing.** EU is suggesting that all administrations give service descriptions in a uniform format. |
| Joinup | **Resourcing.** Solutions for EG can be found through this community.<br>**Resource openness.** Anyone can access the resources provided on Joinup. |
| EIF | **Securing.** Guides European administrations to use common solutions and standards on all levels of interoperability. |
| IMI | **Securing.** A communication channel promoted for authorities in the EU.<br>**Access openness.** Communication through the platform. |
| Social Media | **Resourcing.** Tool used for expediting the project implementation. |
| Meeting documents | **Securing.** Getting all member states on the same page.<br>**Resourcing.** Helps member states implement the gateway. |

Table 10. Suomi.fi boundary resources' functions

| **Boundary resource** | **Functions** |
|---|---|
| KaPA law | **Securing.** The law document sets restrictions on the development and use of Suomi.fi services. |
| Suomi.fi services | **Securing.** The Finnish government obliges administrations to use some of the services.<br>**Resourcing.** All organizations have the right to use some of the services. |
| palveluhallinta.suomi.fi | **Resourcing.** Domain where organizations can adopt and manage their services.<br>**Access openness.** Enables access to the platform.<br>**Resource openness.** Shares data and solutions. |
| esuomi.fi | **Resourcing.** Domain where organizations can adopt and manage their services.<br>**Access openness.** Enables access to the platform.<br>**Resource openness.** Shares data and solutions. |
| Open source code | **Resourcing.** Allows third parties to contribute to the platform.<br>**Resource openness.** Allows third parties to review the technologies. |
| Social Media | **Resourcing.** Tool used for expediting the project implementation. |
| Meetings | **Securing.** Getting all actors on the same page.<br>**Resourcing.** Helps actors use and adopt the services. |

Table 11. TMT boundary resources' functions

| **Boundary resource** | **Functions** |
|---|---|
| Job Ad Interface | **Resourcing.** Helps third parties create and manage content for the platform. |
| | **Access openness.** Gives access to the platform. |
| Statistical reports | **Resourcing.** TMT gives third parties statistical use reports that aid them in improving their services. |
| | **Resource openness.** TMT displays the site activity to third parties. |
| Analytical data | **Resourcing.** Third parties get analytical data to support their decision-making. |
| | **Resource openness.** TMT displays the site activity to third parties. |
| Joint development | **Resourcing.** Collaboration with all actors involved and giving everyone an opportunity to contribute. |
| Meetings | **Securing.** Getting all actors on the same page. |
| | **Resourcing.** Helps actors use TMT and allows them to partake in the development of TMT. |
| Terms and conditions | **Securing.** Agreeing on rights. |

Generally, boundary resources in electronic government have the same core functions that BRs in digital platforms for two- or multi-sided market have. The EG owners should aim at having a sufficient amount of securing BRs that grant the platform owners control over the platform, while still providing enough of resourcing BRs. As can be seen from the tables above, the more regulated the governmental platform is the more securing BRs are needed. TMT has less securing BRs than the more strongly regulated SDG and Suomi.fi platforms have. A regulation or law in itself can give the owners major control over the platform even prior to its development. Unlike platform owners in the free market, EG platform owners can have the power to force third parties to join the platform. When enrolment in the EG systems is obliged, the importance of resourcing BRs might not be recognized by the platform owners. Owners of EG platforms do not necessarily need to attract service providers to the platform with resourcing BRs in the same way if the regulation or law compels the third parties to do so. Both the SDG and Suomi.fi are compelling their third parties to join the platform, while TMT is voluntary for the third parties and users. The overall impression is that TMT is investing more in resourcing BRs than the other two since that is their main method of attracting partners to the site. Platforms that have the legal power to force third parties to join should not overlook the importance of resourcing BRs. The resourcing BRs help the third parties fill the requirements and reach the set objectives in time.

EG environments like the SDG or Suomi.fi require identification tools with high assurance levels, whereas the likes of TMT suffice with low assurance levels. When moving towards higher assurance levels in identification the importance of platform securing increases. It seems that the assurance level in identification is directly connected with the paradox of control, as securing is emphasized when high-level authentication is necessary and less significant in platforms with low-level authentication. Governmental platforms with low-level identification seem to have better prospects for growth since platform owners can focus more on resourcing than securing the platform.

The regulation-based securing, one of the four variants of actions taken by stakeholders in platform ecosystems for resourcing or securing platform (Ghazawneh and Henfridsson, 2013), seems to be much present in most EG systems. Governments often need to maintain the sovereignty of their platforms, which is why securing is often emphasized. SDG and Suomi.fi both practice regulation-based securing, while TMT's owners who do

not need as strong sovereignty as the other two avoid doing regulation-based securing. The level of administrative complexity in the procedures on the platform ultimately determine the need for regulation-based and sovereignty securing. Diversity resourcing is logically not favored by EG platforms since the purpose of a single point of contact is typically to provide services and information on services in a uniform and similar manner. However, there are signs of self-resourcing constructs in EG environments. Boundary resources like Joinup or TMT's joint development interface encourage third parties to also pursue their own initiatives and give them opportunities to influence the development and evolution of the platforms. The Finnish and Estonian X-road collaboration could also be viewed as a form of self-resourcing in the SDG case. The EC will have to respond somehow to initiatives like X-road if they want to create an interoperable public sector in Europe.

Transparency and openness of government and its development is a growing trend (Gil-Garcia, Dawes and Pardo, 2018; Yli-Huumo et al., 2018). The owners of EG platforms should aim at disclosing information and data associated with the EG technologies. The BRs can be used for increasing the openness and transparency of the system. As seen in the tables above, all three EG entities have BRs giving platform access to the third parties as well as sharing code, IP and data. The transparency of the platform helps in gaining the citizens' trust and eventually getting them to use the platform.

### 6.1.1 Boundary resource categories in eGovernment

Application BRs, development BRs and social BRs have been utilized in all three of the studied environments. The findings indicate that the role of social BRs is considerably higher in EG compared to digital platforms. As discussed in previous chapters, the non-technical challenges are greater in the governmental domain, which is one of the reasons why more social BRs are needed. Based on the case study, most but not all of the same BR categories presented in chapter 2.3.1 (Table 1) exist in the EG platforms too. There are still considerable differences between the BRs in digital platforms and governmental digital platforms that are worth noting. In Table 12, I list the main BRs in EG systems in each BR category defined by Seppälä, Juhanko and Korhonen (2015). Each category and how EG BRs might differ from digital platform BRs are discussed after Table 12.

Table 12. Types of boundary resources in eGovernment

| **BR type** | **BR category** | **Main BRs in eGovernment** |
|---|---|---|
| Application BRs | APIs | Authentication<br>Data exchange<br>Messaging |
| Development BRs | SDKs & Scripts | Interoperability components<br>Data models |
| Social BRs | Agreeing on rights | General terms and conditions<br>Regulatory document |
| | Agreeing on IPR | - |
| | Common earnings logic | - |
| | Open data | Open source code<br>Statistical data |
| | Instructions & documentation | Regulatory document<br>Service documentation<br>Procedure documentation<br>Legal interoperability instructions<br>Semantic interoperability instructions<br>Organizational interoperability instructions<br>Technical interoperability instructions<br>Integration instructions<br>Social media<br>Meetings |

### *Application BRs*

**APIs.** One aspect that makes governmental platforms differ from platforms in the private market is that most procedures with public authorities require high-level authentication of the citizen or representative of a business, whereas platforms like Facebook suffice with low authentication methods. The current Suomi.fi identification tools have a substantial assurance level on the eIDAS scale (low, substantial and high). Since public authorities hold confidential information concerning the users, they are also obliged to ensure the information is kept secret and the risk of e.g. identity theft must be minimized. This is why high or at least substantial assurance level identification of the users is key in

governmental platforms. One of the most important boundary resources that an owner of a public sector single point of contact can offer to a public sector service provider is identification tools. The current situation in Finland is that Suomi.fi e-Identification works well within the nation, but from other EU countries, only Germans can use this identification tool. This is because none of the identification tools in Finland has yet been eIDAS notified and do not have the necessary high assurance level. The European SDG will not make progress before eIDAS identification is possible everywhere in the union. Application BRs that enable high-level identification of users are one of the key EG BRs in this category.

The procedures that require high-level identification of a citizen usually involve some exchange of information, document or data between parts. According to the once-only principle, once a citizen has shared some document or information with a public administration, the same document or information should not be requested again by that or any other public administration. This means that interoperability of public administrations should be established that allow the transfer of information or documents from one organization to another on the user's request. This obviously necessitates some sort of technical connection between the different administrations. Application BRs that enable safe data exchange between the parts is almost as important as the identification BRs.

The third main application BR in an EG setting is a communication channel. An EG system should provide a possibility of having a secure online discussion through the platform, where confidential information can be communicated.

### *Development BRs*

**SDKs & Scripts.** As a third party on any platform, available software development kits and tools facilitate the creation of content to the platform. In addition to the usual SDKs and scripts provided in any software development, EG platform owners seem to encourage the use of analogous interoperability solutions and data models. The EC is enforcing public administrations in Europe to share and reuse interoperability components with a few initiatives presented in the case study chapter. Common data models and interoperability solutions are advocated so that all administrations have

similar data structures and semantic and technical interoperability become easier to establish.

### *Social BRs*

**Agreeing on rights.** In a governmental setting, agreeing on rights is quite different. Usually, the regulatory document or law text sets the principal rights of each actor on the platform. In the case of SDG and Suomi.fi, the regulatory power declared who is responsible for creating and managing the platform, and who has the right or obligation to act on the platform. In the TMT case, the general terms and conditions accepted when signing up for the service serve as an agreement on rights between the platform owners and partners.

**Agreeing on IPR.** In the governmental domain, there are no questions regarding IPR between the third parties and platform owners since the political power steers the management of IPR in this setting.

**Common earnings logic.** One big difference between free market platforms and governmental platforms is that principally no one is earning anything on EG platforms, whereas many free market platforms exist just for that reason. There is no need for establishing any earning logics in EG settings. The free market platform can use the earning logics as incentives for the third parties to join the platform. In the governmental setting, this is not a possibility. The governmental platform owner can simply try luring service providers by promising that they reach a sizable amount of citizens through the platform and that the platform is free to use. However, usually most third parties on EG platforms are obliged to join which means no incentives are necessary.

**Open data.** Transparency of decision-making in governments and the transparency of the government in general is a requisite for a functioning democracy. A transparent and open EG is equally important. As a social boundary resource, EG platform owners should have open source code to the technologies and publish the platform's use data. The resource openness is considered as a theme of the upcoming Government 3.0 (Yli-Huumo *et al*., 2018), which is why EG systems should strive to be as transparent as possible.

**Instructions & documentation.** Perhaps the most important resources that an owner of an EG platform can offer is instructions and documentation on how the platform is to be

implemented. If some law or regulation commences the platform, then the regulatory document should serve as the master document for the platform's implementation. Myllärniemi et al. (2018) recommend that the owners of a software framework should provide both high- and low-level documentation to the developers. Likewise in an EG project, the regulatory document should explain the big picture of the EG platform and then other documentation can dive deeper giving low-level details of technicalities.

The governmental single point of contacts are developed mainly for providing electronic public services for the citizens. Therefore, documentation that supports the service development ought to be provided as a boundary resource and not merely on a technical level. Also, if the legislators themselves want to define how the procedures on the system work on a technical level, well thought and detailed documentation has to be provided for the implementer. The other alternative is to give the implementers unrestricted freedom to create the procedure as they see best, but in this case, the regulatory document should emphasis this decision.

As discussed in the previous chapters, the technical challenges are minor compared to the legislative, semantic and organizational challenges when creating interoperable EG systems. The technical readiness exists, but the other cross-organizational challenges are slowing down the development and adoption of EG. Instructions and documentation that assists various public administrations achieve interoperability on all required interoperability layers are important for establishing a working interoperable EG system. The platform owners need to help solve semantic interoperability issues, e.g. in the case of SDG how to overcome linguistic issues in the data exchange or how to guarantee uniform service descriptions and information. They should help solve organizational interoperability issues like duplicate information in various locations. Legal interoperability is a major challenge too. For example, in the SDG case, all member states have their own governments with differing policies, laws, and systems. Accessible interoperability and integration instructions and documentation that lead all actors who are involved with the platform to create consistent structures on all levels of public administration will facilitate the successful formation of an EG platform.

Social media channels can also be used for instructing the third parties. For example, as pointed out by the Finnish national coordinator of the SDG (I#4), an instructional video

uploaded to YouTube is one of the most useful pieces of information for inaugurating the gateway. In addition, social media can be used for increasing transparency of the EG systems and the decision-making behind them. However, the legitimacy of social media as social boundary resources should be questioned, at least in EG environments that require high-level identification. Since, most social media platforms like YouTube, Twitter or Facebook use low assurance level authentication methods, in theory the information regarding the EG platform that is provided through these channels have a higher probability of being fake or false. In high-level identification EG systems a question to address is that should the used social media information channels be on the same assurance level as the EG platform itself, for being considered as a valid BR.

The conference calls or physical meetings between the platform's owners and third parties spark valuable discussions that accelerate the implementation of the platform. The meetings cannot be directly considered as resources that support the third parties development at arm's length since the parties are face-to-face. However, these meetings can produce minutes that can be used by parties not attending the meeting but developing content as third parties. In this indirect way, the meeting discussion can generate valuable social BRs.

To conclude, the BR categories presented in the platform literature do not match entirely with the BRs identified in this case study. For example, there are no signs of EG BRs in the 'Agreeing on IPR' and 'Common earning logics' categories. Still, some similarities are noticeable. To address RQ1 **"**What kinds of resources that resemble platform boundary resources exist in electronic government?**"**, I elicited these main BR categories for interoperable EG single point of contacts: (1) high-level identification tools, (2) secure data exchange tools, (3) secure messaging tools, (4) interoperability components and solutions, (5) regulatory document, (6) transparency resources and (7) instructions and documentation.

Table 13. Boundary resource in electronic government

| **Main boundary resource categories in electronic government** |
|---|
| 1. high-level identification tools |
| 2. secure data exchange tools |
| 3. secure messaging tools |
| 4. interoperability components and solutions |
| 5. regulatory document |
| 6. transparency resources |
| 7. instructions and documentation |

## 6.2 Practical implications

As noted in the previous chapters, EG environments often face factors hindering its development. EG platform owners should aim at providing boundary resources that obviate the hindering factors in EG development and adoption, and function as counteractive supporting factors. However, all issues in EG cannot be solved with boundary resources and reaching interoperable cross-border EG systems require major changes and reforms in various parts of government. Only so much can be done using BRs. However, the slightest assistance the BRs can offer in the development of an EG platform can have a significant impact on the result.

Considering the identified supporting and hindering factors in EG development discussed in chapter 5.2, the boundary resources should strive to enhance the communication between the platform owners and the third-party service providers, give sufficient flexibility to third parties in their development, and help the third parties overcome any legal, organizational and/or semantic interoperability issues. What the boundary resources should not do is overlap or contradict with any other existing regulations or solutions, they should not set unrealistic goals that lead the third parties to create hasty solutions, and not make strict regulations with too detailed process descriptions that are difficult to implement in practice.

The ambitious goals of public sector EG projects discussed in the findings chapter are rarely fulfilled. The pace in governmental institutions is perceived and known to be slow,

which is why one should not expect that EG platforms could be created in a short period of time. As the science author, Prof. Yuval Noah Hariri put it in his bestseller book Homo Deus: A Brief History of Tomorrow (2016), "the governmental tortoise cannot keep up with the technological hare". Keeping up with the newest technological innovations and inventions is not realistic for public sector organizations. Also, legislators seem to get ahead of themselves by laying regulations without having the necessary prerequisites. For example, the success of the SDG depends directly on the success of the prior eIDAS regulation. However, establishing eIDAS in the entire union is still in progress and long past due. EU officials did not verify a functioning EU-wide identification system before laying the SDG regulation that requires such a system. EG projects seem to be often too big to handle for the actual implementers. The ambitious goals are simply not realistic. Instead of laying grandiose regulations on a macro level, a better approach might be to take smaller steps with micro level regulations that guide public administrations to the right direction. Gradually building a solid foundation for an extensive EG system might generate better results in the long run than trying to create an all-encompassing ecosystem at once.

According to Savoldelli, Codagnone and Misuraca (2014), the deployment of EG systems has previously concentrated mainly on technical and operational matters while the institutional and political barriers that are the actual factors hindering the EG development were ignored. Even though these barriers have received more attention recently, the BRs in EG should concentrate even more on lowering these barriers and support the implementation of legal, organizational and semantic interoperability between public administrations.

While searching for boundary resources on the web, I encountered several programs, actions, solutions and regulations that were concerning eGovernment in the EU. As some of the subchapters in chapter 4.1.4 might imply, many of the initiatives within the EU seem to have similar goals. It appears that many programs/actions/solutions/regulations overlap in their objectives. Some of them might even have inconsistent and counteracting requirements. The sheer amount of different decisions regarding eGovernment the union has made is overwhelming and one could imagine why public administrations around Europe have difficulties in finding where to start. Striving to stay consistent with all decisions related to EG would clear up confusion and solve many problems.

In the governmental context, the incentives offered to third-party service providers on EG platforms are more or less non-existent compared to what free market platforms offer their third-party developers. One of the biggest differences between EG platforms and free market platforms is that the former exist for serving citizens and businesses while the latter exists mainly for doing business. Both types of platforms aim at connecting as many people with one another on the two- or multisided market and reaching so-called network effects, but achieving these effects in the governmental context is difficult. Firstly, in the free market platforms, often the offered incentives encourage third parties to join the platform (Gawer and Evans, 2016), which grows the network or community on the platform that ultimately generates the network effects. Secondly, the amount of public sector service providers are quite limited compared to e.g. application developers on the markets, meaning that the potential for network effects is smaller in the governmental context. Without a network or a community, network effects are impossible to achieve and negative network effects can arise. Negative network effects refer to poor experiences on a platform that start negative feedback loops that repel third parties and users from joining and using the platform (Choudary, Van Alstyne and Parker, 2016). All too often (85% according to a ten-year-old study (Heeks, 2008; Helbig, Gil-García and Ferro, 2008)), it seems that end results of EG projects are viewed as failures that most do not find useful and end up in these negative feedback loops. As stated in the literature review, the trustworthiness of EG is a factor influencing an EG system's perceived performance (Janssen et al., 2018). EG platform owners should find a way to offer incentives to third party service providers that encourage them to join the platform and gain the trust of all involved actors on the platform. Merely obligating service providers to join a platform with political power is not supportive. In the public domain, there are not that many spare resources that can be used as incentives. Governmental bodies should put efforts in finding e.g. monetary ways of attracting public sector service providers as well as citizens or business representatives to join and use EG platforms. The potential financial savings EG platforms could generate, would most likely cover for any expenditures monetary incentives on digital platforms would cause.

In conclusion, I devised five recommendations for EG officials that could help in creating EG platforms, listed in Table 14.

Table 14. Recommendations for EG system owners

| **Recommendations for EG system owners** |
|---|
| 1. strive to enhance the communication between the platform owners and the third-party service providers |
| 2. give sufficient flexibility to third parties in their development |
| 3. set realistic goals |
| 4. concentrate on overcoming legal, organizational and semantic interoperability challenges |
| 5. offer incentives for actors on the platform |

## 6.3 Theoretical implications and future research

The findings from the interviews validated some of the EG challenges and issues that scholars in the field of electronic government have acknowledged in previous studies, examined in chapter 2.4. The findings of this study support dos Santos's and Reinhard's (2012) claim that forming integrated and interoperable technological infrastructures out of dispersed systems is one of the biggest challenges in EG. The findings also suggest that political and institutional barriers are in fact the main factors slowing down EG adoption and development, that is in line with Savoldelli's, Codagnone's and Misuraca's (2014) suggestions. Goldkuhl (2008) stated that employing interoperability might be one of the biggest challenges in EG, which was also confirmed in this case study's interviews.

This exploratory case study was only a preliminary step toward specific and focused research of electronic government in the light of digital platform literature and its boundary resources. Above all, the existence of boundary resources in EG settings should be validated by similar studies. Future research should examine various EG systems resembling digital platforms for potential boundary resources that would help create generalizable theories of electronic government boundary resources. Accurate categorization of boundary resources in governmental platforms could be achieved by analyzing several EG environments in different societies.

The study's findings hint that when creating digital systems for public administrations, the designers and developers on lower levels of government tend to create their own solutions instead of reusing existing and functioning solutions provided by leading parties

on higher levels of government. For example, the EU is providing the eDelivery data exchange technology for member states, but some countries in the union are using the Estonian X-road instead as basis for the data exchange between administrations. Future research could investigate why public sector organizations choose to create their own solutions and sometimes reinvent the wheel, instead of reusing existing solutions that would produce homogenous systems that are easier to connect in the future. Two hypotheses could be that member states do not trust EU's solutions, or that they do not fulfill the needs of some organizations, which is why they want to or have to develop their own tailored systems.

Scholars of electronic government have predicted that EGs are evolving towards platform-like systems (Chen et al., 2007; Gottschalk, 2008; Sandoval-Almazan and Gil-Garcia, 2012). More studies on the Government as a platform concept could help better understand the opportunities and threats of governmental platforms.

The most challenging aspect of developing and adopting extensive interoperable EG systems is the legal, organizational and semantic problems. Creating a system of systems out fragmented and dispersed systems that now exist in governments around the world is a challenge with many dimensions. Future EG research should concentrate on solving the non-technical issues that are the major barriers slowing down the adoption of EG. To get truly useful EG systems or platforms, solutions in many layers of government need to be developed. For solving EG challenges and problems, research efforts are now needed in various fields, e.g. political science, information science, information systems, business administration, and public administration.

## 6.4 Evaluation of the study

Qualitative research should be judged based on four evaluation criteria: credibility, transferability, dependability, and confirmability. For proving the study trustworthy, all four criteria need to be considered. (Lincoln and Guba, 1985, 1994; Trochim, 2006)

Credibility refers to the research's results credibility from the perspective of the participants in the research. Only the participants can legitimately judge the credibility of the research findings since they are the ones collecting and analyzing the data. All the

conducted and recorded interviews were transcribed to text. The information can be shared with other researchers for raising credibility. I aimed using multiple sources for data collection and practicing triangulation of the data to add credibility to the results.

Transferability of the research refers to the generalizability of the results. To truly confirm the transferability of this case study's findings, other EG contexts should be analyzed in the light of the results. This case study has three subunits, and the findings are generalizable for all of them. This makes the transferability of the results more legitimate, compared to only having one unit of analysis. However, this case study was only a preliminary step towards more focused research and the main aim was not yet to generate transferable research findings.

Dependability concerns the study's replicability and repeatability. Essentially it questions whether the same results would be obtained if the research was conducted a second time. To add dependability I reviewed the research data multiple times, to make sure all the information from the interviews was fully internalized. Once the interviews were transcribed, I re-read all interviews one by one before starting the analysis and coding process. While coding in ATLAS.ti, I iteratively went through the data a few times to avoid any misunderstandings.

The final confirmability criterion concern the degree of neutrality in the study's findings. To present the findings as neutrally as possible, free from any personal motivations or potential bias, I included direct quotes from the interviews to give the reader a chance to draw own conclusions based on the raw data. As all the interviews were conducted in Finnish, the quoted parts of the interviews had to be translated into English, which might have affected the neutrality of the data.

## 6.5 Limitations

Only one of the three units under analysis in this case study is a finished EG project. Both the Single Digital Gateway and the Finnish labor market platform Työmarkkinatori are at the time of writing EG projects in an initial stage. This being the case, it is likely that some of the central boundary resources of these two governmental platforms do not exist

yet. This sets limitations to the findings. The findings of this case study address mainly challenges of an EG platform in the process of being developed.

The SDG will be an EU-wide EG system and it was analyzed from the perspective of only one member state. The EG state is different in other member states and the identified boundary resources might appear differently in other parts of the union. This case study gives only one perspective the SDG case.

The primary data in this case study was collected in six qualitative unstructured interviews, which gives some limitations to the study. For example, the personal opinions of the interviewees might have caused misleading results. Therefore, this study does not suggest that the results could be generalized. On the other hand, the results could contribute in forming new hypotheses and defining problems in EG. In addition, the possibility of the researcher's subjectivity influencing the results must be recognized (Lincoln and Guba, 1994).

Currently, many online governmental environments are more like portals or link catalogues than actual platforms. The evolution of EG seems to be towards platform-like systems, but for the time being only a few such platforms exist. All three studied environments are platform-like single point of contacts in a governmental setting that share some characteristics with digital infrastructures and digital platforms discussed in the academic literature reviewed in chapter 2. Boundary resources in governmental platforms or other EG systems certainly exist but they are not necessarily similar with BRs in digital platforms. This case study is a preliminary investigation of boundary resources in EG settings. As mentioned previously, this exploratory research merely helps in defining problems and suggesting hypotheses to boundary resources in an EG platform.

## References

Accenture (2018) *GOVERNMENT AS A PLATFORM: THE DIGITAL PLATFORM HAS ARRIVED*. Available at: https://www.accenture.com/t00010101T000000Z__w__/gb-en/_acnmedia/PDF-71/Accenture-GaaP-UK-POV-Updated.pdf#zoom=50 (Accessed: 13 May 2019).

Armstrong, M. (2006) 'Competition in two-sided markets', *RAND Journal of Economics*, 37(3), pp. 668–691. doi: 10.1557/JMR.1990.1123.

Barnard, C. (2013) *The Substantive Law of the EU - The Four Freedoms*. 4th edn. Oxford University Press. doi: 10.1093/he/9780199670765.001.0001.

Bazarhanova, A., Yli-Huumo, J. and Smolander, K. (2019) 'From platform dominance to weakened ownership: how external regulation changed Finnish e-identification', *Electronic Markets*. Electronic Markets. doi: 10.1007/s12525-019-00331-4.

Benlian, A., Hilkert, D. and Hess, T. (2015) 'How open is this platform? The meaning and measurement of platform openness from the complementors' perspective', *Journal of Information Technology*, 30(3), pp. 209–228. doi: 10.1057/jit.2015.6.

Bianco, V. D. *et al.* (2014) 'The role of platform boundary resources in software ecosystems: A case study', in *Proceedings - Working IEEE/IFIP Conference on Software Architecture 2014, WICSA 2014*, pp. 11–20. doi: 10.1109/WICSA.2014.41.

Bohm, A. (2004) 'Theoretical Coding: Text Analysis in Grounded Theory', *A Companion to Qualitative Research*, (1978), pp. 270–275. Available at: http://www.sxf.uevora.pt/wp-content/uploads/2013/03/Böhm_2004.pdf (Accessed: 23 April 2019).

Boudreau, K. (2010) 'Open Platform Strategies and Innovation: Granting Access vs. Devolving Control', *Management Science*, 56(10), pp. 1849–1872. doi: 10.1287/mnsc.1100.1215.

Carter, L. and Bélanger, F. (2005) 'The utilization of e-government services: Citizen trust, innovation and acceptance factors', *Information Systems Journal*. Wiley/Blackwell (10.1111), 15(1), pp. 5–25. doi: 10.1111/j.1365-2575.2005.00183.x.

*References*

CEF Digital (no date) *CEF Digital Home*. Available at: https://ec.europa.eu/cefdigital/wiki/display/CEFDIGITAL/CEF+Digital+Home (Accessed: 16 May 2019).

Chen, Z. *et al.* (2007) 'Semantic integration of government data for water quality management', *Government Information Quarterly*, 24(4), pp. 716–735. doi: 10.1016/j.giq.2007.04.004.

Choudary, S. P., Van Alstyne, M. and Parker, G. G. (2016) 'Pipelines, Platforms, and the New Rules of Strategy', *Harvard Business Review*, 94(4), pp. 54–62. doi: https://hbr.org/2016/04/pipelines-platforms-and-the-new-rules-of-strategy.

Chun, S. A. *et al.* (2010) 'Government 2.0: Making connections between citizens, data and government', *Information Polity*. IOS Press, 15(1–2), pp. 1–9. doi: 10.3233/IP-2010-0205.

Constantinides, P., Henfridsson, O. and Parker, G. G. (2018) 'Introduction-Platforms and Infrastructures in the Digital Age', *Information Systems Research*, 29(2), pp. 381–400. doi: 10.1287/isre.2018.0794.

Corbin, J. and Strauss, A. (1990) 'Grounded Theory Research: Procedures, Canons, and Evaluative Criteria', *Qualitative Sociology*, 13(1). Available at: https://s3.amazonaws.com/academia.edu.documents/38254674/W10-Corbin-and-Strauss-grounded-theory.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1553174374&Signature=7YTFckAPxL56hcuRdYHupZ%2BtKeQ%3D&response-content-disposition=inline%3B filename%3DGrounde (Accessed: 21 March 2019).

Criado, J. I. (2012) 'Interoperability of eGovernment for Building Intergovernmental Integration in the European Union', *Social Science Computer Review*, 30(1), pp. 37–60. doi: 10.1177/0894439310392189.

Davies, R. (2015) *eGovernment using technology to improve public services and democratic participation*, *EU research service*. doi: 10.2861/150280.

*References*

Dixon, B. E. (2010) 'Towards E-Government 2.0: An assessment of where E-Governemnt 2.0 is and where it is headed', *Public Administration & Management*, 15(2), pp. 418–454. Available at: https://scholarworks.iupui.edu/bitstream/handle/1805/4334/Dixon-2010-towards.pdf?sequence=1&isAllowed=y.

Duke, C. (2018) *Single Digital Gateway: How EU could meet expectations of citizens and businesses?* doi: 10.2861/342253.

Ebrahim, Z. and Irani, Z. (2005) 'E-government adoption: Architecture and barriers', *Business Process Management Journal*, 11(5), pp. 589–611. doi: 10.1108/14637150510619902.

Eichholtzer, M. (2019) *Overview of pre-notified and notified eID schemes under eIDAS - eID User Community - CEF Digital*. Available at: https://ec.europa.eu/cefdigital/wiki/display/EIDCOMMUNITY/Overview+of+pre-notified+and+notified+eID+schemes+under+eIDAS (Accessed: 6 May 2019).

Eisenhardt, K. M. (1989) 'Building Theories from Case Study Research', *Academy of Management Review*, 14(4), pp. 532–550. doi: 10.5465/AMR.1989.4308385.

*esuomi.fi* (no date). Available at: https://esuomi.fi/?lang=en (Accessed: 16 May 2019).

EU Growth (2018) *Building the single digital gateway together - YouTube*. Available at: https://www.youtube.com/watch?v=Znkoz0-P3sc&feature=youtu.be (Accessed: 7 January 2019).

European Commission (2012) *Regulation (EU) No 1024/2012 of the European Parliament and of the Council of 25 October 2012*, *Official Journal of the European Union*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012R1024&from=EN (Accessed: 16 April 2019).

European Commission (2013) *A European Single Point of Contact*. Available at: http://www.europarl.europa.eu/RegData/etudes/etudes/join/2013/507453/IPOL-IMCO_ET(2013)507453_EN.pdf (Accessed: 12 June 2018).

*References*

European Commission (2014) *Regulation (EU) No 910/2014 of the European Parliament and of the Council of 23 July 2014 on Electronic Identification and Trust Services for Electronic Transactions in the Internal Market and Repealing Directive 1999/93/EC*, *Official Journal of the European Union*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0910&qid=1558006255970&from=EN (Accessed: 16 May 2019).

European Commission (2015) *A Digital Single Market Strategy for Europe*, *COM(2015) 192 final*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0192&from=EN (Accessed: 4 July 2018).

European Commission (2016) *EU eGovernment Action Plan 2016-2020 - Accelerating the Digital Transformation of Government*, *COM(2016) 179 final*. Available at: https://ec.europa.eu/digital-single-market/en/news/communication-eu-egovernment-action-plan-2016-2020-accelerating-digital-transformation.

European Commission (2017) *COMMISSION STAFF WORKING DOCUMENT IMPACT ASSESSMENT - Accompanying the document - Proposal for a regulation of the European parliament and of the Council on establishing a single digital gateway to provide information, procedures, assistance and problem s*. Available at: https://ec.europa.eu/transparency/regdoc/rep/10102/2017/EN/SWD-2017-213-F1-EN-MAIN-PART-2.PDF (Accessed: 18 June 2018).

European Commission (2018a) *ISA$^2$ WORK PROGRAMME 2018 SUMMARY*. Available at: https://ec.europa.eu/isa2/isa2_en (Accessed: 31 July 2018).

European Commission (2018b) *Regulation (EU) No 2018/1724 of the European Parliament and of the Council of 2 October 2018 establishing a single digital gateway to provide access to information, to procedures and to assistance and problem-solving services and amending Regulation (EU)* , *Official Journal of the European Union*. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R1724&from=EN (Accessed: 7 January 2019).

*References*

European Commission (no date) *ISA² - Interoperability solutions for public administrations, businesses and citizens*. Available at: https://ec.europa.eu/isa2/.

Finnish Government (2017) *KaPa programme less than budgeted – Suomi.fi services completed on schedule - Article - Valtioneuvosto*. Available at: https://valtioneuvosto.fi/en/article/-/asset_publisher/10623/kapa-ohjelman-palvelut-ovat-valmistuneet-aikataulussa-ja-alle-budjetin (Accessed: 6 May 2019).

Fligstein, N. and Mara-Drita, I. (1996) 'How to Make a Market: Reflections on the Attempt to Create a Single Market in the European Union', *American Journal of Sociology*, 102(1), pp. 1–33. doi: 10.1086/230907.

Gawer, A. (2014) 'Bridging differing perspectives on technological platforms: Toward an integrative framework', *Research Policy*, 43, pp. 1239–1249. doi: 10.1016/j.respol.2014.03.006.

Gawer, A. and Evans, P. C. (2016) *The Center for Global Enterprise The Rise of the Platform Enterprise*, *The Center for Global Enterprise*. doi: 10.4236/ajibm.2014.49051.

Ghazawneh, A. (2012) *Towards a Boundary Resources Theory of Software Platforms*, *Jonkping University*. doi: 10.1016/S0009-2614(95)01235-4.

Ghazawneh, A. and Henfridsson, O. (2010) 'Governing Third-Party Development through Platform Boundary Resources.', in *International Conference on Information Systems 2010*, p. 48. doi: 10.1186/s12957-017-1211-7.

Ghazawneh, A. and Henfridsson, O. (2013) 'Balancing platform control and external contribution in third-party development: The boundary resources model', *Information Systems Journal*, 23(2), pp. 173–192. doi: 10.1111/j.1365-2575.2012.00406.x.

Gil-Garcia, J. R., Dawes, S. S. and Pardo, T. A. (2018) 'Digital government and public management research: finding the crossroads', *Public Management Review*, 20(5), pp. 633–646. doi: 10.1080/14719037.2017.1327181.

*References*

Goldkuhl, G. (2008) *The challenges of Interoperability in E-government: Towards a conceptual refinement*, *Proceedings pre-ICIS 2008 SIG eGovernment Workshop*. Available at: https://www.researchgate.net/publication/228903679 (Accessed: 14 February 2019).

Gottschalk, P. (2008) 'Maturity levels for interoperability in digital government', *Government Information Quarterly*, 26, pp. 75–81. doi: 10.1016/j.giq.2008.03.003.

Hamel, J., Dufour, S. and Dominic, F. (1993) *Case study methods*, *Sage*.

Hanseth, O. and Lyytinen, K. (2010) 'Design theory for dynamic complexity in information infrastructures: The case of building internet', *Journal of Information Technology*. Palgrave Macmillan, 25(1), pp. 1–19. doi: 10.1007/978-3-319-29272-4_4.

Hariri, Y. N. (2016) *Homo Deus: A Brief History of Tomorrow*. Harvill Secker.

Heeks, R. (2008) *eGovernment for Development - Success and Failure Rates of eGovernnment Projects in Developing Transitional Countries*, *eGovernment for Development Information Exchange*. Available at: http://www.egov4dev.org/success/sfrates.shtml (Accessed: 7 February 2019).

Heeks, R. and Bailur, S. (2007) 'Analyzing e-government research: Perspectives, philosophies, theories, methods, and practice', *Government Information Quarterly*, 24(2), pp. 243–265. doi: 10.1016/j.giq.2006.06.005.

Helbig, N., Gil-García, J. R. and Ferro, E. (2008) 'Understanding the complexity of electronic government: Implications from the digital divide literature', *Government Information Quarterly*, 26(1), pp. 89–97. doi: 10.1016/j.giq.2008.05.004.

Henfridsson, O. and Bygstad, B. (2013) 'The Generative Mechanisms of Digital Infrastructure Evolution', *MIS Quarterly*, 37(3), pp. 907–931. doi: 10.25300/MISQ/2013/37.3.11.

*References*

Howard, M. (2001) 'e-Government Across the Globe: How Will" e" Change Government?', *Government finance review*, pp. 6–9. Available at: https://s3.amazonaws.com/academia.edu.documents/30927075/eGovGFRAug01.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1531917423&Signature=yi3yTrxUaxyHc%2FbThyj%2B6AcHHe8%3D&response-content-disposition=inline%3B filename%3De-Government_Across_the_Globe (Accessed: 18 July 2018).

Janowski, T. (2015) 'Digital government evolution: From transformation to contextualization', *Government Information Quarterly*, 32, pp. 221–236. doi: 10.1016/j.giq.2015.07.001.

Janssen, M. *et al.* (2018) 'Trustworthiness of digital government services: deriving a comprehensive theory through interpretive structural modelling', *Public Management Review*, 20(5), pp. 647–671. doi: 10.1080/14719037.2017.1305689.

Juncker, J.-C. (2014) *A New Start for Europe : My Agenda for Jobs , Growth , Fairness and Democratic Change Political Guidelines Jean-Claude Juncker A New Start for Europe :* Available at: https://www.eesc.europa.eu/resources/docs/jean-claude-juncker---political-guidelines.pdf.

Karhu, K., Gustafsson, R. and Lyytinen, K. (2018) 'Exploiting and defending open digital platforms with boundary resources: Android's five platform forks', *Information Systems Research*, 29(2), pp. 479–497. doi: 10.1287/isre.2018.0786.

Kazan, E. *et al.* (2018) 'Disentangling Digital Platform Competition: The Case of UK Mobile Payment Platforms', *Journal of Management Information Systems*, 35(1), pp. 180–219. doi: 10.1080/07421222.2018.1440772.

KEHA-keskus (no date) *Työmarkkinatori*. Available at: http://tyomarkkinatori.fi/fi/ (Accessed: 2 May 2019).

King, S. P. (2013) 'Two-Sided Markets', *Australian Economic Review*, 46(2), pp. 247–258. doi: 10.1111/j.1467-8462.2013.12020.x.

Klischewski, R. and Lessa, L. (2015) 'Sustainability of E-Government Success', in *Public Affairs and Administration*, pp. 104–105. doi: 10.4018/978-1-4666-8358-7.ch014.

*References*

Lam, W. (2005) 'Barriers to e-government integration', *Journal of Enterprise Information Management*, pp. 511–530. doi: 10.1108/17410390510623981.

Lauslahti, K. *et al.* (2018) 'Expanding the Platform: Smart Contracts as Boundary Resources', in *Collaborative Value Co-creation in the Platform Economy*. Springer, Singapore, pp. 65–90. doi: 10.1007/978-981-10-8956-5_4.

Layne, K. and Lee, J. (2001) 'Developing fully functional E-government: A four stage model', *Government Information Quarterly*, 18(2), pp. 122–136. doi: 10.1016/S0740-624X(01)00066-1.

Lee, G. and Kwak, Y. H. (2012) 'An Open Government Maturity Model for social media-based public engagement', *Government Information Quarterly*, 29, pp. 492–503. doi: 10.1016/j.giq.2012.06.001.

Lincoln, Y. and Guba, E. (1985) 'Naturalistic Inquiry', *The Blackwell Encyclopedia of Sociology*.

Lincoln, Y. and Guba, Eg. G. (1994) 'Competing Paradigms in Qualitative Research - Guba & Lincoln 1994'. Sage, pp. 105–117. Available at: https://eclass.uoa.gr/modules/document/file.php/PPP356/Guba & Lincoln 1994.pdf (Accessed: 9 May 2019).

Linders, D. (2012) 'From e-government to we-government: Defining a typology for citizen coproduction in the age of social media', *Government Information Quarterly*. JAI, 29(4), pp. 446–454. doi: 10.1016/J.GIQ.2012.06.003.

Marche, S. and McNiven, J. D. (2003) 'E-Government and E-Governance: The Future Isn't What It Used To Be', *Canadian Journal of Administrative Sciences*, 20(1), pp. 74–86. doi: 10.1111/j.1936-4490.2003.tb00306.x.

Mattila, J., Seppälä, T. and Holmström, J. (2016) 'Product-centric Information Management', in *Industry Studies Association Conference*. doi: 10.1002/sce.21051.

Mattila, J., Seppälä, T. and Lähteenmäki, I. (2018) *Who holds the reins? - Banks in the Crossfire of Global Platforms*. Available at: https://www.researchgate.net/publication/327655738 (Accessed: 13 March 2019).

*References*

Ministry of Finance (2016) *KaPA-laki - Valtiovarainministeriö*. Available at: https://vm.fi/kapa-laki (Accessed: 16 May 2019).

Ministry of Finance (2017) *Kansallisen palveluarkkitehtuurin toteuttamisohjelma*. Available at: www.owalgroup.com (Accessed: 16 July 2018).

Ministry of Justice (2016) *Laki hallinnon yhteisistä sähköisen asioinnin tukipalveluista*. Available at: https://vm.fi/documents/10623/2964496/Laki-hallinnon-yhteisistä-sähköisistä-tukipalveluista-571-2016.pdf/fea47fdb-4cd4-4268-91b6-1d0d30ee417d/Laki-hallinnon-yhteisistä-sähköisistä-tukipalveluista-571-2016.pdf.pdf (Accessed: 25 April 2019).

Monteiro, E. (1998) 'Scaling information infrastructure: The case of next-generation IP in the internet', *Information Society*, 14(3), pp. 229–245. doi: 10.1080/019722498128845.

Myllärniemi, V. *et al.* (2018) 'Development as a journey: factors supporting the adoption and use of software frameworks', *Journal of Software Engineering Research and Development*, 6, p. 6. doi: 10.1186/s40411-018-0050-8.

NIIS (no date) *Nordic Institute for Interoperability Solutions*. Available at: https://www.niis.org/ (Accessed: 20 May 2019).

O'Reilly, T. (2010) 'Government as a Platform', *Innovations: Technology, Governance, Globalization*, 6(1), pp. 13–40. doi: 10.1162/INOV_a_00056.

Pardo, T. A., Nam, T. and Burke, G. B. (2012) 'E-Government Interoperability: Interaction of Policy, Management, and Technology Dimensions', *Social Science Computer Review*, 30(1), pp. 7–23. doi: 10.1177/0894439310392184.

Pardo, T. A. and Tayi, G. K. (2007) 'Interorganizational information integration: A key enabler for digital government', *Government Information Quarterly*, 24(4), pp. 691–715. doi: 10.1016/j.giq.2007.08.004.

Parker, G. G. *et al.* (2016) *Platform revolution: How networked markets are transforming the economy and how to make them work for you.* New York: WW Norton.

*References*

Population Register Centre (2018) *Finland's and Estonia's data exchange layers connected to one another on 7 February - the rapid exchange of information between the countries is now possible*. Available at: https://vrk.fi/en/article/-/asset_publisher/suomen-ja-viron-palveluvaylat-liitetty-yhteen-7-2-tietojen-nopea-ja-luotettava-vaihto-maiden-valilla-nyt-mahdollista (Accessed: 16 May 2019).

Population Register Centre (2019) 'Suomi.fi-palveluiden kehitys'.

*Population Register Centre - GitHub* (no date).

De Reuver, M., Sørensen, C. and Basole, R. C. (2018) 'The digital platform: A research agenda', *Journal of Information Technology*, 33(2), pp. 124–135. doi: 10.1057/s41265-016-0033-3.

Sahraoui, S. (2007) 'E-inclusion as a further stage of e-government?', *Transforming Government: People, Process and Policy*, 1(1), pp. 44–58. doi: 10.1108/17506160710733698.

Saldaña, J. (2016) *The Coding Manual for Qualitative Researchers*. 3rd edn, *Sage*. 3rd edn. Edited by J. Seaman et al. Sage Publications Ltd.

Sandoval-Almazan, R. and Gil-Garcia, J. R. (2012) 'Are government internet portals evolving towards more interaction, participation, and collaboration? Revisiting the rhetoric of e-government among municipalities', *Government Information Quarterly*, 29(SUPPL. 1). doi: 10.1016/j.giq.2011.09.004.

Sandoval-Almazán, R. and Gil-Garcia, J. R. (2008) 'Limitations of Evolutionary Approaches to E-government', *Handbook of Research on Public Information Technology, Hershey, IGI Global*, pp. 22–30. doi: 10.4018/978-1-59904-857-4.ch003.

dos Santos, E. M. and Reinhard, N. (2012) 'Electronic Government Interoperability: Identifying the Barriers for Frameworks Adoption', *Social Science Computer Review*, 30(1), pp. 71–82. doi: 10.1177/0894439310392196.

Savoldelli, A., Codagnone, C. and Misuraca, G. (2014) 'Understanding the e-government paradox: Learning from literature and practice on barriers to adoption', *Government Information Quarterly*. Elsevier B.V., 31, pp. 63–71. doi: 10.1016/j.giq.2014.01.008.

*References*

Scholl, H. J. *et al.* (2012) 'Process integration, information sharing, and system interoperation in government: A comparative case analysis', *Government Information Quarterly*, 29(3), pp. 313–323. doi: 10.1016/j.giq.2012.02.009.

Scholl, H. J. (2017) *E-Government*, *Oxford Bibliographies*. doi: 10.1093/OBO/9780199756841-0186.

Scholl, H. J. and Klischewski, R. (2007) 'E-government integration and interoperability: Framing the research agenda', *International Journal of Public Administration*, 30(8–9), pp. 889–920. doi: 10.1080/01900690701402668.

Selander, L., Henfridsson, O. and Svahn, F. (2013) 'Capability search and redeem across digital ecosystems', *Journal of Information Technology*, 28, pp. 183–197. doi: 10.1057/jit.2013.14.

Seppälä, T., Juhanko, J. and Korhonen, H. (2015) *"Platform" – Historiaa, ominaispiirteitä ja määritelmä*. Available at: https://www.researchgate.net/profile/Timo_Seppaelae3/publication/285584237_Platform_-_Historiaa_ominaispiirteita_ja_maaritelma/links/5660295308ae4988a7bf0539.pdf (Accessed: 26 June 2018).

Seppälä, T. and Mattila, J. (2016) 'Ubiquitous Network of Systems', (January), p. 3. doi: 10.13140/RG.2.1.3039.7528.

Streb, C. K. (2012) 'Encyclopedia of case study research', in *Encyclopedia of Case Study Research*, pp. 372–373. doi: 10.5860/choice.48-0043.

Teo, T. S. H., Srivastava, S. C. and Jiang, L. (2008) 'Trust and Electronic Government Success: An Empirical Study', *Journal of Management Information Systems*, 25(3), pp. 99–132. doi: 10.2753/MIS0742-1222250303.

Tilson, D., Lyytinen, K. and Sørensen, C. (2010) 'Digital infrastructures: The missing IS research agenda', *Information Systems Research*, 21(4), pp. 748–759. doi: 10.1287/isre.1100.0318.

Tilson, D., Sørensen, C. and Lyytinen, K. (2011) 'The paradoxes of change and control in digital infrastructures: The mobile operating systems case', in *Proceedings - 2011 10th International Conference on Mobile Business, ICMB 2011*. IEEE, pp. 26–35. doi: 10.1109/ICMB.2011.45.

'*Treaty of Lisbon amending the Treaty on European Union and the Treaty establishing the European Community',* 13 December 2007. 2007/C 306/01. Available at: https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:12007L/TXT&qid=1557747184010.

Trochim, W. M. K. (2006) *Social Research Methods - Knowledge Base - Qualitative Validity*. Available at: http://www.socialresearchmethods.net/kb/qualval.php (Accessed: 10 May 2019).

Vann, V. R. and Atherton, S. S. (2017) *New European Interoperability Framework*, *European commision*. doi: 10.2799/78681.

Wirtz, B. W. and Daiser, P. (2018) 'A meta-analysis of empirical e-government research and its future research implications', *International Review of Administrative Sciences*, 84(1), pp. 144–163. doi: 10.1177/0020852315599047.

Yin, R. K. (2009) *Case Study Research: Design and Methods*. 4th edn. SAGE.

Yli-Huumo, J. *et al.* (2018) 'Suomi.fi – Towards government 3.0 with a national service platform', in *IFIP WG 8.5 Electronic Government (EGOV)*, pp. 3–14. doi: 10.1007/978-3-319-98690-6_1.

Yoo, Y., Henfridsson, O. and Lyytinen, K. (2010) 'The new organizing logic of digital innovation: An agenda for information systems research', *Information Systems Research*, 21(4), pp. 724–735. doi: 10.1287/isre.1100.0322.

# Appendixes

## APPENDIX I

Main topics and questions discussed in the semi-structured/unstructured interviews:

- Introduction
    - Interviewer presenting the research topic and research questions
    - Asking for permission to record the interview
    - Informing the interviewee that names of interviewees will not be disclosed in the thesis
- Questions about the interviewee
    - Title and role in organization
    - Responsibilities in the project or organization
    - Interviewee's and their organization's role in the Finnish EG
- Interviewee's connection to the SDG regulation
    - Acquaintance with the SDG regulation
    - Implementation plans in Finland
        - Interviewee's and their organization's role in the implementation of SDG
    - Knowledge of EU's resources supporting the implementation of SDG
    - Contact with EC authorities regarding SDG
        - Have EC people contacted you and given instructions regarding the SDG?
- Finland's EG authorities' cooperation with the EC
    - How much influence do Finnish authorities have in the regulations?
    - How have the EU regulations been anticipated in Finland?
- eIDAS
    - Situation of implementation in Finland
    - Have eIDAS been discussed in relation to SDG in Finland?
    - electronic identification plans in Finland
    - Cross-border transactions

- Suomi.fi and the Data Exchange Layer
    - What parts can be used for the SDG?
    - What kind of changes is needed in the platform because of the SDG regulation?
    - Have the Finnish and Estonian X-road technology been considered by the EC?
    - Situation of the X-road technology's use around the world
    - Comparison of eDelivery and X-road
    - Benefits of open source code
- Työmarkkinatori
    - Description of the platform ecosystem
        - Actors on the platform
    - How are partners attracted to the platform?
        - What resources are used for this?
        - Are incentives used?
        - Is there something hindering them from joining?
    - Relation to SDG
- EG development and adoption in general
    - Bureaucracy
    - Administrative challenges
    - Organizational challenges
    - Interoperability challenges
    - Technical readiness
    - EG schedules
    - Communication between system owners and implementers
    - The implementer's independence in the development and design of EG
    - Level of detail in regulations and the regulation process
- Asking for recommendations of people to contact for an interview

## APPENDIX II

Single Digital Gateway public administration procedures (Annex II) :

| Life events | Procedures | Expected output |
|---|---|---|
| Birth | Requesting proof of registration of birth | Proof of registration of birth or birth certificate |
| Residence | Requesting proof of residence | Confirmation of registration at the current address |
| Studying | Applying for a tertiary education study financing, such as study grants and loans from a public body or institution | Decision on the application for financing or acknowledgement of receipt |
| | Submitting an initial application for admission to public tertiary education institution | Confirmation of the receipt of application |
| | Requesting academic recognition of diplomas, certificates or other proof of studies or courses | Decision on the request for recognition |
| Working | Request for determination of applicable legislation in accordance with Title II of Regulation (EC) No 883/2004 (1) | Decision on applicable legislation<br>Notifying |
| | Notifying changes in the personal or professional circumstances of the person receiving social security benefits, relevant for such benefits | Confirmation of receipt of notification of such changes |
| | Application for a European Health Insurance Card (EHIC) | European Health Insurance Card (EHIC) |
| | Submitting an income tax declaration | Confirmation of the receipt of the declaration<br>Confirmation |
| Moving | Registering a change of address | Confirmation of deregistration at the previous address and of the registration of the new address |
| | Registering a motor vehicle originating from or already registered in a Member State, in standard procedures (2) | Proof of registration of a motor vehicle |
| | 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 | Receipt of toll sticker or vignette or other proof of payment |
| | Obtaining emission stickers issued by a public body or institution | Receipt of emission sticker or other proof of payment |
| Retiring | Claiming pension and pre-retirement benefits from compulsory schemes | Confirmation of the receipt of the claim or decision regarding the claim for a pension or pre-retirement benefits |
| | Requesting information on the data related to pension from compulsory schemes | Statement of personal pension data |

| | | |
|---|---|---|
| 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 | Confirmation of the receipt of notification or change, or of the request for permission for business activity |
| | Registration of an employer (a natural person) with compulsory pension and insurance schemes | Confirmation of registration or social security registration number |
| | Registration of employees with compulsory pension and insurance schemes | Confirmation of registration or social security registration number |
| | Submitting a corporate tax declaration | Confirmation of the receipt of the declaration<br>Notification |
| | Notification to the social security schemes of the end of contract with an employee, excluding procedures for the collective termination of employee contracts | Confirmation of the receipt of the notification |
| | Payment of social contributions for employees | Receipt or other form of confirmation of payment of social contributions for employees |

(1) Regulation (EC) No 883/2004 of the European Parliament and of the Council of 29 April 2004 on the coordination of social security systems (OJ L 166, 30.4.2004, p. 1)

(2) This covers the following vehicles: (a) any motor vehicle or trailer as referred to in Article 3 of Directive 2007/46/EC of the European Parliament and of the Council (OJ L 263, 9.10.2007, p. 1); and (b) any two- or three-wheel motor vehicle, whether twin-wheeled or otherwise, intended to travel on the road, as referred to in Article 1 of Regulation (EU) No 168/2013 of the European Parliament and of the Council (OJ L 60, 2.3.2013, p. 52).