Interoperability in the Digital Era of Governance: How Denmark facilitates greater levels of interoperable cross-jurisdictional data exchanges within the public sector than the Netherlands.

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How Denmark facilitates greater levels of interoperable cross-jurisdictional data exchanges within the public sector than the Netherlands

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Master Thesis in Public administration

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June 9, 2023

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1. Introduction

1.1 Public sector in the pre-digitalization era

Citizens routinely interact with their governments to declare changes of address, renew IDs and licenses, file or make changes to their taxes and request public services. As the responsibilities for public services and policy areas are dispersed among the different jurisdictional tiers of government, along with private and nonprofit organizations through contracted arrangements, citizens are regularly required to interact with multiple levels of government and non-governmental institutions to declare changes and apply for public services. The multitude of different governmental and non-governmental actors and institutions citizens have to interact with, requires each individual citizen to figure out which jurisdictional level is charged with the policy responsibility which they are seeking.

Prior to the development and utilization of digital tools in public sector operations, the complexity of multilevel governance required citizens to resubmit the same personal information to all the different jurisdictional levels of governance which they repeatedly interacted with. This resubmission of data meant that both citizens and public sectors were burdened with repetitive and time consuming informational exchanges that were costly, cumbersome and laborious for each jurisdictional level and their authorities. The arduousness of cross-jurisdictional data exchanges continued, in the latter part of the twentieth century, despite the introduction of technological hardware that could digitally store data on hard drives (Claudia Gallo et al., 2014).

The burdensome methods of exchanging cross jurisdictional data greatly changed with the exponential increases in computing power and the global development of the internet. From 1986 to 2007, the world's "information storage capacity" grew yearly by 23 percent, with the power of computation annually increasing by 58 percent (Baldwin, 2016, p.

82). The invention of the internet and its subsequent globalized democratization during the 1990s and early 2000s, transitioned humanity into a digital epoch where data exchanges can be instantaneous exchanged across the world at new unprecedented large volumes. This ability for humans to instantaneously facilitate large scale data exchanges across the globe, has pushed nations to create multidimensional public sectors that connects to the internet's global "digital nervous system" that makes up the vast majority of informational exchanges today (Mendelson, 2000, p. 527). As the technological infrastructure behind the internet and the development of smartphones has led most of the developed world to have 24/7 access to the world wide web, public sectors have capitalized on this unprecedented ability to facilitate cross jurisdictional digital data exchanges.

The development of online portals where access to the public sector is funneled through a digital single point of entry, has become a favored policy goal for governments around the world. The ability for citizens to request, view and change information, relating to the different jurisdictional authorities they interact with, within a single online portal, has the potential for governments to minimize the challenges relating to problems with cross-jurisdictional coordination (Hooghe & Marks, 2003). The ability to architecturally design a holistic digital public sector, that facilitates collaboration and automatic data exchanges between the governmental organizations at different jurisdictional levels of government, is something most nations in the world are striving to create. As of the end of 2022, 138 nations have established some form of digital "'one-stop-shop' portal" to communicate and interact with their citizens (United Nations: Department of Economic and Social Affairs, 2022, p. 25). As the European Union's goal for 2030 is to make the European Union interconnected digital infrastructure where cross-border data exchanges can flow unhindered between member states public administrations, domestic interconnectivity is vital (European Commission,

2017b). In order for public administrations to facilitate cross-jurisdictional data exchanges, technical and legal interoperability mechanism must be in place.

1.2 Research Question

The theoretical and empirical goal of this thesis is to explain why Denmark appears to be more digitally interconnected than the Netherlands. Subsequently, the research question is: **what causes and mechanisms has led Denmark to facilitate greater levels of interoperable cross-jurisdictional data exchanges than the Netherlands.** This phrasing has a twofold purpose. Firstly, it allows for the development of a theoretical framework that deductively establishes a descriptive account of the mechanisms needed for the facilitation of data exchanges within and across jurisdictional boundaries.

The thesis produces a deductive theoretical account that establishes testable hypotheses that help make informed inferences about why Denmark has greater levels of interoperable cross-jurisdictional data exchanges, than the Netherlands. To do this, the theoretical framework draws on the Digital Era Governance and New Public Management paradigms, Interoperability and Multi-Level Governance. The data collection was drawn from the most recent Danish and Dutch digitalization strategies, along with other documentary evidence. A qualitative content analysis coding scheme was used to showcase that Denmark has embraced greater levels Digital Era Governance principles than the Netherlands.

1.3 Academic Relevance

There are several comparative studies that investigates interoperability challenges. A 2007 study investigating the Danish and Dutch implementation of their national enterprise architectures (digital infrastructure in the public sector) found that both nations struggled to facilitate data exchanges across jurisdictional tiers. Despite this, the study found that Denmark put greater emphasis on establishing interoperable data exchanges between its

national and subnational jurisdictions, while the Netherlands largely focused on reducing administrative burdens within the separate jurisdictional tiers (Janssen & Hjort-Madsen, 2007). A study comparing the Netherlands and Estonia highlights that Dutch decentralization has led the national and subnational levels of governance to use separate data exchange infrastructures (Bharosa et al., 2020). Another study highlights the challenges involved in incorporating the EU eIDAS regulation (facilitating the use of nationally issued eIDs in other EU member states) in the Netherlands and Estonia and points out that a common hindrance to cross-border cooperation is the different interpretations and applications of the regulation (Lips et al., 2020). Another comparative study of the Netherlands and Estonia highlights that data exchanges are governed centrally in Estonia while the Netherlands has multiple data exchanges systems that lead to less data sharing between the multiple levels of governance (Bharosa et al., 2020). This study is relevant as no up to date comparative study exists that compares Denmark and the Netherlands digitalization strategies through the lens of interoperability.

1.4 Societal Relevance

Understanding what interoperability mechanisms that facilitates greater MLG interoperability, as well as the differing political and societal developments that have created different levels of MLG interoperability in Denmark and the Netherlands, will help policymakers prepare for future societal threats. The Covid-19 pandemic highlighted the acute need for greater interoperable data exchanges between the EU member states and their citizens. Societal lockdowns and travel restrictions throughout 2020 severely curbed the freedom of movement of people and goods, resulting in the Union’s economy being greatly hampered (European Commission, 2022c). Consequently, as the EU economy is greatly dependent upon the seamless movement of people and goods being able to traversing EU borders unhindered, the EU’s corona response took advantage of the high smartphone

connectivity levels the European Union has. Through the creation of interoperability guideline for contact tracing, the “tracing of infection chains across national borders” took place through an interoperability gateway that connected the national contact tracing apps (European Commission, 2020a, p. 10, 2020b). This coordination was expanded in 2021 and 2022 with the EU Digital Covid Certificate that made vaccinations data on individual citizens smartphones apps verifiable across European Union borders (European Commission, 2022c). Despite this fast coordination and the unprecedented development and implementation of European regulatory frameworks, the EU and its member states were unable to response proactively due to the lack of architectural solutions that facilitated interoperable data exchanges and guidelines cross-border sharing guidelines had to be established (Forman & Mossialos, 2021). Therefore, due to the interconnectedness of the European Union’s member states collective economy and their societies, future crises that are transboundary by nature, will require greater levels of cross-border data exchanges in order for the member states to respond proactively (Campmas et al., 2022; OECD, 2021a, p. 12).

2. Background

Before the turn of the millennium, government-to-citizen (G2C) and citizen-to-government (C2G) interactions were usually slow and cumbersome. Public service delivery was almost exclusively reactive in nature, as frontline civil servants had to respond to citizens requests (Scholta et al., 2019). The lack of the digital tools public sectors employ today, meant that street-level bureaucrats relied upon physical human-to-human interactions to respond to citizens' requests (Bovens & Zouridis, 2002).

Societal digitalization transitioned government-to-citizen (G2C) and citizen-to-government (C2G) interactions to become human-to computer interactions (Busch & Henriksen, 2018). The absorption of information and communication technology (ICT) into public sectors operations, constituted the beginnings of e-government (Twizeyimana & Andersson, 2019). The development of computer systems within public sector operations led to the transitioning from analogue to digital technologies. This digital transformation has eradicated the need for large numbers of street level bureaucrats as G2C and C2G communications have become increasingly automated (Margetts & Dunleavy, 2013a; Trittin-Ulbrich et al., 2020). This transformation has turned many public sectors into system-level bureaucracies, where back-office pre-coded algorithms make automated decisions that can issue front office service delivery verdicts through online solutions (Busch & Henriksen, 2018). This capability to automate decision-making powers has been turbocharged by the development of smartphone technologies and their ability to act as the medium for G2C and C2G data exchanges (Lemke et al., 2020).

Global Interconnectivity

Since the Apple's iPhone was first introduced in 2007 the number of people connected to the internet globally has more than tripled, from 1.4 billion (21%) in 2007 to 5.3 billion (66%) in 2022 (International Telecommunication Union, 2022). Out of the 5.3 billion global internet

users, 87% of individuals in the European Union are actively using and connected to the internet. Additionally, 98.8 percent of all populated areas are covered by 4G mobile cellular networks in the European Union (European Commission, 2022a, p. 30; International Telecommunication Union Development Sector, 2022, p. 21). This has created a new era of digital interconnectivity, in which European public administrations have the unprecedented ability to interact with their citizens in a more proactive, efficient and citizen-centric manner when delivering public services (Scholta et al., 2019). With global smartphone contracts hovering around 6.3 billion, and 2.6 billion smart devices currently connected to cellular internet connections in the European Union (Ericsson, 2021, p. 5; European Investment Bank, 2021, p. 99), the behaviors and expectations of EU citizens have transformed to expect fast, efficient and instantaneous service delivery that does not require them to stand in lines at physical governmental offices (European Commission, 2017c). Accordingly, the ability for each individual citizen to interact with their government "in the palm of" their hands has allowed EU public administrations to appease these demands as many EU member states have transitioned from e-government to smart governance solutions (European Commission, 2021a, p. 11; Lemke et al., 2020).

Smart Governance = Online Public Sector Portals

In this new era of digital connectivity where nearly all EU citizens are connected to the internet through smart devices, the European Union and its member states are prioritizing smart governance solutions to communicate and facilitate public service deliveries (Krimmer, Dedovic, et al., 2021). This prioritizing largely comes down to the paradoxical requirements for public sectors to do more with less money, where governments are expected to be as cost efficient as possible whilst continually improving service deliveries (Hansen, 2011; Hood, 1991; Kettl, 2005; Lægreid, 2015). To appease this paradoxical expectation, most European governments have taken advantage of the widespread usage of smartphones and devices with

internet connections, to design C2G and G2C interactions around the needs, demands and anticipations of citizens (Margetts & Dunleavy, 2013b; OECD, 2003, 2019). Therefore, as a key prerequisite for smart governance operations is mass digital connectivity, all European Union's member states have developed different digital online infrastructures for the facilitation of G2C and C2G data exchanges (Berntzen et al., 2020; Sankowska, 2018).

The online infrastructures that public sectors have been building to facilitate digital data exchanges have largely been in the form of online portal architectures (Ji & Jiang, 2014). Online portals provide greater value for taxpayer's money as they help reduce the material and labor costs involved in running front and back-office operations. Simultaneously, digital portal infrastructures help make services more accessible, convenient and personalized to each individual's needs, through proactive self-service capabilities (Claudia Gallo et al., 2014; Dais et al., 2013; Lemke et al., 2020). Self-service solutions, that are facilitated by automated backend government-to-government (G2G) data exchanges, cuts administrative costs and extends the 'opening hours' of the public sector to be accessible around the clock (Don MacLean & Ryad Titah, 2022; European Commission, 2017c; Hansen & Lauridsen, 2004). As smartphones allow for citizens to access self-service solutions, digital public sector portals have become the desired medium for facilitating C2G and G2C communications (Figure 1) in front office operations in European Union.

Public online portal = facilitates cross-jurisdictional data exchanges

In some of the more digitally developed EU nations, high levels of cross jurisdictional data exchanges are facilitated within the digital infrastructure of the public sector (Leosk et al., 2021). Cross-jurisdictional data exchanges connects the backends of the various levels of government through automated government-to-government communication (Figure 2). The facilitation digital back-office cross-jurisdictional government-to-government data exchanges, have helped create digitally interconnected public sector, where front and back-

office operations are able to automatically exchange information without the need for human bureaucratic interference (Goldkuhl & Röstlinger, 2015; Stavros Zouridis et al., 2020). Citizenries can log into the frontend portals infrastructures, to input data that can be accessed, requested and shared between the multiple levels of governance (Figure 3). This front and backend multi-jurisdictional interconnectivity, grants citizens twenty-four seven online access to their public sector and service delivery can be exponentially faster (Dunleavy et al., 2006).

As the levels of cross-jurisdictional digital interconnectedness is not replicated across the European Union, the EU has been issuing directives and guidelines to encourage its member states to increase the volume of automated government-to-government (G2G) data exchanges between national and subnational levels of government. Increasing the volumes of data exchanges between the multiple levels of government is a part of the wider supranational digitalization policy of the European Union to digitally interconnect EU states public administrations across Union (European Commission, 2021a).

EU goal: Digital interconnectivity through cross-border data exchanges

To make the European Union's public sectors more digitally interconnected, the EU has made the facilitation of seamless cross-border data exchanges a crucial element of achieving greater interconnectivity between member states governments (Establishing the Digital Europe Programe, 2021; European Commission, 2021a). The global economy has rapidly digitalized our world and subsequently made Information and Communications Technology (ICT) "the foundation of all modern innovative economic systems," (European Commission, 2015, p. 3). As digital public sector systems have greatly increased the volume and speed at which people, goods and digital services are traversing the internal borders of the EU single market, economic growth is chiefly dependent upon quick data exchanges between public administrations and EU citizens and businesses (Official Journal of the European Union,

2018, p. 2). Consequently, for EU public administrations to adapt and evolve along with technological developments, the EU has made the facilitation of easy, fast and efficient data exchanges as a key policy goal for the continued development and growth of the European Digital Economy (European Commission, 2021b).

EU 2030 goal: "interoperability across all levels of government"

This desire to facilitate greater levels of cross-border data exchanges is rooted in the EU's goal to establish "interoperability across all levels of government" within the European Union (European Commission, 2021a, p. 11). Interoperability is the ability of ICT systems to exchange and purposely use the received information (Zeng, 2019). The European Union views the lack of digital connectivity between its member states' public administrations as a collective action problem that requires supranational coordination (European Commission, 2021b). Since 2018, the EU has been working on establishing a supranational Single Digital Gateway (SDG) that can effectively connect member states' digital national infrastructures (Official Journal of the European Union, 2018). This centralized EU portal infrastructure is currently being further developed as the EU Commission has proposed the establishment of an "Interoperable Europe Portal" that will specifically facilitate interoperable coordination and cooperation between member states (European Commission, 2022b). However, since this proposed supranational portal will lack the authority to enforce member states to implement interoperability solutions, the European Union is reliant upon member states taking voluntary action to facilitate interoperable G2G data exchanges between their own local, regional and national governments (European Commission, 2022b).

The digital capabilities of EU member states public sectors varies across the Union. Some only display information online and provide simple transactional services, while others facilitate vertically and horizontally integrated data exchanges between the multiple levels of government(Layne & Lee, 2001). As these capabilities are developing at different speeds,

heterogeneous information sharing infrastructures exist in the European Union (Krimmer, Dedovic, et al., 2021). As this heterogeneity is seen both at the national and subnational levels of governance of member states, the EU's 2030 goal of facilitating a fully digitally interconnected EU across all levels of national and subnational governance is challenged by the sheer volume of jurisdictions and differentiated approaches to public sector digitalization.

Challenge: decentralization

The 27 European Union member states consist of nearly 90,000 decentralized subnational jurisdictions (OECD & United Cities and Local Governmetns, 2016). This large number is predominantly due to decentralized local governance being deemed a prerequisite for democratic governance in the European Union (European Charter of Local Self-Government, 1985; Savy et al., 2017). This is also applied to the national level of governance, as each EU member state acts as sovereign decentralized nation within the supranational infrastructure of the European Union. The EU principle of subsidiarity enshrines this as the EU's supranational infrastructure should only impose itself if it is deemed to be the best level of governance to solve problems that are transboundary (Consolidated Version of the Treaty on European Union, 2012). Subsequently, decentralization is considered a requirement for both democracy and effective service delivery. This is because EU members' subnational and national governing jurisdictions are closer to citizens and likely have greater expertise in local affairs than the European Union (Savy et al., 2017). Thus, as the EU is not going to transition into a federal state with sovereign powers, digitally connecting the nearly 90,000 public administrations across the 27 member states, is an obstacle to the EU's goal of facilitating seamless data exchanges across member states borders.

Challenge: differentiated integration levels

Facilitating cross-border data exchanges is further complicated by the differentiated integration approaches across the European Union. The 27 member states have all developed their digital infrastructures in different ways and are at different stages and levels of digital maturity and interconnectedness. This makes it difficult for public administrations to send and receive information across borders quickly and easily.

The differentiated approaches are largely attributed to the complexity of the political architecture of the European Union. Its supranational infrastructure has limited coercive powers to enforce legislative changes in the domestic affairs of its member states (Alter & Meunier, 2009). In the area of EU digitalization, the Union has predominately refrained from issuing regulations and decisions that are legally binding and automatically apply to all member states. Instead, the EU has largely issued recommendations, opinions, and directives on the development of digital portals and the infrastructures needed to facilitate data exchanges domestically within members' public sectors. The issuing of directives has been a common approach, as it ensures member states retain their digital sovereignty and can interpret the requirements of the directives to fit within their own national and subnational digital infrastructures (Council of the European Union, 2020). The 2006 EU directive "on the services in the internal market" obligated member states to create digital "points of single contact" for the simplification and streamlining of communication between EU citizens, EU businesses and their respective public administrations (European Parliament & Council, 2006). As member states are responsible for transposing the legal frameworks for establishing portal infrastructures into their own domestic legislative frameworks, the digital interconnectedness of member states' portal infrastructures differs across the Union.

Voluntary enactment of interoperability solutions

As a means to reduce the heterogeneity of data-exchange infrastructures across the European Union, the EU Commission has proposed a new Interoperable Europe Board to advise on interoperability solutions to coordinate and streamline the digital information networks and systems across the EU to either "provide or manage public services to be delivered or managed electronically in the Union" (European Commission, 2022b, p. 25). This proposed Board is a part of the Interoperable Europe Act which stresses the need for a strong EU framework that designs, recommends and helps to implement interoperability solutions in member states (European Commission, 2022b, p. 39). The EU Commission projects that the facilitation of interoperability solutions designed to facilitate seamless cross-border data exchanges has the potential to save member states' residents and businesses between €5.5 and €19.2 billion (European Commission, 2022c). Despite this projected cost saving for streamlining interoperability solutions across the European Union, the act does not grant the Interoperable Europe Board the powers to mandate member states to implement interoperability solutions because of member states preferences for supranational coordination and digital sovereignty (Council of the European Union, 2020; European Commission, 2022b). This means that the EU is reliant upon all its member states voluntarily enacting interoperability solutions within their national and subnational jurisdictions, in order for the Union to reach its 2030 goal of facilitating interoperability across all levels of governance.

Preliminary comparison: Denmark and the Netherlands

The scope of this thesis will be narrowed down to focus on Denmark and the Netherlands as they are leaders within the European Union in public sector digitalization. Denmark and the Netherlands, are considered front frontrunners in the world when it comes to digitalization and digital public services. When examining the UN e-government surveys rankings since

2001, Denmark has averaged a score of 4.5 and the Netherlands has averaged (Table 1). In the Digital Economy and Society Index reports since 2016, both nations havr scored above the EU average, with Denmark having been in first place five times and the Netherlands being in the top five (ibid). The high level of digitalization is also evident with the number of smartphones in use. In Denmark and the Netherlands, 85 percent of the population over the age of 12 had a smartphones with an internet connection in 2020 (Danmarks Statistik, 2020; Netherlands Statistics, 2021; OECD, 2022). The basic broadband connectivity rates is above 80 percent in both nations (European Commission, 2022a, p. 38). Even though no two nations are ever going to be exact replicas of each other, it can be assumed that Denmark and the Netherlands have overlapping interoperability elements that are the same in their digital infrastructures.

Denmark more digitally interconnected than The Netherlands

When comparing the digital infrastructures of Denmark and Estonia with the Dutch infrastructure, it becomes apparent that the different levels of governance are not digitally interconnected across the Dutch jurisdictions. Denmark's public sector is considered to be highly interconnected as automated data exchanges flow largely unhindered between its municipal, regional and national jurisdictions (European Commission, 2021c). Both Denmark and Estonia have one-stop portals that offer task-specific self-service solutions, whilst the Dutch national citizen portal infrastructure lacks substantial self-service capabilities as it lacks cross-jurisdictional interoperability (Bharosa et al., 2020, p. 46). To better understand why domestic cross-jurisdictional data exchanges are essential for facilitating cross-border data exchanges, a short comparison of Denmark and the Netherlands portals follows.

Danish online portal infrastructure

Denmark's public sector portal infrastructure facilitates automated intermunicipal collaboration. Borger.dk is Denmark's centralized one stop portal that citizens use largely to complete public sector tasks in a self-service manner (borger.dk, 2022). In 2020, Borger.dk recorded 58.7 million visits, across the roughly two thousand self-service solutions it facilitates (European Commission, 2021c). It is designed around the services and information most commonly used and requested by citizens and categorizes them into themes (Figure 4) (Regeringen et al., 2007). For example, when a citizen requests to move their address, the pre-coded intermunicipal collaboration automatically facilitates the registration transfer to the municipality they are moving to (Furuli & Kongsrud, 2007). Citizens are not required to interact with either of the two municipalities as borger.dk automatically completes the data transfer between the two.

Denmark has a single national agency for delivering municipal benefits embedded within its portal infrastructure. A national agency for the handling and administering of municipal benefits operates within the domain of borger.dk This agency, "Udbetaling Danmark" (Payment Denmark), is a collaboration between Local Government Denmark (association of the Danish municipalities) and the Danish State (Madsen et al., 2022). When citizens apply for benefits in Denmark, they do so on the portal and Payment Denmark transfers the money to them (Figure 5). This national consolidation of benefits delivery and intermunicipal collaboration allows citizens in Denmark to conduct multiple self-service tasks on a single digital domain (borger.dk, 2022).

Borger.dk also acts an interoperable springboard to multiple levels of governance (Regeringen et al., 2007). When requesting medical information, the software sends citizens to the external healthcare domain (sundhed.dk) where they can see all their personal medical journals and history. The Danish regions are responsible for healthcare but all medical and

health professionals, whether they work in the regional or municipal tiers, can access information with the citizen's consent (Kierkegaard, 2015). Additionally, when a citizen clicks on their tax information, they are automatically forwarded to the Danish state's centralized tax authority domain (www.skat.dk), where they can view, request and submit changes to their personalized Danish tax card (Figure 6). This springboard ability is safeguarded by the Danish electronic identification (eID) infrastructure.

The Danish eID infrastructure automatically authenticates online transfer to non-borger.dk domains. A crucial component of all e-government infrastructures is the ability for citizens to authenticate their identity when logging into the services (Lips et al., 2020). When citizens in Denmark log into borger.dk, they authenticate their identity using the eID application MitID. This not only grants access to the services on the portal domain, but also automatically forwards the authentication to the external domains connected to borger.dk because the entire e-government infrastructure uses a single log-in token (Figure 7) (Hansteen et al., 2016, p. 17). Automatic authentication allows for self-service solutions to be faster, easier and more seamless.

Dutch online portal infrastructure

The Netherlands has a centralized website that acts as an information hub (overheid.nl) for citizens and businesses and pulls together information from the different administrative tiers of the Dutch political system. Mijn.overheid.nl is a portal where citizens can see the personal data registered by the various administrative tiers and government agencies can send secure digital e-mails (European Commission, 2019). The portal is also divided into task-specific themes (Figure 8) but does not allow citizens to perform self-service tasks in the same way as borger.dk. For example, when moving to the municipality of Amersfoort, citizens are required to visit the municipal website and report the move online (Amersfoort Gemeente, 2021), and the municipality of Rozendaal requires citizens to fill out a paper relocation form

that they have to print out and physically take to the municipal office (Rozendaal Gemeente, 2022).

It can be assumed that interoperable collaboration between the multiple levels of governance is lower than in Denmark. Even though the portal allows citizens to see some information held about them by the state and municipalities, the Dutch portal mostly provides direct links to external domains and largely focuses on supplying information regarding citizens' incomes and taxes. The Dutch eID infrastructure (DigiD) also does not provide automatic authentication when moving to other government domains, Citizens must log in manually each time they move between administrative agencies (Figure 9).

Based on this comparison, the Dutch portal infrastructure largely lacks cross-jurisdictional data exchange frameworks and self-service capabilities. Denmark, on the other hand, appear to have interoperable data exchange frameworks that facilitates digital cross-jurisdictional data exchanges. Consequently, as the Netherlands share many of the same characteristics as Denmark, the theoretical framework will establish testable hypotheses to answer why answer the resrach conducting the is puzzling that the Dutch portal infrastructure appears to lack data exchanges between their multiple levels of governance.

3. Theoretical Framework

Public sectors are complex ecosystems of interdisciplinary institutions, administrations and organizations that have to work together across multiple policy domains (Capano & Ongaro, 2020). Due to this multidisciplinary nature, digitalization and interoperability policies are not specifically about technological changes. Instead they are about the leveraging of new technological advancements that facilitate public sector innovation (Dunleavy et al., 2006). As the examination of digital interconnectedness and interoperability changes within Denmark and the Netherlands, covers overlapping and nested policy domains, no single theory can explain the complexity of cross-jurisdictional interoperability policy changes and innovation. Instead, to narrow the theoretical scope, Public Governance Paradigm, Interoperability Governance and Multi-Level Governance and will guide the theoretical framework. As political and policy changes occur across multiple policy domains and are influenced by the different political institutions and policy entrepreneur's beliefs and ideologies, the three theories have been consciously picked to ensure that the cross-disciplinary nature of public sectors is accounted for, in order to make as relevant assumptions and theoretical implications as possible (Capano & Ongaro, 2020).

3.1 Public Governance Paradigms

A number of different beliefs, ideas and norms have shaped the administrative and institutional operations of public sectors since the end of the Second World War. They have shaped the strategies, programs, policies and procedures that make up public sector operations. They have been theorized and classified into different strands of public management theories, that can be termed as "public governance paradigms" (Torfing et al., 2020b). Public governance paradigms are "institutional templates" that make up the ideational constructions behind a nations public sector operations (Torfing et al., 2020b, p. 2).

Public governance paradigms (PG paradigms) are typically made up of a grand theory, comprising of a few main theoretical insights, that highlights the core normative, political, and ideological beliefs that shape how public administrations should be organized, structured and led. These ideas are the overarching blueprints for a broad range of auxiliary concepts, that materialize as alternative solutions, to failures of the previous PG paradigms to solve present and future societal challenges. They provide frameworks for implementing new administrative reforms and supply operational justifications and plans for optimizing governmental operations and service delivery (Torfing et al., 2020b).

Ideological differentiation = new governing paradigms

New public governance paradigms typically come into being, when new political leaders or societal interests groups with different ideologies either enter public governance or have the power to influence policy decision-making (Torfing et al., 2020b). New paradigm ideas that reinvent how to structure public sector operations typically identify how the dominant paradigm is failing to solve the most urgent societal issues and lays out new answers and solutions to these problems. As the development of new paradigms typically are reactions to the failures of their predecessor paradigms, new paradigms reuse aspects of the older PG paradigms. They are subsequently often closely associated and interlinked. As such, PG paradigms are separate and co-exist simultaneously and are hybridization of each other (Torfing et al., 2020b).

Separate, co-existing and hybrid public governance paradigms

As ideological differences in democracies ensures multiple viewpoints can influence the political processes and bureaucratic governance, no single PG paradigm dictates the operational running's of public sectors. New PG paradigms gain prominence and actively begin influencing the institutional policy and operational strategies, they become the new and

most visually prominent paradigm layer at the top of the PG paradigm "layer cake," whilst the other established paradigms "continue to provide a solid foundation" (Torfing et al., 2020b, p. 3).

As certain aspects of PG paradigms fail to provide solutions to prominent societal challenges and other aspects succeed, the more successful or most politically desirable attributes, from multiple paradigms, often merge together to form hybrid paradigms. As the successful sub-components of these theories, make up the norms, beliefs and ideas that shape the contemporary public governance paradigms of nations public sector operations, most nations governing paradigms are forms of hybridization. Despite this natural coalescing of paradigm attributes, PG paradigms also continue to remain separate, as higher levels of theoretical abstraction makes it easier to categorize the ideas, beliefs and norms into overarching theories that can be more easily understood by scholars, researchers, policy makers and other academically relevant people for evaluating, measuring and proposing new solutions to public sector challenges. Public governance paradigms are subsequently both hierarchical layer cake with fairly unconnected administrative systems and "marble cake[s]" with mixed and amalgamated configurations of PG paradigms (Torfing et al., 2020b, p. 3).

Drivers behind development of PG paradigms

There are three overarching factors have driven the development of new public Governance paradigms throughout the twentieth and twenty first century. The first revolves around societal developments that creates new challenges or opportunities for change (Torfing et al., 2020b, p. 16). Globalization, economic growth, financial crises, growing service demands, technological innovations and functional divisions in society are developments and societal events that have opened up policy windows for new ideas about how governments should react to these changes (Kingdon, 2001; Torfing et al., 2020b). Societal changes like the digitalization of public sectors, that can be traced back to specific events or sequences of

events in the past, can be termed as critical junctures that are historical turning for the development of new PG paradigm ideas, beliefs and norms (Skocpol & Pierson, 2002). As such new PG paradigms either emerge over time or are intentionally planned as a reaction to societal developments and changes. Additionally, the emergence of new PG paradigms can be due to functional and dynamic causes. The circumstances, events and influences that trigger or lead to turning points can be functional as new challenges demand new policy solutions, and dynamic as the failures of the contemporary paradigms require adaptations and modifications to respond to new societal challenges and developments. As time progresses and the societal "gains and benefits" of the dominant paradigm atop of the layer cake, gradually diminishes because of new societal developments and changes, new PG paradigms begin to develop (Torfing et al., 2020b, p. 16).

The second and third drivers revolves around the critiquing of the perceived failures of the dominant paradigm and cross-organizational institutional learning (Torfing et al., 2020b, p. 16). As certain attributes of the dominant PG paradigms starts becoming inadequate at solving current and new societal challenges solutions, critical evaluations and ideological opportunism facilitates new solutions being proposed. The proposed solutions that are successful and become entrenched into the operational designs of one level of governance over time, are typically copied and replicated across different organizations, jurisdictions and borders.

The introduction of the internet to the global public was a major critical juncture that has pushed public governance operations into the digital era (Margetts & Dunleavy, 2013b). Digital era governance is a PG paradigm that explains how the incorporation of digital solution in the public sector has allowed governments to digitalize their operations, facilitate inter and cross jurisdictional data exchanges and substantially cut costs as a result of globalized digitalization (Torfing et al., 2020a). Digital era governance is a useful mid-range

theory that helps give contextual relevance to evolution of public sector digitalization in the 21st and provides useful attributes that can be used to derive hypothetical inferences about why Denmark has a more digitally interconnected public sector than the Netherlands. As DEG can be framed as a hybridization of Weberian bureaucracy and New Public Management, a theoretical discussion of the two theories is required to understand the contextual factors that make up the two theories, as well as the critical junctures and developments that led to their creations. Despite the different ideas, norms and beliefs that make the three separate paradigms, they all stepped in the common belief that their implementation and dominance in public sector operations would improve the efficiency of the bureaucratic operations (Andrews & Van de Walle, 2013; Hal G. Rainey, 2014).

3.1.1 Weberian Bureaucracy

Weberian Bureaucracy is a PG paradigm that dominated public governance operations from the post-World War II (WWII) period until the 1980s. Weberian Bureaucracy is organized around strict professionalism and hierarchical control (Torfing et al., 2020b). The development of this highly regulated and top-down bureaucratic model was largely a response to the lack of separation between political bureaucracy and political authority the absence of clearly defined rules, regulations and standards that would guide bureaucratic operations (Pfiffner, 2004). The lack of an apolitical bureaucratic civil service that be uninterrupted by changing political leaders, was deemed important for the rebuilding of nations economies after WWII. As nations embarked upon rebuilding their economies after WWII, the operational scale of governance was deemed inadequate to handle and coordinate the growth of the private sector (Pfiffner, 2004). The need for centralized hierarchical control that delegated discretionary authority vertically downwards, was regarded as necessary to provide the stability for economic growth (Torfing et al., 2020b). This is because many laws and public policies are left open to interpretation and in order for the front line civil servants

to successfully execute public policies, they needed autonomy to carry out service delivery operations (Lipsky, 2010). As a result of this, civil servants and other street level bureaucrats, tasked with executing service delivery, are required to use their delegated authority to carry this out ambiguous rules and procedures (Torfing et al., 2020b).

3.1.2 New Public Management

As global convergence and transnational economic activity exponentially grew during the postwar period, the dominance of the Weberian bureaucratic model began to be challenged by New Public Management (NPM) ideas during the 1980s and 1990s (Lægreid, 2015). The emergence of globalization and the intertwining in a global trend of tax revenue decreasing (Steinmo, 2003). As most governments viewed the reduction of taxation levels as the means to stay competitive within a increasing globalized economy, marketization beliefs began diffusing into public governance operations (Baker & Murphy, 2021).

Proponents of the NPM paradigm saw the strict rule, large scale centralization and stringent hierarchical control of the Weberian PG paradigm, as being inadequate to create conducive environments for economic growth and innovation within a globalized economy (Ostrom, 2008, p. 27). Specifically, NPM practitioners saw Weberian practices as slow, inefficient, and costly, and embraced corporate marketization principles for the running of the public sectors. These market principles largely emphasized the overall importance of privatization, automation, quantitative performance measures, cost reduction and decentralization (Hood, 1991).

Decentralization lies at the core of NPM ideology. Decentralization can be thought about in terms of their architectural design and decision-making capabilities. Supporters of NPM emphasis that large bureaucratic institutions are not equipped with the tools to evolve and react to changes spurred on by globalization, as they are slow, costly and inefficient (Christensen & Lægreid, 2011). Consequently, the NPM paradigm espouses that breaking up

large centralized institutions and reducing the number of public sector institutions will create more agile and responsive institutions that are quicker, cheaper and more efficient at responding to new societal challenges.

Specifically, the of breaking up and separation of large bureaucratic organizations, into smaller units (agenification), was believed to make governmental operations more pliable and facilitate greater levels of control to agency (Andrews & Van de Walle, 2013). The idea was that these manager would be able to bypass the strict hierarchical control of the Weberian paradigm to find new innovative solutions that would be more cost effective for public sector service delivery (Andrews, 2011). Additionally, the NPM focus of consolidating discretionary autonomy with agency managers, along with intense concentration on the automation of public sectors service delivery and operations, helped spur on the widespread automation of public sectors (Hansen, 2011)

Prior the introduction of the internet, automation largely revolved around using computers to store information, conduct tasks and assume responsibilities that street level bureaucrats previously were required to do. As the storing of information became standardized and street level bureaucrats roles were reduced to interpretating the stored data, civil servants at the front line became screen-level bureaucrats (Bovens & Zouridis, 2002). As public sector information management operations became standardized and evolved its capabilities to be able to receive, process and issue public, without human interference, screen level bureaucrats were replaced by system level bureaucracy (Bovens & Zouridis, 2002). Even though NPM reforms led to the automation of many administrative processes and spurred on the early stages of public sector digitalization, NPM's strong decentralizing emphasis on fragmenting and disjointing governing institutions, started to become incompatible with the desire of nation states to set up digital infrastructures that would cut across "organizational boundaries" (Margetts & Dunleavy, 2013b). Therefore, as nations

began seeing and understanding the revolutionary potentials that digital data exchanges could provide public sectors, in terms of cost reductions, speed and efficiency, nations began to develop digital tools that could facilitate cross-jurisdictional collaboration (Dunleavy et al., 2006; Gil-Garcia et al., 2014; Torfing et al., 2020a). This need to create digital infrastructures that cross institutional boundaries has become paramount as the 21st century has seen an unprecedented digital transformation and digitalization has become the default response to calls for public sector reform (Margetts & Dunleavy, 2013b)

3.1.3 Digital Era Governance

As the internet went global in the early 1990s and it became widespread by the 2010s, a new public governance paradigm was emerging that prioritized technological and digital innovation in the public sector during. This new Digital Era Governance paradigm can be classified as a hybridization of the Weberian and NPM models. Digital Era Governance (DEG) emphasis on reintegrating public sector operations, through the re-centralization of the bureaucratic fragmentation that NPM reforms had created, can be viewed as a recalibration back to Weberian centralized control. Additionally, as binary code lies at the heart of digital operations in government, unambiguous rules need to be established in order for computer systems to exchange data and communicate effectively (Federspiel & Brincker, 2010). Therefore, by automating discretionary powers and removing the need for human interpretation to issue decisions, governments have re-instituted strong hierarchical control through algorithms (Araujo et al., 2020; Busch & Henriksen, 2018; Stavros Zouridis et al., 2020). The DEG stressed emphasis on redesigning public sector operations to orientate around digitalized “needs-based holism” can be viewed as extension of NPM. As needs-based holism revolves around the needs of the citizen, the internet and digital technologies provide public sectors with the ability to create digital service delivery that is automated through centralized infrastructures that can agilely react and respond t citizens reacts as they

take place (Margetts & Dunleavy, 2013b). As key to this citizen-centric service delivery is for it to be self-service "do-it-yourself" governance, the key NPM drivers of cost reduction through automation is clearly enshrined in DEG and developed to take advantage of digital innovations (Margetts & Dunleavy, 2013b).

Digital Era Governance can also be a competing paradigm as digital innovations and developments has facilitated new ideas, beliefs and operational methods for improving public sector efficiency. The transition of service delivery discretion, from humans to automated system level discretion, means that DEG has stricter centralized control over decision making than was the case for street level bureaucracy in Weberian bureaucracy (Madsen et al., 2022). Digital Era Governance also separates itself from NPM as the emphasis on centralization of control is the anthesis of NPM decentralization principle. As no nation has a single PG paradigm that dogmatically runs public sector operations, components from different paradigms make up the operations. Therefore, nations possess aspects of the various paradigms (Margetts & Dunleavy, 2013b).

Digital Era Governance generally has more similarities with NPM than differences. This can be seen with the trend of budget centralization in the European Union. The pressure for EU Member States to cut administrative costs can be attributed to EU budgetary rules (European Commission, 2017a; Steinmo, 2003). The 2007 financial crisis led to the European Union implementing a Fiscal Compact in 2013. The compact requires that signatory institute national budgetary rules, which ensures that their budgets must either be balanced or in surplus (European Commission, 2017a). This example illustrates that NPM ideology requires balanced budgets, but DEG re-centralization principles meant that the legislation is set at the national level (Kristiansen, 2018).

From this discussion about Public Governance Paradigm, it can be assumed that nations who have embraced and reformed in line with the Digital Era Governance (DEG)

components are likely to have more digitally interconnected public sectors than nations who have not transitioned into DEG. There are two major differences between New Public Management (NPM) and DEG. Firstly, DEG departs from the decentralized architectural design principle of agencification and instead advocates for the consolidation of bureaucratic agencies. The second difference is that DEG departs from the NPM belief that decision making and issue handling is most efficient and cost beneficial at decentralized agencies and institutions. DEG instead advocates for the re-centralization of issues that make most sense to be handled at the national level (Margetts & Dunleavy, 2013b).

Based up these differences and the preliminary comparisons between the Danish and Dutch digital portal infrastructure, it can be assumed nations who have not reintegrated and re-centralized their public sectors are more likely to have less digitally interconnected public sectors. Additionally, as the comparison found that the Dutch portal infrastructure largely lacks self-service capabilities, whilst the Danish infrastructure facilitates around two thousand self service solutions, it can be implied that Denmark likely has embraced greater levels of DEG principles than the Netherlands. Consequently, the first hypothesis will be: **H1: Nations who have embraced greater levels of DEG principles, are likely to have more digitally interconnected public sectors.** In this proposed hypothesis, the dependent outcome variable is more digital interconnectivity in the public sector and the independent explanatory variable is DEG principles. The expectation is that when applying this to Denmark and the Netherlands digitalization strategies, Denmark will have embraced more DEG principles than the Netherlands.

As a key overarching theme of DEG is to establish digital tools that pushes citizens to use computers and smart devices to serve themselves in the public sector, DEG policies largely revolves around minimizing the complexity of service delivery for citizens and back-office operations. There are two main overarching challenges to reducing the complexity:

technical and legal barriers and the number of decentralized sub-national jurisdictions a nation has. The lack of technical and legal barriers challenges the ability for intra-jurisdictional and cross-jurisdictional data exchanges and large numbers of sub-national jurisdictions increases the scale of needed coordination (European Commission, 2017b; Hooghe & Marks, 2021). This will be developed further in the following interoperability and Multi-Level Governance sections.

3.2 Interoperability Governance

Interoperability is a broad theory that can be used to describe the communicational exchanges between different organizations and jurisdictional bodies. At the most basic technical level, interoperability is the exchange of data between "two or more systems or components," with the purposeful intent of using that information to increase operational and cost efficiency (Zeng, 2019, p. 122). From a public administration perspective, this purposeful intent is typically interpreted as the ability of public sector organizations utilizing Information and Communication Technology (ICT) systems to exchange data in the pursuit of "mutually beneficial goals" (European Commission, 2017b, p. 4). As the mutually beneficial goals of most public sectors is to reduce the administrative burdens surrounding data coordination whilst also increasing the efficiency of service delivery solutions, interoperability governance can be understood as a cost maximization tool (Don MacLean & Ryad Titah, 2022; Kerber & Schweitzer, 2017). Within this economic framing, interoperability solutions can be viewed as policy instruments that help minimize administrative burdens, in order to reduce the operational costs related to the re-entering of data across multiple offices, departments and jurisdictions (Council of the European Union, 2020; Goldkuhl & Röstlinger, 2015; Hobson et al., 2011; Leosk et al., 2021)**.**

As most public sectors are paradoxically required to do more with less money, the simplification of administrative operations is key to interoperability governance (Dunleavy et

al., 2006; Hansen, 2011; Hood, 1991; Lægreid, 2015). Many public sectors have done this by using smart governance solutions to transition their public sector operations to become more proactive (Lemke et al., 2020; Scholta et al., 2019). Most nations have developed some form of infrastructure for online governance, where C2G and G2C interactions are conducted through online citizen portals (United Nations: Department of Economic and Social Affairs, 2022). These portal infrastructures have simplified and minimized the number of administrative steps needed to request public services as they have been designed around the needs of citizen (Linos et al., 2021; Margetts & Dunleavy, 2013b; Stavros Zouridis et al., 2020; Xu & Tang, 2020). For nations to establ such portal infrastructures, ICT standardization must take place first.

Standardization

The standardization of ICT operations reduces administrative burdens associated with material and time related costs within public sectors (OECD, 2012). Prior to the internet and the digitalization of governmental operations, administrative processes required citizens and businesses to request, complete and return paper forms to receive public services and ensure legal compliance had been met (Dunleavy et al., 2006). In turn bureaucratic employees largely had to interpretate and use their discretionary power to grant public services and make sure that regulatory compliance had been upheld (Busch & Henriksen, 2018; Moynihan et al., 2015). As these analogue methods of exchanging information were slow and time consuming, the “cost of moving ideas” was very high (Baldwin, 2016, p. 4). This meant that public administrative relied upon large numbers of bureaucratic employees to use their discretionary powers to keep public service operations going.

This need for human interpretation and discretion to facilitate informational exchanges and issue public sector services greatly changed as technological hardware and software solutions began automating and digitalizing administrative operations. Specifically,

the standardization of software specifications and open software standards have established common frameworks that permits different public sector organizations to exchange data both within jurisdictions and across jurisdictional lines without the need for human intervention (Čačković et al., 2015; Stavros Zouridis et al., 2020). The reliability and predictability of open software standards ensures the different software solutions are able to interoperate with each other, through machine-to-machine data exchanges, as the software infrastructure and computing language are unambiguously standardized (Bozeman, 1993; Feeney, 2015; OECD, 2003). Thus, standardizing public sector hardware and software, not only allows for greater levels of technical and semantic interoperability but also opens the avenue for reducing legal burdens associated with human discretion, that often hinders the facilitation of transboundary cooperation and data exchanges (Bozeman, 1993; Feeney, 2015; OECD, 2003).

System-level bureaucracy: Automated bureaucracy

The standardization of computer systems and software solutions has minimized the need for human judgements when handling individual service requests by citizens (Bovens & Zouridis, 2002; Gay & Pedersen, 2019). Diminishing the need for human discretionary power has largely been driven by the transitioned from analogue street level bureaucracy to automated system-level bureaucracy (Bovens & Zouridis, 2002). System-level bureaucracy builds upon builds upon Michael Lipsky's "street-level bureaucrats" idea, where front line bureaucrats are the public sector agents who have the discretionary power to carry out vague legal mandates when issuing public services (Lipsky, 2010). The incorporation electronic governance and the digitalization of public governance operations has greatly reduced the need for human discretionary judgements, as the "datafication" of society and governance operations have become economically preferred methods of running public sectors (Mejias & Couldry, 2019) This quantification of public sector operations, through digitalized computer systems, has allowed for the large gathering of data that eliminates human errors, is

exponentially faster and substantially more cost efficient than relying on citizens and bureaucrats physically using analogue technologies to gather, store, process and share data (Maciejewski, 2017). Therefore, in its purest form, system-level bureaucracy replaces the need for street level bureaucrats interpretative and discretionary powers, through the use of data driven algorithms that issue decisions that are based upon pre-defined rules and requirements (Evans & Hupe, 2020; Luthfi & Janssen, 2019; Stavros Zouridis et al., 2020). Subsequently, as no single nation has completely automated their public sector operations, to be free from any human involvement and, nations public sectors can be viewed as operating along a digitalized discretionary continuum, where street-level bureaucracy personifies low levels of digitalized discretion and system-level bureaucracy represents high levels of digitalized discretion (Bullock, 2020).

System level bureaucracies are necessary conditions for the facilitation of inter-jurisdictional and cross jurisdictional data exchanges (Hobson et al., 2011; Tepandi et al., 2021). When inter-jurisdictional machine-to-machine data exchanges can take place across divisional, departmental and agency lines, interoperable data exchanges can be described as having a "coherent purpose" (Figure 10) (Zeng, 2019, p. 126). This coherent purpose is a vital prerequisite for facilitating data exchanges that go beyond the confines of a single jurisdictional level of government. Therefore, the ability to share data and to use that data for a systematic purpose is crucial for facilitating interoperable cross-jurisdictional data exchanges (Zeng, 2019). To understand how public sectors get to the stage of system-level bureaucracy possessing the ability to facilitate purposeful data exchanges, the digital maturity of nations must be assessed first (Layne & Lee, 2001).

Digital maturity

Digital maturity generally refers to the how public sectors develop as their ICT capabilities evolve in line with new technology. In 2001, Layne & Lee developed a maturity model in

which public sectors develop digitally along a continuum from: (1) cataloguing, (2) transaction, (3) vertical integration and (4) horizontal integration. This model has been highly influential (1,178 citations on Web of Science December 2022) as scholars have expanded their model to make theoretical inferences about public sector digitalization and how the various stages of development facilitate interoperable data exchanges that go beyond jurisdictional borders. Layne and Lee's model focuses on the technological capabilities needed to facilitate cross-jurisdictional data exchanges. As a key European Union's digitalization goal is to make public service easily available for all its citizens across the Union, digital maturity needs to be viewed through the lens of service delivery and citizen-centric frameworks (Andersen & Henriksen, 2006; Klievink & Janssen, 2009). Therefore, the following paragraphs will outline the stages of public sector development from both a technological and service-delivery perspective.

The first stage involves making public sector information available online. This involves government-to-citizen (G2C) information sharing, where information is only displayed online in non-interactive static formats (Layne & Lee, 2001). This is largely structured through citizens downloading PDF files which they have to fill out and return manually either through e-mail or physical mail (Andersen & Henriksen, 2006). Street-level bureaucrats interact with citizens in municipal offices and input data based on physical forms (Bovens & Zouridis, 2002). At this inter-organizational cooperation is not possible as the street-level bureaucrats are unable to reuse information from outside their departments or digitally share to other agencies. This means that each department at the various levels of government have to re-gather information that citizen have already provided at different jursdictions (Klievink & Janssen, 2009). This mass duplication of information across different organizational departments and jurisdictions is costly and inefficient for both the street-level bureaucrat and the citizen.

The second stage revolves around digitally connecting the organizational processes to facilitate collaborative relationships between public administrations and citizens. Integrating organizational processes helps coordinate the dispersed data held by the many offices, departments and agencies that make up a jurisdiction (Klievink & Janssen, 2009). This coordination establishes a more transactional relationship between public sectors and their citizens, as the digital integration of a jurisdiction's organizational data allows for the simplification of requesting and granting public services (Layne & Lee, 2001). The process of citizens requesting public services and street-level bureaucrats granting them is made less complex by interactive web solutions designed with the citizen's needs in mind (Andersen & Henriksen, 2006). This establishes a two-way communicative relationship in which interactions can be more efficient and accommodate the citizen using online portals.

In Klievink and Janssen maturity model, they state that the third stage of digital development revolves around establishing online portals to accommodate for citizens' needs (Klievink & Janssen, 2009). As the cost efficiency paradox of doing more with less is the goal of most public sector organizations, the minimization of interactional steps needed is key (European Commission, 2017c; Kettl, 2005). To minimize the number of citizen-to-government interactions, the online portals established within single jurisdictions become linked through an online one-stop-shop infrastructure, where citizens are to log in through a single port of entry. National agencies, municipalities and regional governments are still functioning under their own political jurisdictions but share the same overarching public sector digital infrastructure, so that citizens are able to access all the different administrative levels of governance through a single point of entry (Klievink & Janssen, 2009). However, in order for the different tiers of governance and their jurisdictions to share information digitally, vertical integration is required. Therefore, vertical integration is needed for citizens to retrieve and request data from the different jurisdictional levels of government (Andersen

& Henriksen, 2006; Layne & Lee, 2001). As vertical integration is key for the facilitation of cross-jurisdictional data exchanges, legal and technical interoperability mechanisms are required for ensuring that data coordination can be facilitated between the multiple levels of governance.

Vertical integration = legal interoperability

Layne and Lee state that the vertical integration is third stage of public sector digitalization. Within the digital maturity literature, vertical integration is the basis for facilitating data exchanges that go beyond the organizational boundaries of a single level of governance. Unconnected databases working in isolation from each other, within their own jurisdictional boundaries and departments, have been a large obstacle in digitally interconnecting public sectors across the multiple levels of government (Layne & Lee, 2001). This challenge has largely been due to the democratic principle of decentralization that requires more than just one centrally controlled national authority. As a result of this decentralization mandate, "legal constraints" have led to a need for legal interoperability (Gottschalk, 2009). Legal interoperability can be considered the first requirement for facilitating vertical data exchanges between the jurisdictional levels of government because it is the legal path needed for sharing information across political jurisdictions (Goldkuhl & Röstlinger, 2015). As jurisdictional organizations operate under different levels of government, that have separate legal systems and agreements, bridging mechanisms are needed to ensure data can be shared across jurisdictions . Legal interoperability ensures that the authorities at the various levels of government can legally cooperate and coordinate data exchanges (European Commission, 2017b).

Legal interoperability = Interoperability-by-default

To ensure legislation does not hinder interoperable data exchanges, the Commission highlights four main legal interoperability characteristics that nations should undertake when

implementing new legislation. Firstly, states should audit preexisting legislation for the lack of interoperability. Secondly, interoperability assessments should be undertaken prior to legislative adoption. Thirdly, reoccurring assessments on the interoperability performance of passed legislation should take place periodically. Finally, the digital systems that make up the public sectors ICT infrastructure, should be taken into consideration at the earliest point in the process of drafting legislation (European Commission, 2017b). These recommendations help ensure that national interoperability policies adhere to the principle of "interoperability-by-default" (Council of the European Union, 2017; Krimmer, Dedovic, et al., 2021). Interoperability-by-default aims to ensure that when legislation is implemented nationally, it seamlessly facilitates interoperable data exchanges right away and does not need to be retrospectively changed to fit the interoperability requirements. This is important for ensuring new policies and frameworks fit coherently into member states national cross-jursdictional interoperability frameworks because it allows for greater levels of data reuse in order to reduce the complexity of accessing digital public services for citizens (European Commission, 2017b).

As the preliminary comparative observation between Denmark and the Netherlands showcased a lack of cross jurisdictional data exchanges in the Netherlands, it can be assumed that nations who prioritize legislative means for legal interoperability will be more digitally interconnected. As nearly 60 million people visited the Danish online portal in 2020 and offers more than 2000 self-service solutions are integrated within it, it can be assumed that legal interoperability is designed into its infrastructure to facilitate interoperable data exchanges between the various levels of government. The hypothesis will subsequently be:

H2: Nations with interoperability-by-default legislation are more likely to facilitate cross-jurisdictional data exchanges.

Horizontal integration

As opposed to vertical integration facilitating data exchanges between different jurisdictional tiers, horizontal integration brings together the different policy areas, that are scattered across different departments within a jurisdiction (Layne & Lee, 2001). This helps ensure that so that citizens can have a personalized the one-stop-shop portals which they use for events based upon their lives (Netchaeva, 2002; Scholta et al., 2019; Wimmer & Tambouris, 2002). In order to coordinate policy areas and themes horizontally across jurisdictions, interoperability standardizations must be agreed upon. This is important because standardized frameworks that facilitate interoperability allow for reliability and predictability which are essential elements for technical interoperability (Federspiel & Brincker, 2010).

Technical interoperability = Data Reusability

Technical interoperability involves the linking of hardware and software, that are needed to make public sector digital tools operational (European Commission, 2017b). Technical interoperability solutions involve using intermediary "access points" at the back-end of digital systems that enable informational exchanges between the sender and the receiver (Krimmer, Dedovic, et al., 2021). A crucial challenge in the quest for enhancing cross-jurisdictional data is overcoming the problems related to the development of ICT infrastructures from a bottom-up approach. The implementation of the digital infrastructures in many public sectors have developed in an uncoordinated decentralized fashion, where outdated technological systems have created "fragmented ICT island which are difficult to interoperate" (European Commission, 2017b). In nations where digital infrastructures are unable to effectively interoperate through the lack of technical interoperability mechanisms, vertical and horizontal data reusability is very difficult.

Data reusability within the context of interoperability is often termed as the "Once-Only Principle" (Wimmer, 2021). The once-only principle is the idea that when a citizen

submits personal data to a jurisdictional department or agency body, that citizen should then not need to submit the piece of information again at any other level of governance. When a citizen submits data at the municipal level of governance, technical and legal interoperability standards and agreements allows regional and national jurisdictions to access that information seamlessly without having to request access to it. (Krimmer, Prentza, et al., 2021). Therefore, the key component of technical interoperability is to ensure that cross-jurisdictional data sharing takes so that data only has to be supplied once by citizens (European Commission, 2016). The once-only principle is therefore another policymaking tool that can improve administrative efficiency through cost reduction and eliminating the need for gather data multiple times across different levels of government. As the only-once principle is a relatively new term in interoperability governance and likely phrased different term across public administrations, the third hypothesis will be:

H3: Nations with legislating mandating cross-jurisdictional data recycling, are more likely to be digitally interconnected.

As increases in digital maturity leads to both vertical and horizonal integration, that is facilitated through legal and technical interoperability mechanisms, the interconnectivity of public sectors typically allows for cross-border data sharing (Krimmer, Dedovic, et al., 2021). As the European Union has set the goal of creating one a single interoperable system level bureaucracy that facilitates interoperability across all levels of government in the Union (Figure 11), facilitating what the European Commission has termed as, “Multilevel Interoperability Governance” is vital to “delivery seamless public services to citizens” across the EU (European Commission: Reform Support, 2021). As EU wide multilevel interoperability governance (MLG interoperability) is reliant upon member states facilitating seamless cross-jurisdictional data exchanges domestically, challenges related the scale of decentralized governance and sub-national coordination will guide the following section.

3.3 Multi-Level Governance

Multi-level governance theory emerged during the 1990s as an attempt to explain the evolving relationships between EU states within the newly formed European Union. Multi-level governance (MLG) began challenging the traditional notions that nation-states had the ultimate authority over the decision-making powers at the EU supranational level. The theory began arguing that decision-making powers were increasingly becoming dispersed among the various stakeholders at the different jurisdictional levels of governance and showcased the importance of the decision-making powers within sub-national jurisdictions (Marks et al., 1996). Specifically, the proliferation of institutional bodies, that had emerged towards the end of the 20th century, had resulted in a reallotment of policy competencies that had formerly been centralized under the national level of government, with some powers being delegated upwards to the EU level and others being devolved downwards to the subnational levels. As a result of these competencies being scattered among the national, subnational and supranational levels of governance, MLG became defined as "a system of continuous negotiation among nested governments at several territorial tiers" (Marks, 1993, p. 392). This system of continual bargaining between the different territorial jurisdictions takes place within many overlapping and nested jurisdictions.

This architectural design has been termed as a Type II MLG framework, as it typically encompasses large numbers of jurisdictions, like sub-national, national and supernational jurisdictions overlapping each other's policy and political borders. Type II simultaneously allows for sub-national jurisdictions to be nested within national governments and nations to be nested within supranational jurisdictions (Hooghe & Marks, 2003). Type I MLG governance architectures can be found within Type II designs as the nested governance structures. In contrast to Type II designs, Type I have clear border demarcations, fewer levels of jurisdictional tiers and are unlikely to undergo large scale architectural changes. As Type

II designs contain Type I constructions, Type II designs have less clearly demarcated boundaries due to the overlapping jurisdictions and have more levels of governance. Therefore, Type I structures are less responsive and flexible whilst Type II architectures are more flexible and have task specific policy competencies, that allows it to accommodate for policy and political challenges. Conceptualizing MLG architectural designs within the Type I and II constructions is useful for dissecting problems related to the scale of subnational decentralization and coordination.

Coordination Dilemma

As public services are dispersed across the multiple levels of government and citizens are required to interact with the different governmental levels to request and receive public services, jurisdictional policy spillovers take place. Decisions made by one jurisdictional authority, most often affects another and usually no jurisdictional authority has been designated or given the power to stop policy spillovers (Hooghe & Marks, 2021). Globalization has also compounded this as policy areas that were previously confined to a single level of governance within a nation, such as infectious diseases due to limitation of travel capabilities, have become cross-jurisdictional and cross-border policy issues. Additionally, subnational jurisdictions are also considered to be democratic prerequisites for good governance, as local governance is the nearest level to the electorate, (European Charter of Local Self-Government, 1985; Hooghe & Marks, 2003; Savy et al., 2017). The scattered nature of policy responsibilities, along the effects of globalization and decentralization requirement for democratic governance, means policy spillovers are wicked problems that are challenging to mitigate (Head & Alford, 2015).

Policy spillovers are challenging to alleviate because, as the number of jurisdictional authorities increases, the cost and difficulty of inter-jurisdictional coordination increases, which makes it harder to facilitate coordination (Hooghe & Marks, 2003). To mitigate this

coordination dilemma, nation-states can either structurally reform their architectural makeup by reducing the number of independent jurisdictions who need to be coordinated and or limit the number of interactions that need to take place between each jurisdiction.

As the decentralization requirement makes it harder to reduce the number of sub-national jurisdictional authorities, the minimization of costly interactions have become key policy goals for nations, as technological tools have allowed cheaper and faster coordination through digital data sharing practices (Kaiser & Prange, 2004). Specifically, as no nation perfectly fits into the categories of Type I and II MLG, public sector with online portal infrastructures, that automatically facilitates cross-jurisdictional information sharing, can be seen as means to help mitigate the coordination problems (Hooghe & Marks, 2003). Additionally, in Type I MLG systems, that typically are general purpose and have nonintersecting memberships, more centralized nation-states have bundled jurisdictions' competencies together to limit the quantity of administrative authorities that requires coordination. In Type II where subnational jurisdictions can be limitless, the minimizing of interactions between the jurisdictions is often attempted by functional and flexible architectures that accommodate the decentralization prerequisite (Hooghe & Marks, 2003). As the motivation behind reducing the number of cross-jurisdictional interactions, is largely economic, a number of nations have structurally reformed their multi-level governance architectures, regardless of the decentralization prerequisite.

Developed countries have been consolidating their subnational jurisdictions to "take advantage of economies of scale" (Suzuki, 2018, p. 4799). Since the turn of the millennium, structural reforms, in the form of jurisdictional centralization, has taken place in several developed nations. Some have undertaken "one-shot" all at once subnational amalgamations, whilst others have undertaken "progressive consolations" where the number of municipalities have been "gradually reduced" (Suzuki, 2018, p. 4799). Despite reducing the number of sub-

national jurisdictions and increased the geographical sizes of consolidated municipalities and regional jurisdictions, citizens still theoretically retain the same instantaneous access to the public sector, as public services are accessible through the internet. Therefore, nations are in principle able to uphold the decentralization requirement as they still provide digital access to local governance.

Based upon the MLG discussion surrounding how costs rise for sharing information across jurisdictions boundaries, when the number of subnational jurisdictions increase, it can be assumed that higher volumes of subnational jurisdictions also makes it more difficult to coordinate data exchanges. Therefore, it can be expected that EU member states with larger numbers of jurisdictions will find it more difficult to share information than member states with only fewer. As most public sectors have transitioned to some extent into system-level bureaucracies, where digital tools facilitate data sharing, it can be assumed that member states with higher numbers of sub-national jurisdictions will find it more difficult to facilitate data exchanges between their jurisdictions and thus be less digitally interconnected. Therefore, the hypothesis will be:

H4: Nations who have fewer sub-national jurisdictions, are likely to have more digitally interconnected public sectors. The theoretical implication of this hypothesis, if confirmed, would highlight that nations with larger numbers of subnational jurisdictions are less digitally interconnected and thus likely to have less interoperability solutions for facilitating cross-jurisdictional data exchanges.

Finding out if there is a relationship between the volume of subnational jurisdictions and the digital interconnectedness of public sectors, will help make further hypothetical assumptions relating to decentralization and its challenges for achieving interoperable data exchanges within the multilevel governance setting. As the decentralized development of public sector ICT systems have led to a sea of hardware and software components that lack

technical capacities to communicate with each other, it can be further expected that nations who have implemented technologies from an uncoordinated bottom-up approach are going to be less digitally coordinated. Testing this is going to be virtually impossible as the quantity of data required to test the validity of the assumption would be enormous. Therefore, as the data gathering exercise revolves around analyzing the digitalization strategies of Denmark and the Netherlands, a more manageable exercise is to scan the documents for technical interoperability solutions and initiatives that facilitates greater digital interconnectedness across jurisdictions. The expectation is therefore that since Denmark ranks higher in the digitalization rankings, words related to technical interoperability will appear more in the Danish strategies.

4. Research & Methods

To test the four theoretically derived hypotheses, documentary analysis was performed form a variety of sources. The Danish and Dutch digitalization strategies was the main source of data. The Danish and Dutch digitalization strategies were chosen because the digital transformation of society and government have made national digitalization strategies important policy documents for gauging the current and future digitalization developments within nations (Hofmann et al., 2020). Additionally, after having read through the 2001 Danish digitalization strategy, it became clear that the document contained many references to interoperability and digital interconnectivity across the public sector.

4.1 Data Collection

Multiple sources were used for data collection. The data collected for the digital infrastructure comparisons between Denmark and the Netherlands, in the background section, was gathered by directly accessing both the Danish portal infrastructure (border.dk) and the Dutch portal infrastructure (mijnoverhed.nl). Since the author has Danish citizenship and resides in the Netherlands, he was able to access both portal infrastructures and test their capabilities. They were both accessed during 2022 and 2023.

The data collected to test the first hypothesis was primary gathered from the Danish 2022 digitalization strategy and the Dutch digitalization strategy from 2021. They are openly accessible on the Danish and Dutch national government websites. These strategies were chosen because they are the two most recent strategies from each country and accordingly should have the same available technologies and software solutions. Additionally, the 2020s marked a decade and a half since Margetts and Dunleavy proclaimed that NPM was dead and these fifteen years saw intense digitalization of governance. Therefore, the principles of DEG should distinguishable from NPM principles within the strategies.

The Danish governments website “Retsinformation.dk” (translates to legal information) and Overheid.nl (translates to government.nl) were used to confirm whether or not Denmark and the Netherlands possess digital ready legislation and or has legislation mandating the once-only principle. The last hypothesis largely revolved around data gathering from OECD United Cities and Local Governments 2016 report and Eurostat. In in order to produce more accurate and up to date data, a variety of other academic articles, governmental websites and news report were used to gather additional data. Due to this inconsistent gathering of data, the direct data replicability for hypothesis four could be challenging.

As the thesis deals with national digitalization strategies and attempts to answer hypotheses that attempts to compare Denmark and the Netherlands, the level of analysis is the macro national level and observations are also made at the national level.

4.2 Method of Analysis

To test the first hypothesis, a qualitative content analysis was developed. The reason for using a qualitative content analysis (QCA) is because national digitalization strategies are policy documents that have contextual meanings and subsequently can be difficult to make inferences without developing a systematic framework. The framework that was developed followed the thematic analysis approach by creating a coding scheme that looked for patterns (Bowen, 2009). As DEG principles is the independent explanatory variable for the first hypothesis, the theory used as the parent concept, followed by operational child concepts in the form of a taxonomy. Using Margetts and Dunleavy’s 2006 and 2013 articles on the transition from NPM to DEG, the coding scheme used their operational subcategories of DEG: reintegration, needs-based holism and digitalization as the main categories. A further thematic subcategorization was created that derived further principles that fitted within the DEG principles. When the data gathering was conducted, words, sentences and sections of

text that represented the DEG them or subcategories were recorded to observe for DEG distinctions between the two digitalization documents. Under the parent category of reintegration, joined up governance, only once, administrative simplification and standardization make up child subcategorizations. As the background section and theoretical framework has laid out, coding for these child concepts ensures that the gathered content is relevant to testing the hypothesis. Needs-based holism and digitalization make up the other two parent categories and also have relevant theoretical child concepts (coding scheme).

As a possible weakness of just having DEG principles directing the content analysis, is that the digitalization strategies are unlikely to implicitly state that a lack of public sector interconnectivity is that they have prescribed to NPM policies that have failed. Due to this political nature, the coding scheme subsequently has a separate section with NPM as the parent concept and two levels of subcategorization with child concepts that are also derived from Margetts and Dunleavy's 2006 and 2013 articles. This will allow words, sentences and statements that fit within the NPM paradigm to be plotted into the coding scheme. Additionally, hypotheses two, three and four attempts to ensure that multiple sources are drawn upon to try and reduce biases that can come along with gathering data from single source.

As the content analysis coding scheme uses the predefined categorization and subcategorization by Margetts and Dunleavy's, the ability to recreate the and test the content analysis is straight forward. As reintegration, needs-based holism and digitalization and the operational subcategories are not going to change over time, replicating the content analysis should be possible in the future when analyzing digitalization levels. However, as the classification scheme is nominally constructed and social reality and political theories typically evolve with overlapping and simple components, a number of the thematic principles are very similar and future replicability could suffer from different interpretation of

the components. Regardless, of the similarities, future researchers should be able to discern that these similarities add to the understanding of DEG. In order to improve the reliability of the of the coding scheme, further principles from the background and interoperability theory section were added to boost the reliability of the analysis scheme. Specifically, digital-by-default, digital ready legislation, system-level bureaucracy, standardization and proactivity were added. As the coding scheme has not undergone testing by additionally researchers the study could face problem with content validity. Additionally, without expert interviews from civil servants who possess authoritative institutional knowledge of day-to-day operational challenge, the validity of the derived results could suffer.

5. Results

The content analysis largely confirmed the first hypothesis to be true. The Dutch digitalization strategy made multiple references that were coded under the NPM decentralization aggregation principle. The strategy explicitly stated that digitalization decisions-making should be decentralized as "municipal authorities are best quipped to provide customized solutions" for local governance (Economic Affairs and Climate Policy et al., 2019, p. 14). The strategy also stated that each Dutch ministry has their own digitalization policies and approaches which each individual minister is responsible for. This clearly falls in line with the aggregation principle of agencification as the uncoordinated design keeps decision making around digitalization at the peripherals of the national government. The Danish strategy showcased all three overarching DEG principles: reintegration, needs-based holism and digitalization. The strategy strongly emphasizes interoperability, as the Danish word for digital coherence was mentioned 29 times, data reusability was referenced 10 times and cross-jurisdictional data sharing was referred 38 different. The Netherlands only has two mentions in the strategy about working across the multiple levels of governance and only highlights the importance of working towards once-only solutions for sharing data one time.

As the second hypothesis inferred that nations who have interoperability-by-default legislation are more likely to facilitate cross-jurisdictional data exchanges. When searching for interoperability-by-default legislation in Denmark on Retsinformation.dk, nothing came up. After adjusting the wording from interoperability-by-default to digital-by-default, the search result showed that Denmark passed legislation in 2018 that stipulated that all new legislation must be digitally ready before it can be implemented into Danish law (Vejledning Om Digitaliseringsklar Lovgivning – Om at Indtænke Digitalisering Og Implementering i Lovudarbejdelsen, 2018). When doing the same search on the national bank of laws on overheid.nl, no laws or legislation came up. Therefore, the hypothesis can be deemed as being true for the case of Denmark and the Netherlands, as Denmark is able to facilitate greater levels of cross-jurisdictional data exchanges than the Netherlands.

Searching for specific legislation that mandates cross-jurisdictional data recycling, turned up no search results on both nations websites. Therefore, the third hypothesis cannot be answered. However, the Danish digital-by-default legislation specifies that cross-jurisdictional data reusability is a part of the digitalization requirements.

The fourth hypothesis was also largely supported by the data. It was hypothesized that nations who have fewer sub-national jurisdictions are more likely to be digitally interconnected. When simply comparing Denmark and the Netherlands, the Netherlands has more than three times the number of sub-national jurisdictions than Denmark. As of 2023, the Netherlands has 356 sub-national jurisdictions whilst Denmark has 103 sub-national jurisdictions (Table 4). This comparison confirms the hypothesis and is largely in line with the decentralization challenge that EU member state faces. As this comparison is rather simplistic and could be easily falsifiable by making the comparison with other countries, the hypothesis was tested with Estonia. Estonia's X-Road (public sector's digital infrastructure) connects more than 600 public and private sector institutions, as well as national

administrations across borders, through interoperable data exchanges (Eric B. Jackson et al., 2021). Estonia was therefore chosen as it has similarly high levels of interoperability as Denmark and is a similarly small nation. Estonia was added to the descriptive table and also confirms the hypothesis as it has 79 sub-national jurisdictions.

6. Discussion

Based upon the results, it can be inferred that the embracement of digital era governance (DEG), along with the introduction of digital-by-default legislation and having fewer sub-national jurisdictions than the Netherlands, are mechanisms that likely have caused Denmark to facilitate greater levels of interoperable cross-jurisdictional data exchanges than the Netherlands. The content analysis shows that Denmark does highlight the importance of some NPM practices like public-private partnerships, but does so predominately within the framework of interoperable DEG joined up governance, that caters to the needs of citizens, businesses and administrative operations. The Netherlands, on the other hand, largely views it role as facilitating greater digitalization to private sector through NPM principles and does not put much emphasis on facilitating cross-jurisdictional data exchanges.

When incorporating the finding that greater subnational decentralization likely leads to less digital interconnectivity across a nations public sector, within the DEG and NPM paradigm, it can be further inferred that Denmark has undergone greater reintegration than the Netherlands. Denmark and the Netherlands have both greatly reduced the number of sub-national jurisdictions within their territories. In 1970, Denmark reduced the number of subnational jurisdictions from 1413 to 291. This decrease of 1122 was further reduced in 2007 as the number of subnational jurisdictions was reduced from 284 to its current 98 municipalities and 5 regional governments (Table 3). As Denmark has undertaken territorial amalgamations that have consolidated the number of subnational jurisdictions at once, whilst the Netherlands has taken a more progressive approach, it could be deduced that the

Netherlands greater adherence to NPM decentralization principles could be a factor that stops it from taking more substantial at once DEG reintegration structural reforms.

As the two hypotheses relating to digital-by-default legislation confirmed that Denmark has enacted the legislation whilst the Netherlands has not, additionally indicates that Denmark have embraced the DEG principle of digital interoperability, while the Netherlands have put less emphasis on domestic interoperability and instead focuses more on decentralized decision making.

7. Conclusion

The aim of the thesis was to investigate the causes and mechanisms that have facilitated greater levels of interoperable cross-jurisdictional data exchanges in Denmark compared to the Netherlands. As societal digitalization and global connectivity has transformed citizens-to-governments and government-to-government communications to become digital, cross-jurisdictional interoperable data exchanges have become paramount to the paradoxical requirements for public sectors to improve service delivery and reduce operational costs. A preliminary comparison of the online public sector citizen portals in Denmark and the Netherlands, highlighted that the Danish infrastructure incorporated greater cross-jurisdictional interoperability capabilities than the Netherlands.

Section one of the theoretical framework identified the public governance paradigms of digital era governance (DEG) and new public management (NPM) and hypothesized that nations who have incorporated greater level of DEG principles into their public sector operations, are likely to be more digitally interconnected than nations who have incorporated greater levels of NPM. Section two of the theoretical framework identified the theory of interoperability and hypothesized that nations who have legislation that facilitates interoperability-by-default are more likely to facilitate cross-jurisdictional data exchanges. A

second hypothesis was derived that hypothesized that nations with legislating mandating cross-jurisdictional data recycling, are more likely to be digitally interconnected.

The data collection consisted of the author accessing the Danish and Dutch citizen portals, downloading and using the Danish and Dutch digitalization strategies, searching for national interoperability legislation on the two nations national legislation databases, and retrieving data from the OECD United Cities and Local Governments 2016 report, Eurostat and from a variety of academic articles, governmental websites and news report.

The method of analysis revolved around qualitative content analysis. Specifically, a thematic coding scheme was used to look for DEG and NPM principles in the Danish and Dutch digitalization strategies. To improve the reliability of the coding scheme, additional concepts that fit within the DEG paradigm were added to the pool of child concepts to code for.

The results largely confirmed that the Danish digitalization strategy incorporated greater levels of DEG principles than the Netherlands. Denmark's digital-by-default legislation stipulates that any new national legislation created, has to be designed to fit within the current digital frameworks. The digital-by-default legislative framework incorporates the requirement new legislation to be reusable across jurisdictional boundaries. Additionally, the data also showcased that Denmark's more centralized political architecture fall more in line with DEG principles whilst the Netherlands more decentralized political architecture is falls more in line with NPM principles.

A theory that could aid future research when investigating cross-jurisdictional interoperability is collaborative governance. As the Danish digitalization strategy repeatedly discussed that it is mandatory for digital cross-jurisdictional collaboration, the theory of collaborative governance could aid future research as it would likely showcase more political and reasons why Denmark has a high level of cross-jurisdictional interoperability when

comparing it to Denmark. Additionally, conducting interviews with employees who have witnessed the digital transformations within the municipalities, regional governments and national agencies, would enhance future research, as they would be to provide more accurate and likely more reliable information than the digitalization strategies can provide.

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Automated software solutions ensure

Appendix:

Tables

Table 1: UN E-Government Ranking/Surveys

	Global Rankings		European Rankings	
Year	**Denmark**	**Netherlands**	**Denmark**	**Netherlands**
2001	9	8	4	3
2003	4	11	2	8
2004	2	11	1	6
2005	2	12	1	7
2008	2	5	**2**	**4**
2010	5	7	4	2
2012	2	4	3	1
2014	16	5	8	2
2016	9	7	6	5
2018	1	13	1	5
2020	1	10	1	6
2022	1	9	1	6
Average:	**4,5**	**8,5**	**2,8**	**4,6**

	Global Rankings		European Rankings	
Year	**Denmark**	**Netherlands**	**Denmark**	**Netherlands**
2001	9	8	4	3
2003	4	11	2	8
2004	2	11	1	6
2005	2	12	1	7
2008	2	5	**2**	**4**
2010	5	7	4	2
2012	2	4	3	1
2014	16	5	8	2
2016	9	7	6	5
2018	1	13	1	5
2020	1	10	1	6
2022	1	9	1	6
Average:	**4,5**	**8,5**	**2,8**	**4,6**

(Data gathered from the 12 UN E-government Surveys. See references)

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Table 2: EU Digitalization Rankings

		Digital Economy and Soceity Index (DESI) Rankings 2022			
European Union	**UN E-Government Survey 2022**	**Human Capital**	**Connectivity**	**Integration of digital technology**	**Digital public services**
Austria	20	9	14	10	12
Belgium	39	16	27	6	16
Bulgaria	52	26	19	26	25
Croatia	44	8	24	14	23
Cyprus	27	19	12	17	20
Czechia	45	12	17	18	17
Denmark	**1**	**4**	**1**	**2**	**8**
Estonia	**8**	**13**	**26**	**15**	**1**
Finland	2	1	8	1	2
France	19	10	5	19	15
Germany	22	22	4	16	18
Greece	33	17	22	21	26
Hungary	51	21	13	25	21
Ireland	30	3	6	7	6
Italy	37	24	7	8	19
Latvia	29	18	20	23	11
Lithuania	24	23	23	13	10
Luxembourg	26	7	11	18	7
Malta	15	11	16	5	3
Netherlands	**9**	**2**	**2**	**4**	**4**
Poland	34	25	25	24	22
Portugal	38	14	18	12	14
Romania	57	27	15	27	27
Slovakia	47	15	21	20	24
Slovenia	21	20	10	9	13
Spain	18	6	3	11	5
Sweden	5	5	9	3	9

(Data gathered from: (European Commission, 2022a; United Nations: Department of Economic and Social Affairs, 2022)

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Table 3: Subnational Amalgamation

	Denmark	Netherlands	Estonia
Year	Subnational Jurisdictions	Subnational Jurisdictions	Subnational Jurisdictions
1950		1026	
1969	1413		
1970	291*		
1975		853	
1990	289	684	255
1994	289	648	254
1998	289	560	247
2000	289	549	247
2002	289	508	241
2006	284	470	227
2007	103**	455	227
2010	103	443	226
2014	103	415	213
2016		402	213
2017		392	79***
2018		392	
2019		364	
2021		364	
2023	**103**	**356**	**79**

(Data gathered from: (Chatzopoulou & Poulsen, 2017; Danish Ministry of the Interior and Housing, n/a; Henrichsen, 2013; Ministry of Finance of the Republic of Estonia, n/a; NOS, 2022; OECD, 2021b; Preisler & Bogason, 2012; Swianiewicz et al., 2017; Zwaan, 2017)

*1970: Danish structural reform reduces subnational jurisdictions by 1122.
**2007: Danish structural reform reduces subnational jurisdictions by 181.
***2017: Estonia Administrative reform reduced subnational jurisdictions by 137.

Jump back: Introduction, Background, Theoretical Framework, Research & Methods, Results, Discussion, Conclusion

Coding scheme

<table>
<tr><th colspan="2">1. Hypothesis</th></tr>
<tr><td colspan="2">Nations who have embraced greater levels of DEG principles, are likely to have less digitally interconnected public sectors.

Dependent variable (Outcome): Digitally interconnected public sector
Independent variable (Explanatory): DEG principles</td></tr>
<tr><th><u>Digital Era Governance</u></th><th><u>New Public Management</u></th></tr>
<tr><td>Re-centralization / Reintegration
Joined up governance
Only once
Administrative simplification
Standardization
“Needs-based holism”
Citizen centric
Citizen oriented
Holism
One-stop processes
Agility
Adaptability
Real time
User needs
Digital by default
Do it yourself
Self service solutions
Personalization
Proactivity
Digitalization
Interoperability
Digital-by-default
Digital ready legislation
Only Once
Reusability
System-level bureaucracy
Smart governance</td><td>Disaggregation / decentralization
Agencification of central government
Outsourcing
Deregulation
Competition
Mandatory competition
Outsourcing
Strategic review,
Deinstitutionalization
Asset sales
Consumer-tagged financing
Deregulation
Incentivization / Marketization
Privatization
Private finance initiatives
Public private partnerships
Performance-related pay
User charging
Public sector dividends
Incentivization</td></tr>
</table>

Jump back: Introduction, Background, Theoretical Framework, Research & Methods, Results, Discussion, Conclusion

Coding scheme: Danish Strategy

Digital Era Governance	**New Public Management**
" I Danmark er vi bedst, når vi gør ting i fællesskab. Vi løser opgaver på tværs af stat, kommuner og regioner, og vi gør det i samspil mellem det offent- lige og det private. Den tilgang har bragt os langt." (p.7) • Joined up governance • MLG interoperability "tæt og forpligtende samarbejde på tværs af hele den offentlige sektor og i tæt partnerskab med private parter. Det gælder blandt andet på områder, hvor det har været nødvendigt og hensigtsmæssigt at skabe tværgående løsninger, der anvendes bredt i danskernes hverdag" (p.8) • Mandatory MLG interoperability • Interoperablity • Joine up governance • Explicitly states that the Danish public sector highly values these DEG aspects "Dette samarbejde på tværs af sektorer er unikt på verdensplan og har givet enestående resultater og digitale løsninger som NemID, Digital Post, borger.dk, virk.dk mv., som gør hverdagen nem- mere for borgere og virksomheder." (p.8) • Needs-based holisim • User needs "lette unødigt bureaukrati for danske virksomheder og accelerere deres digitale omstilling" (12) • Digitalization – administrative simplification "Digitale fremskridt skal tages i samarbejde mellem det offentlige og det private. Den digitale udvikling skal ske i tæt samarbejde mellem den offentlige og private sektor for at sikre vækst, innovation og sammenhæng på tværs af løsninger i både myndigheder og erhvervslivet." (p.15)	Incentivization: Public private partnerships: • "udrullet teknologiske løsninger bredt…Derfor dækker regeringens strategi som noget nyet både den offentlige sektor og den private sector" (p.3) "Det digitale skal være til gavn for alle, skabe vækst og understøtte konkurrenceevne og produktivitet" (p. 15) • Competition "Digitale fremskridt skal tages i samarbejde mellem det offentlige og det private. Den digitale udvikling skal ske i tæt samarbejde mellem den offentlige og private sektor for at sikre vækst, innovation og sammenhæng på tværs af løsninger i både myndigheder og erhvervslivet." (p.15) • Public private partnerships "**styrke det offentlig-private samarbejde** om innovative løsninger bl.a. ved at opsamle og udbrede viden om offentligt-privat samarbejde, innovative og fleksible udbud" • Incentivization: Public private partnerships "Som led i at **styrke offentligt-privat samarbejde** skal det blive lettere og mere ensartet for SMV'ere at byde på offentlige kontrakter gennem udvikling af et nationalt udbudssystem. Indsatsen vil bl.a. gøre det nemmere at finde frem til relevante udbud, øge datagenbrug og reducere antallet af it-systemer, som virksomheder skal anvende." • Incentivization: Public private partnerships

• Joined up • Across jurisdictions and sectors "Sammenhængende service for borgere og virksomheder" • Reintegration: Joined up "Digitale offentlige løsninger og services skal være sammenhængende, brugervenlige og tage udgangspunkt i den enkelte brugers behov og situation. Samtidig skal den offentlige service være tilgængelig for alle" • Reintegration: Joined up • Needs-based holism: Citizen-centric, personalization, available for all. "Borgere og virksomheder skal opleve en moderne digital service, som er mere brugervenlig, sammenhængende og ensartet – uanset hvilke dele af det offentlige, de er i kontakt med. " (p.21) • Needs-based holism: User needs • Reintegration: Joined up "En sammenhængende offentlig sektor kræver en mere datadrevet offentlig service, hvor data i højere grad anvendes og udveksles på tværs af myndigheder for at sikre en mere sammenhæn- gende og personaliseret service til den enkelte." (p.22) • Reintegration: Joined up • Digitalization: MLG Interoperability • Needs-based holism: Personalization "Der skabes digital sammenhæng på tværs af velfærdsområder gennem bedre mulighed for datadeling i sager, der går på tværs af myndigheder og sektorer." (p. 23). • Reintegration: Joined up • Digitalization: MLG Interoperability "Den digitale service løftes gennem målrettet arbejde med udviklingen af digitale selvbetjeningsløsninger, mere målrettet information og vejledning på borger.dk og nye funktioner i Digital Post." (p.23)	• Competition: Outsourcing (they want to centralize this through a single national system to reduce IT administrative system

• Needs-based holism: self-service solutions "På lang sigt er det visionen, at virk-somhederne kun indberetter samme data én gang til myndighederne." (p.29) • Digitalization: interoperability – only once principle "Automatiserede løsninger kan lette det arbejde og føre til færre fej" (p.29) • Digitalization: System-Level Bureaucracy "digitale løsninger skal afhjælpe unødigt bureakrati og automatisere rapporteringskrav" (p.31) • Digitalization: Administrative simplification • (cross over with NPM but its alluding to DEG) "Derfor vil regeringen fortsætte både det tætte fællesoffentlige samarbejde med regioner og kommuner om digitalisering af sundhedsvæsnet og det stærke offentligt-private samarbejde på life science-området om udviklingen af fremtidens digitale sundhedsvæsen." • Reintegration: Joined up • Digitalization: MLG Interoperability "Eksempler på offentlige apps som dansker anvender…5 mio. gange er appen MinSunhed blevet downloadet…1.6 mio. bruger anvender MinLæge-appen…2.1 mio gange er Sundhedskort-appen downloadet…49,500 gange i døgnet bliver Sundhedskort-appen benyttet…4.6 mio. gange er Coronapas-appen downloadet" (p.35) • Smart Governance	

"Borgere skal tilbydes bedre, mere fleksibel og personlig behandling af høj kvalitet, uanset hvor de bor i landet. Det skal gøres ved at udbrede telemedicinske løsninger som fx virtuelle konsultationer, hjemmemålinger og patientrapporterede oplysninger. (p.36) • Digitalization: Smart Governance "Det skal være lettere at dele oplysninger og sende meddelelser i sundhedsvæsenet, herunder især i forbindelse med sektorovergange mellem praksissektor, kommuner og sygehuse" (p.36) • Digitalization: Administrative simplification "Udbygge *Et samlet patientoverblik*, som skal styrke det nære og sammenhængende sundhedsvæsen ved at lette arbejdsgangene, sikre mere tid til den enkelte patient og fremme gode, sammen- hængende patientforløb, fordi der er let og smidig adgang til de relevante oplysninger, når der er brug for det i patientens behandlingsforløb." • Reintegration: Joined up • Digitalization: Administrative simplification "Det har gjort Danmark i stand til at gå forrest i udviklingen af den offentlige service. Vores sund- hedsregistre, skattesystem, og den digitale post og selvbetjening, der i dag er en naturlig del af danskernes hverdag, står på skuldrene af systemer og dataregistre, der er bygget op over årtier." • Needs-based holism: self-service solutions "Regeringen vil derfor over de kommende år investere i samfundets fælles	

datagrundlag, så virk- somheder, myndigheder og forskere også fremover kan **bygge videre på sammenhængende** og tilgængelige data, der **går på tværs af sektorer i samfundet**. Regeringen ønsker, at offentlige data skal kunne anvendes og deles bredt i samfundet på en effektiv, standardiseret og dataetisk forsvar- lig måde, som værner om borgernes tillid. • Reintegration: Joined Up • Digitalization: MLG interoperability • Digitalization: Standardization "behov for en styrket koordination i den offentlige sektor for at sikre **genbrug** og **sammenhæng** på tværs" • Digitalization: Interoperability: Only Once • Digitalization: MLG interoperability "I fælles arkitektur og udbredte standarder…der kan tale samme på tværs." (46) • Digitalization: MLG interoperability **"Sammenhængende sagsforløb** via datadeling…skal sikres **mere sammenhængende sagsforløb og service**…**på tværs af kommune, sundhedsvæsen og statslige myndigheder**. Det kræver blandt andet bedre mulighed for datadeling i sager, der går på tværs af myndigheder og sektorer. Indsatsen skal afklare de juridiske rammer og modvirke barrierer for effektiv og ansvarlig datadeling mellem myndigheder." (p.63) • Digitalization: MLG interoperability • Reintegration: Joined up governance • Needs-based holism: proactivity, citizen needs, real time,	

"Et **samlet** og **personaliseret overblik** til borgerne gennem videreudvikling af Mit Overblik… Borgerne skal have et samlet og mere målrettet overblik over sine væsentligste oplysninger og gøremål **på tværs af den offentlige sektor på Mit Overblik**. Mit Overblik på borger.dk skal **udvides** og **indeholde mere målrettet information** og vejledning tilpasset den **enkeltes konkrete situation**. (p.63) • **Reintegration**: Joined up governance • **Needs-based holism**: Citizen centric, One-stop portal processes, proactive • **Digitalization**: MLG Interoperability, Smart governance "Mit Virk app'en et samlet overblik over frister og sager i hånden, og de får notifikationer, når de skal handle på noget fra det offentlige." (p.63) • **Reintegration**: Joined up governance • **Needs-based holism**: Citizen centric, One-stop portal processes, proactive • **Digitalization**: MLG Interoperability, Smart governance "**samarbejde på tværs af myndigheder** om dataudveksling og teknologi til avanceret dataanalyse målrettet en mere **proaktiv** og effektiv bekæmpelse af økonomisk kriminalitet." • **Digitalization**: MLG Interoperability • Needs-based holism: Proactivity "tværgående statsligt samarbejde" (p.66) • **Digitalization**: MLG Interoperability "Der skabes **øget sammenhæng** og samlet adgang til sundhedsdata, der skal gøre det	

lettere for borgere, pårørende og sundhedspersonale at tilgå og få et **bedre overblik over oplysninger**." (p.66) • **Digitalization:** MLG Interoperability • **Needs-based holism:** personalization "Virksomheder, forskere og myndigheder skal lettere kunne finde og **genbruge offentlige data** til at skabe innovation, udvikling og værdi med offentlige data. Der etableres ét **samlet overblik over tilgængelige offentlige data**. Datavejviseren vil tilbyde et søgbart overblik **på tværs af de mange platforme**, der huser offentlige data." • **Reintegration: only once** • **Digitalization**: Interoperability: reuse **"**Lovgivningen skal være nem at forstå og enkel at administrere digitalt. Derfor skal indsats for **digitaliseringsklar lovgivning fortsættes og styrkes.** Det skal sikre, at lovgivningen kan omsættes til digitale løsninger på en effektiv, datasikker og etisk ansvarlig måde." (68) • **Digitalization:** Interoperability: Digital Ready legislation "Der er en stærk tradition for at samarbejde og finde nye og pragmatiske løsninger, både **på tværs af de** offentlige myndigheder og **på tværs af den offentlige** og den private sektor." (69) • **DEG: Digitalization: interoperability** " Endvidere er en række myndigheders it-løsninger og processer i dag opbygget, så de afspejler den enkelte myndigheds interne behov og organisering frem for **borgernes og virksomhedernes behov**, som i mange	

tilfælde går på **tværs af myndigheder og sektorer**." (p. **69)**) • **DEG: Digitalization: interoperability** " Hvor det er muligt, sikkert og relevant, skal kommunale, regionale og statslige myn- digheder derfor i stadig **højere grad arbejde henimod at dele data. Øget genbrug af data"** • **DEG: Digitalization: interoperability: reuse**	

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Coding scheme: Dutch 2021 Strategy

Digital Era Governance	New Public Management
"**By working together**, we can **strengthen the exchange of knowledg**e and best practices, and this will **save us from continuously reinventing the whee**l and **coming up with conflicting legislation."** (p.12) • DEG: not specifically stating any of the variable conditions but working together is overaching more of a them in DEG than in NPM.	"An important part of **digitalisation is taking place in social sectors** in which the government plays a relatively large role. This includes healthcare, mobility, energy and the agri-food sector. The digitalisation of public administration itself is also an important task. The **challenge for the government is to speed up and support the digital transition in these sectors**." (p.7) • Disaggregation: decentralization approach – not to steer digitalization but to help.
"Intensive cooperation will be required with other governments, businesses, civil society organisations and knowledge institutions…The government will take the lead in this and give direction to technological developments at an early stage" (p.13) • Hint at reintegration but stating it would rather have a coordinative relationship Not quite DEG but	"The government wants the Netherlands to lead the way in the application of new technology. This means that we need to be at the forefront of research, experimentation and implementation, while maintaining the trust of our citizens and businesses. That is why we are **strengthening the foundation** for **digitalisation**, in the field of **privacy**, **cybersecurity**, **digital skills** and **fair competition**, among other things."

speaks to the overarching thematic principles of coordination. "The government needs to become more **agile**" (p.13) • Needs-based holism: **agile**. This is for the governments and not for the sack of the citizens through public service delivery. "Smart solutions" (p.13) • Digitalisation • Needs-based Holism "**developed** for the further **digitalisation** of **public administration**…Interior and Kingdom Relations will develop this **with local** and **regional authorities**…The **focus** will be on the **digitalisation issues** and **challenges facing** the **government**, as well as the interests of **citizens**, social **institutions** and **businesses**. The implementation of this agenda will also be done jointly."(p.18) • No specific mention of DEG principles but precuros to reintegrtation and	• Just mentions digitalization and frames the importance of it as a means **to strengthen the private sector growth predominately, rather than centrally steer digitalization across the different levels of governance.** "The government cannot do this on its own. If we want to make the most of the opportunities offered by digitalisa- tion and effectively combat any negative effects, intensive cooperation will be required with other governments, businesses, civil society organisations and knowledge institutions. The government will take the lead in this and give direction to technological developments at an early stage." • **Coordinating role only for the civil society and private sector. No mention of subnational jurisdictional level.** "Each minister is responsible for its own area and will start working on the issues at play there.1 At the same time, we must support each other where possible and necessary." • **Disaggregation: decentralized agencification**

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Figures

Figure 1: Citizen-to-government (C2G) & government-to-citizen (G2C) data exchanges

Figure 2: Government-to-government (G2G) data exchanges

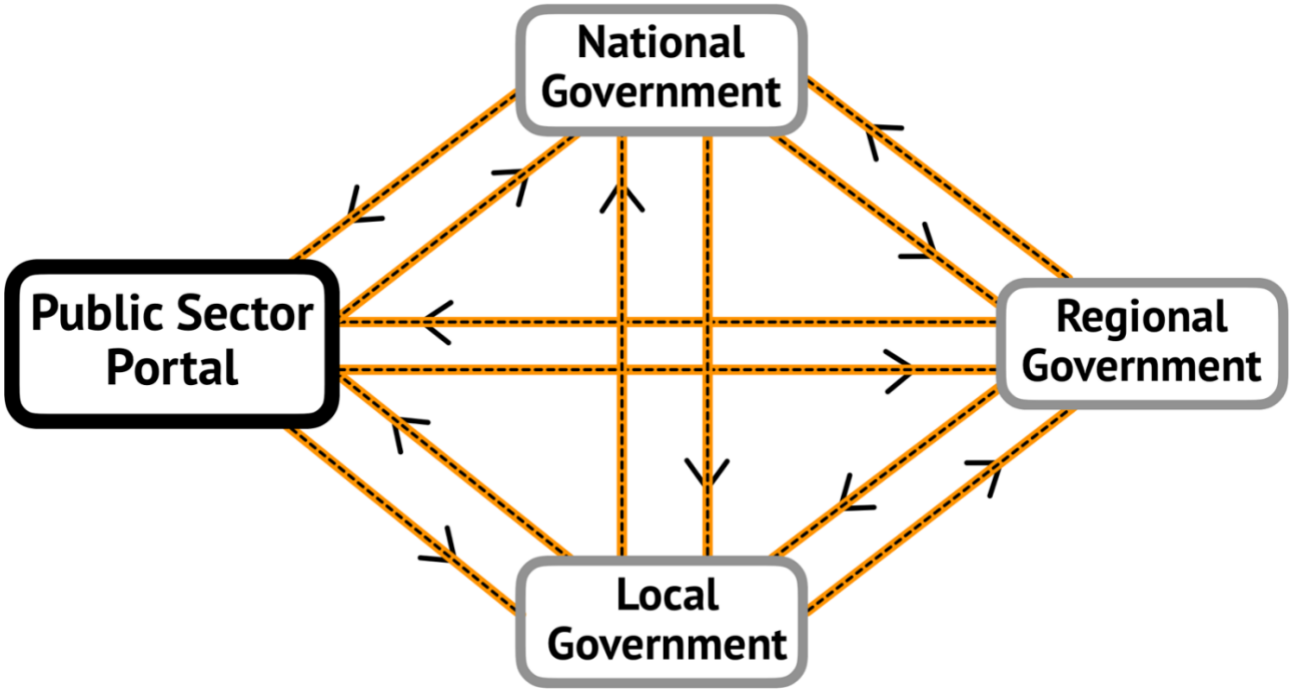

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Figure 3: Front and back-office: C2G, G2C & G2C communication

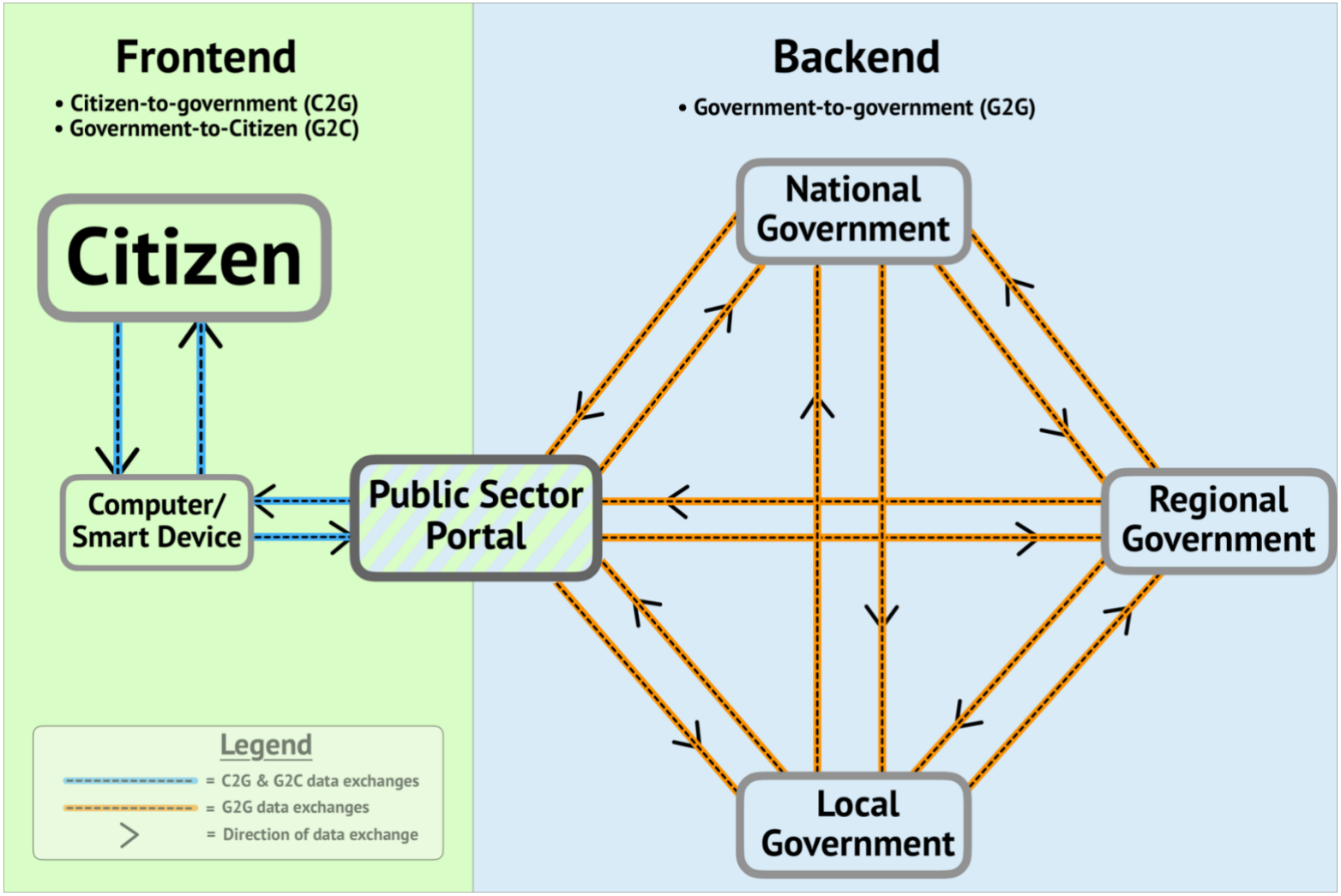

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Figure 4: Borger.dk (citizen themes)

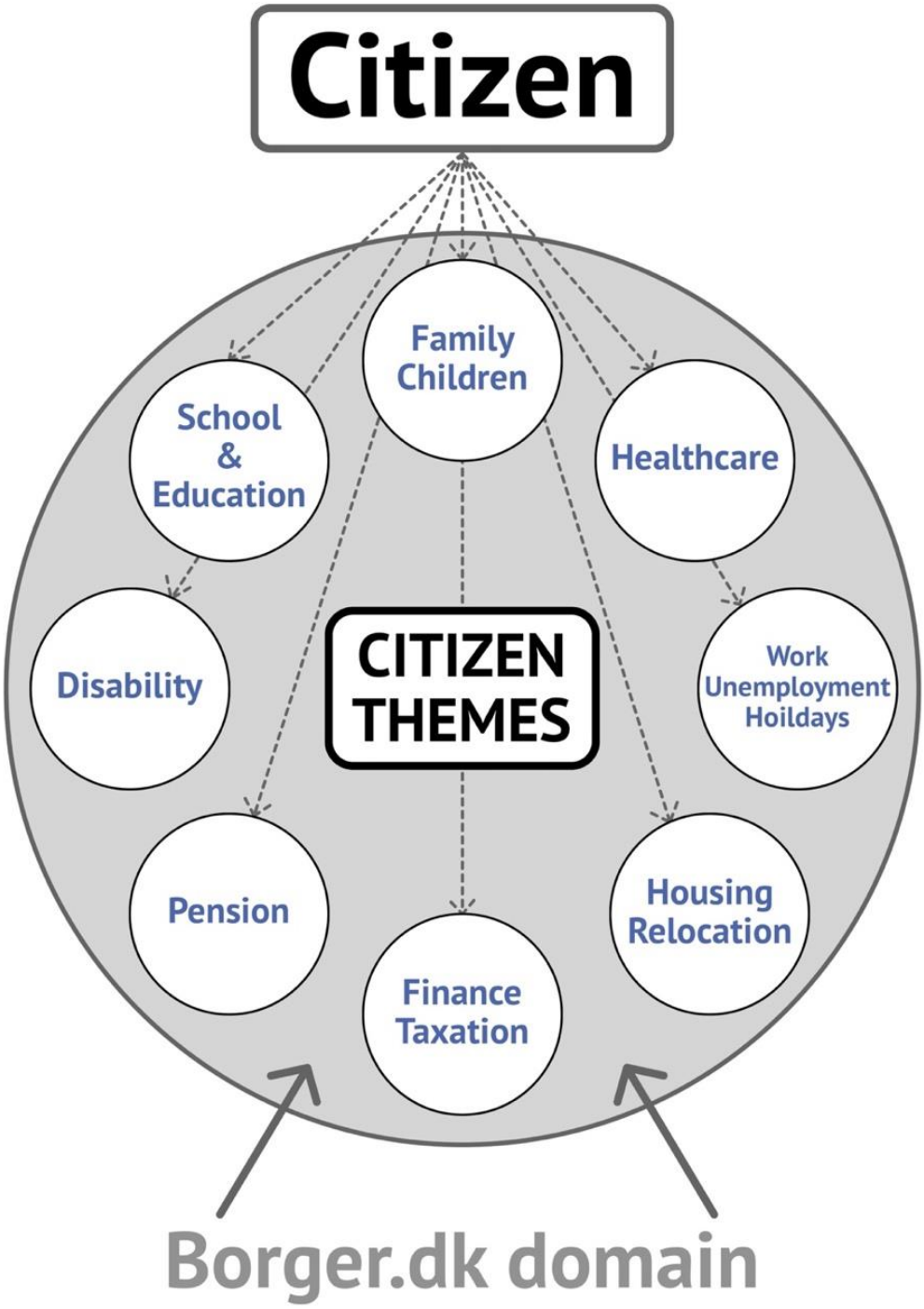

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Figure 5: Centralized agency for social benefit (monetary) delivery

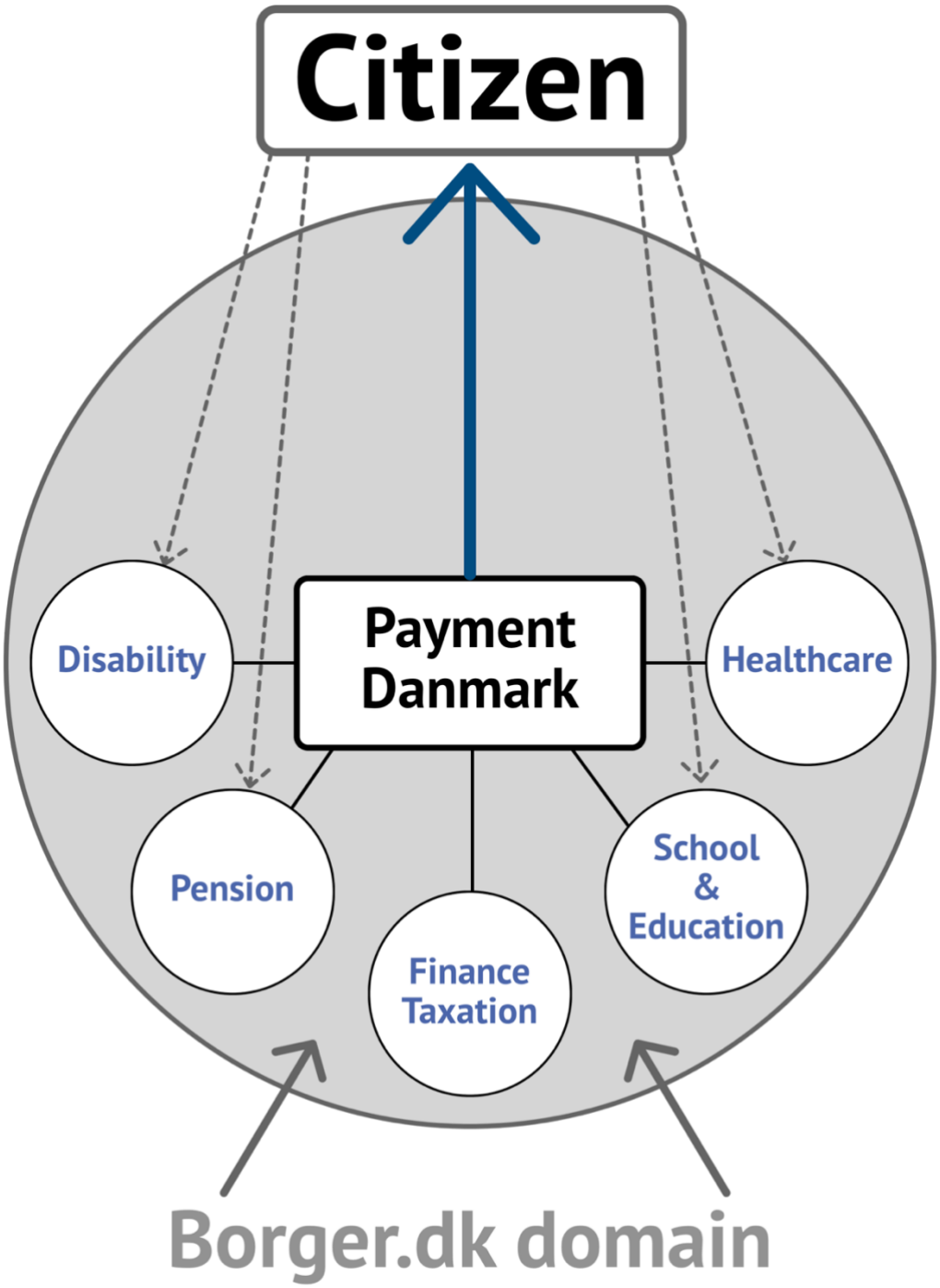

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Figure 6: Danish digital infrastructure: Springboard

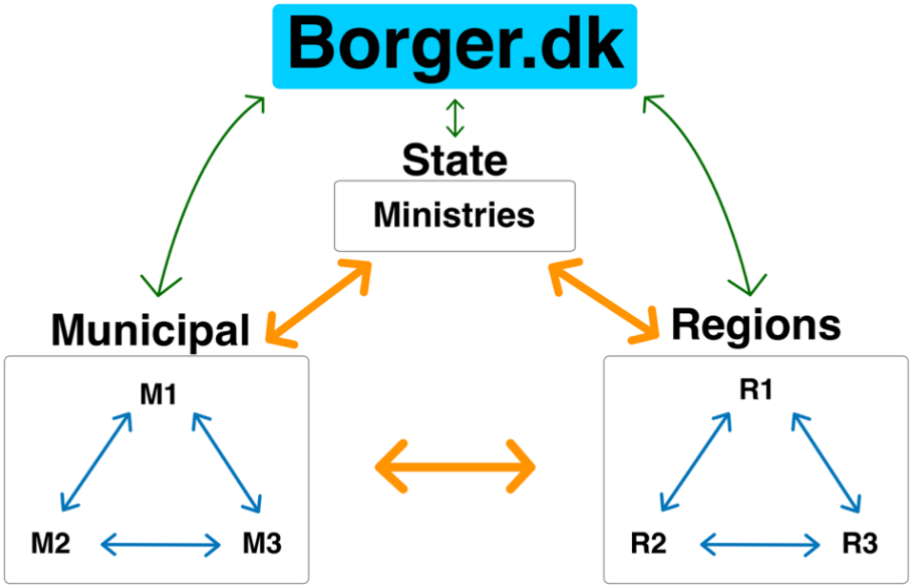

Figure 7: Danish Electronic Identification (eID): MitID

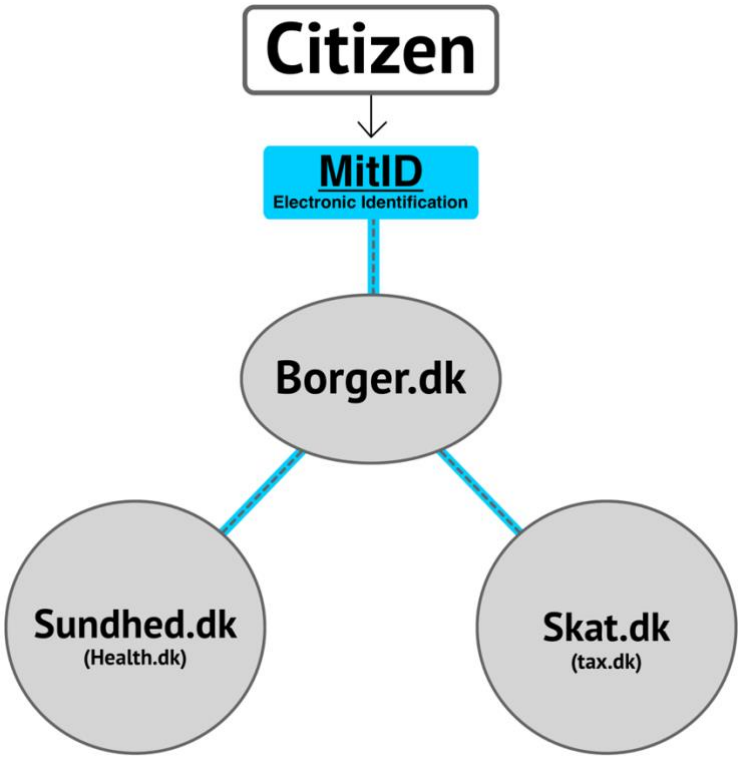

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Figure 8: Mijnoverheid.nl (citizen themes)

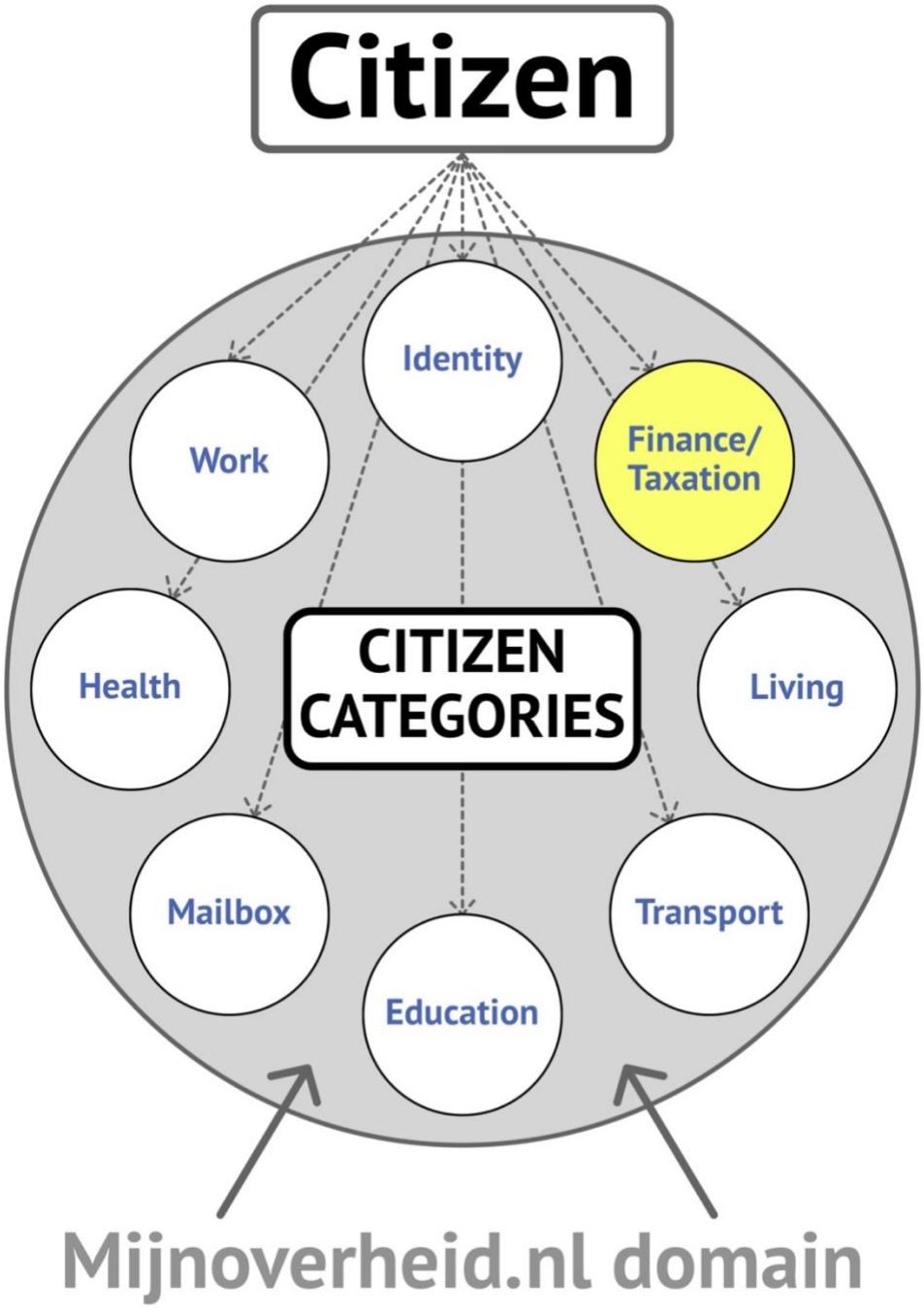

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Figure 9: Dutch Electronic Identification (eID): DigiD

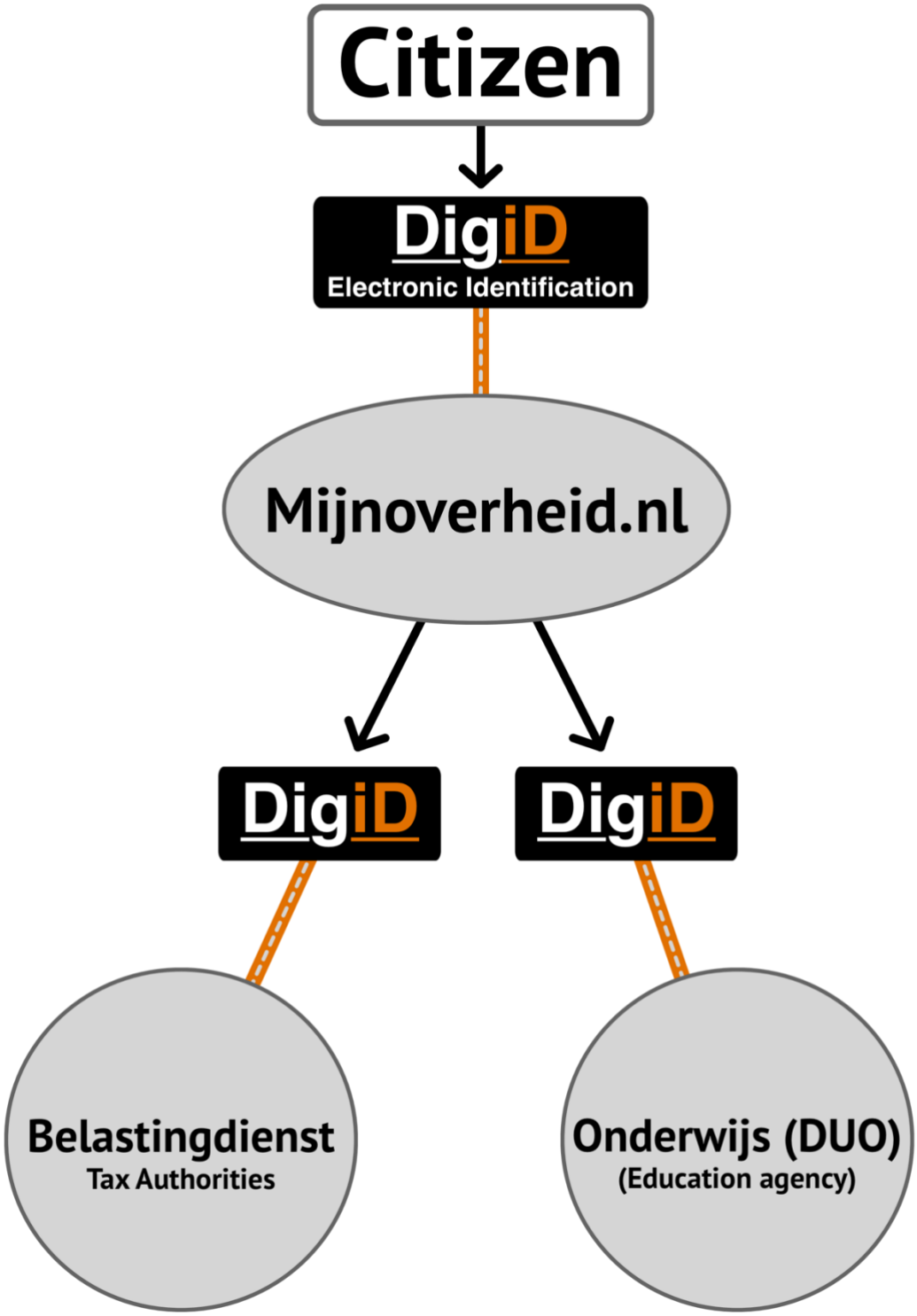

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Figure 10: System Level Bureaucracy: Interoperable Data Exchanges

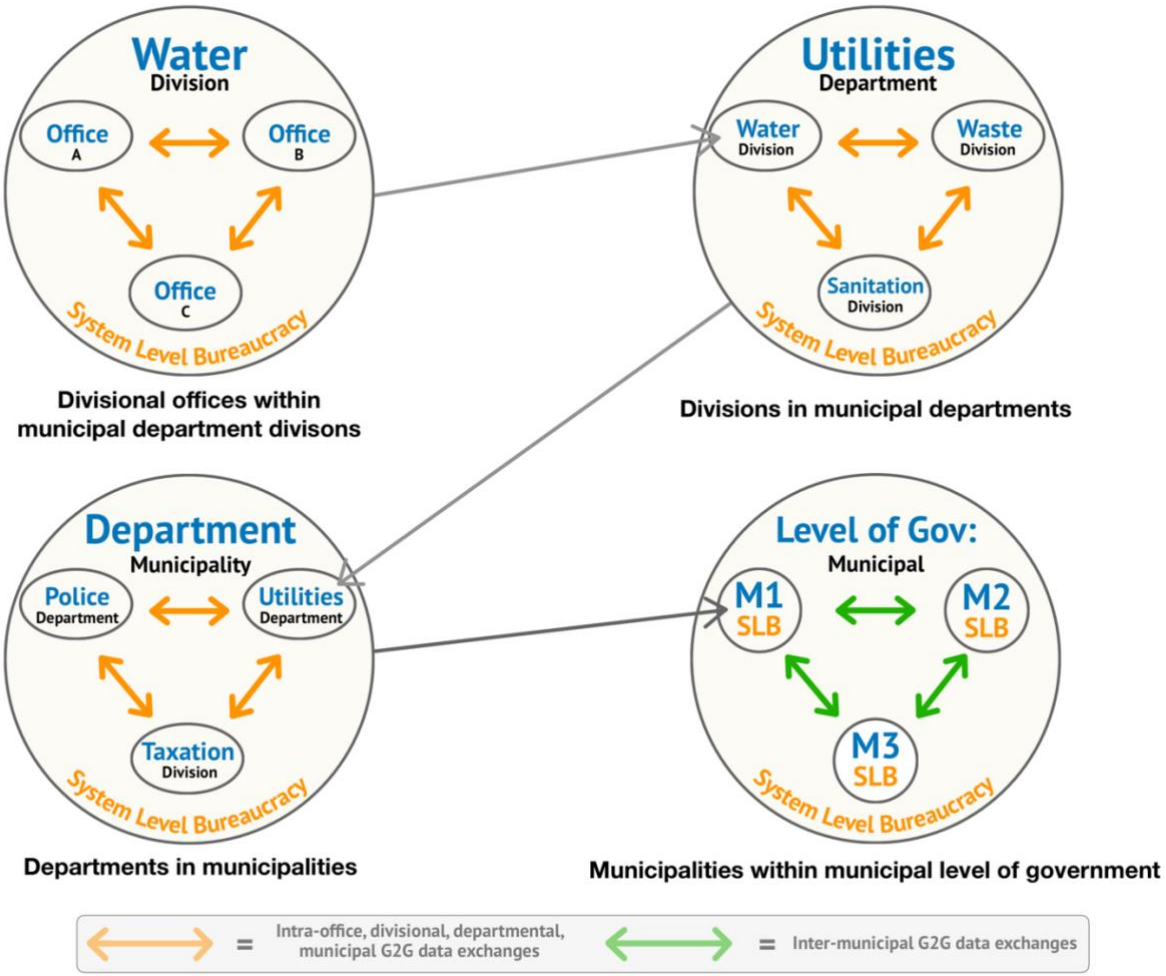

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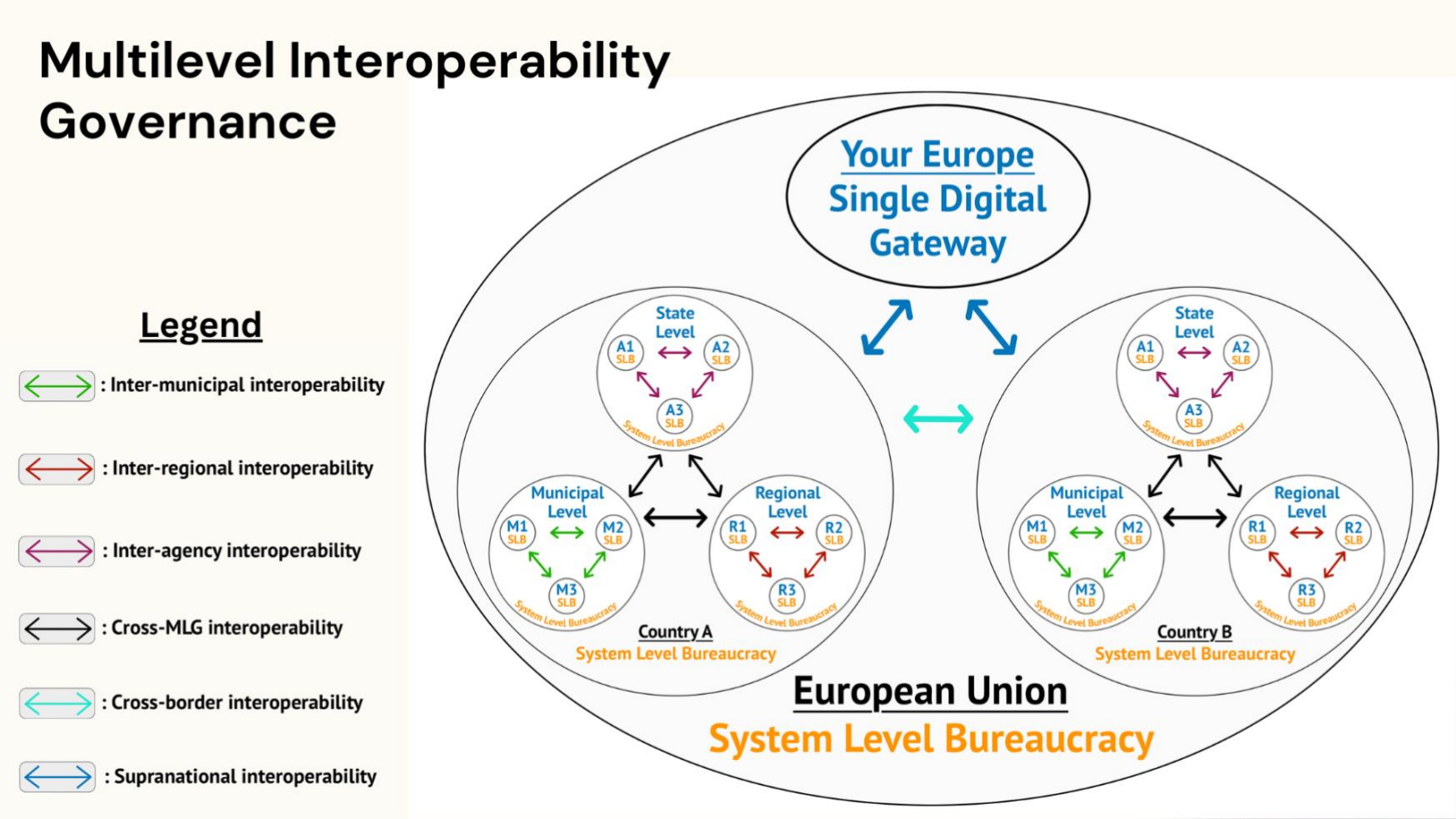
Figure 11: Multilevel Interoperability Governance



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