

Delving into the governance of cross-border interoperability solutions in the EU

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Abstract: The European Union's single market recently celebrated its 30th anniversary. However, unique developments in digital governance have exposed significant barriers to the establishment of a digital single market. One notable challenge is the creation of cross-border digital public services, which is impeded by a lack of interoperability among information systems. Although there have been important advancements toward achieving interoperability, particularly with the development of cross-border interoperability solutions, the governance of these solutions has not been thoroughly examined. This study aims to fill that gap by analysing the governance arrangements of three specific cases: EUCARIS, OOTS, and Peppol. Through an exploratory multi-case study, we identify the governance structures in place and find that network governance is most prevalent, shaped largely by the EU's regulatory and political context.

Keywords: Digital governance, Digital public services, Digital single market, Solutions, Trans-European

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1. Introduction

The European Union (EU) has made significant strides in establishing the European Single Market, but its full realisation, particularly in digital governance, remains a challenge (Leosk et al., 2021; Schmidt and Krimmer, 2022). In fact, the European Union (EU) recently celebrated the 30th anniversary of the inception of the European Single Market. Yet, the rapid advancements in Information and Communication Technology (ICT) have clarified that enhanced integration and interoperability are necessary to achieve the envisioned Digital Single Market and Digital Decade strategy objectives. The Single Market initiative is based on the free movement of people, businesses, services, and capital, which has been successful in the physical realm. However, the digital realm requires the free movement of data and information, which is still being developed. Specifically, developing and implementing cross-border digital public services for citizens and businesses requires significant collaboration and data exchange between the service provider and service consumers in different member states. With the idiosyncratic digital transformation in the member states, digital integration in the EU faces challenges when aiming to establish cross-border digital public services. The absence of interoperability among public administrations and the deficiency in data exchange have become significant impediments to this process (European Commission, 2022a). For example, in the EU, the estimated costs for establishing a cross-border business subsidiary or hiring employees incur 80% more expenses than the same service in the domestic country (European Commission, 2017). An increasing number of citizens live in other EU countries and use cross-border public services, an estimated 30% of the EU population (Halmos, 2018).

The interoperability of digital public services has been a focus of scientific research and practice for several decades (Akbar et al., 2022; Janssen and Scholl, 2007). Researchers have highlighted the immense significance of interoperability for advancing digital government, citing it as an essential requirement for progress (Campmas et al., 2022; Criado, 2009; Fragkou, 2018; Gasco-Hernandez et al., 2022; Scholl and Klischewski, 2007). Additionally, besides the focus on national and local e-government developments, the calls for cross-border interoperability have been emphasised (Dedovic and Homburg, 2024; Krimmer, Dedovic, et al., 2021; Pardo et al., 2010; Schmidt and Krimmer, 2022). To achieve a digital single market in the European Union (EU) and cross-border digital public services, a crucial requirement is the existence of interoperability solutions for cross-border data exchange among diverse systems across national borders (Dedovic and Homburg, 2024). Meanwhile, the EU has prioritised establishing interoperability between its entities for improved digital delivery of European public services through an open method of coordination (Criado, 2012) and recently, through regulatory requirements in the Interoperable Europe Act (Regulation (EU) 2024/903 of the European Parliament and of the Council of 13 March 2024 Laying down Measures for a High Level of Public Sector Interoperability across the Union (Interoperable Europe Act), 2024). The absence of interoperability among public administrations and the deficiency in data exchange have become significant impediments to cross-border digital public services (Leosk et al., 2021; Prentza et al., 2021).

For this reason, significant developments have emerged within the EU to solve the lack of interoperability challenges by developing and deploying cross-border interoperability solutions (CBIS) for digital public services (Krimmer, Dedovic, et al., 2021). The CBIS are the standards-based

information systems that are shared among members with the purpose of enabling interoperability across national boundaries. However, simply developing interoperability solutions does not necessarily mean success in delivering digital public services across borders (Velicogna et al., 2020). Instead, the governance of those solutions remains a primary concern and a crucial determinant (Klievink et al., 2012; Velicogna et al., 2020). The research on interoperability and cross-border digital public services emphasises the challenges of establishing a governance framework and the additional complexity of the governance processes among the multiple actors across different levels (Dawes, 2009; Dedovic and Homburg, 2024; Klievink and Janssen, 2014; Rukanova et al., 2015). The reasons behind these challenges lie in the complexity and larger scale of the infrastructural developments, which include many different actors, each with different requirements and digital maturity (Hanseth and Lyytinen, 2010).

Although the research on CBIS is attracting significant attention (Eibl et al., 2022; Krimmer, Dedovic, et al., 2021; Markus and Bui, 2012; Prentza et al., 2021), the focus is primarily on non-governance aspects (Boldrin et al., 2021; Carretero et al., 2018; Schmitz and Wimmer, 2023), with some notable exceptions from Krimmer et al. (2021), Wimmer et al. (2018), and Rukanova et al. (2015). For example, previous research has contributed primarily to architectural developments and technical factors (Boldrin et al., 2021; Carretero et al., 2018; Siapera et al., 2023), the experiences and challenges in implementation (Cavaye, 1997; Lips et al., 2020; Prentza et al., 2021; Schwalm and Alamillo-Domingo, 2022). Although acknowledged as one of the main challenging factors, CBIS governance remains scarce and largely unexplored (Dedovic and Homburg, 2024; Loukis et al., 2016; Rukanova et al., 2015). Related research on cross-boundary data sharing emphasises network characteristics and network governance approaches (Dawes, 2009; Luna-Reyes et al., 2013; Pardo and Burke, 2008); however, how these cross-border solutions are governed and what governance approaches are employed empirically are mainly unanswered (Dedovic and Homburg, 2024; Janowski et al., 2012; Rukanova et al., 2018). Thus, this paper addresses the research gap concerning the insufficient investigation of governance arrangements for cross-border interoperability solutions.. We define governance arrangements as the institutionally agreed governance model and form, in addition to the decisions on management and control of data, solutions ownership, and associated costs and investments.

The primary purpose of our study is to conceptualise the governance of CBIS. Additionally, we aim to contribute to further understanding of the governance arrangements of the complex CBIS. To achieve this, we explore the governance arrangements of CBIS in the EU, with our main research objective being to identify the existing governance arrangements of CBIS in the EU. Following the objective, we aim to answer the question: "How are cross-border interoperability solutions governed in the EU?". Our emphasis lies on the macro-level analysis, specifically the governance arrangements of the solutions and how these solutions are structurally governed within the EU. We are not delving into micro-level analysis for this study, which may include the relationships between the actors. With this article, we mainly contribute to the e-government literature on the governance of CBIS by demonstrating the existing choices of governance approaches inside the supranational environment. Additionally, we contribute to further understanding of cross-border digital public services by analysing their development as an integral part and enabler, the CBIS.

The outline of this paper is as follows. In the Introductory Section, we discussed the need for our study, posed an existing research problem, and defined the paper's objective. In Section 2, we discuss the existing literature related to CBIS, which supports our analysis. In the third Section, we propose a methodological approach for our study and argue how a multi-case study approach contributes to our main research objective. In the fourth Section, we provide case descriptions and analysis, following the fifth Section's discussion on existing scientific and practical implications. Lastly, in the final Section, we conclude our study, address our research question, and provide future research directions.

2. Theoretical overview

2.1. Governance and cross-border interoperability solutions

The governance of public sector organisations and policies is often defined as an "attempt to steer society and economy through collective actions and forms of regulation that link values and objectives to outputs and outcomes" (Ansell and Torfing, 2022). Governance is also defined as the solution framed for and by organisations and individuals to an existing coordination problem (Markus and Bui, 2012). With these definitions in mind, we define the governance of CBIS as an agreed solution to steer and manage the system's users towards solving coordination problems and achieving a common objective: sharing data and information and delivering digital public services across national borders.

CBIS are standards-based systems that result from transnational arrangements between organisations to exchange data, information, and services across national and organisational boundaries. The characteristics of CBIS often share similarities and differences with the inter-organisational information systems (IOS) (Cavaye, 1997). They are often considered a subset of the IOS, while the crucial difference is in the transnational context and the complexities associated with crossing the national and cultural boundaries (Rukanova et al., 2015). Additionally, while individual organisations often control the IOS within a single country or a firm, the CBIS is often controlled by multiple national actors due to its transnational characteristics (Rukanova et al., 2015). The essential aspect of these systems' governance lies in inter-organisational relationships, actors' collective action, and collaborative engagements, particularly the national and supranational government's role in framing legal and system specifications (Rukanova et al., 2009). The decisions regarding governance structures encompass choices about autonomy, control, ownership, authority, responsibility, trust, and coordination (Cavaye, 1997; Chatterjee and Ravichandran, 2013; Kalvet et al., 2018; Leosk et al., 2021).

The research on IOS emphasises the importance of decisions on ownership and authority when multiple actors are involved (Chatterjee and Ravichandran, 2013). Hence, establishing specific governance arrangements is crucial for enabling these actors to effectively manage the system (Chatterjee and Ravichandran, 2013). In the private sector, these governance structures are often shaped by rational choice and economic perspectives concerning transaction production costs and the actors' responses to environmental pressures (Chatterjee and Ravichandran, 2004; Grant and Tan, 2013).

Transaction cost theory emphasises that actors are motivated by the need to reduce transaction and production costs, resulting in various governance forms that arise from managing these trade-offs (Chatterjee and Ravichandran, 2004). In contrast, the institutionalist perspective suggests that governance forms develop through adherence to established rules and procedures set by other firms (Chatterjee and Ravichandran, 2004). Pardo et al. (2008) identified that governance structures are influenced by the information needs and demands of the problems faced, the knowledge of these needs and the environment, the willingness to accommodate diverse organisational goals, the understanding of participating organisations, legislative frameworks, and the level of executive involvement. Furthermore, Schmidt and Krimmer (2022) emphasise the necessity of an institutional coordination body to ensure the resilience and success of CBIS.

2.2. Governance arrangements of cross-border interoperability solutions

The governance models often employed within the public sector and information systems are hierarchy, market, or networks (Grant and Tan, 2013; Klein, 1996; Kubicek et al., 2011), which have proven valuable analytical approaches at the generic level (Bouckaert et al., 2010a).

Within the hierarchical arrangement, the autonomy of the actors remains low, and the imposition of the authoritative actor and supervisory structure enables routines to be established (Lowndes and Skelcher, 1998). Authority and power are the fundamental resources needed (Chantillon et al., 2017). The guidance and control within the hierarchical model are led by the top-down norms and standards, routines, supervision, inspection, and intervention are the main mechanisms (Bouckaert et al., 2010b). When it comes to ownership of the system, one authority has total ownership over the system in the hierarchical model (Chatterjee and Ravichandran, 2004).

However, within the market model, involved actors have a higher autonomy, and higher contractual agreements exist to diminish trust (van den Broek and van Veenstra, 2018). The basic idea of the market governance model lies in the fact that bargaining and negotiating are the primary processes and resources of the government (Chantillon et al., 2017). The guidance and control of data lie in the supply and demand, and the price mechanisms, self-interest, and profit and losses of evaluation are the main mechanisms (Bouckaert et al., 2010a; Grant and Tan, 2013). Within the market model, there is no direct user ownership; the existing systems are individually owned (Chatterjee and Ravichandran, 2004).

Within the network model, the members' autonomy is moderate regarding their involvement within the system. The primary resources within the network model lie in the mutual co-optation and social trust between the actors (Bouckaert et al., 2010b). The guidance and control lie in the shared values, joint problem analysis, and consensus, followed by trust and voluntary information sharing (Chantillon et al., 2017). This arrangement has shared ownership, and members share resources for joint governance (van den Broek and van Veenstra, 2018; Chatterjee and Ravichandran, 2004).

According to van den Broek and van Veenstra (2018), the governance models encompass the following characteristics. In a market arrangement, data exchange occurs within a marketplace through contractual transactions between organisations, with control of the data transferring to the buyer

after the sale. In hierarchical governance, data is exchanged based on the needs of dominant members who can exert power and authority, and data control belongs to the authority. In network governance, members laterally exchange data while retaining control over the exchange, forming a trust relationship.

Table 1: Features of governance models. Source: Author based on Bouckaert et al., 2010b; van den Broek and van Veenstra, 2018; Chantillon et al., 2017; Chatterjee and Ravichandran, 2004; Grant and Tan, 2013.

Features	Hierarchy	Market	Network
Autonomy of actors	Low	High	Moderate
Resources and processes to manage	Authority and power	Bargaining and negotiating	Mutual co-optation and trust
Coordinating mechanisms	Top-down norms and standards, routines, supervision	Supply and demand, price mechanisms, self-interest	Shared values, standard problem analyses, trust, informal evaluation, and reputation
Ownership	Total ownership of one actor	Fully individually owned systems	Shared ownership
Control over data	Single actor control	Sales data	Members retain control over data

The theory on forms of inter-organisational governance developed by Provan and Kenis (2008) has also been a valuable theoretical position for the role of governance (Markus and Bui, 2012). The core of this theory lies in the assumption that effectiveness and efficiency depend on the modes of governance. The distinct characteristic of governance lies in whether the relationship is brokered or not. There have been three distinct modes of governance: shared governance (or member-led), lead-organization governance, and network-administrative organisation (NAO) governance (Provan and Kenis, 2008). Shared governance modes include member-led inter-organisational relationships in which the authority is not delegated to one organisation or a third party (Kenis, 2019). The contingencies and characteristics of this form include a high level of trust, a small number of participants, and high goal consensus. In contrast, lead-organization governance is characterised by a leading actor within the network responsible for governing the network while maintaining autonomy over its operation (Kenis et al., 2019; Provan and Kenis, 2008). In this arrangement, trust is low-density and highly centralised, with a moderate number of participants and moderately low goal consensus (Provan and Kenis, 2008). Network-administrative organisation (NAO) governance involves network members delegating authority to a third entity whose role is coordinating activities, making decisions, and taking specific actions (Kenis et al., 2019; Provan and Kenis, 2008). The main contingencies of this form include relative trust (not monitored by members), a high number of participants, relatively high goal consensus, and a high need for network competencies. Additionally, Provan and Kenis (2008) studied the influence of governance forms on network effectiveness. They argued that the contingency factors explained above affect the network effectiveness, which they define as “the attainment of positive network-level outcomes that could not normally be achieved by individual, organisational participants acting independently” (p. 230).

We have developed an analytical framework to assist in analysing our cases based on the earlier discussion of the theoretical overview (see Table 2). This analytical framework contains the relevant

features of the governance arrangements in the CBIS. The governance model features hierarchical, market, or network approaches in CBIS governance. The mode of governance features relates to what form the governance employs, whether it is a lead organisation, shared governance, or network administration governance. The control over data contains the decisions on whether the control is over a single actor in the system, whether the control is shared based on sales, or whether the actors retain control over data. The ownership and control over system features include the level of ownership, which includes total ownership, individual ownership, or distributive ownership. The costs and investments feature includes the level of costs and investment dimension over the system, whether the system contains sole investors or is shared among actors.

Table 2: Analytical framework. Source: Authors

Features of the Analytical Framework			
Governance model	Hierarchy	Markets	Networks
Modes of governance	Lead-organisation	Shared governance	Network-administrative organisation
Control over data	Single actor control	Sales mechanisms	Retaining control
Ownership	Total ownership	Individual ownership	Distributive ownership
Costs and investments	Single actor investments	Shared costs	Shared costs

3. Research design

We employ the exploratory interpretative multiple-case study analysis (Yin, 2018). This methodology is applicable where an in-depth investigation is needed (Gomm et al., 2000). Although the small N research, like it is in this study, does not allow for statistical generalisation, it provides an in-depth understanding of the conceptualisation and explores complex interactions (Yin, 2018). The case study is employed when there has been limited research on the existing empirical phenomenon, and where further in-depth explanations are often required. In this study, we use a multiple case study, which allows researchers to explore the differences and similarities between existing cases (Baxter and Jack, 2015). The case study methodology aims to obtain detailed contextual data regarding the cases, regardless of the specific data collection (interviews or observations) (Campbell and Ahrens, 1998).

While there is vast positivist research in e-government research (McBride et al., 2021), we follow the interpretivist approach. The interpretive research on the phenomenon studied cannot be generalised or taken as a universal truth, while the results of the studies should provide a further understanding of the phenomenon (Corbin and Strauss, 2015). Although the exploratory low N case study does not provide statistical correlation and high generalisation, the research's conceptual validity and objectivity are the main reasons behind the selection of this method. In information systems research, interpretive studies aim to enhance understanding of both the context and the process in which the system affects and is affected by that context (Walsham, 2006). Thus, with the main objective of our study, we followed the interpretative research basis.

The unit of analysis of our study is the CBIS, as elucidated in a paper by Krimmer et al. (2021). With the focus on the CBIS as a system, we try to distinguish the focus of our research from the existing discussions on the relationships between the actors or the information systems analysis. This study has been motivated partly by the previous studies conducted for the interoperability landscape evaluation (Krimmer et al., 2022) and the study of Krimmer et al. (2021). These studies identified the landscape and plethora of CBIS in different domains employed for cross-border digital public service delivery. In this paper, we analyse the European Car and Driving Licence Information System (EUCARIS), Once-Only Technical System (OOTS), and Pan-European Public Procurement Online (PEPPOL).

For the case study selection, we base our decisions on several criteria that shape our multiple case study research. The main criteria for selection are based on the logic of replicability, in which the cases are selected to have different characteristics in order to strive towards replicability of the findings, as indicated by Yin (2018). The first criterion includes the system phases, whether in the operational phase or at the final stage of deployment (in the case of OOTS). The reason for this criterion is to include cases that are separate stages in order to identify if there is any influence on the governance arrangement. The second criterion includes that the system should be from different domains and sectors, and in our situation, these include the generic public administration domain, transport and mobility, and public procurement. Additionally, the third criterion refers to stages of the system's evolution when selecting cases, which means that in our cases, there are long-term cases (more than 20 years), mid-term (more than 10 years), and infancy stages (less than 5 years). The last fifth criterion includes the service purpose relations, which include whether the system is designed for G2G, G2B, or G2C services. We argue that selecting these cases contributes to understanding the governance arrangement due to their specific domain characteristics and developmental approaches. The description of the case criteria can be found in Table 3.

Table 3: Summary of the case studies

Criteria/Cases	EUCARIS	OpenPeppol	OOTS
Phase	Operational	Operational	Deployment
Domains	Transport	Procurement	Generic domain
Evolution	Long-term	Mid-term	Infancy
Service purpose relation	G2G	G2B/B2G	G2C

We conducted methods of primary and secondary data collection. First, we conducted desk research and collected all available, relevant, and accessible documents related to the governance of the CBIS. The desk research includes systems documents, grey literature, articles, and reports related to selected cases. Furthermore, we build our argument by conducting semi-structured expert interviews (Bogner et al., 2009) with the relevant stakeholders of the organisations managing CBIS.

The interviewees were selected based on their expertise in developing the interoperability infrastructure. The interviewees are representatives of the network organisations and do not represent the stance of the participant actors involved in the network, like representatives of a particular administration in one Member State. Initially, we collected five interviews through three video calls: two for EUCARIS, three for OpenPeppol, and one for OOTs. These actors are interviewed and asked

exploratory questions about their respective CBIS. As part of the semi-structured interviews, the interview questions were crafted to examine the key aspects of CBIS in relation to their functioning and governance. The main topics covered in the interviews included guiding questions about the general characteristics of CBIS, its members, and their usage. Additionally, the questions focused on the organisational governance arrangements and future plans within the CBIS. Additionally, the interviews were used to validate findings based on the desk research. The interviewees were key persons in governing the CBIS, which contains the knowledge and expertise to provide sufficient information for our inquiry. The questionnaire was developed based on the key objectives of the study, focusing on gathering insights into the CBIS status and governance. Additionally, we reached out for follow-up interviews with all representatives, but only received a positive response and conducted interviews with the two EUCARIS representatives. Because of our research objectives and the main unit of analysis, we reached out directly to the representatives managing the CBIS and not the national member representatives to simply increase the number of interviews. Thus, we found sufficient information during desk research and existing interviews with the leading experts and representatives of the case studies. For the data analysis, we followed the approach suggested by Yin (2018) and Miles et al. (2014). Based on the desk research and interviews, we established the case's history and context and identified the governance structure of CBIS. Additionally, we coded the interviews and documents identified following the open-coding approach and with the support of our analytical framework.

3.1. Case Descriptions

3.1.1. EUCARIS

The EUCARIS is a CBIS that allows data exchange for public administrations in the transport domain across national borders. During the 1980s, stolen cards and traffic offences increased across the EU as a negative outcome of integration policies. These events raised discussion and concerns about mitigating the adverse effects and collaborating more efficiently. Therefore, initiated by the Netherlands, together with Belgium, Luxembourg, Germany, and the United Kingdom, the cooperation mechanism and informal network were established. The cooperation of these states resulted in the joint development of the European Vehicle and Driving Licence Information system. While starting as an informal network and working arrangement (König, 2019), the cooperation grew more formal when the EUCARIS treaty was signed in 2000 and amended in 2017. The initial goal of EUCARIS was to prevent fraud and crime associated with the import and export of stolen vehicles, simplify the registration process, and streamline the exchange of driving licenses and accurate records in national databases. However, with the influence of the EU's policy and regulatory developments, EUCARIS has become a general exchange mechanism for all transport-related data in Europe. The EUCARIS currently connects 35 countries, while negotiations and plans are ongoing to include the non-EU countries as well, in particular the EU candidate countries. During inception, the main objective was to achieve minimum technical harmonisation between the countries and their authorities. This resulted in the EUCARIS system being decentralised to meet the needs and requirements of the countries. The EUCARIS system currently provides 24 functional and technical services based on specific legal requirements.

3.1.2. Once-only technical system (OOTs)

The once-only technical system (OOTs) is a CBIS that enables the exchange of data, documents, and services across borders and sectors. The development of the OOTs has been initiated as part of the large-scale piloting projects, more specifically, the TOOP project (Krimmer, Prentza, et al., 2021), which involved numerous project actors, including member states, academia, and the private sector. This project piloted the infrastructure for once-only data exchange in the business sector across multiple domains. The OOTs were initiated as part of the Single Digital Gateway Regulation (Regulation (EU) No 2018/1724, 2018) regulatory requirements, which mandate establishing the new system. Within the SDGR, the regulation requires the EC, in cooperation with Member States, to establish a technical system for evidence exchange (European Commission, 2022b). The technical decisions over the OOTs result from the negotiating process between the member states and the EC. The OOTs requirements for architecture and systems development have been laid down in the regulation's implementing act.

3.1.3. Pan-European Public Procurement On-Line (PEPPOL)

The Pan-European Public Procurement On-Line (PEPPOL) is a cross-border interoperability system that facilitates data exchange between companies and public institutions across multiple countries in the procurement domain. It was initiated in 2008 as a large-scale project funded by the European Union to simplify electronic procurement across borders by developing technology public procurement standards for European public administrations. The PEPPOL is a collaborative effort involving the EC and 18 PEPPOL consortium members from 11 countries. This system connects different national systems and establishes standards for data exchange between businesses to businesses and businesses to governments. The PEPPOL system is important in solving the problem that arises in economic activities where multiple partnerships exist between intertwined actors. The system allows the actors to exchange documents between buyers and suppliers. Additionally, there is no need for individual connections between the suppliers or the networks. PEPPOL was initially established as part of a European initiative to facilitate the creation of a seamless digital single market across Europe. While its primary focus is within the EU, it is also utilised by non-EU entities.

4. Findings

4.1. EUCARIS

Based on our analysis, the EUCARIS organisational structure is arranged as follows. The central bodies of EUCARIS are the General Assembly, the Chairperson, the Nominated Body for the Secretariat, the Nominated Body for Operations, and the Technical Working Group. The General Assembly is the highest body of EUCARIS and takes all strategic decisions necessary for the effective operation of EUCARIS. The General Assembly appoints the Chairperson and the nominated bodies for the Secretariat and Operations. The Chairman is responsible for chairing General Assembly Meetings, managing the orderly business, and directing the Nominated bodies. The Nominated body for the secretariat is responsible, among other things, for administrative tasks, drafting a budget, and evaluating the needs and problems of the parties and third parties. The Nominated body for Operations is responsible for maintaining and developing further functionalities of the EUCARIS system and is supported by the Technical Working Group. Currently, the registration authority of the Netherlands, RDW, holds positions as chairman and a nominated body. EUCARIS does not have directly employed personnel, but the work is being done on a percentage of full regular employment of the central authority of the nominated party. As noted per one interviewee:

“EUCARIS doesn't have personnel, so to speak. So, everybody is sort of doing this next to their job. So formally, I'm a board member of RDW in the Netherlands. I was granted a few hours to spend on EUCARIS, as well.”

The plan of EUCARIS in the future is to reduce dependency on the representatives of one country and rather have a separate legal entity that acts as a nominating body, thus going from a leading organisation mode of government towards a network administrative organisation. This was reflected by the comments of one interviewee:

“If you really want to be international and even make the ownership and everything even bigger than that... And make it more sustainable. E-Reg can become a sort of nominated body. We already decided this, a nominated body, as we say. To do the executing part. So basically, where RDW is now, the nominated body, this will become E-Reg as the nominated body. That way, we try even to enlarge the sense of the community feeling and the community ownership of all the things that we do. And we try to decrease the dependence on a single country. But that's... We're right in the middle of that.”

EUCARIS system's main actors are the national states, the central authorities responsible for registering vehicles and driving licence data in the national countries, and third parties (i.e., the European Commission). The central registration authorities are the national contact points responsible for the implementation and functioning of the system inside the national territory. The responsibility for compliance within the legal framework in which EUCARIS operates is on the national authority. The European Commission (EC) role acts as a third party that does not have a formal role within the EUCARIS system; however, it influences EUCARIS through the implementing acts (such as the cross-border enforcement directive) where it shapes the usage of the EUCARIS system on other services than initially envisioned by the EUCARIS.

Our analysis shows that regarding the ownership and costs related to the EUCARIS system, the arrangement is formed through a distributed ownership model. The ownership is shared between the parties contributing to and using the EUCARIS system. The ownership and control over the system and data may seem to belong to the coordinating body (currently RDW); however, the coordinating actor is independent of its national positions. This implies that the costs of EUCARIS involve the basic/general fee paid annually, basic costs of contribution per connection, and additional costs, which are divided based on the functionalities of the system that organisations are using. Additionally, the Parties and Third parties are financing their costs generated by participation in EUCARIS, which includes installation and maintenance of national equipment and telecommunications, and subscription to the connection provider. The exchange of information is free.

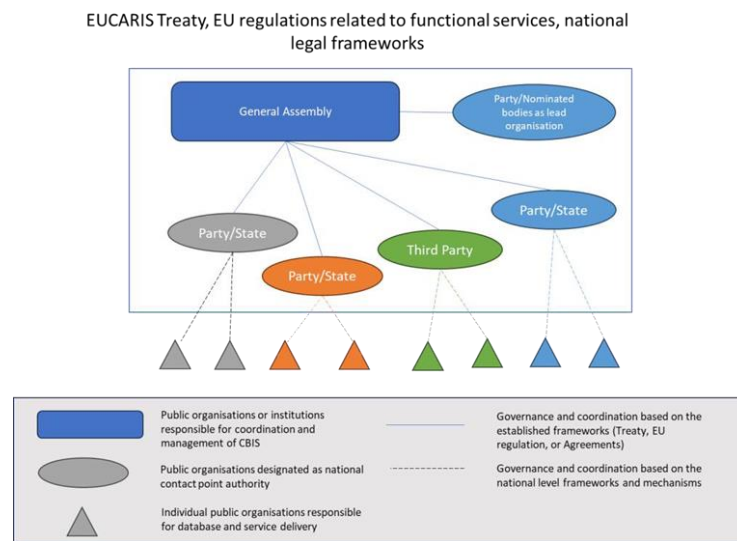


Figure 1: Governance structure in EUCARIS

4.2. OOTs

The OOTs structure is arranged through the SDGR and the Implementing Act. The highest body of the OOTs is the gateway coordination group, which comprises the national contact points of the Member States and is chaired by the EC. The role of the gateway coordination group is to govern the development and high-level management of the OOTs. The coordination group manages and coordinates the OOTs and all related requirements for further system development and improvements. The coordination group also contains the sub-groups that prepare and propose the operational modalities and necessary changes to standardisation, evidence mapping, review and maintenance, operational governance, security and testing, and deployment. The members of the coordination groups, as well as national coordinators, are responsible for implementing national parts of the OOTs and act as the contact point for the other national administrations and the EC. Additionally, within the governance of the OOTs, Unit G.3 of the EC Directorate General (DG) Grow is responsible for the policy and operational steering of the OOTs implementation. At the same time, Unit B.3 DG DIGIT is responsible for the service requested by DG GROW, in addition to the practical implementation of technical development, stakeholder management, marketing activities, technical support, and legal guidance.

Based on our analysis, the division of responsibilities within the Once-Only Technical System (OOTs) is structured between the EC and the Member States, each with distinct roles. The EC holds responsibility for key integral elements of the system, including the management of common services such as the evidence broker, the data service directory, and the semantic repository. This aligns with the general principle that for cross-border services, "*...most sectors have common problems and common solutions could be found to those problems...*" and the EC aimed "*...to have a set of building blocks that could be reusable in all of them...*". In addition, the Commission is tasked with providing technical support to the governance board, overseeing the development, monitoring, availability, maintenance, and hosting of these core components, essentially "*...providing the common services of the building block...*". The goal is often "*...to provide standards and tools, and then create an ecosystem so that the member states have a lot of choice...*". Conversely, Member States are accountable for implementing and managing their respective national components within the OOTs, as generally "*...the implementation is done by the member states...*". These components encompass, inter alia, national procedure portals, eDelivery access points, user identification systems, and national registries. Thus, while the Commission ensures the smooth operation and integration of common services across the system, Member States focus on the functionality and interoperability of their national infrastructures in alignment with OOT requirements.

Concerning the ownership and costs associated with the development, maintenance, and implementation of the Once-Only Technical Systems (OOTs), our analysis shows that the ownership and costs are shared between the Member States and the EC. The EC retains ownership over the common components of the system, such as the evidence broker, data service directory, and semantic repository. The Member States retain the ownership of their national infrastructure and respective components of the OOTs, such as eDelivery access points, national registries, procedural platforms, and eIDAS infrastructure. The general budget of the EU primarily covers the overall costs. It includes the development and maintenance of the ICT tools, support of the implementations, and costs of building blocks and standard services. Additionally, member states are bearing costs related to the national competent, including national web portals, procedures, and national building blocks, unless otherwise defined in the Union legislation.

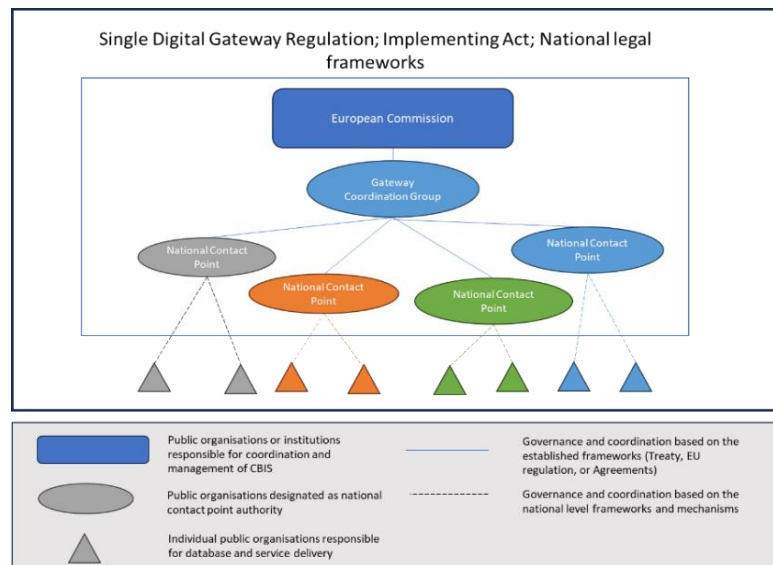


Figure 2: Governance structure in the OOTs

4.3. Peppol

The PEPPOL organisational structure is as follows. The governance of Peppol is overseen by the non-governmental organisation, OpenPeppol, which acts as the Peppol Coordinating Authority. As noted by our interviewee:

“Open Peppol is the governance organisation and Peppol, the Peppol network and the Peppol business interoperability specifications, everything in the Peppol interoperability framework basically is what we do, but the organisation behind that is Open Peppol”.

OpenPeppol, based in Belgium, operates as a member-driven organisation with approximately 500 members representing 39 countries. At the forefront of this organisation is the General Assembly, which serves as the highest authority and includes all members. The Secretary-General and various committees, such as the managing and coordinating security and election committees, provide oversight to the General Assembly. Membership within OpenPeppol is structured into three levels: Peppol authorities, Peppol service providers, and End Users. Peppol authorities are government entities responsible for managing and coordinating the network within their respective territories. At the same time, service providers ensure the functionality of the Peppol network and offer technical and operational support to end users. End Users, on the other hand, are the private or public entities that utilise the Peppol system for procurement services. The relationships between members are governed by agreements, policies, and procedures designed to ensure responsible and transparent actions within the network.

“We have developed quite a comprehensive interoperability framework that consists also of the agreements between the different levels, so between Open Peppol and Peppol authorities and between Peppol authorities and service providers”, as stated by our interviewee.

The ownership of the Peppol system is not attributed to a single entity but instead shared among its members. The association's members provide the primary financial support for the system. Although no direct institutional funding exists, specific organisations classified as institutions must also pay a membership fee. Additionally, the EC indirectly supports the system by offering a service for the Service Metadata Locator hosted by the EC.

“It should be mentioned that we have a very important in-kind contribution, and this is the SML Service metadata locator, that is the central component, a central registry, of all the participants in the network tracks directly to the DNS, and that is a service hosted by the European Commission”, as highlighted by our interviewee.

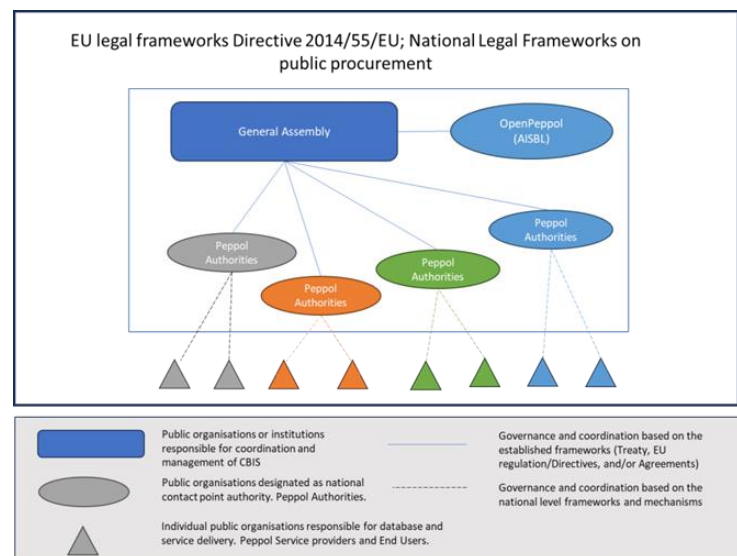


Figure 3: Governance structure PEPPOL

5. Cross-case results and discussion

As depicted in Table 4, our examination of case studies reflects a comprehensive analysis informed by prior literature and theoretical frameworks on CBIS and governance. This analysis explores five critical features of governance, including the structure of governance arrangements, the various modes of governance employed, the management and control of data, the ownership of the systems involved, and the associated costs.

Regarding the governance arrangements of CBIS, we identify the network governance models as the primary approach, as per our findings. The EUCARIS and the Peppol present a clear example of network governance based on relational trust and engagement. However, the OOTs present a hybrid network model based on the legal norms and the role of the EC in the solution's context. This hybrid model includes the central actor in the form of EC, defined through the regulatory requirement and control of the shared parts of the system. The governance models employed involve a higher autonomy of the actors in their usage and management of the systems. The coordinating mechanisms employed within CBIS are shared values and reputation. At the same time, the primary resources

and processes are primarily the mutual co-optation and trust that exists between the actors while using the CBIS.

Regarding the modes of governance, based on our analysis, we identify that the EUCARIS and OOTs employ the lead-organisation mode of governance and coordination. In contrast, Peppol employs the network-administrative organisation mode of governance in the form of the NGO OpenPeppol. The EUCARIS system, whose foundation is on the Treaty and is also highly affected by the regulation, currently employs the changing lead-organisation mode to evolve towards the network-administrative organisation mode in the near future. The OOTs employ the lead-organisation mode, with the EC, specifically DG Grow, being the lead in governing, mandated by the regulation on Single Digital Gateway and implementing the Act. The DG Grow coordinates and acts as the lead organisation in implementing and coordinating the members' implementation. The Peppol system is an example of a system being governed by the network-administrative organisation OpenPeppol, which acts as the main governing body for the Peppol system.

Our findings suggest that the ownership of the system is consistent among the cases and includes distributed ownership. The ownership of the resources and parts of the systems belongs to the individual member states. In the EUCARIS example, the software ownership and responsibility belong to the member state using it, which is responsible for maintaining the system and implementing it, while the EUCARIS bodies support the operations when necessary. In an OOT system, the shared components of the system are owned by the EC. In contrast, the distributed components of the system are distributed ownership owned by the implementing member state. The Peppol ownership also contains a distributed model in which the association of OpenPeppol manages the maintenance of specifications and compliance. The management and control over data are consistent among the cases. The data is controlled and managed by the national governments. This decentralised approach was chosen primarily because of the autonomy aspects, in which the public sector often requires control over its data and base registries, which are involved in the data exchange for digital public services. In particular, data exchange and control are often associated with the decisions of individual organisations rather than the coordinating body.

Table 4: Cross-case results

Features	EUCARIS	OOTs	Peppol
Governance arrangements	Network	Hybrid	Network
Modes of governance	LO (Netherlands) evolving towards NAO	LO (DG Grow)	NAO (OpenPeppol AISBL)
Data control	Members	Members	Members
Ownership and control over system data	Distributed ownership	Shared ownership	Distributed ownership
Costs and investments	Membership fee	Shared costs, according to ownership	Membership fee

The existing governance arrangements of the CBIS indicate a need for a coordinating entity. These findings support the conclusions of Schmidt and Krimmer (2018), although the specific coordinating entity may be in the form of a leading organisation or network of administrative organisations. The presence of this coordinating body addresses challenges associated with network governance, particularly the coordination of diverse stakeholder interests. Additionally, we did not confirm the proposition by Markus and Bui (2018), which suggested that lead organisations are less common and less effective in governing CBIS. The selection of the lead organisation is primarily based on the expertise and capabilities of organisations within the CBIS (EUCARIS) or the regulatory requirement (OOTS). Based on our analysis, we identify that the effective form of governing is the network-administrative organisation, which acts as an independent actor in governing the CBIS. The stability of the network, alongside the number of organisations involved and the development of governance structures, specifically for OpenPeppol and the EUCARIS transition to a network organisation, suggests that a network-administrative organisation, distinct from the lead organisation, can yield positive outcomes. In the case of CBIS, this means improved information sharing and enhanced outcomes in service delivery. Although there are lead organisation examples, we identify the evolving phases towards network-administrative organisation. EUCARIS case demonstrates a common evolution from being a lead organisation towards a network-administrative organisation, as noted by Provan and Kenis (2008).

We argue that the institutional frameworks, precisely, legal mechanisms in which a system operates, shape its governance arrangements. The systems' governance, coordination, and usage are formalised through specific legal agreements, either as an international treaty (EUCARIS), formal agreements (OpenPeppol), or supranational regulatory requirements (OOTs). In particular, the importance of the supranational legal requirements is emphasised through the influence of the usage requirement of the CBIS. Additionally, we identify a specific role of the EC throughout the case studies. The role of the EC (designated DGs) has been intertwined throughout all the cases investigated. The political and legal framework of the European Union significantly influences the roles, memberships, and usage of these systems. For example, the requirement for the EUCARIS system to be used according to EU regulations, despite not being specified in the EUCARIS treaty, demonstrates the impact of environmental changes on the systems. Additionally, due to the competencies of the EC, its role extends to all cases. For instance, in the Peppol system, the EC provides the SML service, while in the EUCARIS system, it acts as a third-party member. This is relevant as it shows the important role of the EC as a coordinating body, which could affect the usage and shape the membership of the CBIS. This finding reaffirms the existing explanations of Chatterjee and Ravichandran (2004) and Pardo et al. (2008), who emphasise the role of environmental and institutional factors in the system.

Although the power of national governments does not diminish, as noted by Rukanova (2018), we find that national governments and their representatives, such as organisational authorities or national contact points, have greater autonomy in managing their national processes and procedures. The significance of autonomy and distributed ownership is evident in all cases examined. Responsibility for coordinating the use of the system rests with the national contact points rather than the lead organisation of the overall network. Additionally, through their respective national contact points, individual members determine the rules and procedures in their national framework.

With this approach, the essential requirement for trusted networks is achieved by clearly defining the members' responsibilities (Pardo et al., 2009).

6. Conclusion

In this study, we aimed to identify the governance arrangements of the CBIS in the EU. The phenomenon of establishing the digital single market and, therefore, cross-border digital public services indicates a need to establish interoperability between distinct organisations. The main enabler for achieving interoperability is the CBIS. However, developing, deploying, and governing those systems is challenging, particularly at the supranational level, which includes multiple actors involved and diverse organisations interoperating. The studies so far have focused primarily on non-governance aspects, while governance remains insufficiently investigated (Dedovic and Homburg, 2024). The primary purpose of our study is to conceptualise and identify the governance arrangements of CBIS. Additionally, we aim to contribute to further understanding of the complex governance arrangements of CBIS. With this study, we tried to fill this gap by answering the question, "How are cross-border interoperability solutions currently governed in the EU?"

We identify that CBIS' governance arrangements mainly include the network governance approaches, intending to govern the relations between the actors through the mechanisms of relational trust and cooperation among the actors involved in the cross-border data exchange or service delivery. Additionally, we identify an existing coordinating entity or broker that acts as the responsible actor for governing relations and maintaining the CBIS. The mode of governance we identify is the lead organisation and the network-administrative organisation. To reiterate, we identify the leading organisation mode (OOTS) with premises of evolving towards a network administrative organisation (OpenPeppol, future EUCARIS). We believe that the condition of how the system is formed affects the governance arrangements. When the CBIS evolves through informal collaborative arrangements formalised under the international treaty (EUCARIS), the leading organisation model is employed with the evolving characteristics towards a network administrative organisation. Similarly, we believe that when the system is formed and developed through regulatory requirement (OOTS), the EC and respective directorate general take up the role of the leading organisation. Based on our logic of replicability, we anticipate that how the system is developed will ultimately lead to a choice of governance arrangements. The arrangements towards the ownership and control of data are solved through distributive ownership and control of the data, indicating the actors' higher autonomy. The coordination activities are maintained through the form of national contact points, which are responsible for the management of the system at the national jurisdictional level.

The implications of our study highlight that the transactional perspective, which focuses on the costs and benefits of transactions, does not necessarily determine the establishment of governance for CBIS. Instead, we find that institutional factors have a significant impact on the governance of CBIS and the environment in which it operates. Specifically, the political processes and legal framework of the European Union play a crucial role in shaping the governance mechanisms and arrangements utilised. Furthermore, we do not find any support for the contingencies proposed by Provan

and Kenis (2008) regarding the number of organisations involved. Our findings align with the research of Dawes et al. (2009), Luna-Reyes et al. (2013), and Pardo et al. (2008), all of which emphasise the importance of network governance approaches, interoperability, and data exchange activities.

We recognise our study's methodological and design limitations, which stem from our research objective and framing of this article, and the challenges associated with qualitative research involving a small number of cases. Firstly, we reiterate that the focus of our study lies within the macro-level perspective, focusing on the governance arrangements while neglecting the interplay between the member states and the actors in these governance arrangements. Secondly, we acknowledge that our study may have a limited temporal scope and may not fully capture all the evolving mechanisms of governance structures. Furthermore, our selection of cases, which includes different phases of the CBIS, also highlights this temporal limitation. Additionally, we note the potential for interpretative challenges, as our analytical method may introduce some degree of subjectivity. Despite these limitations, we believe they provide valuable insights for future research. Thus, we call for future research to investigate the meso and micro level interactions and provide further explanations about the various factors influencing the relationships and cooperation that exist between the various actors involved in the CBIS governance. The outcome of this future research may result in a meta-level governance framework for the CBIS. Furthermore, we suggest exploring the conditions and factors behind the selection of governance mechanisms and investigating how this cooperation is fostered at the supranational level. Methodologically, we suggest utilising longitudinal studies framed within the theoretical assumptions of institutionalism, as this approach could offer a clearer understanding of CBIS governance.

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