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Deliverable 1.1
WP1 "IPS Enhanced Models and Needs Elicitation"

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Abstract: Deliverable 1.1 named IPS Enhanced Models and Needs Elicitation, has two scientific and innovative objectives. Objective 1 To understand stakeholders needs and the state of play in IPS co-creation within the EU value ecosystem. Objective 2 to construct the Government as a Service (GaaS) and Government as a Platform (GaaP)conceptual models, meaning the development of the Integrated Public Service (IPS) Co-Creation Conceptual Model (IPS-Co) and the enhanced Core Public Service Vocabulary (CPSV). To reach both objectives, inGOV project argues that the current challenges faced by the public sector regarding public service provision, including a) the need for trust building, b) providing better services with fewer resources and c) providing services that match the needs of users, can be addressed via co-creation processes and by exploiting relevant technologies. The adoption of co-creation processes and the use of relevant technology can enhance the existent relevant European Union work. Following the aforementioned assumption and by conducting primary and secondary research methods, this Deliverable meets its objectives from an integral approach. The Deliverable is divided into three sections. Section 1 is composed of five chapters. Chapter 1 Integrated Public Services, Chapter 2 Scoping Review of Public Services Co-creation, Chapter 3 A Taxonomy of Public Values and Principles, Chapter 4 Emerging Technologies, and Chapter 5 (IPS) Best Practices. Section 2 includes Chapter 6 Enhanced Core Public Service Vocabulary and Chapter 7 Enhanced IPS Conceptual Model. Section 3 is composed of Chapter 8 Users' Needs Elicitation.

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Executive Summary

Currently, the public sector is facing important challenges regarding the provision of public services. On one hand, trust from users is deteriorating. On the other hand, the public sector needs to provide better services with fewer resources. Users require accessible, user-friendly, personalised, and integrated public services (IPS) that match their needs and circumstances. In the inGOV project, we argue that the solution rests in enhancing existing relevant EU work by adopting public service co-creation and by exploiting relevant technologies. Under this assumption and to comply with the grant agreement, this Deliverable 1.1 covers two scientific and innovative objectives:

- S.I.O. 1: to understand stakeholders needs and state of play in IPS co-creation within the EU value ecosystem.
- S.I.O. 2: to construct the GaaS and GaaP conceptual models, meaning the development of the IPS Co-creation Conceptual Model (IPS-Co) and the enhanced Core Public Service Vocabulary (CPSV).

By conducting primary and secondary research, Deliverable 1.1 meets the objectives from an integral approach. The Deliverable is divided into three main sections. Section 1 is composed of five chapters, from 1 to 5, Section 2 of chapters 6 and 7, and Section 3 is composed of chapter 8. Chapter 1 Integrated Public Services provides an overview of the related terms of PS and IPS, together with a summary of their respective models in the European Union. Chapter 2 Scoping Review of Public Services Co-creation critically evaluates co-creation methods and approaches. Chapter 3 A Taxonomy of Public Values and Principles creates a taxonomy of public values and principles with respect to co-creation and IPS based on the academic literature and examines key EU eGovernment initiatives and policies regarding the inclusion of co-creation public values, principles, and guidelines. Chapter 4 Emerging Technologies identifies and critically reviews emerging mobile technologies with potential in IPS emphasising relevance to EU values and eGovernment principles. Chapter 5 (IPS) Best Practices investigates how co-creation in IPS is understood and carried out in practice across five different cases. These five chapters are the foundation for the two models (CPSV-AP and IPS-Co) presented in Section 2. Chapter 6 Enhanced Core Public Service Vocabulary presents the enhanced CPSV-AP in order to support, in the framework of inGOV, personalised integrated PS co-creation. This provides the basis for implementing GaaS. Chapter 7 Enhanced IPS Conceptual Model presents the IPS Co-creation Conceptual Model (IPS-Co) derived from the tailoring of the Integrated Public Service Conceptual Model proposed in the 2017 European Interoperability Framework (EIF) by including stakeholders' collaboration and IPS co-creation. This resulted in the creation of IPS-Co that provides the conceptual basis to implement GaaP. This GaaP and GaaS approach will be fully developed in Work Package 2 of the inGOV project where the development of the IPS Holistic Framework (IPS-HF) will take place.

Section 3 is composed of Chapter 8 Users' Needs Elicitation, which elicits the needs and considerations on IPS of the stakeholders of the four inGOV pilots. Stakeholders include citizens and businesses, public servants (both the ones providing the service and the ones providing the IT infrastructure) and policy makers.

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Introduction of Deliverable 1.1

Purpose of the deliverable

Currently, the public sector is facing important challenges regarding the provision of public services. On one hand, trust from users is deteriorating. On the other hand, the public sector needs to provide better services with fewer resources. Users require accessible, user-friendly, personalized, and integrated public services (IPS) that match their needs and circumstances. In the inGOV project, we argue that the solution rests in enhancing existing relevant EU work by adopting public service co-creation and by exploiting relevant technologies. Under this assumption and to comply with the grant agreement, this Deliverable 1.1 covers two scientific and innovative objectives:

- S.I.O. 1: to understand stakeholders needs and state of play in IPS co-creation within the EU value ecosystem.
- S.I.O. 2: to construct the GaaS and GaaP conceptual models, meaning the development of the IPS Co-creation Conceptual Model (IPS-Co) and the enhanced Core Public Service Vocabulary (CPSV).

Structure of the document

To achieve these objectives from an integral approach, the deliverable is structured in two sections that inter-relate them.

Section 1 develops the IPS co-creation conceptual model and the interoperability principles from a co-creation perspective, considering stakeholders needs. The model is mainly based on existing scientific literature and relevant EU documents, so its elements and the principles can be updated in future Work Packages based on the findings and application of the pilots that are part of the inGOV project. This Part 1 is divided into 7 chapters. Each chapter has its own objective which also aims to contribute to IPS-Co:

- Chapter 1 provides an overview of the related terms of PS and IPS, together with a summary of their respective models in the European Union.
- Chapter 2 critically evaluates co-creation methods and approaches that contribute to the understanding of co-creation for both inGOV and IPS-Co through a scoping review.
- Chapter 3 creates a taxonomy of public values and principles with respect to co-creation and IPS based on the academic literature and examines key EU eGovernment initiatives and policies regarding the inclusion of co-creation public values, principles, and guidelines.
- Chapter 4 identifies and critically review emerging mobile technologies with potential in IPS emphasising relevance to EU values and eGovernment principles.
- Chapter 5 investigates how co-creation in IPS is understood and carried out in practice across five different cases.

Section 2

- Chapter 6 enhances CPSV-AP in order to support, in the framework of inGOV, personalised integrated PS co-creation. This provides the basis for implementing GaaS.

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- Chapter 7 presents the IPS Co-creation Conceptual Model (IPS-Co) derived from the tailoring of the Integrated Public Service Conceptual Model proposed in the 2017 European Interoperability Framework (EIF) by including stakeholders' collaboration and IPS co-creation. IPS-Co model is the base for GaaP. Figure A-1 below illustrates the contribution of each chapter to the IPS-Co model.

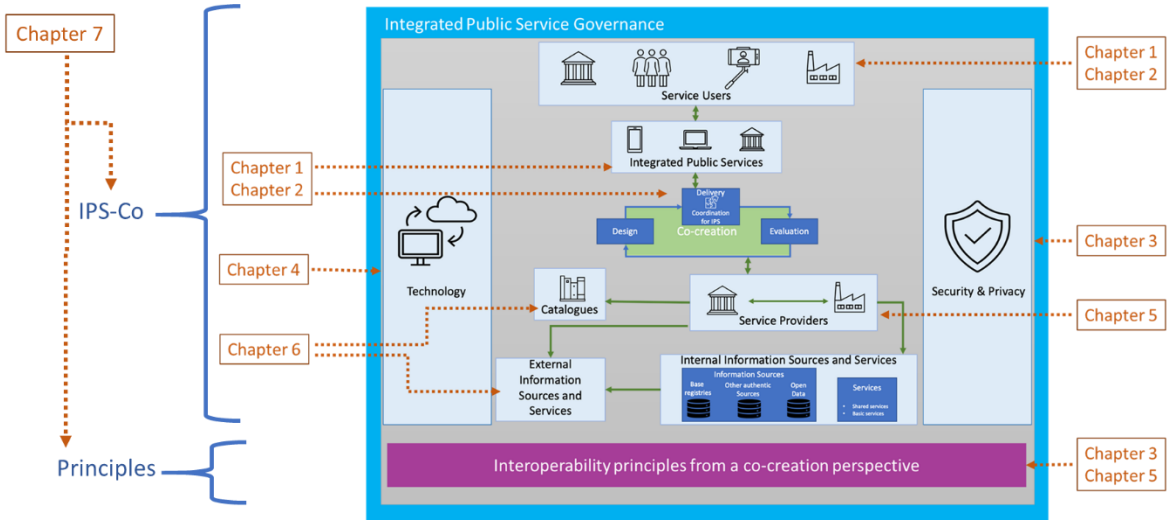

Figure A-1 IPS-Co elements, Principles, and chapters contribution

Section 3

- Finally, Chapter 8 presents the stakeholders' elicited needs and considerations in four inGOV pilots as follows.
  - The needs and considerations of public officers and policy makers in Malta as regards the Digital Common Household Unit;
  - The needs and considerations of citizens, public servants and policy makers in Croatia as regards the City of Bjelovar's virtual assistant;
  - The needs and considerations of citizens, public servants and policy makers in Greece as regards the issue of transportation discount card for the disabled;
  - The needs and considerations of businesses, public servants and policy makers in Austria as regards the tourism overnight stay tax.

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SECTION 1

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Chapter 1. Integrated Public Services

Acronyms and Abbreviations

Acronym/Abbreviation	Description
CEF	Connecting Europe Facility
CPSV	Core Public Service Vocabulary
CPSV-AP	Core Public Service Vocabulary – Application Profile
DPS	Digital Public Service
DSMS	Digital Single Market Strategy
EC	European Commission
EIF	European Interoperability Framework
EU	European Union
ICT	Information and Communication Technology
IDA	Interchange of Data between Administrations
IDABC	The Interoperable Delivery of European eGovernment Services to Public Administrations, Businesses and Citizens
IPS	Integrated Public Services
PA	Public Administration
PS	Public Service

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1.1 Introduction: The European Context

Recently, there has been a significant and rapid increase in the development of Information and Communication Technologies (ICT). At the same time, governments are eagerly pursuing new ways to innovate and use the opportunities made available by ICT. Both European Union (EU) businesses and citizens have encountered barriers when using online services. These can range from having to introduce their data repeatedly to accessing several different platforms to conduct a service. Many times, these services require the interaction with more than one public office, a variety of registries, and completing information repeatedly. This is why digital public services need to be interoperable: Interoperability is understood as the ability of systems to exchange and use information. This is a prerequisite of the seamless integration of public services [31].

The EU has been working towards addressing this issue for a while, in the mid-1990's the first programme focusing on the interchange of data between administrations (IDA) was created, and later in 2005, the Interoperable Delivery of European eGovernment Services to Public Administrations, Businesses and Citizens (IDABC) was launched. The IDABC issued a series of recommendations, developed solutions, and provided services for European Administrations [36]. Moreover, the adoption of the Digital Single Market Strategy (DSMS) in 2015 aimed to help bridge the gap between governmental and trans-governmental silos, and to promote the development of the European Digital Single Market [1]. The DSMS seeks to provide new opportunities for citizens and businesses throughout Europe, by removing key differences between the offline and online world. This involves breaking down the barriers to cross-border online activities [1]. The DSMS is one of the European Commission's (EC) main political priorities and has three policy pillars: (i) improving access to digital goods and services; (ii) providing an environment where digital networks and services can prosper and, (iii) economy and society, having digital be the main driver for growth [1]. Interoperability is a prerequisite for the seamless integration of public services, within the context of the European Digital Single Market. Literature on the DSMS mentions the importance of interoperability between e-government services in order to be able to communicate with each other instead of being delivered in isolation [2]. Considering the importance of interoperability, a push to renew and update the European Interoperability Framework (EIF) was stated [1]. Furthermore, the European Commission recognizes interoperability as a key factor and necessity for making the DSMS possible, the efforts to make European services interoperable can be seen throughout EU, from high level ministerial declarations [3][38] to EU funded initiatives and projects, such as Connecting Europe Facility (CEF) [4], and the ISA2 programme key organization that promotes and maintains the EIF [31]. Moreover, in 2021 the Digital Europe Programme was launched, as a funding programme focused on bringing digital technology closer to businesses, citizens and public administrations [37].

The adoption of the eGovernment Action Plan 2011-2015 by the European Commission was a recent initiative toward digitalization of public services, establishing a pan-European cooperation network aimed to exchange best practices and support the collaborative development of public services available across the EU member states [5]. The updated eGovernment Action plan 2016-2020 stated that digital public services should adhere to the principle of interoperable by default; meaning that "public services should be designed to work seamlessly across the Single Market and across organizational silos, relying on the free movement of data and digital services in the European Union" [6]. Moreover, in the Tallinn declaration on eGovernment, the EU Ministers reaffirmed their vision to "strive to be open, efficient and inclusive, providing borderless, interoperable, personalized, user-friendly, end-to-end digital public services to all citizens and businesses – at all levels of public

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administration" [3]. The 2020 Berlin Declaration on Digital Society and Value-Based Digital Government builds upon the Tallinn declaration, and explores the need of involving citizens and the general public striving to contribute to a value-based digital transformation [38]. The lack of interoperability between the already existing national solutions was the key element addressed by the new European Interoperability Framework (EIF) published in 2017. Being a practical guideline on fostering better performance in the scope of interoperability of public services, the 2017 EIF has developed a set of non-binding recommendations to realise the idea of a Digital Single Market.

Public service design has substantially changed through the development of digital services, and the concept of digital transformation has had a significant impact on the structure and development of public services (PS). In this regard, a concept that is receiving particular attention at the European level is integrated public services (IPS). Considering the increasing relevance of IPS, the aim of this chapter is to define and contextualize public service models, integrated public services, IPS models, and IPS Governance by synthesizing the state of the art of research in essential European policy and research documents. Hence in this chapter, we will provide an overview of the related terms of PS and IPS, together with a summary of their respective models in the European Union. This overview will form the basis for a deeper understanding of these concepts within the context of the inGOV project. Therefore, this chapter is organised as follows: Section 1.2 will present the background for PS and IPS models in the European context with a special focus on the Core Public Service Vocabulary (CPSV). Section 1.3 will then present the theoretical framework for public service life events, which provide a structure for creating IPS out of PS. Section 1.4 will lay out the definitions for interoperability and models of IPS, including an IPS roadmap that follows the 2017 EIF guidelines and principles.

1.2 Public Services: Definitions and Models

Digital public services (DPS) have evolved as a central element of eGovernment[1] [8]. Different administrations and countries have a variety of definitions for this term, and the differences lie mainly in its scope. In the academic literature DPS are defined as services "that are routinely produced by the national, state or local governments and delivered to citizens, businesses and other entities under their jurisdictions" [9], and they are provided or delivered digitally [10], e.g. via eGovernment platforms. Therefore, we understand DPS as public services provided by digital means. Established eGovernment models propose information, communication, transaction, and integration as different categories of eGovernment [11], which strongly focus on the interaction between the public sector and the service users [12].

Linders [13], states that there are three main phases in the service delivery lifecycle: these are, (a) design, in this phase the planning is conducted and the most important strategic decision(s) are taken (b) day-to-day execution, this phase covers daily operations from the transaction to the collaboration and negotiation towards producing the service, and; (c) monitoring, this phase includes not only evaluating the effectiveness of a service, but also identifying the aspects that can be improved.

Based on the aim of this project, the stages of Public Service (PS) are twofold; it includes the informative stage of eGovernment, where the citizens and end users are provided with relevant information (e.g.,

[1] eGovernment is defined as "the use of ICTs to more effectively and efficiently deliver government services to citizens and businesses. It is the application of ICT in government operations, achieving public ends by digital means [7]

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cost, evidence, eligibility, etc.), and the transactional or performative stage, where the actual service is provided to the end users [14, 15]. Models for PS are specified in European documents and in the scientific literature. This section aims to provide a comprehensive overview of the state of the art on PS. The results will be the basis for understanding the concept of integrated public services, which will be introduced in the following sections.

As mentioned previously, the move towards a DSM in Europe pre-empts the need for seamless digital public services available to citizens and users throughout the EU. The development of DPS plays an important role in European policies, benchmarks, and standards for the service provision in different European countries as well as for cross-border activities. The EU eGovernment benchmarking report suggests that users should be able to find general information on services online but instead they continue to search information on how those services work [14]. Furthermore, public services need to be widely accessible anywhere, anytime – particularly for disadvantaged social groups. Users demand personalised digital public services, implying that services match their exact needs and circumstances regardless of the number of actual Public Administrations (PAs) involved in their provision. In this sense, the development of digital public services, is also beneficial for public administrations since, as the benchmarking report suggests "more time could be saved by pre-filling information" [14], also the once-only principle, where users provide certain standard information to the authorities only once, seeks to reduce administrative burdens [1] [5]. The next section will focus on PS models, specifically on the EU Core Public Service Vocabulary.

1.2.1 Public Service Models

The literature on PS models shows that the basis for eGovernment service provision is formed by underlying PS data models [16]. Over the past twenty years, several academics and governments have worked towards developing a concrete PS model that will serve as a foundation for all eGovernment service provision systems [17]. A challenge that governments are confronted with, and one that induces them to embrace user engagement, is the need to make public service delivery more efficient, effective and responsive [18]. To a certain extent, this challenge is linked to citizens' trust in government and democracy: if the public sector cannot deliver, citizens may lose confidence and trust in key public sector institutions. Expectations are high as co-creation[2] and co-production are regarded as a possible solution to the public sector's dwindling resources, by accessing more of society's capacities [18]. In addition, co-creation is seen as part of a more general drive to reinvigorate voluntary participation and strengthen social cohesion in an increasingly fragmented and individualized society [19]. This requires different public administrations to work together to meet end users' needs and provide public services in an integrated way.

To achieve this, the European Union (EU) is working towards providing relevant policy context and practical support. The general outline for these activities is provided by the eGovernment Action Plan 2016-2020. In addition, the EU ISA[2] initiative and its predecessors provide valuable guidelines for public administrations across Europe. Recently, the EU ISA[2] initiative, with the assistance of the EU member states, has established a relevant Working Group and has proposed the Core Public Service Vocabulary

[2] The inGOV project understands co-creation as the voluntary and active involvement of (I)PS end-users in any phase of the initiation, design, implementation, delivery, and evaluation of (integrated) public services. For a more extensive definition and contextualisation of co-creation see Chapter 2.

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(CPSV) as a simple, standard PS model, accompanied by the Core Public Service Vocabulary Application Profile (CPSV-AP).

CPSV is part of the European Commission ISA[2] Core Vocabularies and will be exploited, amongst others, in the Single Digital Gateway directive implementation. This common data model presents a solution and a semantic framework for public services in the context of the ISA[2] programme, and it supports the implementation of the European taxonomy for public services [19]. The CPSV provides a tool for public administrations that helps them to create standardised and user-centric[3] services. During the ISA[2] program, the CPSV has been revised frequently. As a result, the current model provides an enriched evolution of the CPSV-AP. It provides an overview of, and a technical basis for public service design by presenting classes and relations for the service design (see Fig. 1-1), more details on CPSV will be explored in chapter 5 of this deliverable. Moreover, its main aims are threefold, to provide PS information in a user-centric way, map different data models to a common existing model, and provide the basis for interoperable service provision (see section 1.4).

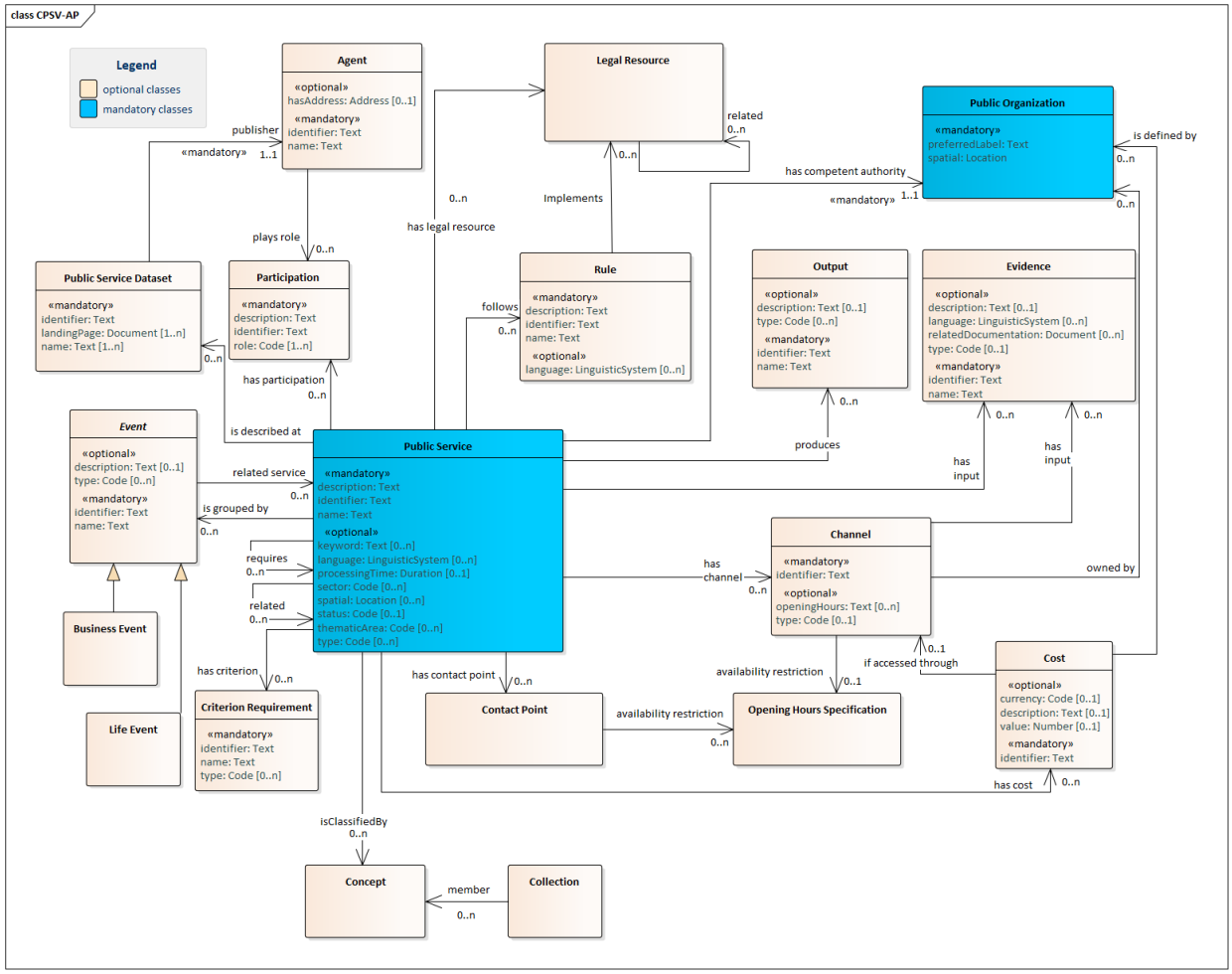

Figure 1-1. Classes of the current CPSV-AP specification [20]

[3] The user having more choice, flexibility, and control.

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One of the most crucial parts of PS design is the accurate documentation and representation of the components that play a significant part in PS delivery, and the interconnections between them [20]. The attainment of these two criteria paves the way for a fuller comprehension of what parts of the PS can be configured, which relations add complexity and workload to the process of PS delivery, and which data flows can be removed or changed for the better. In addition to modelling flexibility, the open availability of the PS models like the CPSV ensures both government accountability and that the provision of the PS is carried out in an optimum way to the benefit of the citizens. In this manner, all users and interested stakeholders can have access to the co-created PS and communicate their feedback on ways in which each process of the PS can be improved and enriched. To make these processes accessible and understandable for citizens, structuring PS according to life events can be a valuable tool [20]. Life events can be defined as "situations of human beings that trigger public services." [20], such as getting married, travelling abroad, registering a new-born, etc. Life events and their relationship to PS will be further developed in the next section.

1.3 Public service life events

In order to enable the digitisation of administrative services, these must be first identified, defined, and placed in the administrative context. A profound and cross-process restructuring, or redesign of all administrative processes is a challenge simply because of their number, operating systems, and differences. While the CPSV forms a basis for a useful and applicable taxonomy of PS and PS models, it is only one tool for the provision of interoperable PS catalogues, as figure 1-2 shows. This figure represents how the CPSV-AP can be used by public administrations in order to make their systems interoperable. It provides PA with templates for describing the services, helps them harmonise models, export the descriptions in a CPSV-AP compliant format and allows to check whether the public service description is compliant with the CPSV requirements [19].

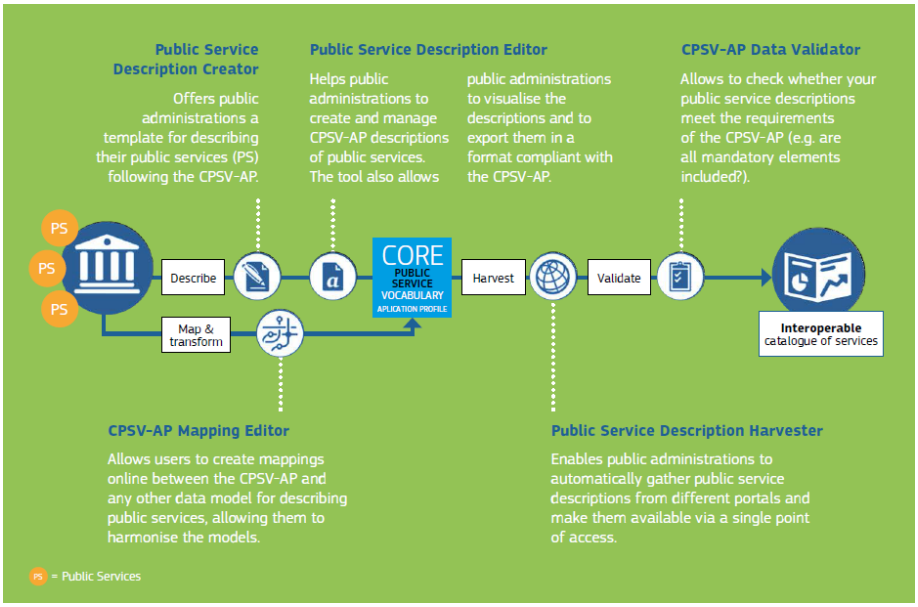

Figure 1-2 CPSV-AP integration into the development of PS catalogues [20]

To handle IPS, CPSV has introduced the concept of "Event" which is subdivided into Life Event (for citizens) and Business Event (for businesses). Life events or business events are the two major forms of the life situation concept, and represent the process landscape from the user's perspective [21]. Here

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we find the first indication of a stronger user centricity. It should also be noted that these life situations are oriented towards the structure of life, from birth to the end of life or “from the cradle to the grave" [22], and take into account citizens’ (or, in New Public Management terms, customers) “context and situations” [23]. However, even if federal or state portals use life situations for structuring, overview and better navigation, this established concept is not necessarily standardised [24]. An analysis of the websites of independent cities found that only half of the websites were structured according to life situations [25]. The literature also criticises the usefulness of a sole breakdown by life situation due to its lack of supraregional orientation [26]. Overall, however, life events is a concept that divides the administration into areas that are comprehensible, clearly structured [23] and accessible to citizens - thus representing an essential basis for the inGOV project.

Life events are a staple of eGovernment research [20]. Existing PS catalogues try to order the massive number of PS following this model [27] and the eGovernment Benchmark uses these approaches as a tool to manifest PS standards in Europe. The CPSV suggests that an event involves the use of several public services. However, more expressive relationships are needed, because not all users have the same requirements and needs, as the scientific literature of life-events has indicated [28]. For example, a life-event can be more accurately modelled as a generic process model of PS that can be instantiated based on the citizen’s profile and circumstances. While these life events can support the formation of PS catalogues and a more user-centric provision of PS, a re-evaluation and re-contextualisation of these aspects of the CPSV, with a focus on IPS and co-creation, is necessary. Moreover, the CPSV-AP encounters some challenges such as the absence of a concrete documentation and guidelines for PA[16]. The following section and next chapters in this report will contextualise these frameworks in accordance with the 2017 European Interoperability Framework. Life and business events will be shown to play a significant role as important building blocks of IPS provision [29].

1.4 Interoperability and Integrated Public Services

In order for public services’ users to address their needs in life events, the different services provided by PAs and service providers must be interoperable. The need for interoperability in digital public services is essential, as the different operating systems must be able to communicate and exchange information with each other. Interoperability is defined by the 2017 EIF as:

> “the ability of information systems to exchange data and enable sharing of information. It improves the efficiency and effectiveness of Europe-wide information-sharing tools, by ensuring the technical processes, standards, and tools that allow EU information systems to work better together. It means that authorized users (such as police officers, migration officials, and border guards) have faster, seamless, and more systematic access to the information they need to do their jobs.” [30].

The following sections will present the 2017 European Interoperability Framework and its relevance for the provision of integrated public services, services that are seamless for the users. The 2017 EIF is a key guiding document for European PS providers and provides recommendations for how to establish cross-organizational relationships.

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1.4.1 The 2017 European Interoperability Framework

Interoperability is a key factor in making digital transformation possible. For citizens to be able to work and relocate freely they must interact with Member State (MS) public administrations [30]. The European Union, and more specifically the European Commission, is taking the lead in creating the right conditions that support inter-administrative collaboration as part of the DSMS. The EC has been working for over two decades on improving interoperability throughout MS, yet there is still the need to coordinate these efforts to avoid digital fragmentation, this is why the European Interoperability Framework was adopted in March 2017 [31]. The implementation of the 2017 EIF aims to improve the quality of European public services and will create an environment wherein public administrations can collaborate digitally. The 2017 EIF aims to reduce fragmentation of services and data, allowing for well-coordinated European and national level service provision [31]. The 2017 EIF provides a generic framework that is designed not only to be used by all public administrations in the EU, but also as inspiration and guidance for EU public administrations. At the same time, it contributes to the establishment of the DSMS, this model can be seen in figure 3 [31].

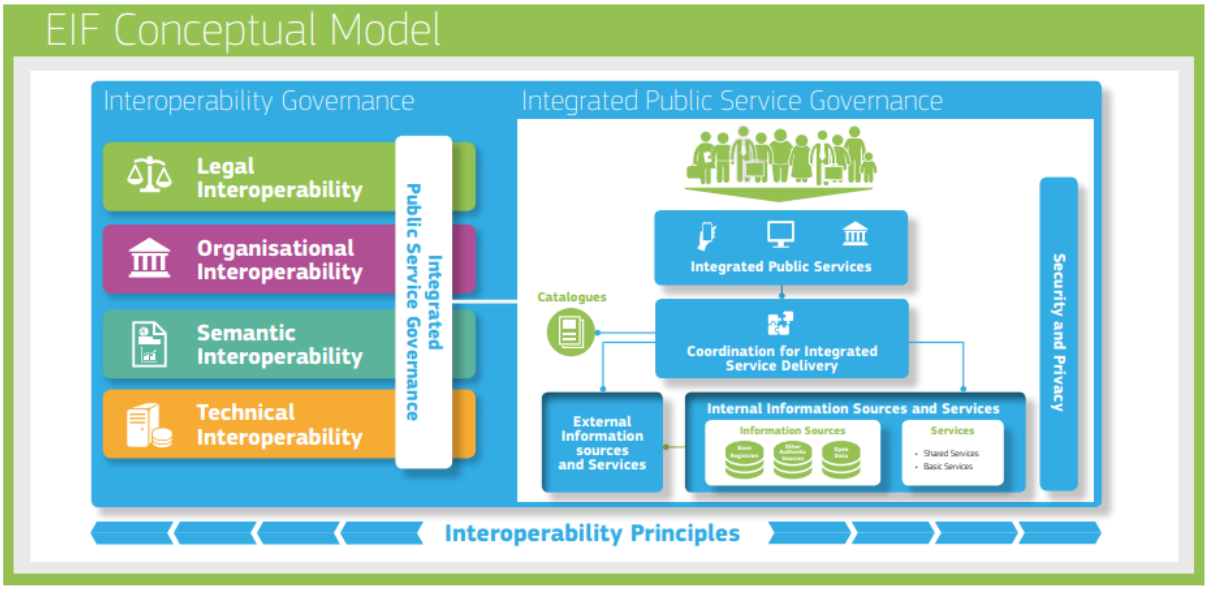

Figure 1-3. The EIF Conceptual model [31]

This model provides a total of 47 recommendations; items to be implemented by PA and service providers in EU member states. The recommendations focus on ways to improve interoperability governance, provide digital services, and make sure that legislation can support interoperability. Moreover, these recommendations are focused on 12 underlying principles including reusability, openness, and user-centricity. This relationship is shown in figure 1-3 [31]. The topic of principles will be further described in chapter 3 of this deliverable.

The 2017 EIF proposes an interoperability model, depicted in figure 1-4, that distinguishes four distinct interoperability layers, namely: legal, organizational, semantic, technical layer, and one cross-cutting layer, Integrated Public Service Governance, that impact digital public services and operate with the overall context of interoperability governance [31].

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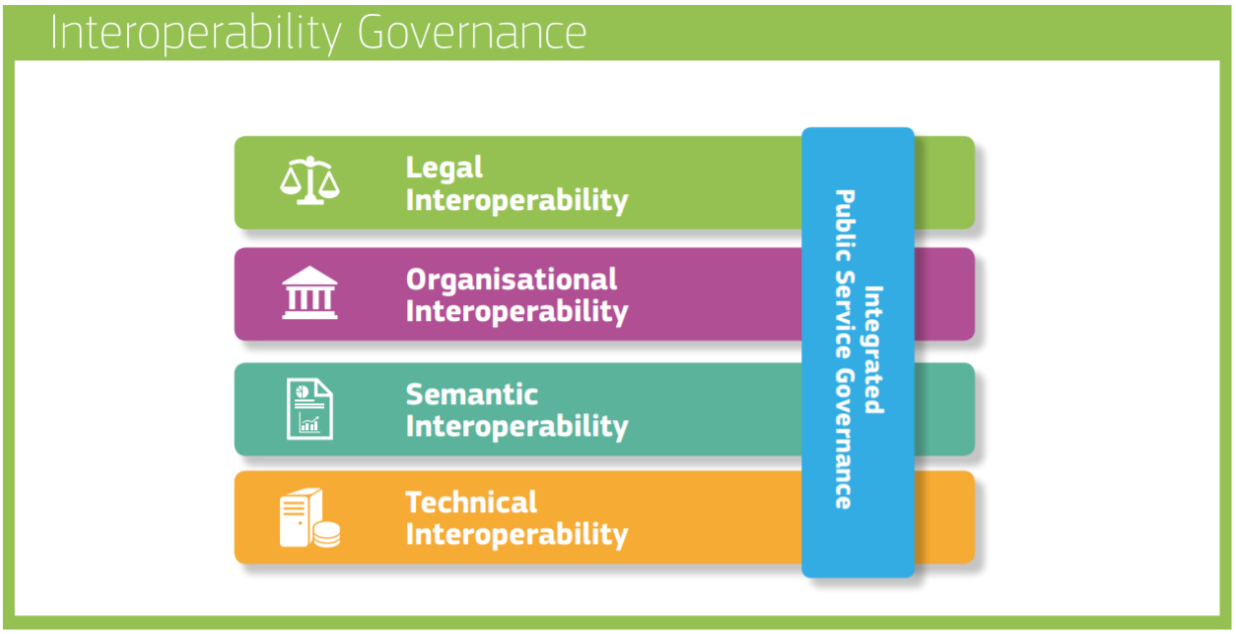

Figure 1-4. Interoperability Model proposed by the 2017 EIF [31]

Below is an overview of the four layers of interoperability and the cross cutting layer, IPS Governance [31]:

- Legal Interoperability: refers to the need for organizations that operate under different legal frameworks, policies, and strategies to find a way to be able to work together. This means working towards the compatibility of public administrations that operate with different underlying legal systems. Ideally, it seeks to establish clear solutions on how to deal with differing legislation across borders, this can also include adopting new legislation.

- Organizational interoperability: has two main objectives - (i) to align business processes, responsibilities, and expectations to achieve beneficial goals, and (ii) to make services available, accessible, and user-centred, meeting the community needs and requirements.

- Semantic interoperability: covers both semantic and syntactic aspects. The latter ensures that data elements can be understood by all parties, whilst the former refers to the exact format of the information exchanged. Therefore, semantic interoperability relates to the preservation of meaning and format of the data and information.

- Technical interoperability: focuses on the technical provisions that are required for different digital information systems to communicate, legacy systems that constitute a significant obstacle to the process, and siloed information systems in public administrations that are difficult to interoperate.

- Cross cutting layer – Integrated Public Service (IPS) Governance: "*is defined as providing the framework for decision-making for the provision of an IPS. It relates to who makes the necessary decisions at each stage of the development, delivery and maintenance of this service and how these decisions are made*" [31]. IPS Governance is a key aspect that can help public administrations offer

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user-centric services and reduce administrative burden for users. IPS governance is a critical success factor for interoperability and the seamless provision of electronic public services across silos, as it focuses on central questions such as what are the main decisions to be taken, who has the mandate to make these decisions, and how these decisions must be implemented. As shown in figure 1-4 and 1-5 it is not only a key factor to consider by organizations trying to achieve interoperability, it is also part of the 2017 EIF's conceptual model for IPS, as it relates to the mechanisms and structures needed to provide IPS [30]. Furthermore, IPS governance is about making sure that a variety of organizations that provide data sources and offer services to users can collaborate [32]. Again, it is crucial to understand that IPS Governance is about who makes the decisions and how, from the beginning of phase one - planning phase - as will be mentioned in the IPS roadmap described in the Section 1.4.4.

This section has briefly put forward the notion of IPS, but the details on what is understood as IPS and the 2017 IPS conceptual model will be further developed in the following section.

1.4.2 Integrated Public Services

Before advancing into the details and particularities of Integrated Public Services (IPS), as well as its presence, and relevance in EU policy, it is necessary to define what we understand by the term IPS. Therefore, the definition that will be used throughout this document and project is adapted from the 2017 EIF as follows: "Integrated public services can be understood as bringing together government services to end-users so that they can access them in a single seamless experience based on their wants and needs" [31]. Therefore, IPS are to be accessed by users in one place as services are grouped when necessary, even across organisational boundaries [31]. This is an improvement to non-integrated services that do not have a smooth operation and do not have all the users' needs in one place.

IPS delivery is a prerequisite to achieving significant strategic goals stemming from the DSMS. The need for interoperable, reusable, and collaborative services are key for IPS, in order to avoid data redundancy boosting efficiency and providing users with high quality services [31]. These aspects will be further elucidated upon in the following chapters of this deliverable. IPS is an ideal scenario in electronic public service delivery, and needs to be achieved not only at the local or national level, but also at the EU level in order to provide a one-stop government or a single-window where users can access public services from one place and address life and business events in a single place [32]. Best practices in this field are also essential and will be identified further along in the project.

When looking at traditional IPS delivery, a simple model is adopted wherein the public sector is the developer and provider of a public service, while the citizens and businesses are considered the consumers. Nevertheless, contemporary IPS is moving towards the delivery of public services that should be co-created and co-delivered and, thus, stakeholder involvement is of paramount importance [33]. The 2017 EIF presents an IPS model that will be described in section 1.4.3 of this document, it is important to note that this model focuses mainly on the actual deployment and daily use of a public service, the day-to-day execution in the PS delivery lifecycle [34].

The inGOV project seeks to involve stakeholders' needs and their participation in both the project stages and developments. Stakeholders involved are both the users and the providers of services, including citizens, tourists, refugees, non-governmental organizations, businesses, PA, digital service providers, public servants, etc. The starting point is the IPS conceptual model presented in the 2017 EIF

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and described in the following section. Throughout the inGOV project, an enhanced model that better serves IPS, including co-creation and user-centricity will be developed, considering IPS best practices.

1.4.3 The Conceptual Model for Integrated Public Services

The current IPS governance model, proposed by the 2017 EIF and shown in figure 1-5 is to be used for the planning, development, operation, and maintenance of public services at all government levels [30]. This conceptual model is based on the idea of interoperability by design: European public services should be designed considering interoperability and reusability requirements. These should reuse existing information and services [30].

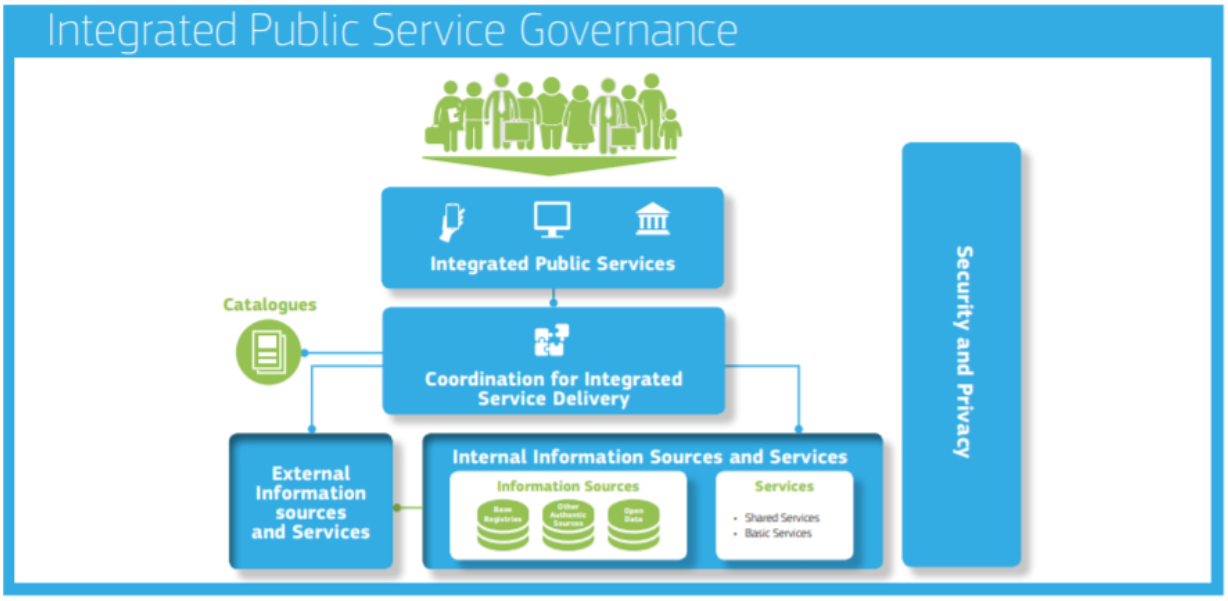

Figure 1-5. Conceptual model for integrated public services [31]

In the following paragraphs the basic components of this model are summarized [30]:

1. Coordination Function: makes sure that the users' needs are properly identified, and the correct European public service is provided. This function can be automated or manual, guided by one person or many, and some of these processes are:
    a. Identify the needs of the user (citizen or business): by their request to use a public service.
    b. Planning: and identifying the sources of information and services needed and aggregating these in a single process, considering user needs.
    c. Execution: by collecting and exchanging information, applying the business rules following legislation and policies currently in place, to grant or reject access to a specific service that has been requested.
    d. Evaluation: by collecting the users' feedback after the service has been provided.

2. Internal Information Sources and Services: Public administrations manage and store many information sources, oftentimes not known outside of one particular organization. Therefore,

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PAs should promote the sharing of services and information by **reusing**, **publishing,** and **aggregating** their data.

   a. **Base registries:** "are trusted and authoritative sources of information which can and should be reused by others" [31] and constitute the master data for public administrations, such as population registries. A single entity should handle the coordination of the registry, and an information steward should make sure the data is updated. Access to these should be regulated to ensure compliance with privacy and follow a data quality assurance plan.
   b. **Open data:** in a move towards transparency, the focus is on releasing machine-readable data that must be interoperable.

3. **Catalogues**: help the various public administrations locate reusable data sources, base registries, etc.
4. **External information sources and services:** public administrations must make use of services and sources of data delivered by third parties.
5. **Security and privacy:** all public administrations should follow the privacy and security by design approach. Data transfers must be done in a secure and controlled network

The current section has presented the different components of the IPS conceptual model proposed by the 2017 EIF. In the following section the Roadmap for developing IPS will be described.

1.4.4 A Roadmap for Integrated Public Services

To provide a broader perspective of the IPS process, the European Commission (2020) has recently developed a roadmap for IPS, illustrated in figure 1-6. This roadmap is aligned with the 2017 EIF's given definition of interoperability and the conceptual model for IPS provision. Moreover, this roadmap describes an ongoing and recurring process, and includes four main stages in which IPS are developed and delivered [32] , described as follows:

- **Stage 1. Identify the need for change:** A variety of stakeholders, from citizens to public administrations push the need for a new IPS into the political agenda.

- **Stage 2. Plan and select:** Once the political momentum has been created, a planning committee needs to be set up to provide a governance structure. This committee is charged with the task of planning which services, data sources, and infrastructure should be combined to deliver the new IPS. In this phase, the legal basis for the service might be needed, either by existing legislation or by agreement.

- **Stage 3. Provide Framework and set standards:** This stage involves the selection and implementation of standards across the different layers of interoperability, and interoperability principles. Legal and organizational changes may be required to operate the service; resolved either by passing necessary legislation, or by defining organizational agreements concerning the distribution of responsibilities.

- **Stage 4. Monitor and maintain:** During this last phase it is necessary to monitor the agreements and standards developed during the previous stages to ensure that the new IPS performs adequately.

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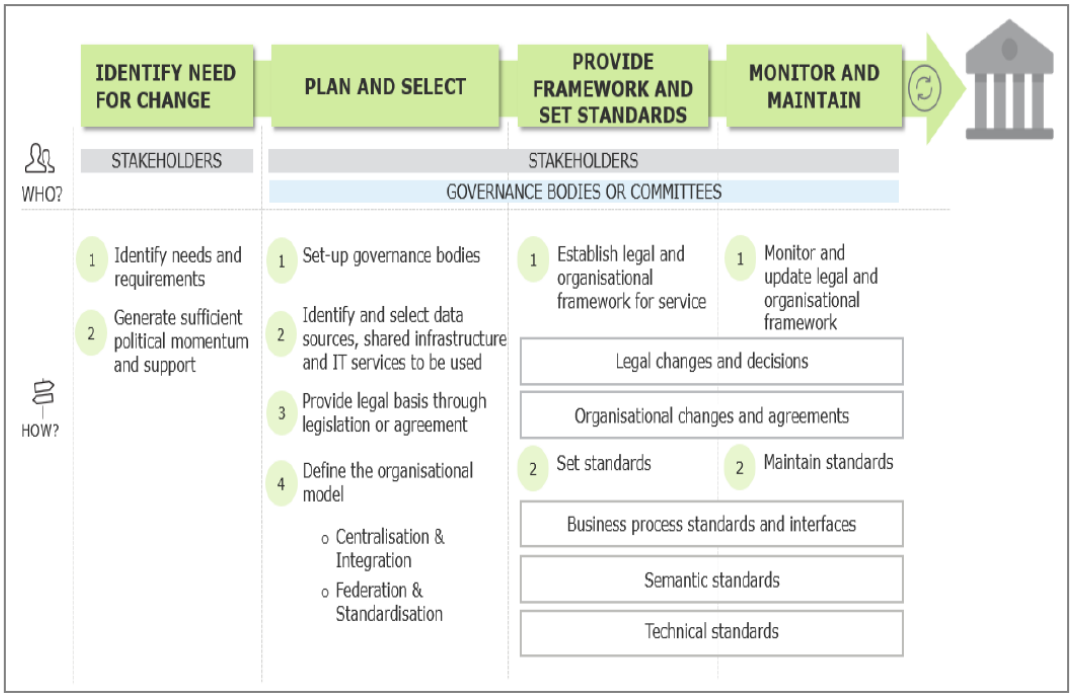

Figure 1-6. Roadmap for Integrated Public Services [32]

Although in theory this roadmap is a good starting point for developing and improving IPS it has not yet been operationalized and evaluated in a real-life setting. The waterfall style might not be the best approach considering that many times decision makers or the governance bodies change over time, software becomes outdated, and needs and requirements may evolve, this is why a more dynamic framework and roadmap might be worth considering such as Agile. The Agile project management allows for small increments, and more frequent reviews including feedback, aiding in avoiding failures [39].

1.5 Conclusions

The objective of this chapter was to provide the readers with an overview and brief introduction to the main PS and IPS concepts that will be developed and built upon and throughout the inGOV project. An overview of the European context and the desire to provide efficient, timely and user-centred public services was presented. Furthermore, the concept of public services with a focus on the CPSV and its relationship to life events was introduced. Life and business events have been at the heart of eGovernment processes, as they represent the goal of providing services to users at significant points throughout their lives. These events, as situations in which citizens or businesses would reach out to a public administration to get information or avail of a service, form the basis for interoperable and integrated public services.

The objective of the inGOV project is to propose an update the 2017 EIF for the provision of IPS with the involvement of the different stakeholders, including users and service providers, such as citizens, tourists, residents, public administrations, non-governmental organizations, and businesses. Consequently, it was considered important to present in this first chapter an overview of existing PS models, and the key concepts within these models, such as the overarching requirement for public services to be interoperable-by-design and able to communicate with each other to provide users with

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a seamless service. These models will constitute the starting point to develop further the 2017 EIF framework by introducing IPS co-creation in the different phases of PS delivery life. The details regarding co-creation will be explored in more detail in the following chapters (see Chapter 2 and Chapter 5), wherein academic literature will be used to present the existing theoretical framework on co-creation and introduce existing co-creation practices.

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Chapter 2. Scoping Review of Public Services Co-creation

Acronyms and Abbreviations

Acronym/Abbreviation	Description
DPS	Digital public services
ICT	Information and Communication Technologies
IPS	Integrated public services
NPG	New Public Governance
NPM	New Public Management
OGD	Open Government Data
PA	Public administration
PRISMA	Preferred Reporting Items for systematic reviews and meta-analyses
PRISMA-ScR	PRISMA Extensions for Scoping Reviews
PS	Public services
ScR	Scoping Review
SLR	Systematic Literature Review
SSCI	Social Sciences Citation Index

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2.1 Introduction

Public sector organizations are facing many challenges concerning the provision of public services (PS). Previous reform efforts in the public sector, especially New Public Management (NPM), supported the inclusion of business practices in the public sector. However, they are not suited to adequately address citizens' needs as in NPM citizens are perceived as customers [e.g., 1] and not as active participants in service design and delivery [2]. Current reform efforts see co-creation as a significant element of modernisation in the public sector. The New Public Governance (NPG) Model defines public service users as co-creators instead of just mere customers [3]. The active involvement of public service users through co-creation promises to foster innovative solutions via joint experiences, resources and skills [4, 5]. Moreover, these collaborative efforts are expected to not only provide more high-quality services, but also to deliver services that are responsive to the users' needs [6]. Together with the digital transformation efforts which are "characterized by hyper-connectedness and collaboration of consumers and organizations across the gamut of value chain activities" [7], co-creation in the public sector can be understood as a starting point for digital transformation and innovation [8].

This digital transformation has included collaborative tools for innovation, which in turn have increased complexity while supporting user-centric approach and inclusive services. As introduced in Chapter 1, these complex and inclusive services can be found in the framework of the EIF as integrated public services (IPS). The development of IPS in the inGOV project is to be achieved by co-creating these services with the affected public service (PS) users. This chapter aims at critically evaluating methods and approaches of PS co-creation via a scoping review [9]. It will focus on four key elements of co-creation: 1) purposes of co-creation processes in the public sector, 2) approaches and tools for co-creation of public services, 3) actors and their roles in the co-creation process and 4) the benefits of co-creation.

This review will form the basis for understanding co-creation throughout the inGOV project and will be used as an input for the development of the IPS co-creation conceptual model in Chapter 7. To achieve this, chapter 2 has the following structure: In section 2.2, we provide an explanation and contextualisation of co-creation in the inGOV project. Section 2.3 describes our research strategy; section 2.4 presents the results of our scoping review and section 2.5 discusses our results. The main implications for inGOV are presented in section 2.6.

2.2 Understanding Co-creation for inGOV

Co-creation is increasingly viewed as a key part of governance for public sector practitioners and has been receiving growing attention by scholars [4, 5, 10, 11]. It represents an innovative approach for public organizations. This approach supports the delivery of high-quality services in a context of constrained resources through the involvement of stakeholders in the planning, design, implementation, delivery and evaluation of PS [12]. Particularly in the context of the digital transformation, co-creation is identified as an appropriate strategy for transforming services based on the incorporation of digital technologies [13].

In the academic literature, the concept of co-creation is often used as a synonym of co-production [10] or as closely interrelated [14]. The complexity around both concepts has created a debate in the literature concerning the differentiation between them. In general, co-production is understood as "a

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relationship between a paid employee of an organization and (groups of) individual citizens that requires a direct and active contribution from these citizens to the work of the organization" [15].

Co-creation of public services can be defined as:

> "[…] a process through which two or more public and private actors [to] solve a shared problem, challenge, or task through a constructive exchange of different kinds of knowledge, resources, competences, and ideas that enhance the production of public value […], or services, either through a continuous improvement of outputs or outcomes or through innovative step-changes that transform the understanding of the problem or task at hand and lead to new ways of solving it." [4].

Based on the above explanation of the two concepts, co-creation in the public sector can provide a more holistic and inclusive picture than co-production. In this line, Torfing, et al. [4] emphasize that co-production is a phenomenon that is stretched to describe the phases of the public service cycle and does not provide insights into the new and broader interactions between the public sector and society that co-creation encompasses, while co-creation understands that all stakeholders can provide value to the provision or creation of public services. This perspective includes a wide variety of actors. For example, "public actors can be politicians, public managers, or frontline staff and the private actors can be service users and their relatives, voluntary groups of citizens, civil society organizations, social enterprises, private corporations, and so on." [4]. Hence when considering the definition of co-creation, it differs from co-production in three main aspects: (1) the actors involved, (2) the interaction purpose, and (3) the focus on value co-creation instead of public service production [4]. Therefore, considering the aim of the inGOV project, we have decided to align our understanding of co-creation with the definition developed by Torfing, et al. [4]. Yet, due to the complexity of the concept, our approach to co-creation will be complemented with other relevant co-production literature [cf. 3, 5, 16, 17].

Co-creation processes can take place in all phases of the public service cycle.[1] These phases can, in their most detailed differentiation, include co-planning, co-design, co-prioritisation, co-financing, co-implementation/management, co-delivery, and co-assessment/evaluation [16, 18, 19]. In accordance with Linders [16] and the aim of the project, our focus will be on three phases: co-design, co-delivery and co-assessment. To provide a comprehensive background on co-creation for the inGOV project, we will present the main characteristics of co-creation in the phases of the public service cycle below.

2.2.1 Co-design

Co-design provides an important frame for the conception and layout of the service that is to be designed. This phase might encompass, e.g., user consultations [19], design labs [17] or other formats that include the addressed stakeholder in the development of the specific service that it is aimed at. The key elements of co-design, in a user to government scenario, are the consultation and ideation of service design elements Linders [16]. This can happen in advance of the creation/ delivery of the service or during the actual service delivery [5].

[1] For a more general overview of this concept see Chapter 1.

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The inclusion of a variety of stakeholders, respectively users, in the design of an application or service not only provides a more user-centric experience, but also creates mutual trust between the authorities and the respective stakeholders. By building trust and consequently increasing the willingness of users to adapt the respective service, the co-design phase forms the basis for the next phase – the actual co-delivery of the service [3].

2.2.2 Co-delivery

Aside from planning and design phases, co-delivery can also happen during the service delivery phase. Linders [16] suggests that co-delivery (in parallel to e.g., crowdsourcing) is a part of citizen to government co-creation. Co-delivery typically happens through trained stakeholders or, more specifically, peer groups and can be defined as concurrent to the service. Co-delivery enhances the acceptance of the services through the involvement of peers in the process. This can happen for example through peer support groups, nurse-family partnerships or even trained youth council that support peer education [5].

Including stakeholders in the service delivery phase can enhance the communication between service providers and users and allows for a more integrative user experience. Previous projects have identified knowledge as well as competencies on both sides (local professionals and lay people) as relevant for the success and effectiveness of service co-delivery [3].

2.2.3 Co-evaluation

This phase can have a variety of different names, including co-monitoring and co-assessment, however, the key elements remain the same: The evaluation phase assesses the service after its delivery in an effort to learn from it or adapt it through possible prospective elements [5]. Linders [16] highlights citizen reporting as a possible format for this phase. In a broader sense, possible examples for co-creation in this phase can include tenant inspectors or even user online ratings [17].

Through evaluating and assessing the provided service, this phase can provide an important factor in empowering involved stakeholders [3]. Sicilia, et al. [3] highlight the importance of sharing information to support the agency of the stakeholders. Furthermore, co-assessing services and service provision not only allows additional user-centricity but might be able to improve communication and understanding between the involved stakeholders. After explaining the three phases of the public service cycle, section 2.3 will explain the research strategy employed to conduct the scoping review.

2.3 Research Strategy

In order to increase our understanding of PS co-creation for the inGOV project, in this chapter we conducted a scoping review following the “Preferred Reporting Items for systematic reviews and meta-analyses”, also known as PRISMA [20]. More specifically, the PRISMA Extension for Scoping Reviews “PRISMA-ScR” [21]. Subsection 2.3.1 outlines the general methodological approach. Subsection 2.3.2 presents the selection of the articles based on the eligibility criteria and subsection 2.3.3 explains the analytical process.

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2.3.1 Methodology

To conduct the review, we first identified scientific articles through the PRISMA method. PRISMA provides predetermined protocols for the data collection process that decrease bias collection while enhancing the transparency and reproducibility of the review [20, 22]. As a second step, we used the PRISMA extension for scoping reviews (PRISMA-ScR) [21] "to identify and examine characteristics or factors related to a particular concept" [9]. This is a valid tool to identify decisive aspects of co-creation in the extensive field of co-creation. Consequently, it is very useful for our project.

2.3.2 Article selection

Following the PRISMA-ScR method [23] we searched in the electronic data bases Web of Sciences and Scopus using a defined search string. The search string was used consistently in the two data bases and combines three types of search terms: (a) terms related to co-creation; (b) terms related to e-government; and (c) terms related to the public sector. The search process was concluded on March 3rd, 2021 (See Additional Material 2-2 for the Scoping Review Search Log). From this search, 627 were deemed potentially eligible when considering the eligibility criteria language, field, and type of publication.

The definition of the eligibility criteria allows to decrease bias in the selection of articles and their scoping to enhance the validity, applicability, and comprehensiveness of the review. PRISMA-ScR differentiates between study eligibility and report eligibility criteria[2]. Study eligibility criteria focuses on the topics, outcomes, and study design [20]. In our review, we included empirical studies; hence we excluded theoretical or conceptual studies, and reviews and focused on articles that a) deal with co-creation or co-production of b) public services in the context of c) digital transformation or ICT implementation. Report eligibility criteria focuses on more formal elements, such as year, language, publication status and field of study [20]. In our review we selected papers from international peer-reviewed academic journal articles in English and we focused on articles published in Social Sciences Citation Index (SSCI) journals. As Walker and Andrews [24] argue, this approach ensures a suitable publication quality and more academic rigour. We did not specify a time limit since the main body of the literature has been published over the last 20 years, which was confirmed in the search for articles. The oldest article that was included in the full text screening was published in 2003. Considering the multi-disciplinary nature of the topic, the query included the domains of social sciences, computer sciences and library sciences for Web of Science, and the subject areas of social sciences and computer sciences for Scopus.

We checked the 627 articles that have been identified in the first step for duplicates and disregarded 92 automatically and 21 after the abstract screening process. Two researchers acted as reviewers and another as advisor. The advisor provided his opinion on critical or unclear articles where the two reviewers were having disagreements. Based on this analysis, the two reviewers discussed and agreed on the inclusion or exclusion criteria and a pre-selection of 13 articles (4 relevant and 9 irrelevant), which were used to train the tool that supported the screening process (ASReview).

Once we gathered the results from the data bases, we employed ASReview, a machine learning tool that supported our title and abstract screening. This AI-aided and open source tool allows for a more

[2] See Additional Material 2-1 for the PRISMA-ScR checklist.

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efficient and less error prone screening process [see 25 for more information] when compared to a regular screening process. Based on a pre-selection of training articles by the reviewers, the tool suggests the titles and abstracts of articles from the literature selection that might be relevant according to the training data. It is up to the researchers to classify each proposed title and abstract as relevant or irrelevant. The tool is constantly learning from this data and will suggest articles accordingly. As a result, the researchers can see the most relevant articles first and consequently the tool reduces decision fatigue and speeds up the screening process.

With the support of ASReview and a common basis of analysis, the two reviewers independently followed the same screening process for the 535 articles that were included in the abstract screening process after the exclusion of duplicates. Both researchers screened 375 articles or 70.09% of the sample. This stopping point was selected after the ASReview tool suggested 35 irrelevant articles in succession [26]. The resulting list of articles was compared afterwards, and discrepancies were discussed. Concerning those discrepancies, the reviewers asked the advisor to screen the abstracts and titles based on the agreed eligibility criteria. The result of these steps, after the exclusion of additional duplicates, was the selection of 75 articles for the full text screening. A second screening involved a full-text article review based on the eligibility criteria, including the above-mentioned key elements of co-creation. One reviewer conducted the full-text screening in the qualitative analysis tool NVivo 20. A second reviewer checked this selection. In this case, the advisor also helped to decide on discrepancies that emerged in 11 cases. As result of this process, 49 articles were disregarded in this phase. This decision took place based on the study design, topic, lack of focus on public services or because the articles were not fit to the context of this study. The final selection of relevant articles on the topic of public service co-creation resulted in 25 articles, which were included in the final scoping review. Figure 2-1 presents an overview of the selection process.

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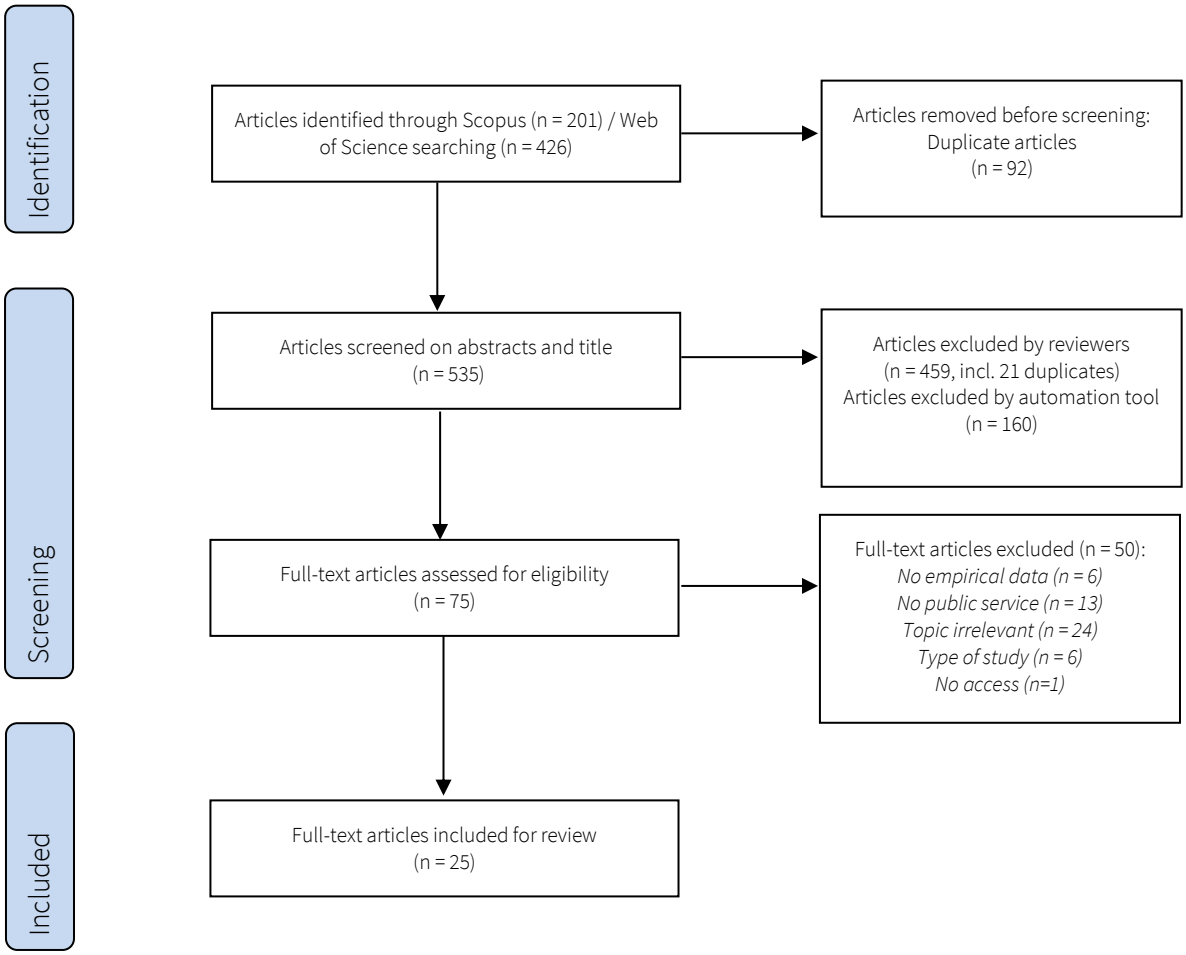

Figure 2-1. PRISMA Flow Diagram

2.3.3 Data Analysis

A coding process was followed to address the key elements of co-creation. To do so, we developed an initial coding list derived from the key elements of co-creation, which are directly linked to related literature (see Additional Material 2-3). Nevertheless, given the exploratory nature of this study, we followed a thematic analysis process, including two phases of coding: open coding and axial coding. The coding process was undertaken with the qualitative research tool NVIVO 20 by one researcher in discussion with a second researcher to validate emerging connections during the axial coding.

2.4 Results

In this section, we report the findings of the review based on the final eligible articles. First, we present the results considering the co-creation phases and the type of co-created public service [16]. Second, we present the results based on the four key elements: 1) purposes of co-creation processes in the public sector, 2) approaches and tools for co-creation of public services, 3) actors and their roles in the co-creation process and 4) the benefits of co-creation.

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2.4.1 Co-creation phases and public services

For the co-creation phases, we build on the framework of Linders [16] that proposes a three-phase co-creation process. These phases are co-design, co-delivery, and co-evaluation. This framework has also been used to categorize the empirical literature. Since some articles do not explicitly mention the phase of the case in question, as part of the review we have identified the phases for all articles. This identification was based on both Linders [16] framework and the article's case description. Table 2-1 below shows that 11 articles of the final selection examined co-design cases. Co-delivery was studied by 4 articles, and co-evaluation by 7. Meanwhile, 4 articles reported to analyse the entire public service cycle (the three phases). In addition, 6 articles reported an evaluation phase in the design stage [27-31], such as the user testing of a designed app [28].

Table 2-1 also includes the type of policy areas to which the studies belong and the setting of the service, that can be analogue, digital or hybrid. In this regard and based on the analysis of the SLR, we identified that 5 of the co-created public services examined in the sample are analogue public services. From the 25 articles, 14 articles reported co-creation processes of digital public services provided or supported via mobile applications, websites, digital platforms, among others. Finally, 7 articles reported to co-create a hybrid public service, meaning that it is provided both by digital and analogue channels.

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Table 2-1. Overview of the articles

Co-creation phase	Policy areas	PS Setting	References
Design	Water and Sanitation	Analogue	[29]
	Mobile app – urban guide	Digital	[28]
	General PS	Digital	[32]
	General PS	Hybrid	[33]
	Health and Safety	Hybrid	[34]
	Urban Mobility	Analogue	[31]
	Health	Analogue	[35]
	General PS	Hybrid	[36]
	Education	Analogue	[37]
	General PS	Hybrid	[38]
	Elderly care	Digital	[39]
Delivery	Unemployment	Digital	[40]
	General PS	Hybrid	[18]
	Finances & Unemployment	Digital	[41]
	Sustainable energy	Analogue	[42]
Evaluation	General PS	Digital	[27]
	General PS	Hybrid	[43]
	Safety	Digital	[41]
	General PS	Digital	[44]
	General PS	Digital	[45]
	General PS	Digital	[46]
	General PS	Digital	[47]
Whole service cycle	Urban mobility	Hybrid	[30]
	General PS	Digital	[48]
	General PS	Digital	[16]
	General PS	Digital	[49]

2.4.2 Purposes of co-creation

When analysing the rationale behind the co-creation processes, we aimed to identify the reasons and purposes behind its implementation. We clustered those aims into five groups: co-creation to improve public services, to innovate, to create new public services, and user-driven co-creation. . Yet, it is important to highlight that 4 studies included more than one objective [cf., 33, 39, 42, 48]. The clusters and the references are presented is Table 2-2 below.

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Table 2-2. Co-creation purposes.

Purposes	References
To improve public service provision	[16, 18, 29, 30, 33, 35, 36, 38-41, 43-47, 49]
To innovate	[33, 34, 37, 39, 42, 48]
To create new public services	[27, 28, 42]
User-driven co-creation	[16, 31, 35, 39-41, 48]

Note: some studies reported more than one purpose through one or different cases.

2.4.2.1 To improve of public service provision

The results of our analysis on identification of needs are presented in Table 2-3. Some studies highlight the need to improve public service performance due to low quality related with service completion rate and transparency [47], users' acceptance and adoption of the PS [38], and specific issues. For instance, as Putra and van der Knaap [30] examine, the use of co-creation to identify solutions for traffic congestions problems. In the case of public spending, also several reasons were identified. For example, Hepburn [39] highlights the need to increase the efficacy of PS provision while Huang and Yu [36] focuses on avoiding no extras costs and time.

Table 2-3. Needs for improvement

Needs for improvement	References
Citizens' complaints and no responsiveness by the government	[33, 43, 47]
Low quality of PS provision	[30, 38, 47]
Accountability of PA	[43]
Reduce public spending	[36, 39]
Reputation of PS provider	[40]

The main rationale behind co-creation processes when aiming to improve PS provision is that both citizens' insights and citizens' active participation can lead to better outcomes [40, 41, 47]. In turn, public services providers can meet users' needs in a responsive manner [33, 47]. An interesting example for this is provided by the optimized food inspection model based on Open Government Data (OGD)[18]: "The model works by classifying food serving establishments based on how likely they are to have a critical food safety violation […] the model was finding critical violations, on average, 7.79 days earlier; this represented an improvement on the current model in use." This improvement that co-creation processes can lead to improvements in the performance of PS.

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We derived from our analysis that the most mentioned purpose in the selected articles is the improvement of public service provision, as it was identified in 17 articles. Table 2-4 also presents the identified purposes and their corresponding references.

Table 2-4. Co-creation to improve PS

Purpose	References
Enhance public service provision (i.e., efficacy, effectiveness)	[18, 29, 33, 36, 39-41, 44-46]
Increase quality	[27, 35, 47]
Sustainability	[39, 47]
Support due to governmental limited resources	[39]

2.4.2.2 To innovate

Based on our analysis we identified 8 articles that aim to foster innovation through co-creation processes [30, 33, 34, 37, 39, 42, 48, 32]. Our findings show that co-creation results not only from cooperation between the governments, private actors, and NGOs, but is also embedded in the cooperation itself. In this sense, co-creation can be a niche of incubation and multi-scale spatial networking to promote innovation [42]. Additionally, we identified that innovation-seeking projects can include participants and can also involve the design, evaluation and monitoring of DPS [48]. Moreover, co-creation is expected to lead to the development of innovative ideas using digital techniques [30] in a more efficient manner [39], including the users in the centre of the process [37]. Moreover, 2 articles highlighted the potential of co-creation to support digital transformation processes (see Table 2-5). One of the highlights when reviewing these articles is that involving users facilitates their transition from using analogue services to digitals, which can be less costly for PS providers. Bridge [32] argues that co-creating can help to understand users' circumstances, while developing digital services based on users' insights to meet their expectations, to avoid the trap of "one size fits all". In the case of Deakin, et al. [48], they argue that co-creation is an interesting process for innovation-seeking projects to allow a larger number of participants to engage in the design, evaluation and monitoring of digital public services.

Table 2-5. Co-creation for digital transformation

Digital transformation	References
Take-up of e-government services	[32]
Identify users' requirements	[32]
Digitalized public services	[48][32]

2.4.2.3 To create new PS

When considering co-creation processes for the creation of new PS. From the 25 articles, only 3 focused on this aspect. One is the study of Jarke [28], which examines the process of co-creating a new

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application for supporting elderly people. Second, Soares da Silva et al., [42] study the case of a cooperative initiated by citizens and supported by other stakeholders, including the government, to provide a wind park after the failed attempted by governmental actors. Finally, the article by Paskaleva, et al. [27] presents a variety of co-creating processes with the aim of creating public services with a focus of co-designing tools such as mapping services, collaborative design, and prototyping.

2.4.2.4 User-driven co-creation

This section of the review is aimed at identifying the drivers employed by the governmental actors to improve the interaction with users in the public service provision. However, it is important to point out that the authors do not mention a specific purpose of the co-creation process related to the public service provision. In these cases, co-creation is implemented to empower citizens [33, 35, 39, 49], enhance trust among users [41], inclusion and support by enabling the participation of disadvantaged groups, such as elderly people [31, 33] or the "distant others" (i.e., more isolated users) [35, 48] in the social, economic and civil life; and to improve the perception of users about PA and reputation of the service providers [40, 41]. Table 2-6 presents these results.

Table 2-6. User-driven co-creation

Purpose	References
Empower citizens	[33, 35, 39]
Enhancing trust among users	[41]
Inclusion of and support to disadvantaged groups	[31, 33, 35, 48]
Improve the perception of users about PA and reputation of the service providers	[40, 41]

2.4.3 Co-creation approaches and tools

Co-creation processes take place through digital tools, analogue tools, and a combination of both (hybrid co-creation). While analogue public services are still highly used by users, governments have been increasingly adopting digital tools to engage users in public service provision to extend the applicability of co-creation process, increase the efficiency and effectiveness, among others [50]. Therefore, it is relevant to identify and classify the co-creating tools based on the adopted approach. We identified 10 articles that reported the use only of digital tools, such as websites, forums, SMS, mobile applications, online surveys, among others. Other 9 articles reported the use of analogue tools, such as interviews, surveys, focus groups, meetings, among others. In addition, 6 articles examined hybrid co-creation. An interesting example in this regard is the case of *Crowdmapping* in Turin (Italy) [43] where a collaborative platform that promotes both offline (e.g., meetings) and online interaction (e.g., online reporting platform, online geographic maps) to co-create was adopted. The offline aspect aimed to enhance the "digital literacy" of certain groups of citizens. Finally, 6 articles did not describe the use of specific tools [e.g., 42]. These results are presented in Table 2-7 and more details on the type of tools are in Table 2-8.

Table 2-7. Co-creation approaches

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Type of co-creation	Number of articles
Digital co-creation	10
Analogue co-creation	9
Hybrid co-creation	6

We were able to identify a variety of tools used to co-create in 20 articles. Some of these tools involve co-creating actors in a more active way (e.g., hackathons, co-creative workshops) while more traditional tools, such as online surveys, illustrate a more passive co-creation process. The tools can also be differentiated based on the phase of public service co-creation, yet only 2 articles [16, 18] that examined co-creation in the delivery phase describes the use of OGD and data and information platforms to support co-creation process. Table 2-8 shows these results of tools implemented in the co-design, co-delivery, and co-evaluation phase.

Table 2-8. Co-creation tools and approaches

Tools	References
Co-design	
Customer Journey Map	[32]
Focus Groups	[27, 32]
User testing Labs	[29, 32]
Community fora/dialogues	[32]
'Deep dives'	[32]
Co-creative/Design workshops	[30, 33, 34, 37]
Data Walks	[28]
(Web-based) crowdsourcing	[27, 49]
Persona technique	[37]
Observational techniques	[37]
Visualization techniques	[37]
Interviews	[27, 29, 31, 37]
Mapping	[37]
Design Fictions	[38]
Hackathons	[49]
Mobile applications	[36, 49]
Seminar	[29]
Meetings	[29, 34, 43]
Transect-walks	[43].
Interviews	[43].
Opensource online platform	[43].
Design techniques	[34]
Social Media	[36]
Surveys	[27, 36]
Online message board	[36]
Hotline	[36]
Forum/Meetings	[27, 35]
Training sessions	[27]
Prototyping/Piloting	[27, 30]

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Commenting platforms	[16]
Ideation techniques	[16]
Participatory Mapping	[31]
Photo Diary Elicitation	[31]
Co-delivery	
Open Government Data	[16, 18]
Data and information dissemination platforms	[16]
Co-evaluation	
Non-emergency call centres (mobile and web-site based)	[45]
Social Media	[47]
Mobile applications	[47]
Online platform	[44]
Web-based applications	[16]
Open Government Data	[16]
Mobile applications	[16]
Competition platforms	[16]
Groupware tools (e.g., wikis and collaboration platforms)	[16]

Another interesting distinction is the use of OGD to engage users in the co-creation of digital public services [18, 28]. Within this approach, different strategies can be used such as open government data portals, code exchange through "app contests", civic issue trackers (i.e., user monitoring, crowdsourcing, users as sensors), and participatory open data (i.e., Data provided by both governments and users) [28].

Similarly, Trischler and Scott [37] argue that the combination of co-creation and collaborative techniques can lead to a better and in-depth understanding of users' experiences and in turn, support the design of complex public services. For instance, Concilio, et al. [33] make use of techniques such as design tables during co-creative workshops. Another illustration is the use of design fictions, a speculative design process that includes scenarios, brainstorming, rapid prototyping, and multidisciplinary techniques to explore and define new services and "what-if" scenarios [38]. Bridge [32] also reported the use of several tools and argue that online tools provide a better experience while being less costly than analogue engagement methods:

- Online community = forums, polls, surveys, videos presentations, social media.
- Deep dives = ethnographic research, social media (blogs and videography).
- Online forums combined with face to face meetings.

2.4.4 Co-creation actors and roles

The articles were also analysed based on the role of the actors. A wide variety of co-creating actors were identified. Yet, most of the articles reported the involvement of citizens and governmental actors (See Table 2-9 for an overview), followed by the engagement of private actors. It is relevant to note that 1 study [39] mentioned the involvement of users without specifying who were those users.

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Table 2-9. Co-creating actors and roles

Actors	*Total*	As initiators	As supporter
Citizens	22	1	21
Users	1	-	1
Academia/Research	9	2	7
Private sector	11	-	11
Non-profit organizations	7	1	6
Governmental actors	23	12	12

The co-creating actors could initiate the co-creation process or could be part of the co-creation process by sourcing resources, such as time, funding, experience, information, expertise, among others. Concerning the roles, in most of the cases, the co-creation approaches were implemented top-down, with the government being the main co-creating actor. A few cases were mentioned were citizens or non-profits organizations initiated the co-creation process (bottom-up). In these cases, the government played a role as sponsor, providing the frame and funding for the initiatives. For instance, the study of Moon [49] illustrates some examples where citizens are the ones leading the coproduction process and creating new services. In these cases, the role of the government entails the provision of open APIs and open data. For example, the 'Public Parking Lot Finder' in the City of Pusan, South Korea is an app developed by a citizen to locate public parking lots available around the city. It employs information such as parking fees, location, operating hours, contact information and so on. The GPS-based app was developed based on the open APIs and open data provided by the City of Pusan [49]. Another example is the case examined by Soares da Silva and Horlings [42], which presents a cooperative co-created, managed and owned by citizens. Finally, another case examined by Meijer [40] is a website established by a non-profit for the co-delivery of unemployment support and guidance due to the failure of governmental services.

When considering the described background, Linders [16] labels these types of co-creation process based on the roles as citizen sourcing (Citizen to Government) and government as a platform (Government to Citizen). The author also presents a third category called "Do It Yourself Government". Yet, similar to previous studies [e.g., 50], we do not consider citizens' "self-organization" as a case of co-creation, since we understand co-creation in the context of public services provision.

An interesting aspect that is sometimes neglected in the co-creation and co-production literature are the strategies used to invite, engage stakeholders to co-create as well as to raise awareness over these processes. When looking at this in our review, only 5 articles explicitly described how the users were engaged or kept informed about the co-creation process [22, 27-29, 31]. For instance, Jarke [28] examines the engagement of elderly adults in the design of new digital public services. In this case, a project board was set up to organize a recruitment campaign that included leaflets, newspaper articles, and worth-of-mouth promotion by the already engaged users. In the study of Paskaleva and Cooper [27] a PR campaign and Social Media were used to target and engage stakeholders in the co-creation processes. The study of Moon [49] reported the invitation of lay partners to co-design a system of integrated care to improve the quality of the care and support to patients. The volunteers could request a nomination by sending their profile to health and social care organizations, and if selected, they would be part of the Lay Partners Advisory Group. The authors argue that the recruitment process is a successful lesson as it allowed to include people with expertise in strategic work.

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2.4.5 Co-creation benefits

Through the analysis of the 25 articles, we have identified 7 common themes around the benefits and outcomes obtained through co-creation processes (see Table 2-10). These benefits seem to be broader and more comprehensive than the co-creation purposes, as they surpass the initial expected outcomes. Yet, in general, the benefits and outcomes related to co-creation processes are not exhaustively described. The first theme concerns organizational changes as well as changes in the organizational culture, processes, and capacity. Authors argue that co-creation favours and increase public service providers' accountability [16, 43], and it can also lead to change management [29]. Moreover, co-creation processes might promote organizational changes to overcome ethical concerns [38] and to further promote co-creative practices in the public sector [27]. In the same line, co-creation can lead to cultural changes towards user-centred working processes [35].

The second theme is the **enhancement of user-centricity**. Particularly, it focuses on benefits related to the users' needs, experiences, and requirements. PS co-creation can provide additional channels for interaction with the users where users can voice their concerns [40, 41, 47]. In addition, it can provide users with support structure [40, 41] for improving emotional and social development [28, 40]. Co-creation can also lead to a higher level of social inclusion when including disadvantaged users, such as elderly people or weaker groups [31, 43]. This can also result in better services for these users, covering their particular needs and requirements [28] and leading to increase users' satisfaction [49]. In addition, some authors mentioned that by engaging users in the co-creation of PS might lead to a higher users' sense of ownership of both the co-creation processes and the service [28, 42]. Finally, Farr [34] highlights how co-creation can lead to increased levels of privacy.

The third theme identified through the analysis of the selected articles is **enhancement and personalization of public services provision**. Similar to the purpose of improving public services, this category is the most often mentioned by the selected articles (see Table 2-10 for an overview). Several authors reported that co-creation has led to improved public service performance and provision [28, 34, 37, 39, 41, 46, 47, 49] as well as to more personalized and convenient public services [29, 32, 38] thanks to the information and resources provided by different stakeholders [31, 34, 40, 41]. Moreover, co-creation can lower the costs and resources needed by public service providers [32, 45] due to the outsourcing of public service support [28, 40, 46] and to building a common vision of the management of public services [43].

The fourth theme includes benefits related to the **improvement of government functions**, such as decision-making process, capabilities, capacity, and digitalization of public services. From the 25 articles, only 3 have highlighted these benefits. De Filippi, et al. [43] argue that co-creation can favour collaborations between citizens and public service providers and improving planning and management operations. Jacobs, et al. [29] reported that co-creation can lead to unified solutions among different stakeholders and consequently to new ways of increasing public sector capacity and knowledge exchanges. Finally, Linders [16] claims that co-creation can improve performance management and data-driven decision-making processes.

The fifth theme includes articles that focuses on the **sustainability of public services as well as co-creation practices**. Authors agree that through co-creation, the sustainability of public service provision, collaborative practices and newly co-created services can be strengthened [30, 33, 34, 42]. Moreover,

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co-creation can also lead to a higher level of user acceptance and plausibility of services and technologies, leading to more sustainable public service provision [38].

The sixth theme is related to public sector innovation. These articles argue that co-creation can foster innovative ideas [29, 32, 42] and partnerships [33] with a variety of expertise and resources to lead to innovative solutions [30]. Co-creation can also result in new initiatives and public services; it can be particularly helpful in conceptualising new services [37, 38, 42] that meet users' needs with the support of innovative approaches, such as OGD [49]. Moreover, Moon [49] also highlights the potential of co-creation process to develop ICTs and digitized public data and public services.

Finally, the seventh theme focuses on the enhancement of social well-being. In these cases, articles reported the improvement of quality of life and well-being of users that are involved in the co-creation processes as well as for the rest of the communities [31-33].

Table 2-10. Benefits of co-creation

Themes	Benefits	#	References
1	Organizational change	5	[16, 27, 29, 33, 35, 38, 43]
2	User-centricity	12	[28, 31, 34, 40-43, 47, 49]
3	PS improvement and personalization	23	[27-29, 31, 32, 34, 37-41, 43, 45-47, 49]
4	Improvement of government functions	6	[16, 29, 43]
5	Sustainability of PS provision	4	[30, 33, 34, 38, 42]
6	Public sector innovation	11	[29, 30, 32, 33, 37, 38, 42, 49]
7	Social well-being	3	[31-33]

2.5 Discussion of the results

Based on the scoping review we can observe that most empirical articles that analysed co-creation from a co-creation phase perspective focused on co-design. This phase has two characteristics, it allows the inclusion of citizen requirements, and it is prevalent in co-creation processes (cf., Table 2-1) since it is more feasible to include users in this stage than in e.g., the service delivery [49]. In contrast, co-delivery is only included in few of the examined articles. Meanwhile co-evaluation has been observed in two dimensions: Firstly, co-evaluation has been applied in projects of the evaluation phase in the public service cycle. Secondly, evaluation projects have been prominent co-creation projects in all phases of the public service cycle. While our results have highlighted co-creation projects in the co-design phase, other papers have shown the possibility of including co-creation in several or all phases of the public service cycle. Co-creation has also become more prevalent with digitalisation [16]. As our analysis shows, most articles focused on digital public services or looked at least at a hybrid variant, that allows for online and offline elements. In this regard, pure offline co-creation only concerns a minority of co-creation projects. The ease of co-created PS evaluation seems to be facilitated by digital tools (cf., Table 2-1).

The results also show that the co-creation of PS mainly aims to improve public service provision, or a perceived improvement through innovation, new services, user-centricity, or digital transformation. On the one hand these developments are reactionary since co-creation might be perceived as the answer for low quality services or a lack of public accountability [45, 47]. On the other hand, the inclusion of

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citizens for a better outcome and a more user-centric service might be seen as a goal in itself [35]. The user-driven co-creation of PS supports user empowerment, especially through providing more transparency and accountability for the governmental actors, which lead to a higher level of trust and inclusion [39].

The tools and approaches used to achieve the inclusion of the users in the co-creation process are classified as digital tools, analogue tools, and hybrid approaches. Our results show a balanced use of digital and analogue methods, but also support the emergence of hybrid co-creation methods (cf., Table 2-7). The literature shows that these analogue methods include mostly personal interactions or direct conversations, as can be found in interviews and workshops [37]. Meanwhile digital tools allow a wider variety in of methods used for co-creation, such as mapping, the use of (open government) data (OGD), and mobile applications [37, 47]. It seems that a broader conversation and higher inclusiveness can be achieved through social media. Overall, a situational hybrid approach that combines on- and offline tools as well as low-threshold and higher-threshold co-creation tools and methods supports the design of complex services and allows for a broad involvement of user groups [32, 33, 37, 38].

While a wide variety of actors can be involved in co-creation processes, and Linders [16] highlights citizen-to-citizen co-creation, our focus has been on co-creation efforts between the public sector and public service users. For efforts that include, or are initiated by, the public sector, the literature shows mostly top-down co-creation processes. Governmental actors have also been identified in the analysed literature as the actors that have been involved in all observed co-creation cases and as the most regular initiators (cf., Table 2-9). Aside from the public sector itself, citizens play the most important role as public service users and co-creators, followed by private businesses and academic or non-profit actors (cf., Table 2-9). This shows the importance of the citizens as the focus and recipient of public service co-creation. This result might also be related to the way public administration label collaborative processes between public and private actors. This also implies that user-centric service development mainly focuses on citizens as the users of co-created public services. Consequently, a very important part of co-creation processes is the inclusion of these citizens as well as the successful inclusion of other actors, when necessary. While different on- and offline recruitment methods have been observed in the literature, there is not yet a comprehensive overview on methods to successfully include users' expertise through co-creation. This aspect is highly relevant since previous research identifies the lack of awareness and self-selection as two of the main challenges of (digital) co-creation to engage a wide range of users as co-creators [51, 52].

Through the analysis of the 25 articles, we identified common themes around the benefits obtained via co-creation processes. Based on our results, we can state that the benefits seem to be broader and more comprehensive than the co-creation purposes, surpassing the expected outcomes. As the purposes of co-creation indicated, change, innovation, and service improvement seem to be at the core of public service co-creation. The support of change management and a redesigned work progress, the identification of users' needs with the consequence of enhanced and personalized public service provision, and the sustainable development and implementation of public services are the overarching benefits that have been identified. While co-creation is mainly seen as a method for better user involvement in the phases of the public service cycle and an answer to users' needs regarding (digital) public services, our results show that co-creation can have far-reaching benefits for administrational, political and societal level. It can also be a lever to create a better functioning of public service provision, to improve quality of life, to increase inclusion either through more civic engagement or addressing

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underrepresented groups and to enhance transparency and trust from a citizen perspective respectively accountability and openness for public administrations.

Based on these insights from co-creation theory and the literature in inGOV we can state that co-creation can be seen as a beneficial and inclusive approach to public service provision that is enhanced by digital and hybrid formats and can benefit accountability and openness in all phases of the public service cycle. Hence, we follow this holistic and interactive understanding and define co-creation *as the voluntary and active involvement of (I)PS end-users in any phase of the, design, delivery, and evaluation of (integrated) public services*.

2.6 Conclusions: Implications for the inGOV project

Through a scoping review of 25 articles, this chapter identified the main aspects related to the co-creation of public services, such as co-creation in the phases of the public services cycle, the purposes of co-creation, co-creating actors, tools and approaches, and the benefits of implementing co-creation processes. A wide variety of co-creation processes with different purposes and actors have been identified.

Aside from this definition aforementioned in the discussion section, the results of this scoping review provide general insights on the co-creation of public services that benefit the inGOV project and the pilots for public service co-creation that are planned within the project. Nevertheless, some limitations need to be noted regarding the articles' selection. Although concepts such as e-participation, digital service design, among others, could also be understood as co-creation, they were excluded. Furthermore, the scope of this review in this stage did not include challenges and obstacles of co-creation. This will be studied in future stages along with the implementation of the projects' pilots.

The results of this review show that co-creation can be important in all phases of the public service cycle. For the inGOV project, the co-design stage is especially important since user-centric design will be an essential requirement of the pilots that will be conducted. inGOV also includes the delivery phase through the collaborative delivery of the planned pilots and the project will implement a co-evaluation process after implementing the pilots to pave the way for an improved delivery after the project. These phases will be accompanied using different online and offline tools that need to be considered according to the involved actors. User-centric service improvement and sustainable public service provision are at the core of the inGOV project, and consequently co-creation is deemed as an appropriate approach for providing (digital) public services in the pilots.

Therefore, co-creation in inGOV will aim to provide user-centric services. In the inGOV project these users are mainly citizens, and in one case businesses. Other actors involved include regional governments and academia, responsible for initiating respectively evaluating and supporting the development and implementation of these services. The aim of the project is the user-driven co-creation of these public services from different sectors. While evaluation phases are already included in the planning of the project, over the course of the project, the evaluation of the process, the selection of fitting tools to include the potential PS users (analogue tools for in-depth qualitative discussion, mobile and digital applications for innovative and more illustrative co-creation) and finally the transparent and sustainable implementation of the integrated public services will be requirements for a successful co-creation process. In order to achieve this, Chapter 3 examines the public values, principles, and guidelines related to co-creation and IPS, such as user-centricity, transparency,

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sustainability, among others, while Chapter 5 builds on the present chapter to analyse IPS and co-creation best practices to draw conclusions based on empirical data.

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Chapter 3. A Taxonomy of Public Values and Principles

3.1 Introduction

A comprehensive understanding of public values and principles of Integrated Public Services (IPS) and co-creation is key for the tailoring of the IPS model from the perspective of co-creation. Public values and principles steer or legitimize public action and are foundational to governmental behaviour [1][2]. Yet, the development of guidelines is needed to put public values and principles into practice. The development of such guidelines can help policy-makers when designing and implementing integrated public services and co-creation processes.

Key EU eGovernment initiatives and policies, such as the 2017 European Interoperability Framework (EIF) [3], the 2016-2020 EU eGovernment Action plan [4], and the various Ministerial Declarations on eGovernment/Digital government [e.g., 4, 5], contain a multitude of guidelines. Among them are guidelines for cross-border digital public service delivery that can support the achievement of a wide range of public values and principles [1].

While several guidelines have been identified or used in policy documents and the scientific literature, public values and principles and guidelines with respect to co-creation practices have been considered to a much lesser extent. Some public values and principles that public organisations want to achieve are shared between IPS and co-creation, such as inclusion. Furthermore, some guidelines have only been recently introduced, e.g., the EU 2020 Berlin Declaration [5] with human-centred systems. In the context of IPS, co-creation guidelines can enhance achieving public values and principles. For example, bringing in users' experience can help to improve both responsiveness and the quality of the public services.

Due to the fragmented landscape of public values and principles, an important prerequisite for enhancing existing frameworks, models and reference architectures is to create a taxonomy that can serve as a concrete guide for both academics and practitioners. Hence, the purpose of this chapter is threefold: 1) to provide a definition of public values and principles and guidelines in the IPS and co-creation context, 2) to identify and thematize/cluster public values and principles and guidelines regarding IPS and co-creation, and 3) to examine if public values and principles and guidelines with respect to co-creation are present in EU eGovernment initiatives and policies.

In order to achieve the aforementioned objectives, we will address the following questions in this chapter:

1. What are public values, principles, and guidelines in an IPS co-creation context?
2. What are the elements that constitute a taxonomy of IPS co-creation?
3. What kind of public values and principles and guidelines with respect to co-creation are present in the EU eGovernment initiatives and policies?

The methodological process to answer the three questions includes the two following steps: 1) desktop research that involves a review of relevant academic literature, key EU eGovernment initiatives and policies, and reports, and 2) a content analysis of the EU eGovernment initiatives and policies. The findings help, on one hand, to identify how a wide variety of public values, principles and guidelines have to be taken into account when setting up an IPS co-creation project. This is reflected in the

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developed taxonomy. On the other hand, the document analysis indicates that certain clusters of public values and principles and certain themes of co-creation guidelines appear much more often than the others in EU eGovernment policies. This chapter is structured as follows: after this introduction, section 3.2 provides the background to public values, principles, and guidelines. Section 3.3 details the taxonomy. Section 3.4 shows the results of the content analysis of the EU eGovernment initiatives and policies. Section 3.5 summarizes the main results and presents concluding remarks.

3.2 Background

Public values and principles are an important subject in the Public Administration literature, and it is recognised that large sets of public values and principles are affected by policies [6]. Yet, thorough discussions on the relation between public values / principles and specific instruments or policies are still limited [7, 8]. In inGOV, we look at public values and principles as inputs for IPS co-creation. This means that they legitimize activities and in general provide guidance for the actions taken by public administrations and public servants [1, 2, 9, 10]. Public values and principles give structure to choices that are made regarding the governance of public services, this includes the way co-creators can provide input [11]. As Nieuwenhuizen and Meijer [8] remark, public values and principles "provid[e] public actors with ideas about what should be done and what values should be strived for in governance."

In the inGOV project, we understand public values and principles following Bozeman's [12], definition of public values:

- The rights, benefits, and prerogatives to which end-users should (and should not) be entitled;
- The obligations of end-users to society, the state, and one another; and
- The principles on which governments and policies should be based.

Public values and principles have an impact on several governance aspects of the activities related to public service design and delivery. In the co-creation and co-production literature, they are often grouped in this respect. In the context of the inGOV project, we take as foundation the clustering developed by Jaspers and Steen [1]:

1. Service delivery
2. Relationship between governments and end-users/service users
3. Democratic quality of the service delivery process

The Service delivery cluster tries to achieve public values and principles including efficiency, effectiveness, quality, adaptability, user orientation, satisfaction and sustainability. The relationship between governments and end-users/service users entails public values including learning, trust, accountability, responsiveness, transparency, considering end-users' capacities[1], reciprocity, ethical and honest behaviour, human rights, and individual freedom. The third cluster is related to the democratic quality of the service delivery process and looks at public values such as participation, empowerment, inclusion, social capital, equity, rule of law, diversity and monitoring of privacy and confidentiality [1, 6, 9, 13].

[1] Considering the goals of inGOV project, we will use 'end-users', rather than 'clients'.

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3.3 Taxonomy

This section details the taxonomy as follows: First, the methodology is explained in subsection 3.3.1. The taxonomy is introduced in subsection 3.3.2. Subsection 3.3.3 presents the general results of the taxonomy, including interrelationships between public values and guidelines. Subsections 3.3.4 and 3.3.5 present the guidelines with respect to IPS and co-creation. Additional Material 3-2 contains the full list of guidelines together with the references to the sources consulted and which are part of the references in this document.

3.3.1 Methodology

A review of the most relevant academic literature and key EU eGovernment initiatives and policies was carried out to assess public values and principles with respect to IPS and co-creation. To understand whether the public values and principles in the co-creation literature were suited in an IPS context, the 2017 EIF [3] was first coded with respect to a large set of public values and principles. This resulted in public values being arranged in three clusters, as indicated above (section 3.3.2). We opted for the 2017 EIF because of its importance in both IPS and the inGOV project.

In the case of the taxonomy, we included the following data sources:

For IPS, our base was:

(1) Key EU eGovernment initiatives and policies, and reports: the EU eGovernment Action Plan 2016-2020 [14], the EU2020 Berlin Declaration [5], the 2017 EIF [3] the 2021 Joint Research Centre (JRC) Public Sector Modernisation for EU Recovery and Resilience Science for policy brief [15], the Tallinn Declaration on eGovernment [4], the Recommendations for organising and governing integrated public services as part of the Interoperability Solutions for European Public Administrations[2] (ISA[2]) Action 2016.33 [16] and the Sharing and Reuse of IT Solutions Framework [17].

(2) Seminal e-government articles resulted from the snowball method application [18-22].

For co-creation, we used four types of sources:

(1) Systematic literature reviews (SLR's) in co-creation and coproduction [23-28]. An analysis of the SLR's was suited as a starting point to examine guidelines for co-creation as they have inquired into best practices, enablers and/or barriers to co-creation.

(2) Inclusion of recent books on co-creation [13, 29, 30].

(3) Revision of papers through the snowball method [11, 25, 31-35].

(4) Revision of reports from the H2020 CITADEL project on co-creation [36-38].

The taxonomy relies on a thematic approach [39]. First, academic literature, key initiatives and policies, and reports were read to familiarize us with the data. Second, the guidelines, sources and descriptions were categorised. Third, an iterative process was followed were guidelines were grouped and themes for the guidelines were searched and reviewed. Fourth, the eventual themes were defined and named. Each of the guidelines was then coded with respect to the identified 25 public values and principles. This allowed to examine 1) the three clusters of public values and principles presented in the research background and 2) the coherence between guidelines public values and principles across the two groups.

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3.3.2 Introduction of the taxonomy

According to Bharosa, et al. [10], a taxonomy is "a collection of controlled dictionary definitions that are organised into a hierarchical structure". In contrast to traditional taxonomies that have a clear hierarchical structure, the taxonomy presented here is more complex. Based on the inGOV project goals and the research background, the structure of the taxonomy is described in Table 3-1. First, in line with the central focus of the inGOV project, two groups are distinguished that help to organise the guidelines: IPS and co-creation. The guidelines are pooled in themes that link with these two groups. However, it is important to emphasize that certain guidelines relate to both IPS and co-creation partly or completely. Second, guidelines can be linked to none, one or more clusters of public values and principles they aim to achieve. These clusters are derived from literature [1]. Depending on which clusters the guidelines link to, public values and principles can be operationalized in different ways. However, the classification of the public values and principles into clusters is not clear-cut and is more an ideal type of clustering. As a result, in the taxonomy, guidelines can be part of one particular cluster, but are still linked to public values and principles that are ideal type assigned to a different cluster.

Table 3-1 Dimensions of the taxonomy

Dimensions	Description
Cluster	A clustering of public values and principles with respect to different aspects of the service governance
	1. Service delivery 2. Relationship between governments and end-users/service users 3. Democratic quality of the service delivery process
Group	Structural elements of IPS from the perspective of co-creation that organise guidelines
	1. IPS 2. Co-creation
Theme	Category of guidelines within a group
Public Values and principles	1. The rights, benefits, and prerogatives to which end-users should (and should not) be entitled 2. The obligations of end-users to society, the state, and one another; and 3. The principles on which governments and policies should be based
Guidelines	Actions or activities that aim to achieve public values and principles into practice

3.3.3 General taxonomy

3.3.3.1 Guidelines

The taxonomy contains 114 guidelines distributed across the two groups (IPS and co-creation). IPS has 66 guidelines and 10 themes (category of guidelines), while co-creation has 48 guidelines and 7 themes. Figure 3.1 details the number of guidelines according to their theme and group.

Guidelines are to some extent fuzzy and can overlap between groups. Guidelines from IPS can entail elements of co-creation. Openness (GL 56[2]) for example comprises empowering users to take part in the phase of the design of the IPS [3], while a related guideline User-centricity (GL 60) is incorporating

[2] The numbers of principles refer to tables 3.2-3.24 and Additional Material 3-2 (below).

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Users' feedback throughout the service's phases. Elements of co-creation are also included in guidelines such as End-user engagement (GL 28), Inclusion of political stakeholders at the start of the project (GL 29), developing an agile strategy in a co-creative process (GL 30) and Communicate and engage with stakeholders (GL 31). While elements of co-creation are contained within IPS, the opposite does not appear to be the case. While elements of governance from IPS overlap with co-creation (e.g. GL 23, 24), the co-creation guidelines appear to focus more on the co-creation process, rather than on the service delivery process.

The inGOV project aims to present an IPS Co-creation Conceptual Model (IPS-Co) that will result from tailoring the Integrated Public Service Conceptual Model proposed in the 2017 European Interoperability Framework (EIF (see Chapter 7). The taxonomy presented below provides the background for IPS-Co. Specifically, guidelines 55 to 66 constitute the Theme 'Interoperability' and relate to the EIF Principles, which in IPS-Co we aim to tailor from a co-creation perspective.

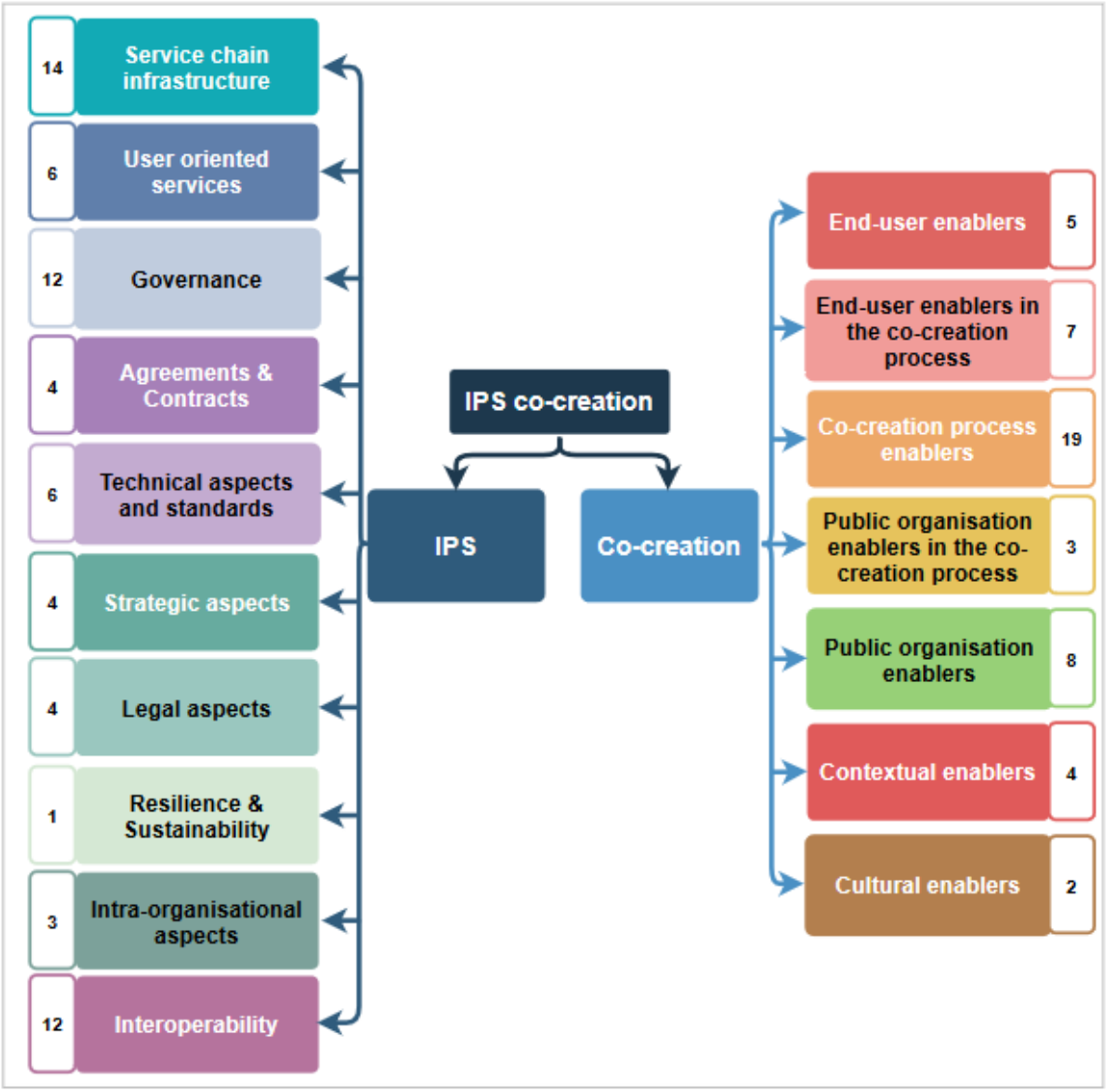

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Figure 3-1 High-level taxonomy of the number of guidelines per theme of guidelines per group

3.3.3.2 Public values and principles

Concerning the **association between Groups and Clusters** (figure 3-2), the taxonomy reveals that for IPS the order is the Service delivery cluster first, followed by the Relationship cluster, and the Democratic cluster. Public values that are (ideal type) in different clusters, are operationalized mainly through the perspective of Service delivery. For example, in the guideline Inclusion and accessibility (GL 61), inclusion is described as developing multiple channels of service delivery but does not relate to co-production/co-delivery as an extra channel or the inclusion of multiple user groups into the governance process. However, this is not strict and public values and principles that take on a perspective associated with the Relationship and Democratic clusters are included into the IPS group. See for example Empowerment in the guideline of Openness (GL 56) and Learning, Participation in the guideline of Reusability (GL 57).

For co-creation, the order is the Service delivery cluster, the Democratic cluster, and the Relationship cluster. Human rights were not found in the co-creation guidelines. Overall, guidelines most often address public values from either the combination of the Service delivery and Relationship clusters, or all three clusters.

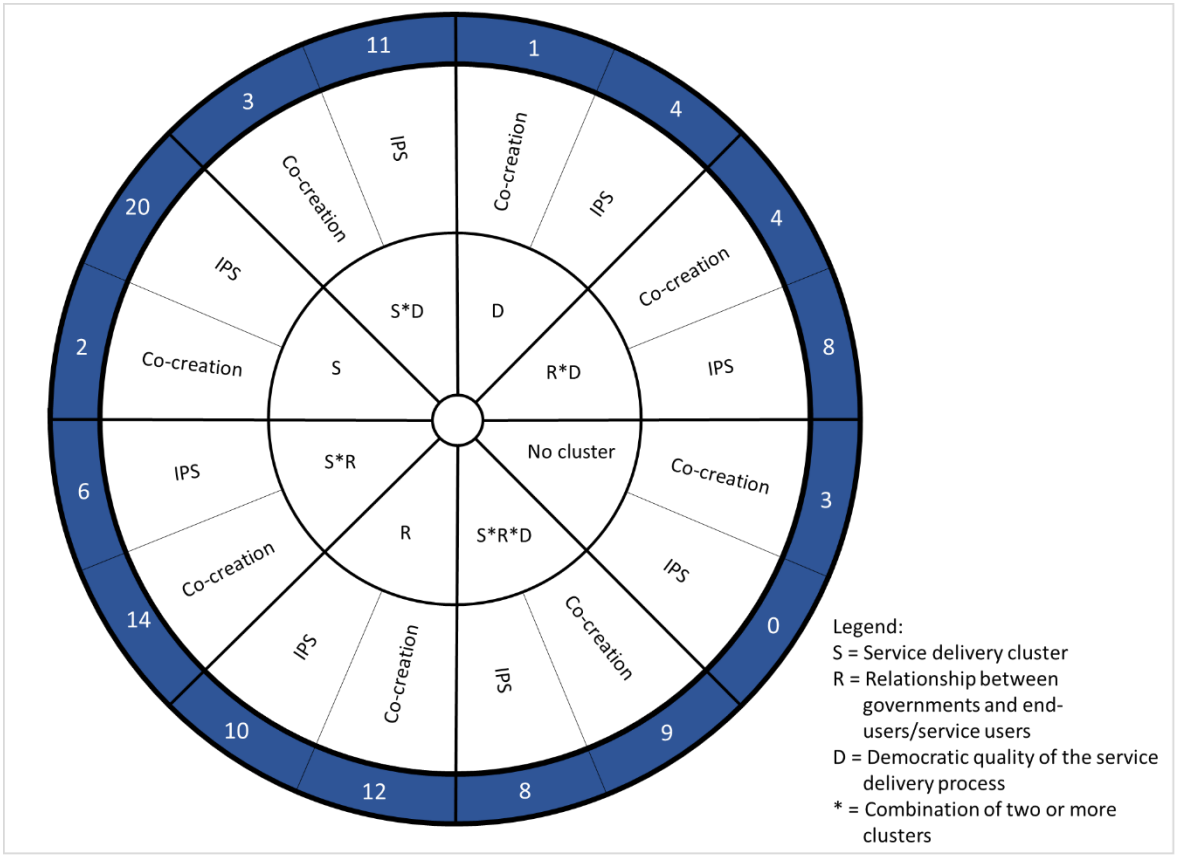

Figure 3-2 High-level taxonomy of the number of guidelines across the clusters

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The relation between public values and principles and clusters seems to be more of an ideal-type kind. Public values and principles are often operationalized from the perspective of a different cluster. Sustainability (Service Delivery cluster) in IPS refers to the long-term viability of the building blocks (GL 9, 51). In co-creation it also entails the durableness of interactions and the co-creation / governance process (e.g. GL 75, 79) (Relationship cluster), in addition to the sustainability of the service delivery (GL 75). Accountability can be looked at from the perspective of end-users (Relationship cluster) (e.g. GL 80), but also that of policy makers (Democratic cluster) (e.g. GL 11, 43, 45). Learning (Relationship cluster) is not only related to various stakeholder groups learning how to participate in a co-creation process (e.g. GL 78, 98) (Relationship cluster). It also consists of technical knowledge (GL 69, 73, 81, 99), general digital skills (GL 20), and learning from other services or projects (GL 5) (Service delivery cluster).

The breakdown of the public values and principles across the groups in figure 3.3 shows how some public values and principles are not addressed in the guidelines. For public administrations and co-creators who favour public values and principles such as Equity, Reciprocity and Social Capital, and to a lesser extent Sustainability and Empowerment when initiating, developing or implementing IPS co-creation, using co-creation guidelines such as Leadership (inter alia Equity and Reciprocity), and taking into account and strengthening community characteristics (inter alia Social capital) are key.

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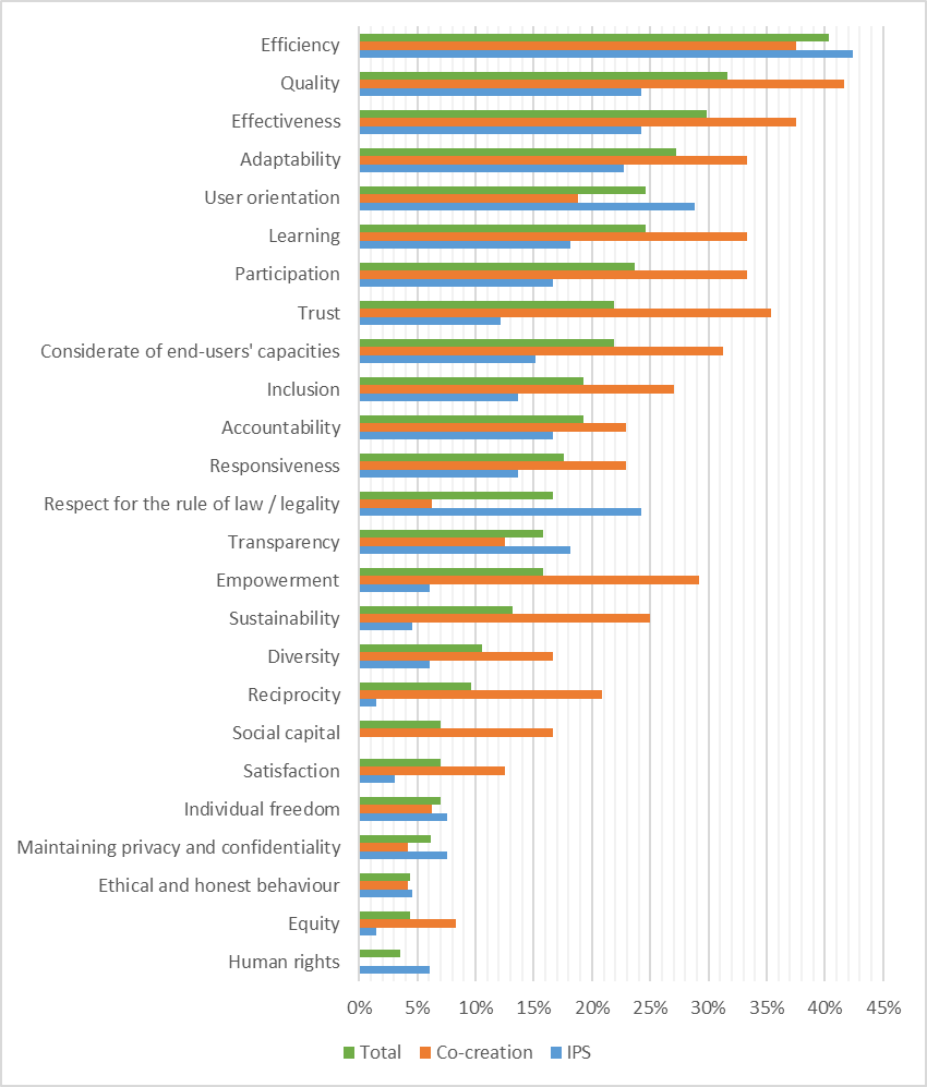

Figure 3-3 Percentage of relative frequency of Public values and principles per group

The following guidelines could not be linked to the set of public values and principles: 'Anticipate and cope with Public Value(s) tensions', 'Organisational values' and 'Risk management'. This could be the result of the number of public values and principles the taxonomy started form. For example, Nabatchi [40], Moore [41] list risk-readiness as a public value. This public value could be linked to the guideline of Risk management, as well as to the guideline of Anticipate and cope with public value(s) tensions, both guidelines of co-creation.

3.3.4 Guidelines in IPS

Figures 3-4 to 3-8 show the guidelines per theme, accompanying tables 3-2 to 3-11 that describe the guidelines.

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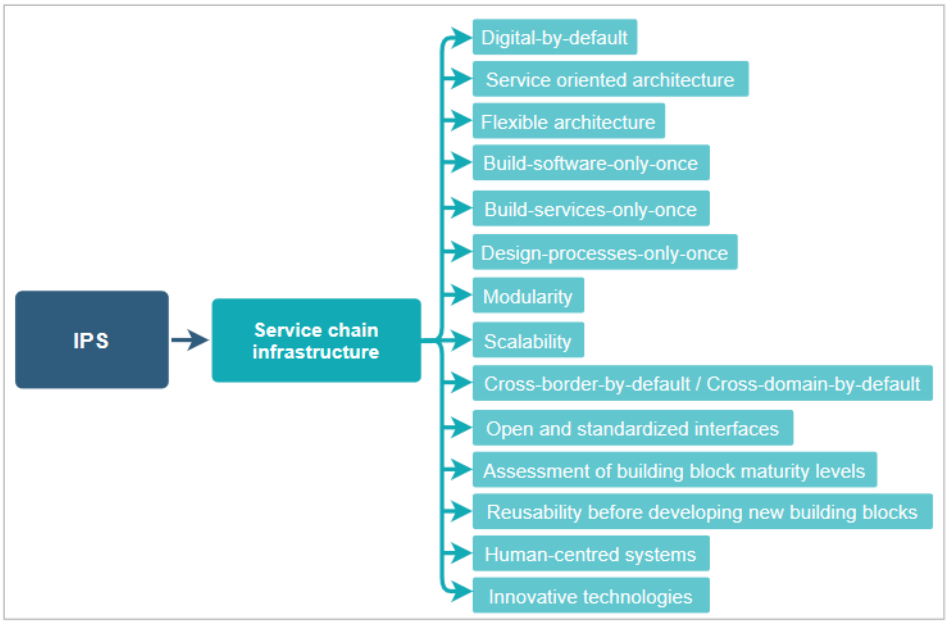

Figure 3-4 Themes and guidelines in IPS

Table 3-2 Guidelines with respect to the Service chain infrastructure

1. Digital-by-default. This guideline refers to the preferred option for developing and delivering service through digital technologies. Related guidelines include building blocks such as a single of point of contact, a no-wrong-door policy (GL15), and multiple online and offline channels for the delivery of digital public services (GL 19).
2. Service-oriented architecture. An IPS co-creation that employs a service-oriented architecture can more easily reuse existing processes and services. This guideline can reduce development times. IPS co-creation are more efficiently developed, increase the quality and sustainability of the service, and provide more transparency about the public services that public administrations aim to deliver (through co-creation).
3. Flexible architecture. Related to a service-oriented architecture, allowing flexibility in an architecture for IPS co-creation can reduce the different organisational and technical capabilities between public administrations and co-creators. This way, adoption towards all service users can be gradual.
4. Build-software-only-once. Software that is developed only once can increase overall efficiency of service development and delivery, as well as the quality.
5. Build-services-only-once. Developing IPS from distinct public services and re-using these public services across IPS co-creation can increase efficiency and the quality of the services. It can also contribute to learning from other IPS co-creation efforts.
6. Design-processes-only-once. In the same line as Building-software-only-once and Building-services only once, processes can also be developed so they can be reused across multiple IPS co-creation services.

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7. Modularity. This guideline refers to building blocks of IPS (entire services, process steps, data) that can be reused in a modular service setup. This way, renewing or replacing some steps of IPS can be done more easily. It is linked to a Service-oriented architecture and a Flexible architecture.
8. Scalability. The technical capacity that an IPS co-creation has to offer can change between phases and over time. A barrier to IPS co-creation is the scalability from experiment to broad implementation (GL 95). A scalable service can reduce this barrier from a technical perspective and make a service more adaptable.
9. Cross-border by default / cross-domain by default. Digital technologies allow public service to be cross-border and cross-domain. This can lead to more user-oriented services, but also to services that can more efficiently be integrated while respecting legislation in various public sector domains and across countries.
10. Open and standardized interfaces. Through open and standardized interfaces (also linked to GL 37, 38), different user groups and a larger number of users can more easily access IPS co-creation, public services can be integrated more efficiently, and innovative channels for service delivery developed and added to an existing service.
11. Assessment of building block maturity levels. Assessing the maturity level of building blocks increase the effectiveness of examining whether a building block can be reused.
12. Reusability before developing new building blocks (Share/Reuse or explain). IPS co-creation should in the co-commissioning or co-design phase first assess whether certain building blocks of the envisioned public service are reusable.
13. Human-centred systems. This guideline calls for the creation of IPS that take into consideration the potential drawbacks and doubts about advancing digital technologies. This can be done through transparency with respect to technologies, but also the adoption of new legal frameworks. Eventually, the guideline aims to increase the trust service users have in public services.
14. Innovative technologies. In cohesion with the previous guidelines, innovative technologies can increase efficiency, effectiveness, and the quality of both the service delivery and the co-creation process.

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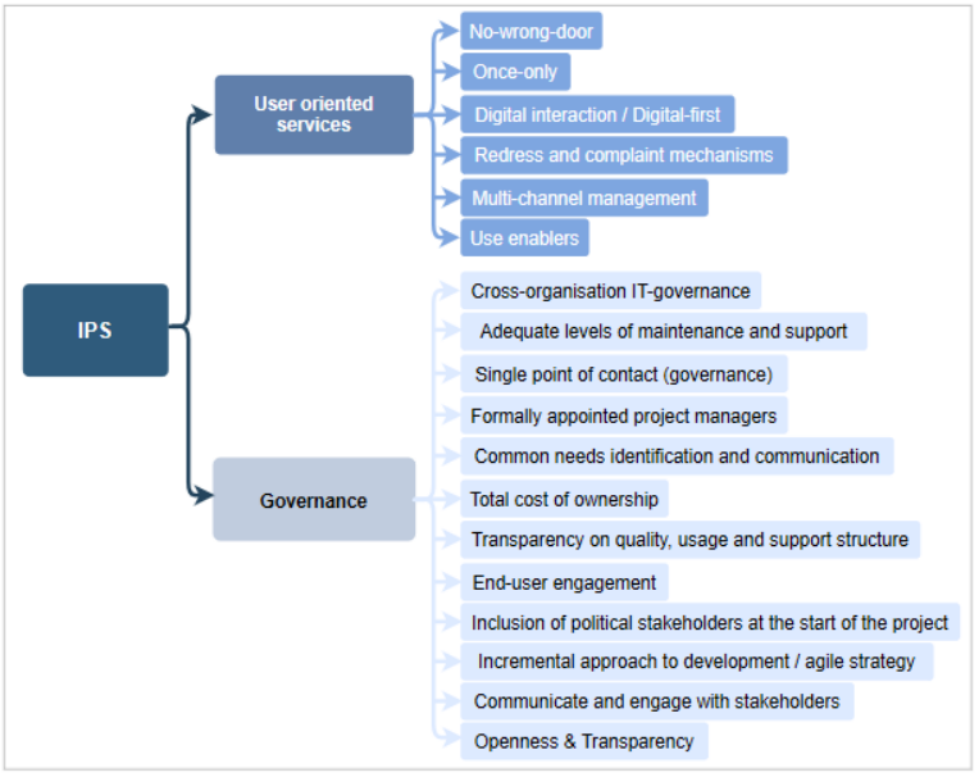

Figure 3-5 Themes and guidelines in IPS

Table 3-3 Guidelines with respect to User-oriented services

15. No-wrong-door. The no-wrong-door guideline (also see GL 1) proposes that public services can be accessed, irrespective of the entry point through which users interact with public administrations in general.
16. Once-only. This guideline states that information on users should be asked once-only and reused many times, taking into considering the protection of personal data and maintaining privacy and confidentiality. This reduces the burden on users, increases efficiency of data gathering and the quality of data that are used.
17. Digital interaction / Digital-first. This guideline proposes that digital interactions can make interactions with public administrations of in the context of service delivery or in the co-creation process (e.g. through easy to use digital platforms) more efficient. However, at the same time, user groups that do not have adequate capacities should be taken into account.
18. Redress and complaint mechanisms. These mechanisms can empower users to give feedback, or for example notifying public administrations about errors in the data they use. Such mechanisms should incorporate the different channels through which users might prefer.
19. Multi-channel management. This guideline can increase inclusion of various user groups with different preferences and skills to have access to IPS. Channels can be online and offline, but the service delivery across channels should be coordinated. Multiple channels increase the individual freedom of service users to interact with (certain) services when and how they want.

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20. Use enablers. There are several related guidelines that can more easily enable the use of an IPS. These include incentives for digital service use, enhancing digital literacy (see also GL69), giving attention to the usability and availability of a public service, but also its technical inclusiveness and accessibility (see also GL 61).

Table 3-4 Guidelines with respect to Governance

21. Cross-organization IT-governance. Breaking down silos in IT-governance can enhance efficiency and effectiveness of IT building blocks. For example, with respect to reuse (GL 41) or common procurement (GL 38).
22. Adequate levels of maintenance and support. To ensure the effectiveness of an IPS co-creation . Incorporating costs for maintenance and support at the beginning of a project can reduce the total life cycle costs.
23. Single point of contact. Where in GL 1, a single point of contact refers to a building of service delivery, in the Governance theme, it relates to providing one contact point for an entire IPS for co-creators in for example the design process, but also for users involved in co-delivery.
24. Formally appointed project managers. Formally appointed project managers that are specifically assigned to lead an initiative can make the coordination of IPS co-creation efforts more efficient and effective. Such project managers can be a strategy for Leadership (GL 84).
25. Common needs identification and communication. Identifying common needs across public administrations, as well as co-creators can lead to more equitable IPS co-creation solutions that incorporate a broad range of needs and that is adaptable to changing needs. A clear communication can enhance the needs of potential user groups. This relates to both those users that are already in the scope of the co-creation process and those user groups that might be targeted in a later phase.
26. Total cost of ownership. This guideline changes the perspective of accountability from a single public service within the IPS or from one particular involved public sector organisation to the entire IPS co-creation across its life cycle phases. A total cost of ownership perspective looks at all the costs across the service's life cycle, including design, development, acquisition, deployment, operation, change management and end-of-life management. Consequently, opportunities for a more efficient and effective management can be discovered (e.g. in the acquisition of IT across public services that are building blocks of the IPS co-creation).
27. Transparency on quality, usage, and support structure. Transparency with respect to quality, usage, governance, standards, and technical specifications can help more easily to assess the reusability of a public service to be used in the context of an IPS co-creation. Transparency can not only increase the quality of a new IPS co-creation . It can also help to examine whether earlier solutions are adopted by users, so knowledge on what user-oriented services are can be shared.
28. End-user engagement. Digital tools can empower users to contribute more easily, lower the barriers to participation and lead to a more user-oriented co-creation process and service delivery. It is related to GL 70, 74 in the co-creation group.
29. Inclusion of political stakeholders at the start of the project. Including public policy makers at the start of an IPS co-creation can resolve disagreements early-on and provide a sound foundation for IPS co-creation projects. This especially relevant for cross-domain, cross-border or intergovernmental projects and projects that require additional legislation.

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30. Incremental approach to development / agile strategy. Adopting an incremental approach facilitates adaptability to changes in the internal and external service context.
31. Communicate and engage with stakeholders. The participation of stakeholders across the service life cycle can increase adoption, the overall quality and a more user-oriented product.
32. Openness & transparency. Linked to GL 56, 57, Openness & transparency relates to (1) giving users the autonomy and tools to manage their personal data, (2) allowing the monitoring administrative processes that impacts users directly, and (3) open up service governance to include or take into account all relevant stakeholders.

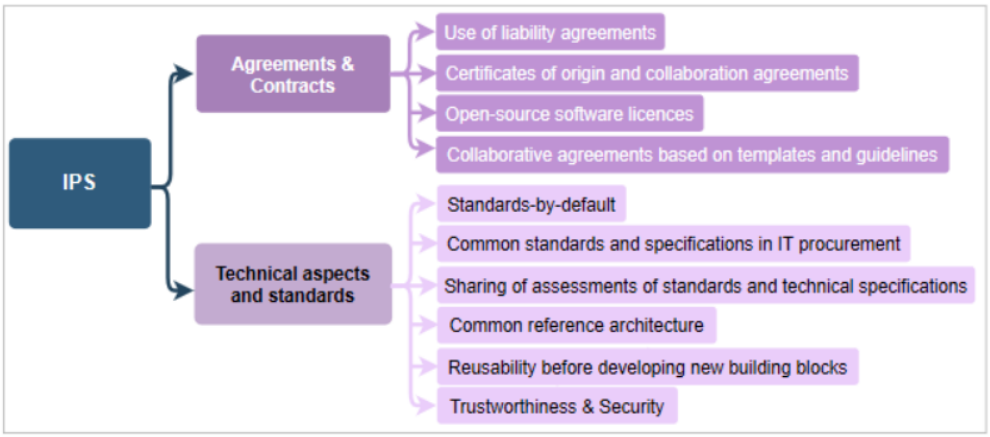

Figure 3-6 Themes and guidelines in IPS

Table 3-5 Guidelines with respect to Agreements & Contracts

33. Use of liability agreements. The use of liability agreements can aid respecting various intellectual property rights. Standardisation makes reuse easier.
34. Certificates of origin and collaboration agreements. Such documents give project mangers the means to reuse developed building blocks, while also respecting the ownership of the contributions of participants.
35. Open-source software licenses. These licenses can help legal interoperability and reuse easier.
36. Collaborative agreements based on templates and guidelines. Collaborative agreements can help to establish trust between partners. Because of the clarity of roles and responsibilities, partners know what is expected of them. Using templates and guidelines can enhance the quality of these agreements.

Table 3-6 Guidelines with respect to Technical aspects and standards

37. Standards-by-default. Examining whether standards can be used before developing new specifications can enhance technical and semantic interoperable and can make efforts to integrate public services into IPS more effective.
38. Common standards and specifications in IT procurement. A common public procurement holds the promise of significant cost savings. Not only with respect to IT procurement, but also the time and efforts that public administrations have to invest in procurement processes.

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39. Sharing assessments of standards and technical specifications. Through transparency regarding the assessments of standards and technical specifications, participants in IPS co-creation initiatives can more easily examine their suitability for reuse. (Also see GL 37, 38)
40. Common reference architecture. This guideline refers to an architecture for semantic interoperability, that increases the efficiency of data exchange and data integration.
41. Reusability before developing new building blocks. Linked to GL 41, this guideline looks at the technical assessment of reusability. A reusability check can increase accountability to public policy makers on choices and funds that were used, learn from existing building blocks, and make service development more adaptable and efficient.
42. Trustworthiness & Security. The technical specifications and standards that an IPS co-creation uses have to assure maintaining privacy and confidentiality of data within the legal framework. They should also be responsive to changing demands and requirements of users. Taking trustworthiness and security into consideration can facilitate adoption by users.

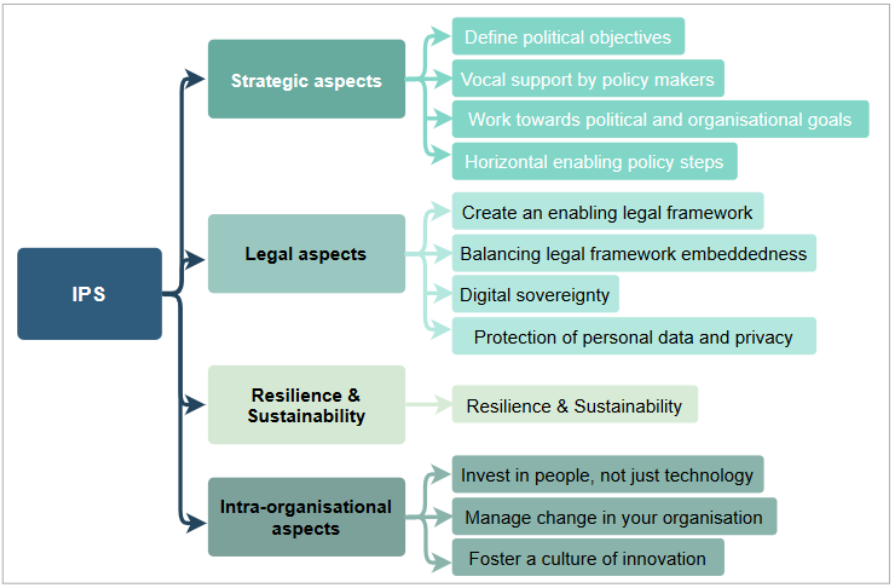

Figure 3-7 Themes and guidelines in IPS

Table 3-7 Guidelines with respect to Strategic aspects

43. Define political objectives. Concrete political objectives with respect to IPS co-creation initiatives or outcomes can increase the accountability of ongoing or new projects.
44. Vocal support by policy makers. Policy makers that make public their satisfaction with the goals, processes and outcome of IPS co-creation can increase new initiatives or create momentum for ongoing projects.
45. Work towards political and organisational goals. To fully capture the potential of IPS co-creation, objectives should be aligned to political and organisational goals.
46. Horizontal enabling policy steps. Public policy that takes a horizontal approach in public administrations with respect to IPS co-creation can increase learning from older or ongoing initiatives through the sharing of best practices, and consequently increase its quality. Subsequently,

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policy can be more responsive to for example the opportunities for reuse or the use of novel technologies.

Table 3-8 Guidelines with respect to Legal aspects

47. Create an enabling legal framework. Linked to GL 55 and GL 110, 111 for co-creation, IPS should be developed in a legal framework. At the same, it should be flexible so experimentations with and learning from the possibilities of new technologies is stimulated.
48. Balancing legal framework embeddedness. Assessing whether novel IPS co-creation initiatives can be delivered in the context of current legal frameworks in the co-assessment or co-design phases, as well as incorporating changes to legal frameworks that can enhance the efficiency of the development process.
49. Digital sovereignty. This guideline relates to the requirement that technologies and services are developed in a globalized economy. Yet, IPS should still comply with European legislation and European values.
50. Protection of personal data and privacy. Maintaining privacy and confidentiality, especially for public services that deal with highly-sensitive data, is a key guideline. It is ensured through a legal framework, but also at the level of direct interaction with an IPS. Following this guideline can enhance the trust of users.

Table 3-9 Guidelines with respect to Reusability and sustainability

51. Resilience and sustainability. IPS co-creation should consider the sustainability of its technological choices and look at strengthening the resilience of key service ecosystems.

Table 3-10 Guidelines with respect to Intra-organisational aspects

52. Invest in people, not just technology. To enable the provision of IPS , public servants have to learn how these services work, and what their governance requirements are. Public administration should take the current set of technical skills of public servants into consideration and provide opportunities to learn new skills and co-creation approaches.
53. Manage change in your organisation. Organisational structures should be adaptable to changes required from IPS co-creation, in order to increase effectiveness of IPS co-creation services.
54. Foster a culture of innovation. Enacting IPS co-creation requires organisations to take on a new organizational culture that puts openness to learning new possibilities of embracing the potential of new technologies and collaboration approaches.

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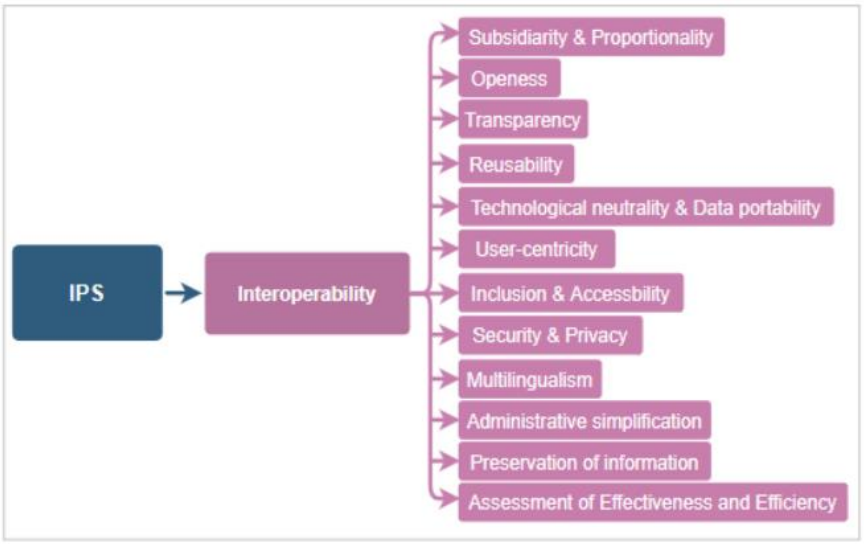

Figure 3-8 Themes and guidelines in IPS

Table 3-11 Guidelines with respect to Interoperability

55. Subsidiarity & Proportionality. Actions with respect to IPS co-creation must be addressed as closely as possible to the users, and in alignment with the proportionality principle. Through interoperability frameworks and strategies, IPS co-creation initiatives can be aligned to support Europe's Digital Future.
56. Openness. Data, standards, and software should be as open and reusable as possible across IPS co-creation initiatives, thereby respecting existing legal frameworks. This can contribute to adaptability, user orientation, the quality of IPS, and the lowering of the barriers to user participation.
57. Transparency. Enabling visibility of internal processes, data, and interfaces that play a role when co-creating IPS while securing the protection of personal data. Transparency of internal administrative processes can favour co-creation with IPS stakeholders and users.
58. Reusability. IT solutions that favour IPS co-creation should be easily reusable across different IPS initiatives, so that new IPS can be developed more efficiently and integrated into existing service ecosystems.
59. Technological neutrality & Data portability. Technological neutrality implies that IPS co-creation processes should minimise technological dependencies, and that the IPS should be adaptable to new technologies. Data portability allows for data to be reused and moved across sectors, borders, and tools.
60. User-centricity. IPS co-creation should focus on developing public services considering user needs. The development of IPS should consider the multi-channel delivery of public services, the development of a single point of contact, the incorporation of user feedback, and collection of relevant information from the user only once.
61. Inclusion and accessibility. Users – regardless of personal characteristics – should be able to easily get access to IPS as well as to IPS co-creation initiatives.
62. Security and privacy. A common security and privacy framework, as well as procedures for secure and trustworthy data exchange across IPS co-creation initiatives, can help to achieve the maintenance of privacy and confidentiality, create trust, and ensure respect for human rights and individual freedoms.

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63. Multilingualism. In multilingual contexts or for cross-border IPS co-creation initiatives, multilingualism entails that users can access the IPS in their preferred language. Furthermore, multilingualism should be considered during each of the three stages of the co-creation process.
64. Administrative simplification. IPS co-creation initiatives should aim to reduce and simplify the administrative processes of IPS.
65. Preservation of information. The observance of this principle implies that information gathered during the creation and delivery of IPS can be preserved long-term in a technologically-neutral manner for appropriate use in the future; thereby respecting the privacy of the involved co-creators.
66. Assessment of Effectiveness and Efficiency. IPS co-creation efforts should aim to enhance the effectiveness and efficiency of public services.

3.3.5 Guidelines in co-creation

Following the CITADEL project [37], the basis of the thematization that is derived from the classification of Meijer [42], we distinguish between end-user, government and cultural domains. The co-creation guidelines are grouped into 7 themes: 1) End-user enablers, 2) End-user enablers in the co-creation process, 3) Co-creation process enablers, 4) Public organisation enablers in the co-creation process, 5) Public organisation enablers, 6) Contextual enablers (outside of a single co-creation process), and 7) Cultural enablers (see also figure 3-1 above). It is important to highlight that the difference between theme 1 (end-user enablers) and theme 2 (end-user enablers in the co-creation process) is that theme 1 is about end-user enablers that are not specific to an IPS co-creation process, while theme 2 has guidelines that can be taken into account during one or more phases of the IPS co-creation process. The total number of guidelines in the co-creation group is 48. Figures 3-9 to 3-12 show the number of guidelines per theme for the co-creation group. Tables 3-12 to 3-18 contain the description for the guidelines.

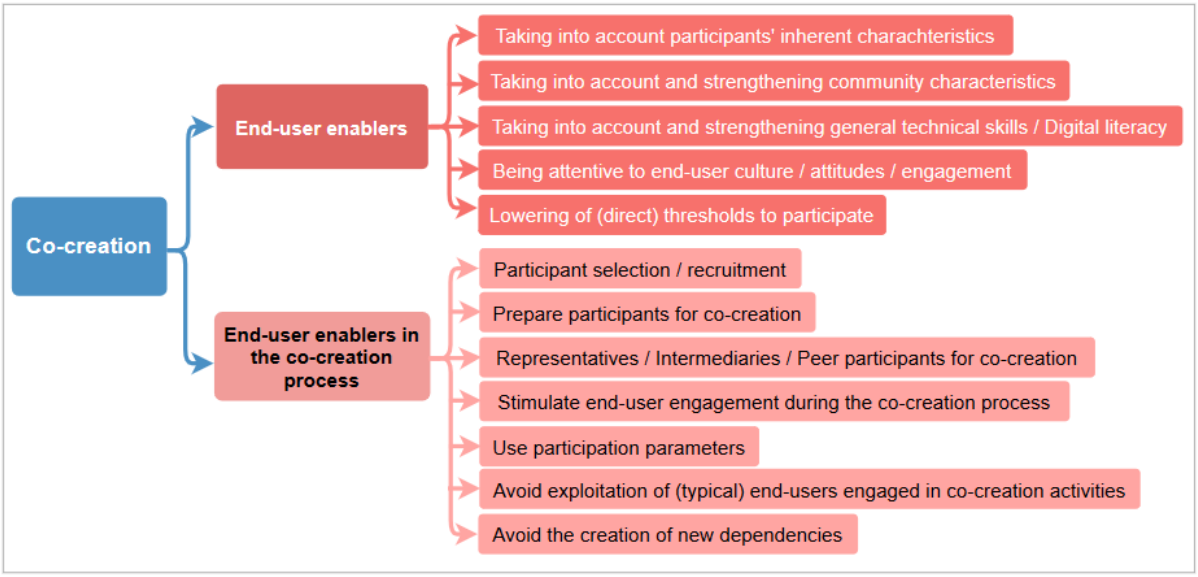

Figure 3-9 Themes and guidelines in co-creation

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Table 3-12 Guidelines with respect to End-user enablers

67. Taking into account participant's inherent characteristics. Co-creation processes can be initiated with various different users and user groups. Depending on the goal of IPS co-creation taking into account their skills (e.g. through an ICT-by-inclusion-design), capabilities, and personal characteristics can empower participants, create trust, stimulate participation and increase overall satisfaction of participants with the service delivery and the governance process.
68. Taking into account and strengthening community characteristics. IPS co-creation processes (or specific instruments) can have an effect on existing social dynamics, which might be a barrier. For certain user groups, community support can increase the trust to participate in an IPS co-creation process.
69. Taking into account and enhancing general technical skills / digital literacy. In general service delivery and specifically in the context of IPS co-creation that relies on (digital) co-creation instruments, not taking into account the technical skills and digital literacy of users and participants can inhibit adoption of the eventual service and exclude persons from the governance process. Training programs directed to specific user groups can alleviate this potential barrier.
70. Being attentive to end-user culture / attitudes / engagement. Participants in co-creation processes not only have to possess certain skills, but also attitudes and the level of engagement is important, for example with respect to the openness to learn new approaches and skills. Communicating the general benefits of IPS co-creation process might increase trust and lower barriers to participation.
71. Lowering of (direct) thresholds to participate. Thresholds include the time and costs related to participation and service use.

Table 3-13 Guidelines with respect to End-user enablers in the co-creation process

72. Participant selection / recruitment. Depending on the aim and scope of an IPS co-creation , different participants might need to be included at various phases of a service's life cycle. Participants' capacities can be considered in the co-design phase in order to represent the diversity in skills. Differing selection mechanisms exist and participants might have to be recruited through different channels.
73. Prepare participants for the co-creation. Participating in co-creation processes requires specific skills and capabilities. This includes (i) providing them with relevant information and basis resources, and (ii) giving technical preparation.
74. Representatives / intermediaries / peers. Representatives of user groups, individual intermediaries or peers can substantially reduce barriers for participants or service users and increase trust. Intermediaries can for example provide translation.
75. Stimulate end-user engagement during the co-creation process. End-user engagement is not only key before a co-creation process, but also needs to be stimulated during the process. This is to avoid participants dropping out. A strategy to stimulate end-user engagement is giving co-creators a sense of ownership.
76. Use participation parameters. Participation can be measured through several parameters, e.g. extrinsic motivation, intrinsic motivation, satisfaction, trust, ability, and self-efficacy. This

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information can be used to change certain aspects of co-creation, such as the type of co-creation instruments that is used or give additional incentives to increase engagement of individuals or groups (GL 75).
77. Avoid exploitation of (typical) end-users engaged in co-production initiatives. Through (i) digital technologies that require less effort, (ii) better professional support, and/or (iii) peer support for volunteers.
78. Avoid the creation of new dependencies. Co-creation has the risk that new dependencies are created, for example when end-users come to rely on representatives / intermediaries / peers (GL 74), instead of learning how to use a public service. Therefore, both users and co-creators need to be trained or given adequate information on co-creation.

Figure 3-10 Themes and guidelines in co-creation

Table 3-14 Guidelines with respect to Co-creation process enablers

79. Financial capacity / resources. IPS co-creation initiatives can only be sustained through adequate financial capacity. Especially at initiation, having enough resources is key to establish an IPS co-creation initiative. A sound allocation of resources over the phases is also vital, as many costs are incurred in the development and delivery phases. Enough financial leeway is necessary to be responsive to unforeseen demands by users and participants.
80. Communication. Not only is communication in general important (GL 70), also during the co-creation process it is an instrument to provide accountability to users and stimulate participation.

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Through diverse, easy, and accessible means of communication, communication can be inclusive and responsive to the input of participants.
81. Technical capacity (and general technical training throughout the co-creation process). Similar to communication (GL 80), technical capacity needs to be stimulated before (GL 69) and maintained during co-creation processes. This includes (i) adequate project management to plan and consequently avoid (unforeseen) technical errors, (ii) regular training activities, and (iii) making use of easy to use and commonly known platforms and tools.
82. Use (and combine) appropriate strategies. Additive and substitutive forms of co-creation exist and have different effects on public sector / end-user resources. Substitutive forms decrease public sector resources and increase end-user resources (e.g. volunteer end-users that aid professionals). Additive forms (e.g. professionals support user / community activities) increase public resources and are more ambiguous with respect to end-user resources. Depending on the specific IPS co-creation , some (combination of) strategies are more efficiency and sustainable.
83. Mobilising and retaining user motivation for participation. Co-creation can be an intensive process and users have to be motivated to ensure participation. Strategies include the creation of a feeling of ownership, showing the value of user input and feedback, and provide a platform to collect feedback, reviews, and report feedback back to users.
84. Leadership. This guideline is vital for a successful IPS co-creation governance and can help to achieve many public values. One strategy consists of policy entrepreneurs that are dedicated to specific public services. Different leadership styles include deliberative leadership, interactive leadership, distributed and relational leadership, horizontal leadership, integrative leadership, and volunteer leadership.
85. Shared vision / goals / expectations. A shared vision is key to generating trust among partners and to have a sustainable IPS co-creation and governance process. Strategies can keep objectives simple, being attentive to diverging values and to focus on the long-term outcomes.
86. Process design. The (co-creation) process design of an IPS has to be specific to the initiative, incorporating the specific topic, context, demands, requirements, and user characteristics.
87. Shared rules and regulations. Agreeing on a number of rules can lead to the sharing of risks. Shared rules and regulations that are transparent to new participants can enhance trust and the quality of the service when scaling up initiatives.
88. Anticipate and cope with public value(s) tensions. Public values do not always align with each other. Decisions sometimes have to be made about prioritizing certain public values over others. An example of a values tension is the relation between inclusion and efficiency in the service delivery. Developing and coordinating multiple channels that various user groups employ create tensions with several strategies.
89. Anticipate and cope with possible conflict. In an IPS co-creation context, multiple stakeholders with varying goals and skills have to collaborate. This can sometimes lead to conflicts. Conflicts can be managed by Anticipation, which includes (i) clear and agreed upon objectives, (ii) constant stakeholder involvement, (iii) working on the legitimacy of the co-creation process, (iv) representing all groups that are affected by a decision in the process, and (v) learning from each other's experiences and perspectives. When conflicts surface in a co-creation process, they can be addressed through (i) creating a fair, equal and trusted environment to give room to disagreement, (ii) providing facilitation, (iii) using a flexible and adaptable co-creation process, (iv) empowering

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participants to make decisions and give ownership to their decisions, and (v) ensuring a transparent co-creation process to both the internal and external service context.
90. Interaction enablers. Several related guidelines might be used, focused on or encouraged to enhance interaction of participants in the co-creation process. Interaction enablers include affinity between participants (their relational proximity), power of certain participants over others as a mechanism to stimulate compromises, increasing the level of trust, providing accessible and clear information, encouraging the exchange of information, providing incentives for participation and being accountable to one another.
91. Use of ICT's in general. ICT's can facilitate co-creation processes and lower barriers to participation. To preserve inclusion and ensure a user orientation with respect to users or group that favour offline participation, ICT-based tool might have to be mixed with offline tools. To increase trust and transparency, the ICT-based tools themselves can be co-created. When using ICTs in co-creation processes, preserving privacy and security are an important theme.
92. Phases: General. An IPS co-creation service delivery and governance process covers multiple phases that are interdependent. Taking these into account, along with possible risks, costs and the timing can positively impact sustainability. Experience with co-creation and higher frequencies might increase trust and sustainability.
93. Phases: Co-commissioning. If identified early on, differences in service design (e.g. regarding user capacities) and delivery can be avoided or taken into account. This might lower costs and lead a more user-oriented service. One strategy is to involve the users of the IPS e as soon as possible.
94. Phases: Co-design of improved pathways to outcomes. Co-designing an IPS can lead to (inter alia) a more effective, inclusive responsive and user oriented public service. This includes experimentation, service personalisation and an ongoing review with respect to the design, so continuous improvements can be made.
95. Phases: Co-delivery. Public services that are provided by users (in their community) might be more user oriented and qualitative, delivered more efficiently and effective because delivery is more tailored to specific needs and stimulate social capital.
96. Phases: Co-assessment of public services. Co-assessments that enable users themselves to give feedback on can lead to public services that are more responsive to user needs and requirements, and eventually increase quality and effectiveness.
97. Risk management. Many risks exist in relation to co-creation processes, whether real or perceived, and can differ between stakeholder groups. Risk management can focus on personal outcomes (of participants), community outcomes, organisational outcomes, organisational processes, non-compliance with legal and regulatory constraints, and non-compliance with public governance guidelines.

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Figure 3-11 Themes and guidelines in co-creation

Table 3-15 Guidelines with respect to Public organisation enablers in the co-creation process

98. Change the roles of professionals. Professionals involved in co-creation processes are key to enable their success, but they have to adopt new roles that differ from traditional bureaucratic roles. This includes (i) providing continuous leadership aimed at the changing the organisational culture, (ii) empowering professionals to take particular needs in specific IPS co-creation contexts into account, and (iii) promoting regular opportunities for training.
99. Enhance the skills required from staff for co-creation. For example, through regular training opportunities that enhance: ▪ Segmenting skills: Segmenting user groups in order to better considerate users' capacities ▪ Communication skills: Diverse communication regarding different user roles ▪ Enabling skills: To be able to take on coordination roles such as facilitator or mediator
100. Supporting organisational policy towards co-creation. These include (top down) support, enhanced professional autonomy, adequate time, inter-organisational support structures and collaborative arrangements.

Table 3-16 Guidelines with respect to Public organisation enablers

101. Supportive institutional design. Institutional designs that foster inter-organisational and cross-sector collaboration and allow for a dialogue between public policy makers and stakeholders might be more supportive to co-creation initiatives.
102. Use incentives to stimulate co-creation. Positive incentives (e.g. clarity about service improvement) or negative incentives (e.g. scarcity) incentives can facilitate professional attitudes that are open to IPS co-creation.
103. Stimulate an organizational culture that is receptive towards co-creation. An organizational culture that is open to IPS co-creation approaches can be more open to learning new practices, increase quality, as well as increased efficiency and effectiveness. Such public administrations do

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not see IPS co-creation as a risk, but as an opportunity. They are also open to different views on what a qualitative service is, rather than only an administrative view. Through training programs, culture can become more receptive and a greater employee cohesion regarding shared values can bring about co-innovation.
104. Change organizational goals and legitimacy. These include a shift from throughput legitimacy to input and output legitimacy, as well as from short-term organizational goals to a long-term perspective.
105. Stimulate positive attitudes in public organisations with respect to co-creation. These are positive attitudes with respect to the involved stakeholders, referring to trust, commitment between partners, and satisfying relationships.
106. Adopt a pro-active leadership style of top management. A pro-active leadership style with respect to various enablers for co-creation, such as taking into account stakeholder perspectives and being vocal about IPS co-creation and approaches (e.g. GL 44), can create an organisational context that is stimulating for new IPS co-creation initiatives and that is open to learn.
107. Anticipate and incorporate the loss of jobs by professionals. IPS co-creation practices might lead to reduction of certain roles and responsibilities for professionals, for example regarding the direct provision of public services to end-users. Anticipating this job loss can facilitate a positive perspective on co-creation practices by professionals and ensure its sustainability.
108. Alleviate structural barriers at the organisational level. The traditional administration-focused organisation of public administrations can inhibit processes of IPS co-creation. This includes (1) the creation of organisational structures that are aligned to co-creation and open to participation (see also GL53), and (2) the re-organisation of business processes, for example to allow co-delivery.

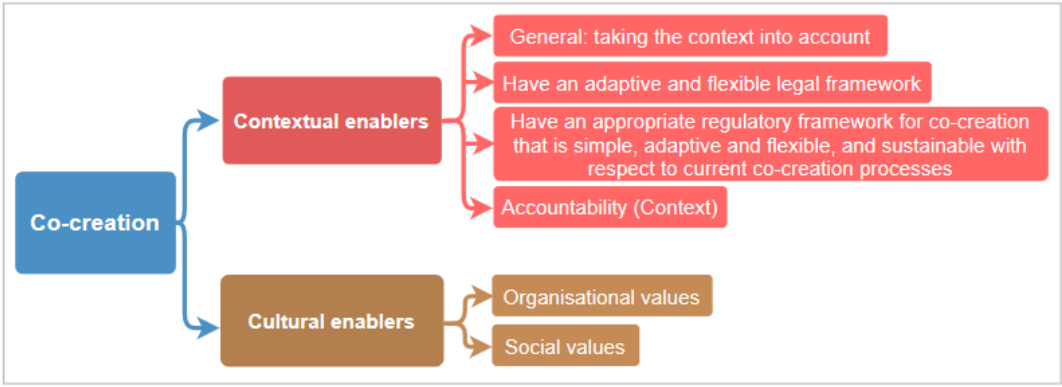

Figure 3-12 Guidelines with respect to Public organisation enablers

Table 3-17 Guidelines with respect to Contextual enablers

109. General: taking the context into account. There are many contextual factors related to IPS co-creation, e.g. the political, economic, cultural, social, technological, and environmental context. They can drive engagement, but also pose challenges for IPS co-creation.

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110. Have an adaptive and flexible legal framework. A framework that provides a broad legal basis for IPS co-creation processes with clear legal requirements that are still adaptable to specific IPS co-creation processes and changes in the context.
111. Have an appropriate regulatory framework for co-creation that is simple, adaptive and flexible, and sustainable with respect to current co-creation processes. Such an approach can help achieving public values such as adaptability, respect for the rule of law / legality, efficiency and effectiveness.
112. Accountability. Traditional accountability is vertical and linked concretely defined legal and administrative rules. IPS co-creation requires a more professional and horizontal accountability.

Table 3-18 Guidelines with respect to Cultural enablers

113. Organisational values. The success of IPS co-creation initiatives is supported by organisational values that are aligned to co-creation values and to the use of ICT's.
114. Social values. Culturally and politically embedded practices can impede using innovative co-creation practices. Co-creation practices should be attentive to those barriers and try to create social capital that is open to co-creation.

3.4 Analysis of EU eGovernment initiatives and policies

3.4.1 Methodology

As stated in the introduction of this chapter, the document analysis aims to answer the following research question: 'What kind of public values and principles and guidelines with respect to co-creation are present in the EU eGovernment initiatives and policies?' This question is broken down into three sub-question that are to be addressed throughout the chapter. Namely:

1. Are certain clusters of public values and principles more recurrent than others in EU eGovernment policies, hinting at decision-makers' preferences?
2. Are certain themes of co-creation guidelines more recurrent than others in EU eGovernment policies, hinting at decision-makers' preferences?
3. Do linkages and correlations exist between certain clusters and certain themes?

To reach this objective the methodology outlined below has been followed.

3.4.1.1 Elaboration of the dataset: EU eGovernment policies and legislation

The documents dataset builds upon the list of EU eGovernment policies presented previously (see section 3.3) to present an accurate overview of the EU's approach to eGovernment. It is composed of 11 currently legally-binding documents, including EU directives, regulations and decisions (e.g. Regulation 1316/2013 establishing the Connecting Europe Facility), 16 non-binding declarations and statements from EU institutions (e.g., Tallinn Declaration), and 9 working documents produced in the context of previous EU-funded experimental projects in the field of eGovernment innovation (e.g. EIF Implementation Strategy). For the full list of documents, refer to Table A.2 in Additional Material 3-1. The composition of the dataset reflects this study's objective to document the current consensus among European decision-makers pertaining to eGovernment. More precisely, this dataset is meant to provide a reliable overview of decision-makers' expectations, preferences and objectives when devising new ways of delivering online public services to European citizens.

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3.4.1.2 Analysis of the eGovernment policies

The above-mentioned primary data is examined using a directed qualitative content analysis method. As Hsieh and Shannon [43] explain, this method consists of coding a given set of data using a pre-existing codebook. This specific approach to content analysis is termed 'directed' because it leads one to direct – i.e. orient, or guide – one's analysis towards existing, stated considerations that the research aims at exploring. In our case, as it will be developed in the following sub-chapter, the analysis is directed towards identifying pre-defined co-creation public values, principles, and guidelines within the given dataset.

3.4.1.3 Elaboration of the codebook

As explained above, the analysis of primary data is directed towards identifying a specific set of predefined items within the studied dataset. These items are 24 co-creation public values and principles, and 48 co-creation guidelines. There are three clusters of values and principles (see Table 3-19) and seven themes of co-creation guidelines (see Table 3-20). These items – and the classification thereof – derived from the taxonomy elaborated in Section 3.3 relies on a thorough analysis of relevant academic literature and EU documentation.

Table 3-19 Clusters of public values and principles

Cluster	Description	Items covered
Cluster 1 (C1)	Relationship between governments and end-users/service users	Accountability; Learning; Being considerate of clients' capacities; Reciprocity; Responsiveness; Trust; Transparency; Individual freedom; Ethical and honest behaviour
Cluster 2 (C2)	Service delivery	Effectiveness; Efficiency; Quality; Satisfaction; Sustainability; Adaptability; User orientation
Cluster 3 (C3)	Democratic quality of services delivery	Respect for the rule of law/Legality; Empowerment; Inclusion; Social Capital; Participation; Equity; Diversity; Maintenance of privacy and confidentiality

Table 3-20 Themes of co-creation guidelines

Theme	Description	Items covered

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Theme 1 (T1)	Citizen enablers	Taking into account participants' inherent characteristics; Taking into account and strengthening community characteristics; Taking into account and enhancing general technical skills/digital literacy; Being attentive to citizen culture/attitudes/engagement; Lowering (direct) thresholds to participate
Theme 2 (T2)	Citizen enablers in the co-creation process	Participant selection/recruitment; Prepare participants for co-creation; Representatives/intermediaries/peers; Stimulate citizen engagement during the co-creation process, Use participation parameters; Avoid exploitation of (typical) citizens engaged in co-production initiatives; Avoid the creation of new dependencies
Theme 3 (T3)	Co-creation process enablers	Financial capacity/resources; Communication; Technical capacity (and general technical training throughout the co-creation process; Use (and combine) appropriate strategies; Mobilizing and retaining user motivation for participation; Leadership; Shared vision/goals/expectations; Process design; Shared rules and regulations; Anticipate and cope with public values tension; Anticipate and cope with possible conflict; Interaction enablers; Use of ICTs in general; Phases: General; Phases: Co-commissioning; Phases: Co-design and improved pathways to outcomes; Phases: Co-assessment of public services; Risk management; Supportive institutional design
Theme 4 (T4)	Public organisations enablers	Use incentives to stimulate co-creation; Stimulate an organizational culture that is receptive towards co-creation; Change organizational goals and legitimacy; Stimulate positive attitudes in public organizations towards co-creation; Adopt a proactive leadership style of top-management; Anticipate and incorporate the loss of

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		jobs by professionals; Alleviate structural barriers at the organizational level
Theme 5 (T5)	Public organisations enablers in the co-creation process	Change the roles of professionals; Enhance the skills required from staff for co-production; Supporting organizational policy towards co-creation
Theme 6 (T6)	Contextual enablers	Taking the context into account; Have an adaptive and flexible legal framework; Have an appropriate regulatory framework for co-creation that is simple adaptive and flexible, and sustainable towards current co-creation processes; Accountability
Theme 7 (T7)	Cultural enablers	Organizational values; Social values

3.4.1.4 Performing of the coding

First, two different researchers were asked to read all the documents carefully and to dissect their content. It was decided to rely on two different researchers to increase reliability. Based on their different scientific backgrounds and different sets of experiences[3], the researchers only validated findings they could both agree on. As a second step, they were asked to code the dataset according to the codebook, using two different, successive approaches:

- A search for identical, and explicitly related terms: the researchers looked whether the terms cited throughout the codebook were present in the analysed documents. Then, the researchers looked for synonyms and other closely derived terms. For instance, when researching whether the value of "efficiency" was present in a given document, the researchers did not only look for the word itself. They considered "efficiency" to be represented within the document if they could find any close term or synonym, e.g. "efficient", "cost-saving" or "cost-effectiveness".
- A search for implicitly related terms and sentences: as a second step, the researchers looked for words and paragraphs whose meaning could be interpreted as corresponding to one or more of the values, principles and guidelines present in the codebook. Continuing with the example of "efficiency", this value was considered present in a document whenever a sentence or paragraph thereof recommended to adopt measures, such as the take-up of a technical solution or the better use of existing resources, to reduce the cost and enhance the quality or of a certain service, even though the term itself was not explicitly mentioned.

Subsequently, the researchers compiled a spreadsheet keeping track of the number of occurrences of each item within each document analysed. Certain aspects of their approach throughout the execution of this analysis were adapted iteratively throughout the execution of this analysis. This means that their

[3] One researcher in Information systems, with a quantitative studies background, and one researcher in European Studies, with a qualitative studies background

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interpretation of the codebook evolved along the research process. As a consequence, several readings were necessary to ensure no item from the codebook was left unnoticed in the documents.

3.4.1.5 Present the findings

As was already touched upon above, to add more detail and focus to our answer to the initial research question ("What kind of public values and principles and guidelines with respect to co-creation are present in the EU eGovernment initiatives and policies?"), we address it by breaking it down into several sub-questions. These were inspired by the overarching objective of this deliverable – namely, the definition of a conceptual framework for integrated public services (IPS) co-creation. The sub-questions are the following:

4. Are certain clusters of public values and principles more recurrent than others in EU eGovernment policies, hinting at decision-makers' preferences?
5. Are certain themes of co-creation guidelines more recurrent than others in EU eGovernment policies, hinting at decision-makers' preferences?
6. Do linkages and correlations exist between certain clusters and certain themes?

Once the analysis was completed, these sub-questions were tackled in light of the findings. This was done devising tailored approaches to fit the scope of each sub-question:

- To address sub-question 1, we considered the total number of occurrences of items pertaining to public values and principles. Then, we grouped them per cluster. Finally, we calculated the percentage of each cluster in the occurrences of public values and principles to understand their distribution across the total number of occurrences of items. Subsequently, their respective shares of total occurrences were compared
- To address sub-question 2, we employed the same approach but for items pertaining to co-creation guidelines, in order to compare the distribution of themes across the total occurrences of co-creation guidelines.
- To address sub-question 3, we went back to each document and mapped the frequency that a public value or principle appeared on the same paragraph as a co-creation value or principle. We then analysed the context of each instance to understand if the items are correlated, or just coincidental. After compiling the actual correlations between items, we counted them and only retain those that appeared more than once.

3.4.2 Findings - Analysis and discussion

In this section, we present the findings derived from the directed content analysis of EU eGovernment initiatives and policies. First, we address each research sub-question presented above. Second, we discuss these findings, in light of the answer to the sub-questions and following the main research objective.

3.4.2.1 Clusters of public values and principles are evenly distributed among EU eGovernment policies

Our analysis sheds light on the hierarchy existing between the different clusters of public values and principles within the sampled initiatives and policies (see sections 1 and 3 of the methodology). In total, within the whole dataset, there were 708 occurrences in which public values and principles included in the taxonomy were identified. The clusters of public values and principles appear in the following decreasing order of frequency (see figure 3.13):

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1. C1 - relationship between governments and users (≃37% of total)
2. C3 - democratic quality of service delivery (≃36% of total)
3. C2 - service delivery (≃27% of total)

An interesting result was that all items from public values and principles could be found at least once in the overall dataset. In detail, the three most common items identified were, in decreasing order of frequency:

1. inclusion (C3; ≃9% of total),
2. efficiency (C2; ≃8% of total),
3. transparency (C1; ≃8% of total).

Conversely, the three least common items identified were, in decreasing order:

1. satisfaction (C2; ≃1% of total)
2. reciprocity (C1; < 1%)
3. social capital (C3; identified only once).

Interestingly, both the top three items and the bottom three ones represent each one of the three clusters.

Considering these results, we note that the two most common clusters of public values and principles ("C1 Relationship between governments and users" and "C3 Democratic quality of service delivery") are more oriented towards "foundational" considerations than towards those related to the way these principles encourage improved and more user-centric service provision. In this respect, EU policies seem to focus their efforts on the way in which eGovernment should impact power relations between the state and society, as well as within society itself. Indeed, how to deliver a service ("Service delivery C3"), which is more related to the practical aspect of policy making (e.g. costs, technical specifications) has an inferior percentage (27%) when compared to the 37% and 36% of "C1 Relationship between governments and users" and "C3 Democratic quality of service delivery" respectively. It must be stated, however, that these results cannot be overrated. Indeed, C3 and C1 both contain more items than C2. Therefore, their relative preponderance could also be the direct result of their size.

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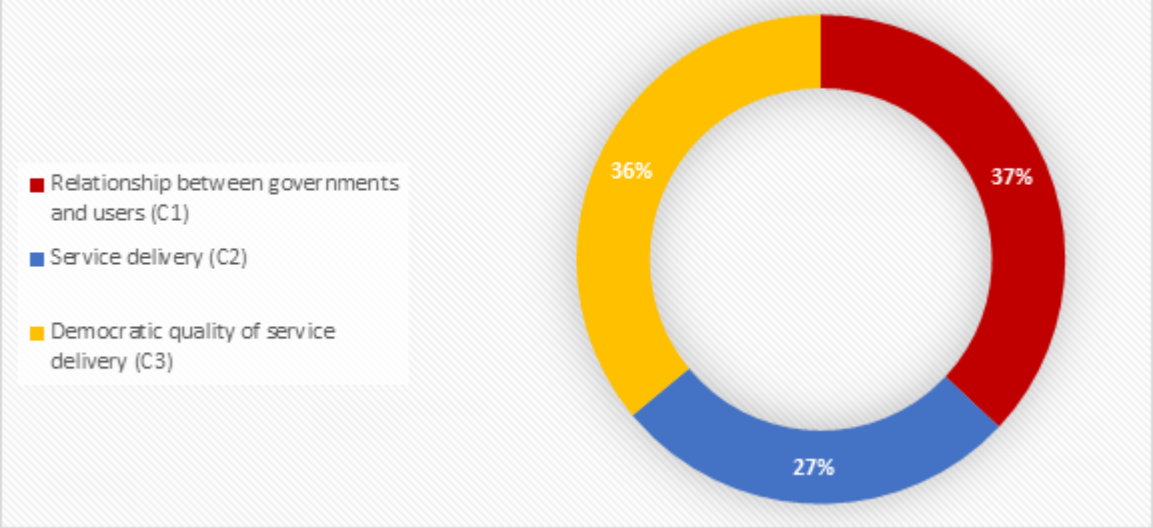

Figure 3-13 Occurrence of clusters of public values and principles in the analysed documentation

3.4.2.2 Certain themes of co-creation guidelines are more recurrent than others in EU eGovernment policies, suggesting the existence of priorities in policymaking

It appears that there is a significant gap separating the most recurrent themes (T3 in particular) from the others, which only appear sparsely throughout the analysed dataset. This might have implications for our general understanding of co-creation guidelines. In total, throughout the whole body of documents analysed, co-creation guidelines could be identified 340 times, with great variations in the way each theme is represented within the total of occurrences. In fact, themes occur in the following decreasing order of frequency:

1. T3 - co-creation process enablers (≃51% of total)
2. T6 - contextual enablers (≃17% of total)
3. T4 - public organisations enablers (≃12% of total)
4. T1 - citizen enablers (≃10% of total)
5. T2 - citizen enablers in the co-creation process (≃5% of total)
6. T5 - public organisations enablers in the co-creation process (≃5% of total)
7. T7 - cultural enablers (≃ identified only twice).

Throughout the dataset, a significant disparity was noted between the frequency of occurrence of the most recurrent themes, describing “hard factors” (i.e. material, technical capacities) as well as regulatory and contextual factors of co-creation, and that of the least recurrent ones, describing “soft factors” (i.e. culture, skills). It is important to highlight that there is also a disparity in the number of items per theme, which may at least partially account for the disparities in frequency of the themes themselves, even though not fully. In fact, the frequency of themes does not mirror their size by number of items (in decreasing order, T3, T5, T2, T1, T6, T4, T7).

A great disparity was also noted in the distribution of each single item within the themes identified. A significant number of them could not even be identified at all within the analysed dataset. The three most recurrent items were, in decreasing order:

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1. have an adaptive and flexible legal framework (T6; ≃12% of total)
2. shared rules and regulations (T3; ≃9% of total)
3. technical capacity (T3, ≃8% of total)

Conversely, the following guidelines are nowhere to be found in the whole dataset: 'taking into account and strengthening community characteristics' (T1), 'use participation parameters' (T2), 'avoid the creation of new dependencies' (T2), 'phases: general' (T3), 'phases: co-commissioning' (T3), 'anticipate and incorporate the loss of jobs by professionals' (T4), and 'organizational values' (T7).

Overall, we noted that the most common themes of co-creation are rather oriented towards influencing the co-creation process and the regulatory context in which it occurs, than towards influencing its actors (public institutions and users) directly. Indeed the "Co-creation process enablers (T3)" represents 51%, which is a higher percentage when compared to the 10% of the "Citizen enablers (T1)". In addition, the "Contextual enablers (T6)" has a higher percentage (17%) when compared to "Citizen enablers (T1)". This could tentatively be explained by rational factors. Considering the competences currently delegated to the EU, it is much more straightforward for EU policymakers to impact material and legal/regulatory conditions than to influence the attitudes and competences of public administrations, businesses, and citizens.

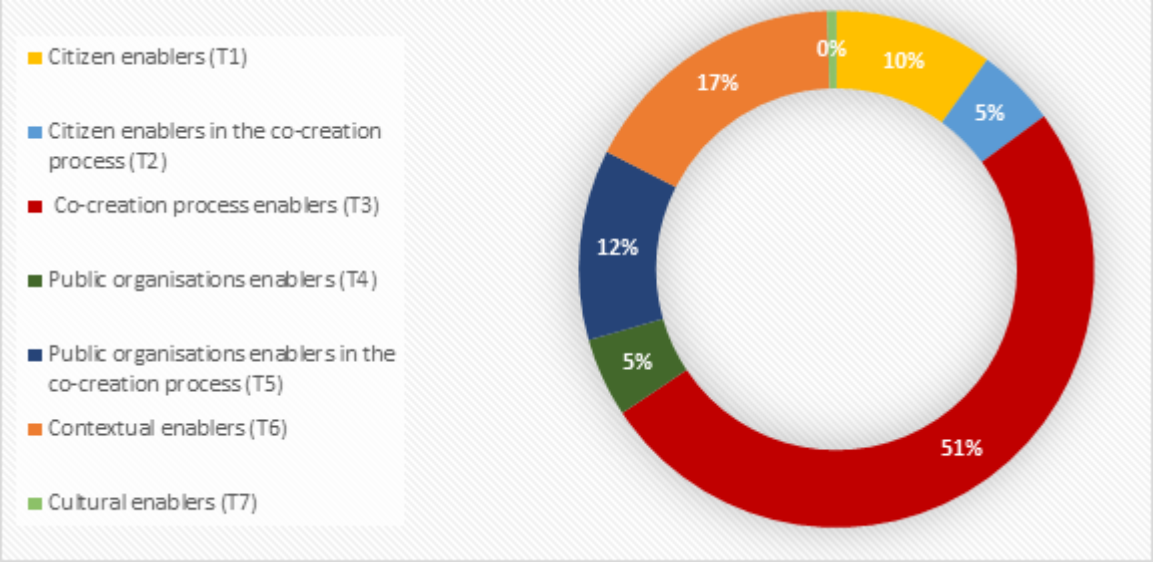

Figure 3-14 Occurrence of co-creation guideline themes in the analysed documentation

3.4.2.3 Consistent linkages and correlations can rarely be found between certain values and principles, and certain co-creation guidelines

Although we were not able to identify a great quantity of recurrent correlations between a given value or principle, and a co-creation guideline, we have isolated three instances of such persistent interlinkages:

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1. Interlinkage between the value of efficiency (C2), and the co-creation guideline to have 'shared rules and regulations' (T3). In three separate policy documents, these two items were given as co-dependent, with the implication that shared rules and regulations in the domain of eGovernment are expected to lead to gains in efficiency (see Additional Material 3-3).
2. Interlinkage between the value of sustainability (C2) and the co-creation guideline to 'alleviate structural barriers at the organizational level' (T4). In two separate policy documents, these two items were also given as correlated, denoting an assumed positive relationship between the simplification of organisational structures and their sustainability in the long run (see Additional Material 3-3).
3. Interlinkage between the value of transparency (C1) and the co-creation guideline describing the 'use of ICT in general' (T3). It was observed twice. Interestingly, the instances of linkage between these two items denote assumed positive relationships in both directions. It is indeed suggested that an increased transparency of eGovernment services stimulates the uptake of ICT, and, conversely, that an increased use of ICT leads to more transparency in the relationship between government and citizens (see Additional Material 3-3).

Considering these results, we note that consistent and recurrent interlinkages are rare throughout EU eGovernment policies. This may indicate a certain imperviousness between public values and principles, and co-creation guidelines. When these interlinkages exist, as Table 3-21 shows, they describe an assumed relationship, which fits our definition of guidelines as actions or activities that aim to achieve public values into practice (see Table 3-1, earlier). The direction of the relationship stays constant, from co-creation guideline to value or principles, for interlinkages 1 and 2. However, it is bi-directional between transparency and the use of ICT. This suggests that a greater transparency of eGovernment tools and services can stimulate a greater use of those. Conversely, it also suggests that a greater use of ICT in general fosters more transparency.

Table 3-21 Summary of findings

Number of occurrences	Public values and principles	Relationship	Co-creation guidelines
3	Efficiency	←	Shared rules and regulations
2	Sustainability	←	Alleviate structural barriers at the organizational level
2	Transparency	⇆	Use of ICT

3.4.2.4 Concluding remarks

In light of the different findings presented above, several considerations can be made. These considerations help to increase our understanding of co-creation public values, principles, and guidelines.

The results indicate a greater recurrence of "Relationship between governments and users" (C1) and "Democratic quality of service delivery" (C3) respectively 37% and 36% of the total. Therefore, the EU's approach to eGovernment suggests that IPS co-creation initiatives promote values and principles that pay particular attention to the respect of democracy, legality and individual rights of citizens and businesses. The 27% of "Service delivery" (C2) demonstrates that EU policies are less focused on how

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to deliver a service in practice (e.g. costs, technical specifications). This distribution of public values and principles identified in EU eGovernment policies reflects wider debates in society.

Considering the above, priority should be given to ethical considerations and power relations when designing eGovernment tools and services. The EU approach to these is defined by the respect for democracy and the rule-of-law, and on the preservation of the rights and freedoms of European citizens and businesses. Compliance with European values must be a priority. However, as was explained in the analysis, the relative preponderance of those values and principles cannot be overstated. Thus, it is important to pay close attention to promoting C2 values and principles as well. Indeed, upholding service delivery values and principles can foster a greater uptake and sustainability of new eGovernment applications. Cost and administrative burden must be contained while maintaining a high quality of service.

In a second stage, we noted a greater recurrence of "Co-creation process enablers" (T3), which represents 51% of the total, and "Contextual enablers" (T6), that represents 17% of the total. Thus, we understand that existing policies have focused on addressing the need to influence processes, structures, and the overall socio-economic context towards conditions favourable to co-creation. The proportion of "Citizen enablers" (T1) guidelines, roughly 10%, demonstrates less focus on how to influence stakeholders (public authorities, businesses, citizens) directly towards positive attitudes to co-creation and digitisation in general. Considering the existing repartition of competences between local authorities, regional public administrations, Member-States and the EU (multi-level governance), the focus of EU policymakers on the process and its regulatory context may be justified. Indeed, taking into account the role of the EU as a supranational rule-setter, it seems legitimate that EU policymakers focus on the aspects of eGovernment policy they have the most control upon.

Furthermore, the equilibrium of multi-level governance currently in place in the EU suggests that Member States and local authorities are the best equipped to deal with co-creation actors. Public administrations involved in co-creation on the field are recruited, trained, and bankrolled by local and/or national governments. It thus seems legitimate that questions relative to their engagement in co-creation, as well as their cultural and technical preparedness to do so, is best left to those levels of governance. The same goes with citizens. The media spheres and public spaces through which they could be engaged also follow local and national boundaries, rather than continental lines.

Considering the above could prove valuable for the conceptual framework. Indeed, the EU's focus on influencing the co-creation process and its regulatory framework highlights the complex equilibrium of its multilevel governance. Hence, in order for innovative co-creation initiatives to succeed, national and local policymakers must be engaged with. They must be seen as essential partners in translating EU broad objectives, and enabling regulations, into concrete realities that can impact the most important actors of co-creation on the field: civil servants and citizen.

In the last stage of our analysis, we suggested that interlinkages between public values and principles, and co-creation guidelines are rare (only three were observed out of more than a thousand of items identified). This leads to interesting conclusions. The linkages have described assumed relationships and in all three cases, they suggest that the implementation of guidelines influences the extent to which certain values and principles are complied with. We might explain that as follows:

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- Shared rules and regulations → Efficiency: a generalized, shared set of rules and regulations across the EU means simplified procedures, more predictability, and less adaptation costs. All of this could lead to a reduction of financial and technical burdens across the board, making the use and provision of public services more efficient.
- Use of ICT ⇆ Transparency: more transparency in the rollout and functioning of eGovernment services should lead to more trust in it, and in ICTs in general, boosting their uptake by the public. Conversely, the more the public uses ICTs, the more they are aware of their characteristics, advantages, and limitations. This allows a smoother transition to eGovernment services since citizens are more familiar with digital services.
- Alleviate structural barriers at the organizational level → Sustainability: This goes hand in hand with the explanation of the second interlinkage above.

The fact that so few interlinkages can be observed empirically may come as a result of the following limitations to the selected approach:

- EU policies do not attempt to explicitly link public values & principles/guidelines interlinkages in the same paragraphs, given that those interlinkages can be derived from "common sense".
- More interlinkages exist but they only appear once throughout our dataset. This does not mean that they are insignificant or uninteresting, but rather that they do not form a recurring pattern in EU policymakers' aspirations and preferences.

While the three empirically identified interlinkages provide a good working basis to take into account for the conceptual framework, further investigation is needed to understand whether other relationships could be drawn between more values and principles, and more co-creation guidelines. Doing so would provide interesting insights for the conceptual framework, given that knowing what these relationships are could allow certain "shortcuts". For instance, having identified interlinkage "b", we know that stakeholders must be stimulated to use ICTs to make sure potential IPS applications are transparent for them. Conversely, we know that designing transparent applications will encourage the uptake of ICTs among the public. Continuing this reflection could bring more of these conclusions and allow them to take a more central role in our overarching approach

3.5 Conclusions

The aim of this chapter was twofold: (1) To create a taxonomy of public values and principles with respect to co-creation and IPS based on the academic literature. The taxonomy consists of guidelines that aim to achieve public values and principles. (2) To examine key EU eGovernment initiatives and policies regarding the inclusion of co-creation public values, principles, and guidelines.

Based on the co-creation literature, a taxonomy was developed to organize the guidelines associated with public values and principles into (i) two groups and (ii) three clusters. The literature review yielded 114 guidelines from which 66 belong to IPS and 48 to co-creation. These guidelines were further grouped into respectively 10 and 7 themes. The main results of the taxonomy can be summarized as follows:

- There is a large variety of guidelines that address many different aspects of IPS co-creation.

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- The division of guidelines into two groups is not strict. Some guidelines in IPS that deal with governance aspects are also important in co-creation.
- Some public values and principles can be more easily linked to a certain group, but this is not clear-cut. This means that practitioners should focus on guidelines (or more general, elements) of both groups. Co-creation can help to enhance the achievement of public values and principles, which are currently not fully addressed in IPS (e.g. Equity, Reciprocity and Social capital).
- Public values and principles can be more easily attributed to a specific cluster of public values, but repeatedly also play a role in different clusters.

The document analysis of the List of EU eGovernment initiatives and policies shows that there is a prevalence of some clusters of public values and principles, and of some themes of co-creation guidelines. It also indicates that certain correlations exist between them. The results of this analysis can be summarised as follows:

- Public values and principles belonging to the clusters of "Relationship between governments and users" and "Democratic quality of service delivery" appear more frequently than those belonging to the cluster of "service delivery".
- This reveals a particular attention from EU policymakers to the way in which eGovernment should impact power relations between the state and society, as well as between actors within society itself in those initiatives and policies. In comparison, considerations on the way public services are provided, their quality and user centricity seem less salient.
- There is a great discrepancy between the different themes of co-creation guidelines. In particular, guidelines belonging to the theme of "Co-creation process enablers" account for more than half of all guidelines identified in the policies. In comparison, those belonging to the two themes relating to public organisations, and the two themes relating to citizens account for a smaller amount of the total. This possibly indicates a strong focus on "hard" co-creation features, related to the way co-creation is implemented through a series of phases and steps in the development of public services, while significantly less attention is apparently dedicated to cultural, organisational, capability and stakeholder engagement factors represented in the other themes.
- Few linkages exist between, on one hand, public values, and principles, and, on the other hand, co-creation guidelines. Where existing, they often indicate a positive relationship between the respect of guidelines and the promotion of values and principle.

These results underline the value of the inGOV project to add knowledge on co-creation in the development of IPS. The taxonomy that was developed in this chapter provides an input for the IPS co-creation conceptual model (Chapter 7) and the IPS Holistic Framework (to be developed in WP2). These initial results present to policymakers and co-creation actors a set of best practices and, through the themes, a set of vital areas of interest that should be taken into account when initiating and coordinating an IPS through co-creation within the phases of its life cycle. Furthermore, policymakers have to consider and cope with potential tensions between certain guidelines and between public values and principles. This should be taken into account in order to develop the public service, to ensure its adoption and finally to achieve the public values and principles that are fundamental to the goals of the integrated digital public service. Based on the input from the pilots and best practices, the

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taxonomy can be further developed, for example, to give direction for prioritization of public values and principles (across phases of the service process).

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Chapter 4. Emerging Technologies

Abbreviations and Acronyms

Acronym/Abbreviation	Description
BC	Blockchain
ET/ETs	Emerging Technology/technologies
App/Apps	Mobile app(s)
KG/KGs	Knowledge graph(s)
LOD	Linked open data
IoT	Internet of things
NLP	Natural language processing
NLU	Natural language understanding
NER	Named entity recognition
AI	Artificial Intelligence
ML	Machine Learning
FAQ	Frequently Asked Questions
API	Application programming interface
RWD - Responsive web design	RWD - Responsive web design
PWA/PWAs - Progressive Web App(s)	PWA/PWAs - Progressive Web App(s)

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4.1 Introduction

There are many contextual factors related to IPS co-creation including among other the technological context (Chapter 3 - Guideline 109). Specifically, for the development and delivery of services it is preferable to use digital technologies (Chapter 3 – Guideline 1). Among all the available technologies innovative/emerging technologies can increase efficiency, effectiveness, and the quality of both the service delivery and the co-creation process (Chapter 3 – Guideline 14). Additionally, the embracing of the potential of new technologies can foster a general culture on innovation (Chapter 3– Guideline 54). Towards this direction, this chapter identifies and critically reviews emerging/innovative technologies with potential in IPS considering EU values and eGovernment principles, and thus contribute to increasing our understanding of the Technology element of IPS-Co.

This chapter is organized into several distinct sections. The first part, Section 4.2., explains the methodology used and describes the process followed during the literature review and the analysis of EU-funded projects. Findings from this section pave the road for Section 4.3. starting with an introduction to the process of identification of emerging technologies. Following that section, a description of identified emerging technologies is given, with each technology described in more detail. Section 4.4. showcases use cases of emerging technologies at public administration with a detailed overview of different thematic areas and technologies used for each. Then, Section 4.5. contains the actual evaluation of emerging technologies. First, a method and reasoning behind the adaptation of the evaluation framework are given. Then, the framework itself is described in more detail as well as the evaluation process. For practical reasons, detailed evaluation reports of identified technologies are given in Additional Material 4-2, Additional Material 4-3, Additional Material 4-4, Additional Material 4-5, Additional Material 4-6), while top-level pointers are added as parts of Section 4.4. Finally, Section 4.6. combines all the effort done in previous sections and showcases recommendations for using emerging technologies in public administration. Each of the identified technologies is separately analysed, with a special note on the IoT also provided.

4.2 Methodology

Emerging technologies are technologies whose development, practical applications, or both are still largely unrealized [77]. These technologies, depending on context, may be new or not so new but whose application leads to qualitatively different results for the stakeholders concerned. In this study we consider emerging technologies as technologies that: i) either have appeared in the recent years and are in the edge of research efforts at the IPS co-creation domain or ii) more established technologies whose applications, however, lead to new/innovative results at the IPS-Co domain.

As such, emerging technologies are in the focus of the scientific and research community that puts effort (e.g. through projects) and produces artifacts (e.g. papers) in order to explore and understand their potential. The focus of the inGOV project is on the public services, so the goal is to identify emerging technologies relevant to (integrated) public services. Based on these facts we followed two parallel paths to identify emerging technologies relevant to public services:

- Identify emerging technologies through a literature review of relevant papers.
- Identify emerging technologies by analysing current, relevant EU funded projects.

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4.2.1 Literature review

The literature review is based on the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) methodology [1]. PRISMA facilitates the transparent and complete reporting of systematic reviews and has been updated (to PRISMA 2020) to reflect recent advances in systematic review methodology and terminology. It offers guidance to report why the review was done, what the authors did, and what they found. Specifically, PRISMA offers a checklist and a flow diagram template to help authors improve the reporting of systematic reviews and meta-analyses. The two main steps proposed by PRISMA are the "Identification" and "Screening".

Step 1: Identification or relevant papers

We identified the relevant papers by searching in Scopus[1] for papers including the terms "public services" AND "technology". We used Scopus since it indexes only high-quality papers, thus assuring the quality of our literature review too. The search terms used (i.e. "public services" AND "technology") are very generic in order not to introduce bias to the search. This initial search (using only the search terms) identified 3489 papers. Then we applied the following inclusion criteria:

- Search for recent papers i.e. after 2017. We searched only for recent papers in order to identify the recent "hot" emerging technologies.
- Search only for journal papers written in English.

After applying the inclusion criteria 442 papers are left. The search query (with the inclusion criteria) used is the following:

```
TITLE-ABS-KEY ( "public service" AND "technology" ) AND PUBYEAR > 2017 AND ( LIMIT-TO ( DOCTYPE , "ar" ) ) AND ( LIMIT-TO ( LANGUAGE , "English" ) )
```

Step 2: Screening

We then screened the papers by reading their abstract. Through the screening we excluded:

- Papers that are not focusing on public services (e.g. make use of emerging technologies at the industry)
- Papers that are using "trivial" technologies (e.g. SMS, web pages)
- Irrelevant papers (e.g. not relevant to public services and not using technologies).

This resulted in 99 papers. Finally, we continued reading the complete papers and excluded 7 literature review papers that also study emerging technologies under diverse scopes (The 7 literature review papers will be studied at a second phase). The screening resulted in the final set of 92 papers. The following diagram (Figure 4-1) presents the PRISMA-based flowchart of the literature retrieval process. This covers the steps 1 and 2 of our methodology.

[1] https://www.scopus.com/

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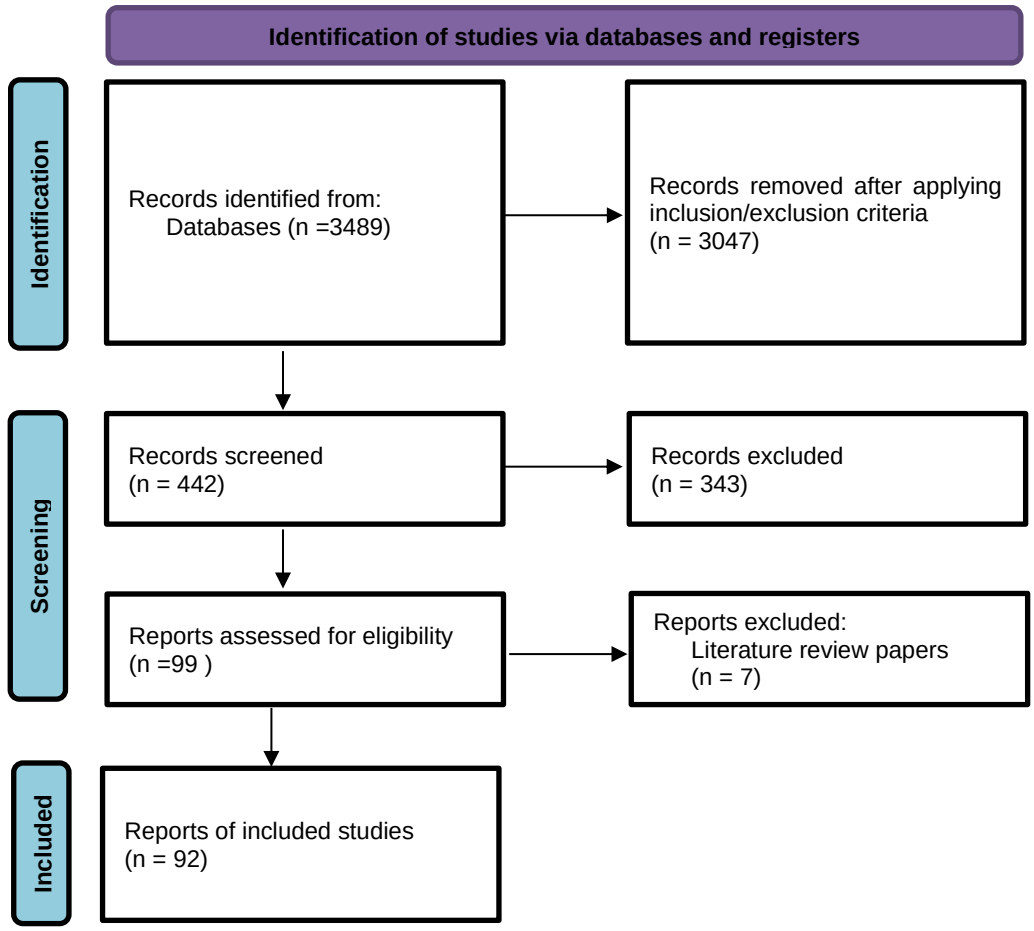

Figure 4-1 The PRISMA-based flowchart of the literature retrieval process

Step 3: Categorization

The remaining 92 papers were analysed and categorized in order to retrieve the following information:

- Which technology was used in the paper.
- Which thematic area the paper focuses on. We used the thematic areas (Government broad objective) proposed by the Classification of the functions of government (COFOG)[2].
- Which is the specific public service that makes use of the identified technology.

COFOG is a standard published by the United Nations Statistical Division proposed to classify the purposes of government activities. It comprises of two levels: i) Government broad objectives and ii) sub-items (groups and classes) that define the means by which these broad objectives are achieved. For the paper's categorization to thematic areas we use the "Government broad objective". COFOG is presented in Table 4-1.

[2]https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Classification_of_the_functions_of_government_(COFOG)

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Table 4-1The COFOG classification of government activities

Government broad objective	Sub-items
General public services	Executive and legislative organs, financial and fiscal affairs, external affairs; foreign economic aid; general services; basic research; R&D related to general public services; general public services n.e.c.; public debt transactions, transfers of a general character between different levels of government.
Defence	Military defence; civil defence; foreign military aid, R&D related to defence; defence n.e.c.
Public order and safety	Police services; fire-protection services; law courts; prisons; R&D related to public order and safety; public order and safety n.e.c.
Economic affairs	General economic, commercial, and labour affairs; agriculture, forestry; fishing and hunting; fuel and energy; mining, manufacturing, and construction; transport; communication; other industries, R&D related to economic affairs; economic affairs n.e.c.
Environmental protection	Waste management; water waste management; pollution abatement; protection of biodiversity and landscape; R&D related to environmental protection.
Housing and community amenities	Housing development; community development; water supply; street lighting; R&D related to housing and community amenities; housing and community amenities n.e.c.
Health	Medical products, appliances, and equipment; outpatient services; hospital services; public health services; R&D related to health; health n.e.c.
Recreation, culture, and religion	Recreational and sporting services; cultural services; broadcasting and publishing services; religious and other community services, R&D related to recreation, culture, and religion; recreation; culture and religion n.e.c.
Education	Pre-primary, primary, secondary, and tertiary education, post-secondary non-tertiary education, education non definable by level, subsidiary services to education, R&D; n.e.c.
Social protection	Sickness and disability; old age; survivors; family and children; unemployment; housing; R&D; social protection and social exclusion n.e.c.

4.2.2 EU funded projects

In this study, research projects that were funded through calls of the last period, i.e.2018-2020, of the Horizon 2020 framework programme that are related to the use of ICTs in the public sector, are considered. This type of calls was included in Societal Challenge 6 (SC6) "Europe in a changing world - inclusive, innovative and reflective societies". Two out of the three SC6's calls are related to the public sector, namely "Socioeconomic and cultural transformations in the context of the fourth industrial revolution" and "Governance for the future". Three topics, which released eight (8) calls for proposal between 2018 and 2020, describe the use of ICTs in the public sector:

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- DT-TRANSFORMATIONS-02-2018-2019-2020[3]: Transformative impact of disruptive technologies in public services. This topic focuses on public administrations' and policy makers'"use of disruptive technologies (such as artificial intelligence and big data analytics, block chain, Internet of Things, virtual and augmented reality, simulations or gamification)";
- DT-GOVERNANCE-05-2018-2019-2020[4]: New forms of delivering public goods and inclusive public services. This topic refers to "the transformative impact of new technologies" in the public sector;
- DT-GOVERNANCE-12-2019-2020[5]: Pilot on using the European cloud infrastructure for public administrations. This topic refers to public administrations' use of" open and big data, in particular as facilitated by high-performance computing (HPC) capabilities offered by the European Cloud Initiative"

The search resulted in 20 projects namely GLASS, inGOV, ACROSS, DE4A, INTERLINK, mGov4EU, WAI-Guide, AI4PublicPolicy, DECIDO, DUET, IntelComp, PolicyCLOUD, QualiChain, URBANAGE, ETAPAS, IMPULSE, URBANITE, HECAT, TOKEN, CO3. More details about the identified projects can be found in the Additional Material 4-1 - EU funded projects used by the review.

4.3 Emerging Technologies

This section presents (section 4.3.1) and describes (section 4.3.2) the emerging technologies identified at the literature review.

4.3.1 Identification of prominent Emerging Technologies

The 92 papers that are included at the literature review were: i) analysed to identify the technology they use and ii) categorized based on the thematic field the paper focuses on using COFOG. Table 4-2 presents the popularity of emerging technologies gleaned from the identified papers.

[3] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/dt-transformations-02-2018-2019-2020

[4] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/dt-governance-05-2018-2019-2020

[5] https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/opportunities/topic-details/dt-governance-12-2019-2020

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Table 4-2 Popularity of technologies

Technology		Number of papers
AI	AI generic	4
	Deep Learning	3
	Image recognition	5
	Machine Learning	8
	Natural Language Processing (NLP)	3
	Recommender systems	1
	Speech Recognition	3
	Virtual Assistants	2
	AI Total	29
Big data		4
Blockchain		13
Cloud computing		2
Drone		2
Gamification		1
Internet of Things (IoT)		21
Knowledge Graphs		1
Mobile apps		11
Robotics		2
Virtual & Augmented Reality (VAR)		4
Wireless technology	NFC	1
	Wireless technology	1
	Wireless technology Total	2
Total		92

It can be seen that AI with its subcategories (e.g. Machine Learning, image recognition) appears to be the most popular among the emerging technologies. Other very popular technologies for public services include Blockchain, IoT and Mobile apps. Table 4-3 presents the thematic areas (i.e. Government broad objective) based on COFOG that make use of the emerging technologies identified from the 92 papers reviewed.

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Table 4-3 Thematic Areas that make use of emerging technologies

Thematic Area	Number of papers
Economic affairs	12
Education	7
Environmental protection	8
General public services	42
Health	4
Housing & community amenities	1
Public order & safety	10
Recreation culture & religion	5
Social protection	3
Total	92

The thematic area that is the most popular is the "General public services". Other popular areas include the Economic Affairs, Education, Environment Protection, and Public Order & Safety. Table 4-5 presents more detailed information on the use of emerging technologies by thematic area. More specifically:

- Within the Economic Affairs category the most popular technology is blockchain.
- Within the Education category, the most the popular technology is the VAR (Virtual & Augmented Reality).
- Within the Environmental Protection category, the most popular technologies are AI and IoT.
- Within the General Public Services category, the most popular technologies are AI, blockchain, IoT and Mobile apps.
- Within the Health category the most popular technology is AI.
- Within the Public Order & Safety category, the most popular technologies are AI and IoT.
- Within the Recreation, Culture & Religion category, the most popular technologies are AI and IoT.
- Within the Social Protection category, the most popular technology is AI

Finally, Table 4-4 presents the use of emerging technologies by running EU funded projects. The project search resulted in some technologies that were not identified by the literature review. These include the Digital Twins and HPC. The most popular technologies among the projects are AI with its sub-categories (deep learning, machine learning, NLP, Virtual assistants), big data, block chain and gamification.

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Table 4-4 Use of emerging technologies at EU funded projects

Technology	Number of projects	Projects
AI generic	3	URBANAGE, ETAPAS, IMPULSE
Deep Learning	1	AI4PublicPolicy
Machine Learning	4	DE4A, AI4PublicPolicy, QualiChain, DECIDO
NLP	4	AI4PublicPolicy, IntelComp, PolicyCLOUD, ETAPAS
Virtual Assistants	3	inGOV, AI4PublicPolicy, ETAPAS
Big data	4	DECIDO, PolicyCLOUD, ETAPAS, URBANITE
Blockchain	6	GLASS, DE4A, QualiChain, IMPULSE, TOKEN, CO3
Cloud computing	3	ACROSS, DUET, IntelComp
Digital Twins	2	DUET, URBANAGE
Gamification	4	QualiChain, URBANAGE, HECAT, CO3
High Performance Computing (HPC)	2	DUET, IntelComp
Knowledge Graphs	1	inGOV
Mobile apps	3	inGOV, ACROSS, mGov4EU
Robotics	1	ETAPAS
VAR	2	DUET, CO3

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Table 4-5 The use of emerging technologies per thematic area.

Technology		Economic affairs	Education	Environment protection	General PS	Health	Housing & community amenities	Public order safety	Recreation culture & religion	Social protection	Total
AI	AI generic				2	1		1			4
	Deep Learning				1			2			3
	Image recognition	1		2				1		1	5
	Machine Learning			2	4		1			1	8
	NLP				1	1		1			3
	Recommender sys.				1						1
	Speech Recognition				1				2		3
	Virtual Assistants		1						1		2
	AI Total	1	1	4	10	2	1	5	3	2	29
Big data		2			2						4
Blockchain		4			8	1					13
Cloud computing					2						2
Drone						1		1			2
Internet of Things IoT		3	1	3	9			3	2		21
Gamification			1								1
Knowledge Graphs				1							1
Mobile apps		1	1		9						11
Robotics					2						2
Virtual & Augmented Reality (VAR)			3							1	4
Wireless technology	NFC	1									1
	Wireless tec. generic							1			1
	Wireless Total	1						1			2

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Grand Total		12	7	8	42	4	1	10	5	3	92

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4.3.2 Description of Emerging Technologies

The following section will present and describe several emerging technologies identified previously through the extensive literature review. Although the literature review has recognized a wide range of emerging technologies, not all of them are described here. The general criteria for the following emerging technologies were their popularity and their perceived relevance within the inGOV project context – both on a pilot level, but also within the broader, pan-European context of inGOV contributions. Following that approach, we identified these technologies as relevant and with the highest potential:

- Blockchain
- Chatbots
- Mobile apps
- Internet of Things (IoT)
- Knowledge graphs and linked open data

Arguably, the IoT is not evaluated within the context of the 4 inGOV pilots; it still remains a viable emerging technology with a wide range of applications as it was demonstrated in the literature review [2], [3],[4], [5], [6], [7], [8], [9], [10], and [11]. It was given an overview and evaluated with the same rigor as other identified emerging technologies.

4.3.2.1 Blockchain

One of the most commonly mentioned emerging technologies within the context of its usage in governmental services is certainly blockchain. There is no single definition of blockchain, but in general, we can imagine it as a distributed ledger that is in its nature immutable. Other blockchain characteristics are outlined in [12]. Transactions recorded on the blockchain are append-only. They are written by a group of parties that can be either trusting or non-trusting within a network with single, central authority control. Typically, transactions are stored in sequential and chronological order. One of the more widespread use cases employing blockchain technology is the trading of various assets. Those assets can be tangible - in that case, transactions are related to assets like property, real estate, or even cash. On the other hand, assets can be intangible. Typical examples could include IP (including patent filings) or even branding, goodwill, and copyrights.

This versatility of blockchain technology makes it a good platform for trading and tracking almost anything with value (real or perceived). In its essence, the critical concept of blockchain technology centres around the viable combination of peer-to-peer infrastructure and cryptographic mechanisms. Earlier mentioned transactions are recorded in blockchain nodes. To ensure trustworthiness and immutability, every transaction needs to pass the validation process successfully. Its content is then validated through a consensus mechanism. A consensus mechanism is essentially a collectively agreed-upon protocol accepted as such by all nodes. The reliability attribute is achieved thanks to its cryptographic foundation while, at the same time, its distributed approach and peer-to-peer architecture ensure system reliability. Without the need for third parties, disintermediation is used to provide blockchain trust [13]. This distributed nature also lends itself greatly as a tool for avoiding a single point of failure and corruption. Blockchain architecture can be divided into two general types. The first is described as public vs. private, while the second one is permissioned vs. permissionless [14]. Public vs. private relates to the nature of the access to the blockchain. The public blockchain is open for all to participate, while the private asks for

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authorization before access and interactions are allowed. Permissionless vs. permissioned addresses the participation in a consensus mechanism. In a permissionless approach, anyone with access to the network can participate, while in permissioned, only a smaller number of restricted nodes will part-take in the consensus mechanism.

Blockchain use cases are numerous. Earlier, it was mentioned that it lends itself greatly to the storing and trading of anything of value. However, likely the most significant blockchain benefits within the inGOV project context are its application in government public services - from anti-corruption, voting, and elections to public procurement and, possibly, to any sectors dependent on the immutability of recorded transactions or contracts [15]. More detailed recommendations and evaluation of blockchain are provided later in this chapter.

4.3.2.2 Chatbots (virtual assistants)

Another popular emerging technology today, even with non-technical people, is chatbots, especially beneficial in governmental and public services, healthcare, customer service, and elsewhere [16]. Although commonly referred to as chatbot(s) - that phrase is a shorter version of its full name - chatterbot. Generally, a chatbot is an artificial intelligence program that simulates the characteristics of human conversation and is served to users in a digital format. Platforms vary, and the typical implementations are on the web and in mobile apps.

Thanks to the fact that chatbots are automated programs that can interact with users in a similar way to an actual human, they have the potential to provide a cost-effective and beneficial interaction platform for users. The general principle revolves around capturing user input, followed by an analysis of a user message/request (sometimes using the natural language processing capabilities), and based on the analysis, returns a response.

Chatbots provide conversational capabilities through textual and voice formats and can be supported in a multitude of different languages. With that in mind, practical research shows that textual implementations are more internationalized, and the number of supported languages is relatively high. However, the number of languages supported through voice input is considerably lower. By analysing the messages sent by the user, using natural language processing (NLP) and natural language understanding (NLU), the chatbot acquires information about the needs, wants, and possible solutions of the user inquiry.

That analysis entails a lot of 'under the hood' work such as intent recognition (what does the user want), entities catching and recognition (specific information like day of the week 'Saturday,' including named entity recognition - NER), user emotions, is content positive or negative (sentiment analysis) and other capabilities that NLU, NLP, and underlying AI enable.

Chatbots can be implemented via a set of guidelines or Machine Learning (ML) algorithms depending on user needs. Ones that operate on a defined set of guidelines are commonly called FAQ chatbots. They are simple, and the lack of underlying sophistication limits their features. They can answer specific predefined questions with predefined answers, but they cannot offer any human-like conversational traits. These latter traits can be accessed when implementing a chatbot with ML. Those chatbots come with an artificial neural network based on the (approximation of) the neural networks in our brains. Unlike chatbots powered by simple FAQ logic, these chatbots can self-improve by learning from every new dialogue and every new phrase it analyses using NLP and NLU [17]. Another great feature of this chatbot type is its

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constant response accuracy improvement through information propagation across the underlying neural network.

Some of the main fields of chatbot usage, aside from general customer service, are health services, public, and government services, employment, and transportation. The primary usage of chatbots is in customer service as it has the benefit of 24/7 automated service offered to customers and offloading work from workers. These chatbots are typically simple guideline chatbots that provide certain information to customers, and they often can forward requests to an actual human agent if they cannot resolve the request.

Conversely, chatbots with integrated ML can find broader usage in healthcare, recreation and culture, government and public services, education, fraud detection, and elsewhere [18], [19], [16]. During the COVID-19 pandemic, there have been many chatbots and virtual assistants that have helped users triage their symptoms, ascertain their levels of exposure, and gauge their risks for contracting COVID-19 illness [20]. While human supervision is still required, advances in this area are very promising.

4.3.2.3 Mobile apps

The need for presenting data and offering governmental services in a structured, accessible, and functional manner provides an excellent opportunity for mobile applications [21]. Mobile applications, also known as mobile apps for short, are software applications developed to run on mobile devices. Mobile devices include a range of devices such as smartphones, tablets, or smartwatches, and they exclude laptops and desktop computers.

The main benefit of mobile apps versus websites is accessing and taking advantage of mobile devices' unique capabilities. Those characteristics include increased mobility and portability, easier and more versatile connectivity and the access to low-level system functionalities that are otherwise inaccessible to regular websites. While today it is possible to gain access to a camera, microphone, or even Bluetooth (through experimental Web Bluetooth API[1]), some low-level APIs might only be available to native apps on mobile devices. From a technical perspective, there are three general types of mobile apps.

- Native apps

Are device-specific and downloaded onto the device. They have access to low-level system capabilities (camera, low-energy Bluetooth). They are hosted on app stores and need to be updated through these and distributed following app store provider's practices. Thanks to low-level access to device hardware, they can have high performances and execute complex and advanced tasks. They are specific for every operating system.

- Hybrid mobile apps

They are generally considered to be platform-agnostic, though some variants may exist given the different web wrappers. In essence, they are HTML-based apps accessed within the native surrounding of the mobile device while being presented through available web wrappers [60]. For example, on iOS devices, that is done through UIWebView/WKWebView[2].

[1] https://webbluetoothcg.github.io/web-bluetooth/

[2] https://developer.apple.com/documentation/webkit/wkwebview

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To accommodate different devices, they utilize responsive web design (RWD) principles to adjust to different screen sizes and form factors. While executed through a web wrapper, they have limited access to native device hardware features. However, with further developments of frameworks like React Native, Ionic, and others - it is possible to achieve cross-platform availability of apps and somewhat broader access to device features.

- Progressive Web Apps (PWAs)

PWAs combine the features of native and hybrid apps [22]. They do not need to be delivered through the app store – they are accessed like web pages but can be "pinned" and added on mobile devices just like native apps. They combine both offline and online modes of working. They do not have access to all low-level hardware and software capabilities, and their UX and UI can be somewhat limited if a need for more advanced features is present. PWAs can run on different mobile operating systems - they are typically cheaper to build in comparison with native apps. However, with the advance of more modern languages and frameworks like Flutter - it is now possible to deliver native apps across different operating systems from virtually the same codebase, thus making the development of those native apps more affordable.
Native mobile apps offer the highest performance and best user experience possibilities. They are developed using languages and frameworks for specific operating systems. For iOS devices, that is likely Swift or Objective-C. Java or Kotlin are used for Android applications. Lastly, Flutter can be used for both iOS and Android and essentially offers native experiences.

Also, native apps allow the broadest range of access to low-level system capabilities (through APIs). They can be downloaded to the user's device and accessed both in offline and online mode. Generally, they are platform-specific, and the costs to develop and maintain used to reach a hefty price. However, recent developments with the Flutter, as mentioned above (using Dart programming language), offer excellent ROI [23]. Mobile apps are used in almost all industries and verticals - from social media apps, healthcare, and productivity apps to gaming industry and VR/AR solutions. Their versatility and broad acceptance make them an excellent choice for public service delivery and interactions.

4.3.2.4 Internet of Things

Internet of things (IoT) is an emerging technology that is slowly but surely finding its way into our everyday use and is transforming the way we live. IoT represents a connection of physical objects over the internet, making a network of defined objects that communicate [24]. In practical terms, IoT is embodied in various forms - smartphones, sensors on smart devices, wearables, and software to communicate. IoT builds on top of that connection by creating automated processes that gather, analyse the data, and generate a response based on the analysis.

IoT has a wide range of applications, and typical use cases can benefit greatly from machine learning and artificial intelligence in general. IoT gathers vast amounts of data that a machine-learning algorithm can then use to make predictions based on the available data. The continuous inflow of new data can be used to train the machine-learning model further. IoT can also be beneficial for integration with chatbots and conversational AI using NLP, as seen in digital personal assistants like Siri, Alexa, and others. By enabling real-time data collection and analysis, IoT allows for a radical increase in responsiveness, reactivity, and potential problem avoidance. This is particularly useful in smart city contexts [25], [26] [66].

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Data is constantly being gathered from interconnected devices as it may be helpful to the user. This, however, comes with challenges. Privacy, security of the platforms, and safety of the data and users are central considerations when evaluating IoT and its potential and use cases. Being an emerging technology, IoT is a still young and developing technology and is missing reliable standards for its working framework. Compatibility is a critical component of the IoT platform, and until there is an extensively applied compatibility standard, we cannot see and realize IoT's full potential [27].

Likely, IoT is best known for its usage in smart cities, smart homes, and environmental projects worldwide. IoT enables system components to be more measurable and innovative, making services and data more user-friendly, actionable, and relevant. Consider the case of smart cities; we can look at the smart parking solution that provides users the information about available parking spaces around the city. Intelligent parking solutions like that reduce the amount of traffic around the city and reduce pollution by eliminating the need to drive around the streets looking for a spot and increase the user's well-being [26].

4.3.2.5 Knowledge graphs and linked open data

Implementing integrated public service (IPS) requires closing the gap between different governmental data silos by introducing standardization and interoperability of the data. This is where Knowledge Graphs (KG) come in as they can organize the data from a range of different sources [28]. Unlike typical tabular or tree-like data formats, knowledge graphs use graph-like structures. Data integration is accomplished by extracting meaningful information from a specific data structure and propagating its connection to other data throughout the rest of the knowledge graph. Integration is accomplished via ontologies which are the graphs schema that allows extraction of meaning of the data.

Knowledge graphs' ability to contextualize the data using semantic data and data linking to provide a structure allows for high analytical capabilities, sharing, integration, and interoperability of the data. Knowledge graphs' deeper insight into data structures helps understand the relationships between the data and allows for better decision-making, like policy-making. Knowledge graphs integrations are highly beneficial in many fields, and they accomplish it by combining data standardization, data interoperability, performance, and fluent data representation by using semantic standards [29].

Some complications come with knowledge graphs implementation, such as the lack of best practices, the integration of unstructured data, and the lack of a framework for evaluating the knowledge graphs. Mentioned integration of unstructured data is currently one of the more prominent obstacles and can introduce a high level of complexity in the knowledge graphs implementation.

A fascinating area is at the intersection of KGs and linked open data. KG's graph nature and utilization of its key elements (entities, their properties, relationships, and rules) lend itself very well in contexts where different data siloes need to be connected, and some valuable insights are to be derived from it. Later, the recommendation section will show how knowledge graphs can build upon CPSV and create valuable public services [30].
Knowledge graphs already have a broad adoption and usage on the Web. Maybe the most prominent example includes Google[3] and their reliance on KGs to build relationships between different entities and offer additional search results page elements ('information cards or panels'). Another relevant industry

[3] https://blog.google/products/search/introducing-knowledge-graph-things-not/

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example is Facebook[4]. Being a social network, describing relations between people and their social connections is a prime example of how knowledge graphs can be utilised and offer value beyond what is possible with regular, table-like database structures.

4.4 Use Cases of Emerging Technologies at Public Administration

This section presents the identified public services that make use of the emerging technologies. Out of the 92 papers, 50 present specific cases of using the emerging technologies. The remaining 42 papers discuss the technologies in a broader view or under specific perspectives (e.g. law, security) and do not focus on specific cases.

The following table presents the identified public services for each of the emerging technologies categorized by thematic area based on COFOG. For example, the first table presents the 3 identified public services that use the technology "AI generic". Each of these public services fall under a different thematic area namely "General public services", "Health" and "Public order & safety". The public service that uses "AI generic" in "Health" is the "Health insurance auditing" and is described in the paper [31]. Table 4-6 presents similar information for the other emerging technologies.

Table 4-6 Public services per emerging technology

Thematic Area	AI generic
General public services	• AI-based self-service machine
Health	• Health insurance auditing [31]
Public order & safety	• Policing [31]
Thematic Area	Deep learning
Public order & safety	• Facial Recognition for police Surveillance [33] [6] • Issuing fire safety certificates [34]
Thematic Area	Image recognition
Economic affairs	• Smart parking system [8][36]
Environmental protection	• Detection of unauthorized waste dump sites [35] • Improve urban traffic efficiency [36]
Public order & safety	• Facial recognition via police body-worn cameras [37]
Social protection	• Hand gesture recognition to communicate with people with disabilities
	Machine learning
Environmental protection	• Check land mowing • Carbon emission assessment of blocks
General public services	• Immigration process control • Personalising the digital service experience
Housing & community amenities	• Support city-level investment decision making
Social protection	• Detect day-care services that require further inspection • Optimising the employment services

[4] https://developers.facebook.com/docs/graph-api/

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	NLP
General public services	• Analyzing citizens' opinions about bureaucratic service
Health	• Mining citizen feedback for primary care practices [44]
Public order & safety	• Filtration of terrorism-related texts [45]
	Recommender system
General public services	• Personalized city's digital services [46]
	Speech recognition
General public services	• Automatic transcription to provide subtitles for video recordings of political council meetings [39]
Recreation culture & religion	• Live TV subtitling of the public service broadcaster [47][48]
	Virtual assistants
Education	• Virtual assistants at the library [18]
Recreation culture & religion	• Individualised and personalised formats in news [19]
	Big Data
Economic affairs	• Management of urban bus networks [49]
	Blockchain
Economic affairs	• e-currency for e-government services [50] • Public blockchain of agricultural supply chain system [51]
General public services	• Privacy Preservation in E-Governance System [52] • EIDAS [53], [54]
Health	• Sharing and security of medical health records [55]
	Drone
Health	• Disinfection of surfaces against the COVID-19 pandemic
Public order & safety	• Search for missing persons [57]
	IoT
Economic affairs	• Real-time traffic monitoring [3] • Smart parking system [8]
Education	• Integration of IoT at electrical engineering education [6]
Environmental protection	• Marine disaster prevention and mitigation [7] • Smart power meter [9] • Energy management in public buildings [46]
General public services	• Road maintenance services [5]
Public order & safety	• Emergency response [4]
Recreation culture & religion	• Detection of health problems at sports • Intelligent management of public sport facilities [10]
	Gamification
Education	• Training and assessment of public service personnel
	Knowledge Graphs
Environmental protection	• Water resources management
	Mobile apps
Education	• Enhancing the communication services for higher educational
General public services	• New service delivery channel • Communication services of the University
	VAR
Education	• Virtual resources and environment for teaching

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	• Virtual environment for training using wearable technology • Create VAR education resources
Social protection	• Virtual participation in civic life for people with disabilities
	Wireless technology
Economic affairs	• Mobile payment systems in public transportation using NFC
Public order & safety	• Emergency call solution

4.5 Evaluation of Emerging Technologies

The following section explains the approach taken to identify, adapt, and apply an evaluation framework for emerging technologies. Our approach was to adopt an existing framework, extend it where needed, and then follow the evaluation process. The framework itself, adaptations made to it, and the evaluation method and process are described in this section[5]. The analysis of those results helped us develop concrete recommendations that we are laying out in section 4.6. Finding a single evaluation framework for emerging technologies, or technologies in general, has proven to be a challenging task. Academic sources do not list a single framework and given the complexities of technologies and different areas of their applications, having a single, standardized evaluation framework is hardly a realistic expectation.

4.5.1 Evaluation framework and adaptations made

Following the literature review and research efforts, we identified [69] as a conceptual method for the evaluation of emerging technologies. In [69], the method was applied to evaluating blockchain and smart data discovery technologies, and a concept of 'feeding the hierarchy' was introduced. The paper correctly recognizes the complexity of emerging technologies as one of their key defining characteristics. With that complexity, several challenges related to objective evaluation is made obvious. Having a simplistic framework will result in poorly evaluated technologies, and more sophisticated (yet relevant) details will be omitted. Conversely, having a too detailed and too complex framework brings the risk of getting lost in detail and losing the big picture and the ability to generalize conclusions.

Our original assessment related to the framework introduced in [69] was that, although it is relatively detailed, it fails to capture several characteristics we found to be relevant within the inGOV context. The initial framework attempts to evaluate technologies from three key perspectives: System, environment, and evolution. Each of these top-level dimensions is then divided into social and technical subdimensions. For example, when evaluating ETs at the System dimension, we can look at the Social sub-dimension and attributes like functional relevance. In contrast, if we are looking at the Technical sub-dimensions, we would find ourselves dealing with the evaluation of reliability, security, performance, and similar attributes. The following table shows all the dimensions and subdimensions. Our additions are shaded with green for more clarity.

Table 4-7 The evaluation framework with different dimensions and subdimensions

SYSTEM	**Social**	Functional relevance	Functional completeness
			Accuracy
			Functional adequacy

[5] See Additional Materials for more detailed results of the evaluation of specific technologies.

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	Technical	Reliability	Maturity
			Availability
			Fault tolerance
			Recoverability
		Security	Confidentiality
			Integrity
			Non-repudiation
			Accountability
			Authenticity
			Fraudulent behaviour
		Performance	Temporal Efficiency
			Resource Utilization
			Capacity
		Implementation	Ease of Use
			Complexity
			General development methodology approach
		Deployment	Hosting
			Cost
			Scalability
			Data Processor
ENVIRONMENT	Social	*Usability, Accessibility, User Experience and HCI, in general*	User adequacy
			Recognizability
			Learnability
			Operability
			Error protection
			Interface aesthetics (UI)
			Accessibility
			User centricity
		Organizational	Technical skill mastery
			Administrative simplification
			Reduction in administrative burden
			Availability of education
		Economic	Financial risk
			Profitability / TCO
			Added value / Market share
			Cost of technical implementation
		Political	Political support
			Trustworthiness
			Transparency
			Accountability
			Supportive legal framework
		Societal	Ethical and environmental acceptance
			Social influence
			Trust in government
			Ethics
			Accountability
			Availability of localised version
		Regulatory	Privacy
			IPR/IPL
			Conformity / Compliance
	Technical	Coexistence and Interoperability	EIF and EIRA conformity

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	compatibility		Conformity to semantic standards
		Organizational adaptability	
		Functional adaptability	
		Social adaptability	
		Financial Feasibility	
	Social	Assessment of Effectiveness and Efficiency	
		Sustainability	
		Satisfaction	
		Adoption	
EVOLUTION			
		Portability	Adaptability
			Installability
			Replaceability
		Maintainability	Modularity
	Technical		Reusability
			Analysability
			Modifiability
			Testability
		Scalability	

It is reasonable to ask why we only made additions and did not remove any evaluation dimensions. The reason lies in our assessment that removing any of the existing dimensions will reduce the comprehensiveness of the evaluation framework. The general principle followed, which defined and informed additions of specific elements and dimensions, was based on the author's assessment of emerging technology attributes relevant for the inGOV context and not covered in the original list of evaluation dimensions. For example, 'EIF and EIRA conformity' was added to address expectations that inGOV deliverables and general project goals will be aligned with EIF and EIRA. Another example is the addition of 'user-centricity since the original framework had somewhat limited ability to address user experience and customer experience advances. Lastly, as an example that describes and justifies these additions, we can consider additions of dimensions like 'administrative simplification,' 'reduction in administrative burden,' and 'availability of education.' - all these are relevant within inGOV context and the intention that software tools and technologies to be developed and described will be used in government or public service environments, where these dimensions are relevant.

We also tried to combine similar dimensions where that made sense. We believe that the proposed evaluation framework offers a good balance between the details and insights gained. However, future work could indicate that some changes might be needed and that the evaluation framework should be further adjusted. We relied on the process utilising 'hierarchy feeding' with its general structure shown in the following diagram.

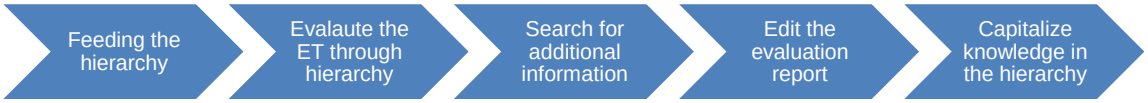

Figure 4-2 Diagram showing emerging technologies evaluation process

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The process starts with the initial documentation gathering and research on the current state of emerging technologies. Literature review and findings performed earlier are directly usable in this context and are highly valuable. The evaluation is then performed by comparing evaluation criteria with the characteristics of emerging technologies being evaluated. During that process, it is common to see that additional information search might be required. Those new insights and findings are added to the initial evaluation report, and the report is updated accordingly. While this process might seem overly descriptive and lacking in its concrete approach, it is essential to emphasize that the final step of the evaluation is capitalization from the new knowledge gathered during the evaluation process. This capitalization is best reflected in section 4.6, where we describe recommendations for the use of emerging technologies in public administration.

4.5.2 Blockchain

A detailed evaluation of blockchain is added in Additional Material 4-2**.** Following the evaluation approach mentioned in previous sections (as derived from [69]), blockchain was evaluated through all applicable dimensions. Based on the results of such evaluation, concrete recommendations and ideas were developed and described in section 4.5. Key findings confirm blockchain's strengths when evaluating security, accuracy, reliability, integrity, fault tolerance, accountability, non-repudiation, and authenticity attributes and dimensions. On the other hand, confidentiality, GDPR compliance, supportive legal framework, ethical and environmental acceptance, and EIF and EIRA compatibility present areas where additional caution might be required.

4.5.3 Mobile apps and technologies

Additional Material 4-3 contains the detailed evaluation of mobile apps as one of the identified emerging technologies. Following the same approach as is the case with all evaluated ETs, mobile apps were evaluated and analysed by following the process and framework described in the previous section. When considering mobile apps and technologies, the evaluation shows strengths in areas related to reliability, maturity, functional completeness and relevance, security, performance, resource utilization, general development methodology approaches, accessibility, user-centricity, and technical skill mastery. Challenges and additional attention might need to be addressed in areas related to confidentiality, fraudulent behaviour, implementation complexity, financial risks, and considerations, and EIF and EIRA conformity.

4.5.4 Chatbots

Following the same approach as the two previously described emerging technologies, chatbots were evaluated using the same evaluation framework. Detailed results are added as Additional Material 4-4. Based on the results of such evaluation, concrete recommendations and ideas were developed and described in section 4.5. Key strengths include functional completeness and relevance, technology maturity, reliability, availability, resource utilisation, capacity, and ease of use. Challenges are present and should be adequately addressed within the contexts of accuracy, fault tolerance, availability of education, trustworthiness, ethics, and privacy.

4.5.5 Knowledge graphs and linked open data

Evaluated jointly, using the same approach as all other identified ETs, knowledge graphs and linked open data are covered in Additional Material 4-5. Knowledge graphs display their strengths when considering

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functional relevance, completeness, and adequacy. They also perform well when evaluated in contexts of maturity, performance, deployment, hosting, reduction in administrative burden, and transparency. At the same time, areas like availability, ease of use, political support, and supportive legal framework might require additional considerations and caution.

4.5.6 The Internet of Things

While considering factors laid out in *'A special note on the IoT'* section at the end of the introductory part of section 4.6., a detailed evaluation is presented in Additional Material 4-6.

4.6 Recommendations for using Emerging Technologies at Public Administration

This section relies on the work done and laid out in the previous section and associated appendices. It offers a list of recognised emerging technologies within the inGOV project context - both on the project pilots' level and on the general, pan-European dimension of the inGOV project.
We did not follow just the statistical overview to identify emerging technology for in-depth analysis and create recommendations. While that was a guiding principle, we applied a holistic and empirical approach and made these recommendations and ideas based on the needs of specific inGOV pilots and generalized them to the pan-European level. The recommendations are a direct result of the evaluation of each recognised ET based on the evaluation framework adapted from [69].

This attempt at recommendation creation and generalization is novel within this project context and can benefit from future scrutiny based on the project results and deliverables. We see it as a good starting point as it incorporates findings from extensive literature review, desk research, and the experience of industry practitioners. However, further improvements should be considered.

We generalized technologies that could be used within a specific pilot context by understanding the project pilots' different cases. For example, in the case of the Croatian pilot, we recognised the potential to use chatbots and virtual assistants. However, while this presents a good starting point, we realised that using knowledge graphs with the chatbot could provide better results and offer a more comprehensive user experience. That example was directly influenced by paper [69]. Following this approach, the following four areas and technologies were identified, and further recommendations were created.

- Blockchain
- Mobile apps
- Chatbots and virtual assistants, and
- Knowledge graphs and linked open data

The latter two (chatbots and knowledge graphs with linked open data) are described and recommended jointly. While each of these emerging technologies has their applicability, based on the available literature research, we concluded that the combination of those has significant potential of yielding best results within the inGOV context, as detailed in the section related to recommendations for these emerging technologies.

A special note on the IoT

As an example of emerging technology, the Internet of Things was introduced in earlier sections and was evaluated alongside other recognized technologies. Moreover, while we did consider that IoT is mentioned

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and used in almost two dozen cases (based on the conducted literature review), we omitted it from the list of final technology recommendations as it was not directly applicable within the current inGOV context. This decision primarily reflects current project understanding and understanding of the pilot's current and to-be scenarios. None of the four pilots who are part of inGOV have planned IoT implementations. Being pragmatic, while still wanting to add a broader EM perspective, we defined IoT as such technology and described it. However, we did not include it in our list of recommendations that are more geared towards expected pilots' and project scope.

4.6.1 Blockchain

Being an immutable, append-only distributed ledger of recorded transactions, blockchain lends itself to many public service use cases [12]. Thanks to its distributed (P2P) and cryptographic nature, it fulfils the requirements of trustworthiness and traceability without the ability to manipulate recorded transactions single-handedly.

If we expand our view, we can look towards Ethereum as a critical enabler of blockchain implementations and the potential of smart contracts and decentralized financial (DeFi) models [70]. The OECD Blockchain primer[6] almost anecdotally asks if blockchain is a technology, currency, or new internet. In a sense, it is all of those things.

Within the European Union, the role of blockchain in the public sector has been well-recognized and even formalized within the EU's blockchain strategy framework. To facilitate the adoption of blockchain and related services, the EU envisioned the creation of EBSI[7] (European Blockchain Services Infrastructure). Built as a peer-to-peer network of interconnected nodes, EBSI pulls together resources from all 27 Member states, Norway, and Liechtenstein, organized in the European Blockchain Partnership (EBP). EBSI use cases specifically outline notarisation, diplomas, EU self-sovereign identity, and trusted data sharing as the initial set of supported use cases, with more expected in the future.

Thanks to this perceived (and realistic) feasibility, blockchain can find its place in the provision of PS related to public procurements, public tenders, validation of payments (of taxes or other kinds of contributions), healthcare (for more intelligent patient record management systems) and elections. As the OECD primer suggests - the increase of transparency, traceability of goods and services, data, and financial assets can facilitate market access and improve the efficiency of transactions. It is important to note that those applications are not limited to the private sector - some of the most exciting and promising areas of blockchain application are in government and public sector cases [15].

Some proposed use cases and scenarios include:

- digital identity management and associated rights (credentials, licenses).
- health, insurance, financial, and other personal records.
- land title / cadastral registry and records.
- management of benefits, aid, scholarships, and other social transfers.
- public tendering and procurement, including contract and vendor management.
- voting records.

[6] The OECD Blockchain Primer - https://www.oecd.org/finance/OECD-Blockchain-Primer.pdf

[7] EBSI – European Blockchain Services Infrastructure- https://digital-strategy.ec.europa.eu/en/policies/ebsi

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- smart contracts on top of blockchain technology.

4.6.2 Mobile apps and technologies

Thanks to their ubiquity and high penetration of smartphones and mobile technologies in Europe, mobile apps are familiar to users, and they present exciting opportunities for utilization in the context of public services and integrated public services. While the choice of the technology platform and app development type might vary, the general concept and idea are well-known and accepted by broad demographics. Within the context of PS, three main types of mobile apps are to be considered - each with their characteristics explained earlier in this chapter. The native apps will provide the best user experience and access to low-level APIs needed for advanced features.

Hybrid apps will provide a reasonably good experience, in some cases even excellent, and their benefit will be that developers, who develop standard web apps using HTML+CSS+JS stack, will be able to write those apps wrappers [71]. Thanks to React Native[8] or Ionic[9] frameworks, it is possible to achieve cross-platform deployment from a single codebase, and the tech stack used for general website and web app frontend development makes it easier to find developers with needed experience.

The third type is at the intersection of web+mobile apps and desktop apps. They are called progressive web apps (PWAs) [22]. Easy to use, easy to deploy since they do not need to be deployed through app store providers - they have the potential to achieve easier and broader penetration. However, they lack more advanced functionalities reserved only for native apps, and even though the standards and toolset are well-defined, the actual use of PWAs remains somewhat underwhelming.

Recently there have been some major developments. Started by Google and now supported within the development community, a new framework called Flutter[10] was created. It uses a modern programming language called Dart[11]. It offers the ability to build cross-platform apps (for Android and iOS) from a single codebase with native access to device features and excellent performances. We see it as a technology of choice for most mobile apps in the foreseeable future. We need to recognize its limitations, as well. While its performances are native-like and users get access to low-level APIs, building compute-intensive applications or advanced and 3D games are not areas where Flutter excels.

However, solutions envisioned for inGOV pilots will mostly deal with data access, integration, and management with a number of (backend) services. As such, it is not foreseen that access to low-level functions related to gaming, 3D performances, and similar highly intensive features will be required. With this consideration in mind, it is safe to assume that Flutter will successfully address most typical scenarios. Considering the typical use cases of PS and excellent ability to connect with solid back-end infrastructure and mature technology stack, Flutter could address the majority of needs. It is possible to build native performance apps for both Android and iOS from a single codebase, making this framework versatile and recommended. It is also worth noting that Flutter can create web experiences and translate its code to JavaScript and HTML+CSS.

[8] https://reactnative.dev/

[9] https://ionicframework.com/

[10] https://flutter.dev/

[11] https://dart.dev/

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Again, practical choices and considerations should be taken into account. However, for most cases described in pilots and our understanding of the current mobile app landscape, building native apps, potentially with Flutter to simplify the process and achieve greater efficiency and time-savings, is recommended when considering mobile apps as an emerging technology in the PS context.

4.6.3 Chatbots and knowledge graphs and linked open data

Chatbots represent one of the most familiar, public-facing interfaces for users to interact with a service using text messages or even voice. Outside of the public service provision context, they are often seen and used as support for helpdesk services or helping users obtain helpful information. However, when analysed within the context of the inGOV project, pilots, and in the general e-gov domain, chatbots offer the broadest range of benefits when utilized alongside semantic technologies like knowledge graphs and open linked data. According to [72], emerging technologies, including Big, Open, Linked Data (BOLD) and chatbots, offer exciting avenues for PSI provisioning improvements.

Public service information (PSI) provision is an area that lends itself well to chatbots, KGs and LOD. As described by [73], public service provisioning (PSP) can be divided into two stages. The first one is an informative stage. In it, users interact with a service to inform the user about the service. This interaction can go beyond simple FAQ sessions and help users triage their cases, find out their eligibility for specific programs or get information about what kinds of documents and costs might be associated with using a specific service.

Following the informative phase, users can proceed to a performative stage - this, in its essence, means that now the actual service can be invoked. Within the context of the inGOV project and its pilots, this informative phase can be utilized and showcased as an example in which the efficiency of public administration and user satisfaction can be improved [74]. Sometimes, governments tend to overlook this phase. Their common justifications are in line with claims that all the required information is already available online and that users can find all about it by reading the website.
While that might be the case for basic situations, there are more complex procedures with particular cases where having written instructions will not be efficient and informative enough. More importantly, the information offered in this manner will not be personalized. Complex public services like the issuance of a passport come with many rules and exceptions, and in most cases, different attributes can be combined, thus leading to very complex scenarios. This is where semantic technologies like knowledge graphs have huge potential. It is recommended that public services are built on top of Core Public Service Vocabulary (CPSV). CPSV can be considered an extensible, modular, content, syntax, and technology-neutral public services data model [75].

However, CPSV on its own is not sufficient. Based on it, an Application Profile - CPSV- was developed, and it can exploit Linked Open Data (LOD) and its applications. The critical goal or purpose of CPSV-AP is the ability to describe public services, life, and business events. As [75] concludes, using KG for providing personalized information on public services (modelled on top of the CPSV) is feasible and shows potential. KG offers significant benefits, including providing personalized information of even more complex public services (issuance of passport).

The same paper also states that KG development is still complex and difficult for public servants, especially if there is a need to create them on a large scale. Moreover, while this paper focuses on KG and Linked

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Open Data, it also opens an exciting area where chatbots can utilize the underlying KG and LOD foundation. Such implementation would allow users to engage with and get personalized information about services - and even initiate performative stages of interaction with public services.
Developing that idea, another paper [30] takes that approach further and outlines the concrete use case where a PassBot is created. Within the context of inGOV pilots, it is sensible to apply the same approach for several pilots (Croatian, Greek, Maltese).

To address natural language processing and understanding (NLP/NLU) challenges, it is recommended to evaluate a more comprehensive array of possible and available solutions and APIs. Those include solutions like DialogFlow (Google), Wit.ai (Facebook), Lex (Amazon), Watson (IBM), and others. Again, using the same recommendation laid out in paper [30], architecture should be based on APIs as key structural chatbot elements).

The paper [76] provides recommendations that should be considered during chatbot technology selection and development. Those recommendations are likely to be extended with specific requirements. Again, within the inGOV context, the platform should support languages other than English (Croatian, Greek, Maltese). Additionally, support for rapid application development should be considered the price (ideally, free) and license (again, ideally, open-source).

While the actual selection of platform will depend on specific requirements, Rasa open-source framework[12] appears to be well-documented, developer-friendly with support for NLU and ML. It also relies on widely used Python programming language, and its support community is active, large, and welcoming. One of the key differentiators is defining intents in local languages and then training the model to understand languages other than English. Additionally, Rasa offers a fully commercial, enterprise solution that can be obtained after piloting and if the use cases require doing so.
Furthermore, another framework within the open-source and freely available chatbot solutions is BotPress[13]. BotPress offers AI-powered chatbot technology with reasonably well-documented deployment and development procedures. During initial test cases and the development of mini proof of concepts, both Rasa and BotPress showed promise within the inGOV pilots' project scope.

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Chapter 5. IPS Best Practices

Acronyms and Abbreviations

Acronym/Abbreviation	Description
ACI	Automobile Club d'Italia
AgID	Agency for Digital Italy (Agenzia per l'Italia Digitale)
ASP	Application Service Provider
CIE	Electronic Identification Card (Carta di Identità Elettronica)
CSC	Costumer Service Centres
EU	European Union
GDPR	General Data Protection Regulation
ICT	Information and Communication Technology
INPS	National Institute of Social Protection (Istituto Nazionale Previdenza Sociale)
IPS	Integrated Public Service
IT	Information Technology
KS	Norwegian Association of Local and Regional Authorities (KS)
NAV	Norwegian Labour and Welfare Administration
NGO	Non-Governmental Organization
NICSP	National Info Communication Service Provider
NISS	Nordic Institute for Interoperability Solutions
OOP	Once Only Principle
PA	Public Administration
SPID	Public System of Digital Identity (Sistema Pubblico di Identità Digitale)

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5.1 Introduction

In order to complete the development of the IPS conceptual model (See Chapter 7) and the holistic conceptual framework for IPS co-creation, it is necessary to understand where the state-of-the-art stands in this respect. To this end, the previous chapters have studied the current academic, political, and regulatory prevailing consensus. Building upon this, the following chapter presents a review of selected case studies that showcase the practice of co-creation in IPS. This review consists in studying a series of initiatives and eGovernment development projects attempting to setup an IPS while displaying characteristics of co-creation processes. In light of the taxonomy developed earlier (see Chapter 3), best practice cases are analysed in function of several dimensions corresponding to the main features of IPS and co-creation (as identified in subsection 3.4.3 "General Taxonomy").

Overall, eight themes were developed on the basis of previous chapters that guided the initial analysis of the selected best practices (i.e. integrated public services, end-user enablers, end-user enablers for co-creation, co-creation process, public organization enablers for co-creation, public organization enablers, contextual and cultural enablers). In addition, three corollary dimensions of analysis were added to capture the inherent to each of the IPS co-creation experience (namely, 'motivation for co-creation', 'barriers' and 'outcomes'). To apply these dimensions to our specific best practice cases, a multiple-case study [1] approach was adopted. It combines two main types of data collection methods: desk research and semi-structured interviews. The desk research aims at building a preliminary knowledge basis out of all existing and accessible sources of information (project reports and documentation, news, social media, etc.). In turn, the semi-structured interviews with project managers and key informants aim at gathering privileged information and first-hand accounts of how precisely IPS co-creation unfolds in real life circumstances, and the kind of challenges it faces.

In the end, this review of best practice cases demonstrates that although the initiatives examined share a number of defining characteristics (e.g. once-only principle, open-source solutions, involvement of policymaking stakeholders), their closeness to the theoretical concepts of IPS and co-creation process varies. This shows that these concepts are still difficult to find in real life conditions, and, as of now, mostly remain ideal types to aim for. In their concrete application, it was noted that the IPS and co-creation concepts are facilitated by two main factors. First, IPS co-creation occurs most smoothly when there is a supportive institutional culture (based on notions of transparency and citizen participation) and setup (where competences are clearly distributed among the relevant PAs or jurisdictional levels). Likewise, an appropriate legislative framework can facilitate the initiation of co-creation activities for IPS.

This chapter is divided into three consecutive sections. First, the research design is presented, touching upon the case selection and data collection methods, as well as the strategy for cross-case analysis and the limitations inherent to the methodology used in this study. Second, the findings resulting from the analysis are presented in detail for each case. Third and last, a cross-case analysis is conducted. Ultimately, concluding remarks are formulated, providing overarching takeaways to be drawn from this chapter.

5.2 Research Design

To understand how public organisations engage in processes of co-creation for the provision of integrated public services (IPS), a qualitative approach was adopted. The purpose of adopting a qualitative design is to gain a holistic understanding of the phenomenon under study [2]. In representing the phenomenon in the real world, the qualitative research makes use of an interpretive approach concerned with

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understanding the meaning which people attach to this phenomenon [3]. Given its long tradition, Saldana [4] describes that there are more than 20 qualitative research genres available to investigators. From the broad range of research strategies, a case study inquiry, following Yin [1], was deemed appropriate to empirically investigate the phenomenon of co-creating IPS.

Case studies are a suitable methodological approach when seeking to understand phenomena holistically, within a real-life context and from the perspective of those involved [5]. Our study followed a multiple case study design [1], which means that the selected IPS initiatives each make up a unit of analysis. The reason for doing a multi-case study is to understand how an analysed phenomenon performs in different environments. The cases used for the in-depth study were selected because they are characterised by a prominent role of co-creation in the development of integrated public services (IPS).

In conducting this cross-case analysis our aim was not necessarily to compare the cases among them but rather to identify whether similar patterns or discrepancies on various focused dimensions emerged during our in-depth study. The analysis of patterns and themes is a way to reflect on how the cases give access to different or overlapping insights about IPS and co-creation approaches in developing public services. In other words, the comparative elements of a cross-case analysis are a way to delve deeper into the specific phenomenon, and do not represent a sample of it.

5.2.1 Case Selection

The case selection procedure followed a purposeful, intensity sampling strategy [6], in which information-rich cases that manifest co-creation in IPS were selected. In our case selection procedure, we relied on the findings of previous European research projects that empirically analysed the phenomenon of IPS and, where available, co-creation activity. Our aim in the selection of cases was to include those that would provide variation along the different dimensions of IPS co-creation. Because the conduction of in-depth case studies requires the use of multiple sources of data (interviews, document analysis, observation), the selection of cases was also dictated by the possibility of retrieving the necessary information within the time-frame allocated to the case studies in the plan of this project.

The selection of cases was stepwise. The first selection criterion was specified in the Grant Agreement (p. 91), which identifies as eligible cases the ISA study report of IPS best practices [7]. In this study, integrated public services “refer to the result of bringing together government services so that citizens can access them in a single seamless experience based on their wants and needs”, providing seamless services to the users while respecting principles such as once only, digital by default, multi-channel, reusability, openness and digital interaction.

The second step consisted in a desk research identifying cases which satisfy the criterion of adopting the co-creation concept in the design and provision of public services. Specifically, the initiative would cover one or more aspects of co-creation in terms of involvement of public and private actors (including end-users) during the design, delivery, or evaluation of the public service. The eligible cases for the co-creation criterion were searched in the CORDIS Results Pack on digital government, which is a thematic collection of innovative EU funded research results about co-creating public services [8].

The combination of the two criteria produced an extended list of potentially relevant projects for analysis (see Additional Material 5-1). After establishing the first contacts and reviewing potentially relevant information around the projects, through shared deliberations the research team decided to include two

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cases from the list provided. Therefore, in addition to the three mandatory cases, two criteria were established for the selected cases: (1) be explicitly integrated public services, and (2) clearly involve co-creation activities in the process of service design, delivery and/or evaluation. Finally, the case selection had to reckon with the limits in accessing relevant information and the temporal constraints for carrying out the investigation. The list of initiatives was validated by the partners of the consortium. Below, in Table 5-1, is an overview of the five cases included in the analysis.

Table 5-1 Cases overview

	Name of the initiative		
Integrated public service (IPS)	Transfer of business register data over X-Road. Estonia and Finland	Municipality Application Service Provider (ASP) Hungary	Digital application for social security (Digisos). Norway
Co-creation	VARAM (Ministry of Environmental Protection and Regional Development). Republic of Latvia	"Io Italia" App. Italy	

5.2.2 Data Collection

To develop detailed individual case reports, the data collection process consisted of an initial desk research, with a thorough inquiry of available documents, and the conduction of semi-structured, guided interviews with relevant actors in the cases selected.

The desk research was a critical step in gathering as much available information on each case. Secondary data constitutes the first step in making thick description of cases [4]. These included document studies, such as official strategies, white papers, legislative acts, plans, reports etc. to understand and describe the institutional context or the governance tradition in which the initiatives are organized. It was important to select documents from similar sources, namely information provided by authorities at different jurisdictional level in the form of agreements or normative acts, to allow cross-case comparison. However, sources relevant to the case were added to reflect specificities, such as electronic resources published in various outlets such as blog posts, websites or newsletters as to complement the description provided in official channels (see Table 5-2). The content analysis of included sources was driven by the design and purpose of this study: to investigate cases displaying IPS and co-creation activities further categorised into themes and sub-themes as explained below.

Table 5-2. Data collection methods used across cases

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Initiative	Interviews	Documents	Other (websites, news clippings, blog posts)
ASP Hungary	1	3	2
XRoad Estonia/Finland	1	4	3
Digisos, Norway	2	3	3
VARAM, Latvia	1	3	2
IoItalia, Italy	2	4	6
TOTAL	7	17	16

All the cases included semi-structured interviews based on shared guidelines and a previously developed protocol (see Additional Material 5-2). For the identified best practices, a number of potential informants in different roles (i.e. public officials, project coordinator, leader of the initiative etc.) were identified and contacted in order to organise individual semi-structured interviews to collect insights on the co-creation process and enablers, as well as the challenges and main outcomes relevant for understanding practices of stakeholder engagement in IPS. Interviews were carried out individually, except for one unplanned occasion in which we interviewed a group of two people. However, as Yin [9, p. 140] points out, interviews with very small groups (2-3 persons) can be treated as adjuncts of interviewing individuals. Compared to other methods with larger groups (such as focus groups), group interviews are comparable to individual interviews in managing the dynamics of interaction and no rational of putting individuals at ease is sought with this method.

Once the potential respondents were identified, we focused on key informants. As Patton [6, p. 430] argues, "key informants are a prized group"; and interviews with them are among the most common used in qualitative inquiry. Key informants are especially knowledgeable about the topic under research and can illuminate the investigation with valuable and relevant expertise into the background of a problem. To inform our cases, from the pool of team leaders, project coordinators, senior managers, or key stakeholders we identified key informants and engaged them in a genuine cooperation to gather their knowledge for the study. For each case we strived for interviewing at least one key informant. After the transcription of interviews, respondents were asked to comment and validate the proceedings of the meetings. Interviews were analysed manually, first applying codes to salient attributes and then clustering them around the main thematic categories identified for co-creation and IPS.

Before the interviews, an interview guide and an informed consent form were prepared in order to collect data in a structured and transparent way. The informed consent form contains information about the InGOV project, the purpose of the case studies as well as the measures taken to ensure informants' confidentiality, and the procedures about the treatment of data.

The protocol for conducting the interviews was previously developed and approved by other partners of the consortium. The structure of questionnaire contains a number of sections, with questions grouped around the specific themes of co-creation guidelines found in the Taxonomy of Public Values, Principles and Guidelines (See Chapter 3). This was considered to be well aligned with the structure and approach selected for the analysis of results (see below). Finally, the interviews lasted on average 60 minutes, were conducted remotely, recorded, and verbatim transcribed.

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5.2.3 Strategy for cross-case analysis

The strategies adopted for the cross-case analysis primarily follows the rationale outlined by Stake [19]. In this process, the approach is moving back and forth between the detailed case reports and the definition of themes. There are various techniques that can be employed in conducting cross-case analysis of multiple cases. Stake [5] distinguishes three alternative tracks between: 1) reporting case findings; 2) merging case findings; and 3) providing factors for analysis. The first track is useful in reporting case study findings with their unique characteristics, while the third is more quantitative oriented and aims at generalisations shifting from findings to factors. In comparison, the second track is oriented towards combining similar findings across cases, with less emphasis on the unique features of the individual cases. For our purposes, we followed the analytical strategy that mostly aligns with this second track, by merging findings across cases, while keeping into account the unique findings in singular cases.

A set of eight themes, derived from the main themes of IPS and co-creation presented in the Taxonomy of Public Values, Principles and Guidelines, guided the initial analysis and writing of individual case reports (see subsection 3.4.3 "General Taxonomy" for more information). Below we provide the themes with their relevant features.

a) *Integrated public service enablers:* analysed the aspects which would characterise the solution an 'integrated public service', such as digital by default, once only principle, multi-channel, digital interaction, openness, transparency, and interoperability.
b) *End-user enablers*: analysed the involved users in co-creation in terms of composition, characteristics, skills and what motivated them to participate in co-creation.
c) *End-user enablers in the co-creation process:* analysed how the users were identified, engaged, and managed (e.g. identification of user representatives/intermediaries) and which challenges, if any, were encountered in users' engagement.
d) *Co-creation process enablers*: analysed if procedures/guidelines were in place to support co-creation, how the co-creation was executed in practice (e.g. workshops, surveys, interviews), which communication and supporting tools were used and if strategies to solve conflicts between parties were established.
e) *Public organisation enablers in the co-creation process*: analysed how the team members from public organisations were involved in the co-creation process, which were their roles and responsibilities and if additional incentives were provided to them.
f) *Public organisation enablers*: analysed the organizational culture and the propensity towards co-creation; and if the organizational structure and business processes are aligned with co-creation and open collaboration.
g) *Contextual enablers:* analysed the presence of a regulatory framework for co-creation and legal and administrative rules, and who is accountable for them.
h) *Cultural enablers*: analysed the social values to avoid knowledge practices that are culturally and politically embedded and organisational values to understand if these are aligned to co-creation values and to the use of ICT's.

In addition to the above themes, our analysis aimed at complementing these criteria with information regarding the motivation, the final or intermediary results achieved, and the challenges encountered in the progression of the initiatives.

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- *Motivation*: analysed the motivation behind the engagement of end-users in the different phases of the public service implementation; but also considered the more general motivation of starting the initiative.
- *Outcomes*: analysed the perceived added value of the inclusion of users in the implementation process of a new public service and benefits.
- *Barriers*: analysed the main barriers encountered during the co-creation and stakeholder engagement and how these challenges were addressed.

5.2.4 Limitations and reflections on method

The overall aim of this chapter is to analyse emerging patterns of co-creation in the development of IPS that is a relatively young phenomenon yet increasingly relevant in the context of public services. With this purpose in mind, it is important to be aware of the challenges inherent in conducting case studies and ensure that data are analysed and reported rigorously.

All the cases were researched remotely with no access to fieldwork or possibility of conducting onsite observations. On one side, this was due to movement restrictions related to the epidemic situation experienced by all countries under study. On the other side, most of the co-creation activities happened in the past, reason why reliance on document analysis was so critical. Access issues made it difficult to organize more interviews or focus groups with potential respondents, especially final beneficiaries, and citizens. Likewise, time constraints allowed us to focus on key informants, which in certain cases precluded the possibility of interviewing potentially relevant stakeholders, such as respondents from municipalities. These aspects might hinder a broader understanding of the process of co-creation as seen from multiple actors' perspective. Nevertheless, the findings we discuss in the next pages are useful in understanding a renewed approach in how to conceive public services from an active stakeholder engagement perspective.

5.3 Detailed analysis of case studies

In this section we present and discuss in detail the cases selected based on the information gathered through desk research and semi-structured interviews. For each of these five cases, results are presented in a systematic manner using a table structured according to the dimensions of analysis listed in the previous section. Each table is preceded by a short description about the case. The introductions are structured as follows: a general description of the projects (context, nature and content, timeline) followed by a list of objectives, stakeholders, and end-users. In the concluding paragraphs a thorough consideration on challenges and outcomes of the initiatives is provided. This was deemed appropriate since challenges and outcomes are often influenced by contextual conditions inherent to each individual case. It is worth noting that here, the cases are described in a random order as they are compared in a more structured manner in the section dedicated to the cross-case analysis.

5.3.1 Digital application for social security (Digisos), Norway

In Norway, social welfare is operated by municipalities (over 350 across the country). Before the launch of Digital application for social security (Digisos), procedures, ICT tools and, ultimately, the quality of service varied from one municipality to another [10]. Additionally, it was often required from beneficiaries that they physically come to municipal offices to carry out a wide range of procedures. This used to make social welfare provision complicated and demanding for beneficiaries. To address this, the Directorate of Labour

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and Welfare (NAV) and municipalities launched a project to develop a single online service able to streamline procedures and enable beneficiaries to follow them online rather than physically [11].
Digisos provides a digital channel through which users can apply for a municipal-level benefit via a national-level portal. Previously citizens had to apply for this benefit in person, over the phone or by post. Instead, Digisos provides a single nationwide digital portal via which the application can be made, and through which the applicants' identity is authenticated [10].

The program is operated by the Directorate of Labour and Welfare (NAV) that oversees and regulates the provision of social welfare services and payments across the country. It has consisted in the development, testing, rollout and implementation of an integrated online public service allowing NAV beneficiaries to complete all relevant procedures and get all relevant information remotely and seamlessly [10], [11].
The first phase of the project consisted mainly in gathering insights from beneficiaries to understand their needs. Then, in a second phase, under a rationalized and simplified project management structure, the ICT tools and relevant services were designed and rolled out. In 2019, the project became a regular service operated by NAV. As of June 2021, over 98% of the population lives in municipalities that have chosen to adopt Digisos for their online social welfare provision.

In its development phase, Digisos relied heavily on input from service and end users (whose nature and extent are described in the table below). Indeed, as the interviewees argued, it was necessary to involve service users (the municipal caseworkers) to ensure their trust and goodwill along the project and to benefit from their experience on the field, and end-users (social welfare beneficiaries) to fully understand their needs and capacities.

Objectives:

- Provide a single, seamless experience;
- Replace complex and atomized procedures;
- Transform processes to provide social welfare benefits with better and simpler functionalities;
- Make the provision of services faster;
- Make it easier for beneficiaries to contact case workers, or obtain information about their own case directly;
- Allow beneficiaries to become self-sufficient.

Main Stakeholders:

- Directorate of Labour and Welfare (NAV);
- Norwegian Association of Local and Regional Authorities (KS), interest group representing all the municipalities in Norway, also the provider of technical solutions and eGovernment platforms for municipalities;
- The country's four largest cities (Oslo, Bergen, Trondheim, Stavanger).

End-users:
People with economic and social strains, to whom the State provides "safety net" assistance in terms of boosting incomes, increasing school attendance, improving nutrition, encouraging the use of health services, and providing job opportunities.

Information on aspects of the IPS and co-creation were collected from desk research and a group interview conducted with a senior adviser and a team leader at NAV, both involved in Digisos. They have been part of the team in different stages of the project development and involved in interacting with users

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(beneficiaries) as well as caseworkers. In the desk research, programme documents (a report, guidelines) and online newspaper clippings as well as online programme presentations were included. The following table provides the results of the analysis performed under the defined dimension of analysis.

Table 5-3. Results of *Digisos* analysis

Dimensions of analysis	Results
Integrated public service enablers	Multi-channel: The service is provided through digital channel and physical channel. Digital interaction: The end-users can access the service via the single portal with single sign-on through e-ID. Once only principle: The data inserted by the applicant is enriched with data held on the applicant by other governmental organisations such as Husbanken (national public housing authority) and Skatteetaten (Norwegian Tax Authority), as well as internal NAV databases such as the national register. Shared infrastructure: there is a common platform for all municipalities. Collaboration agreements: there are data processing agreement and collaboration agreement. Inclusion of political stakeholders: political stakeholders were involved at the beginning of the project. Multilingualism: Digisos solution is available in different languages. Reusability: an existing platform and standards facilitate the development of the Digisos solution and to store data related to the citizen applications for financial social assistance.
Motivation for co-creation	Necessity to involve the caseworkers to ensure their trust and goodwill along the project and end-users (social welfare beneficiaries) to fully understand their needs and capacities.
End-user enablers	Social welfare beneficiaries, as end-users, were consulted in the co-design and co-assessment phases of the co-creation. They were selected at random, and belong to all age groups, genders and races. Some of them had high ICT proficiency, while others were not familiar with digital tools. Each cooperating end-user was awarded a gift voucher, but this was not advertised beforehand. Participants were only motivated by their own will to collaborate.
End-user enablers in the co-creation process	No specific group of end-users was targeted, there was no demographic consideration (no specific age, socio-professional, racial profiling). There was no minimum requirement of ICT proficiency. The project team selected voluntary end-users by directly visiting NAV local branches. The end-users have been identified until a satisfying representation of the population was sampled. No particular challenge has been identified during the engagement of end-users. No preparation for end-users has been foreseen. No parameters have been identified to measure the end-user's participation in the co-creation.

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Dimensions of analysis	Results
Co-creation process enablers	The project is financed with state budget. End-users were involved in the following phases of the co-creation in different ways: Co-design: Interviews at NAV local branches, where their needs and expectations were discussed Co-design and co-assessment: Testing and feedback sessions, whereby end-users were invited to act as beta-testers and provide their impressions on the mock-ups presented to them Additionally, caseworkers were also invited to participate in training workshops where they were introduced to Digisos and its main functionalities. Two project managers (one appointed from NAV and one from the municipalities) were responsible to coordinate the projects and also the co-creation with end-users. Video meetings were the main tool to communicate with the end-users and co-workers based in remote locations. No particular strategies were in place to solve conflicts during co-creation. No risk management processes were in place.
Public organisation enablers in the co-creation process	Municipal elected officials and caseworkers were an important part of the project. In Norway, municipalities are responsible for the delivery of social welfare services (NAV is only a nationwide regulator and coordinator). Their cooperation was thus crucial. Municipal policymakers, represented by their interest group KS (Norwegian Association of Local and Regional Authorities), were part of the project board from the first stage of the project. There were even two project managers (one appointed by municipalities, the other by NAV). Caseworkers were only involved in a second phase, to enhance trust between them and the project team and to share insights. No particular incentive was provided to municipal administrations and to caseworkers, who participated pro-bono.
Public organisation enablers	The successful implementation of Digisos (rolled out in a few years in a very fragmented administrative set-up) proved that collaboration between municipalities and the central administration was possible, and even beneficial. This inspired many new plans to make the whole social protection apparatus more integrated and smoother
Contextual enablers	No regulatory framework for co-creation is in place. GDPR represented an issue. At the start, it was unclear for the project team how they could gather data on the field while respecting privacy laws. Legal advisers were brought in to ensure the total compliance with the law.
Cultural enablers	NAV could not do anything without the goodwill of municipalities. It was tough to enforce the co-creation mindset with them, because the prevalent culture of municipalities corresponded more to the "old way" of making policy. According to our interviewees, they abode by heavy procedures and felt that involving users was not so crucial since municipal workers knew the reality of the field. It must be noted that this is the point of view of NAV officials, as no municipal stakeholder could be interviewed.

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Throughout the project's life cycle, the project team had to cope with a number of barriers. First, the principle of a single entryway to the fragmented Norwegian welfare system provoked tensions between the different stakeholders involved (NAV, KS and municipal governments). This was because local actors (KS and municipalities) perceived this 'centralising' project as a potential threat to the constitutional repartition of power between the State and the local government.

Second, the concept of adopting co-creation caused mixed reactions among service users (municipal caseworkers). Caseworkers had strong opinions about how the project should be managed and about the needs of users. They struggled to understand why NAV wanted to "bypass" them by interviewing beneficiaries directly. This translated into an initial distrust deficit between caseworkers and NAV, which had to be addressed throughout the process.

Ultimately, privacy regulations (mainly GDPR) proved challenging to observe when interacting with end-users. This also proved to be a point of tension with caseworkers, as they struggled to understand why certain questions could not be addressed to respondents (because of GDPR). However, these barriers ended up being overcome by the project team, as the successful rollout of Digisos demonstrates. The completion of this eventful process brought the team to formulate the following lessons learnt:

- More integration can be beneficial in complex administrative set-ups (such as the Norwegian social welfare system)
- It is really important to get input from the field when developing a project like this (in Digisos case, case-workers and end-users)
- The larger the number of stakeholders involved, the more complex project management becomes
- Shared ambitions to ameliorate the status-quo always end-up resolving problems

The project went much faster than expected. Today, 98% of Norwegians live in municipalities that have adopted Digisos. The main objective of Digisos was to deliver better services to citizens, providing them with a digital solution that would ensure a seamless experience and meet their needs. In order to achieve this, at the pilot stage, NAV involved the end users in a co-creation process by testing the service and giving their feedback. The involvement of the case workers during the co-design phase was crucial in collecting inside knowledge. In addition, the digitalization of this service required that the frontline staff have the right skill set and willingness to cope with possible issues or resistance to change. Their participation was voluntary and one of the challenges was the strong opinion case workers had in how the processes should be run. Overall, Digisos is a successful case of collaboration between various jurisdictional levels in a fragmented setting which led to a fast digitalization of social service provision, with almost all municipalities having adopted it by now.

5.3.2 Municipality Application Service Provider (ASP), Hungary

Initially, Hungarian municipalities were free to use whichever solution they chose to provide citizens a digital access to their services. This meant that large and wealthy cities could provide effective and modern (and thus expensive) solutions, while some rural, poorer towns could not even afford to develop a simple website. In an attempt to provide a centralized solution to this issue, the Hungarian government set up the Municipality ASP centre through the "Establishing a Municipality ASP centre" pilot project which ran between 2012 and 2015 supported by EU funds [12].

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Following the successful pilot, the Government decided to develop the service and extend it at the national level on a mandatory basis. The implementation started in 2016 with the project "Municipality ASP 2.0" financed by EU funds within the framework of the Public Administration and Civil Service Development Operational Programme. It consists in a new cloud Application Service Provider (ASP) model to be used as the back-office IT system by all Hungarian municipalities. The system also provides a front-office portal by which clients (i.e. residents and businesses) can access municipality services. Also, the necessary legislation has been adopted to make the use of the services offered by the Municipality ASP mandatory for local governments, although it is possible to apply for an exemption. The implementation of the new model has been a success with 99% of municipalities making use of the system as of August 2019, only 35 out of 3197 municipalities opted out [7], [12].

The Ministry of Interior was the initiator of the project; however, the Hungarian State Treasury now has responsibility for the Municipality ASP Centre. A consortium was created in 2016 between the Ministry of Interior (project sponsor), the government IT Development Agency (project leader), the Hungarian State Treasury and several state-owned companies. Decisions were made by the Project Steering Committee, representing each consortium member. Working groups provided input for the Steering Committee to decide upon [7].

The project team wanted to involve service users (municipal officials) in the development of Municipality ASP because it was necessary to get a comprehensive understanding of the needs of each locality. This was particularly true for large cities, which have the most refined and complex needs, and which already implemented solutions of their own before the centralization of digital access to municipal services.

Objective:

Provide all municipalities and counties with a single model for online public services, making them seamless for users and efficient for local authorities.

Main stakeholders:

- Local governments
- Consortium composed by the following entities:
- Ministry of Interior
- Hungarian State Treasury
- State-owned companies:
    - KINCSINFO – IT company responsible for the Hungarian State Treasury IT infrastructure
    - National Info communication Service Provider (NISZ) – IT agency responsible for the maintenance of the base IT infrastructure
    - Kopint-Datorg – a subsidiary of NISZ, IT agency responsible for the service portal
    - Idomsoft – a subsidiary of NISZ, IT agency responsible for the Government Enterprise Service Bus

End-users:

Local residents and businesses that can access the service through trusted profile, phone identification, personal eID card, and now face recognition. Local government officials are the service users and they access the service in back-office through personal eID card to enter eID server.

Information on aspects of the IPS and co-creation has been collected from desk research and one interview conducted with an e-Government Adviser at the Hungarian Ministry of the Interior who had a leading role

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in the project. In the desk research, secondary sources, such as available case studies, reports and presentations on ASP were included, complemented with available resources on the internet.

The following table provides the results of the analysis performed under the defined dimensions of analysis.

Table 5-4. Results of *ASP* analysis

Dimension of analysis	Results
Integrated public service enablers	Digital interaction: one single digital administrative portal to access eGovernment services through the Hungarian eID. Once only principle: the relevant data are extracted directly from the national base registries and the users do not need to provide them several times. Citizens and companies only have to provide the information once. Reuse of building blocks: reuse of different building blocks such as e-identification, e-authentication, e-delivery and intelligent online forms. Reusability: re-use of the existing government service bus Reduction of administrative burdens: access to the needed data is guaranteed to citizens or businesses in a modernised and efficient way through the coordination of the system. User centricity: the eServices are available to citizens and businesses via the platform that can easily access them through the ASP's Local Government E-Administration Portal that acts as a point of single contact for local government e-administration. Collaboration agreements: combining legal acts and organisational agreements to provide a clear governance structure.
Motivation for co-creation	Understand the needs of each locality. In particular, for large cities which have the most refined and complex needs.
End-user enablers	Citizens (local residents and businesses) were not part of the co-creation even if a central government hotline (which acts as a service desk) has been defined for end-users to voice their concerns and provide feedback. Local government officials as service users (with the double role of back-office and end-users) were directly involved in the co-creation through local government interest groups providing feedback during the different phases of the service implementation, in particular in the service design and in the testing. Municipalities taking part in the pilot phase were equipped with new IT material paid by the central government. Local officials integrated in working groups, and those involved in the roll-out of ASP in each locality, received financial compensation.
End-user enablers in the co-creation process	Point of contact with municipalities were local government interest groups. The interest groups provided a list of suitable candidates, with the following criteria: Pilots had to be located in central Hungary Pilot have to include smaller, rural villages and towns No difficulties were encountered during the pilot phase. No parameters were used to assess local government participation.

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Dimension of analysis	Results
Co-creation process enablers	Procedures were designed to engage with local government interest groups. Consortium members were responsible to engage with local governments. Two resources were in direct contact with local government interest groups. Two modes of interaction for local officials: On-site during training sessions Via the intermediary of local government interest groups (officials would submit feedback to these associations, and then the associations would liaise with the two colleagues mentioned above) Means of communication among consortium and with municipal officials E-mails Integrated service desk function in the back-office of ASP portal No specific strategy to address conflicts and tensions during co-creation. No risk management mechanisms were in place.
Public organisation enablers in the co-creation process	Two dedicated members of the consortium were responsible to coordinate the interaction with the local government interest groups.
Public organisation enablers	NA
Contextual enablers	Several laws impeded the takeover of certain responsibilities by the State. In order to set up the Municipality ASP Centre, it was necessary to pass a specific piece of legislation, to provide a legal basis for the service. This legislation granted the relevant ministries and government bodies the powers needed to develop, operate and maintain the system. , Further legislation enabled the different users to access the citizen data stored by the different Public Administrations in the base registries with a simple automated data transfer. The Municipality ASP Centre was designed to be compliant with t these provisions, and no additional legal changes were required.
Cultural enablers	Resistance from local governments fearing a breach of their autonomy. Mitigated by making the move to ASP financially beneficial for them, with new IT equipment provided and the centralization of the cost of local eGovernment services. With ASP, the services are financed by the state budget, without retribution on municipal budget.

Throughout the development and rollout of Municipal ASP 2.0, several barriers had to be overcome by the project team. First, the initial legislative framework impeded the centralization of digital municipal services because of local autonomy provisions. This obstacle was circumvented by voting new laws, which was made possible by the support of the central government and its parliamentary majority. Further, certain local governments (and large cities in particular) demonstrated some resistance when the system was generalised to all localities in the later stages of the project.

In the end, these barriers did not impede the successful rollout of the portal. The following lesson could be drawn from this process by the project team. When developing new eGovernment solutions, it is necessary to involve its users (in this case local officials) from the onset, and they must be trained to use the new solutions. This allows for an exchange of valuable insights which is crucial to understand user needs, and to address potential resistances early on. The team therefore concluded that communication with all the

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stakeholders is key to stimulate an effective uptake of new solutions and to make them understandable and familiar to those involved.

5.3.3 X-Road Business Registry, Estonia/Finland

Previous to the introduction of a shared business registry between Finland and Estonia, the latter was already using X-Road infrastructure within the country [13]. With the aim of reducing red tape for entrepreneurs and making the procedures straightforward in establishing a business activity in Finland and vice versa, Estonia officially proposed Finland to jointly manage data through X-Road. The two countries agreed to use an already existent infrastructure, X-Road, as a public data exchange layer in both countries and to cooperate in order to maintain and further develop the system.

In 2013, the Prime Ministers of the two countries signed an agreement which officially launched the project [14]. Subsequently, the national business registers of Estonia and Finland have concluded an agreement on the automatic transmission of their data through X-Road infrastructure [15]. X-Road infrastructure is federated, allowing users to exchange data across border free of charge (before the project, the exchange of data was free only within the national borders of the two countries). The exchange of data takes place between the national business registers of the two countries to carry out their duties and cannot be shared with other organisations. Due to the high costs of the initiative, the idea was that if Finland start using the X-Road system, the two countries could also share the costs, not only the benefits. For this reason, Estonia and Finland contributed for the establishment of a co-operation institution called NIIS [16], which is an organization that gave the mandate to develop the X-Road system to the next level, supported by the two Governments [17].

X-Road is a Government to Government communication channel based on the Once Only Principle (OOP), which means that end users provide needed information *only once* into the system. The two business register authorities contribute to all the stages of this public service development (design, delivery, evaluation). The prime ministers of Estonia and Finland were involved in the earliest phases of the project and provided the high-level political support, which led to the federation of the Estonian and Finnish data exchange layers under the X-Road system [18].

Objective:
The aim of the initiative is to reuse the X-Road data exchange infrastructure in order to enable automated bilateral exchange of business register data between Finland and Estonia. This would allow the exchange of information across border paperless.

Main stakeholders:

- Centre of Registers and Information Systems (Estonia)
- Finnish Patent and Registration Office
- X-Road operators (Information System Authority, Estonia; Population Register Centre, Finland).

End-users:

- Business Registers (Finland and Estonia)
- Businessmen of both countries (who are the main beneficiaries)

Information on aspects of the IPS and co-creation has been collected from desk research and one interview conducted with a project coordinator from the Estonian Centre of Registers and Information Systems, who

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was responsible for the coordination and implementation of the initiative. In the desk research, secondary sources, such as available case studies and reports X-Road were included. This was complemented with an analysis of official agreements and available resources on the internet.

The following table provides the results of the analysis performed under the defined dimension of analysis.

Table 5-5. Results of *X-Road* analysis

Dimension of analysis	Results
Integrated public service enablers	Cross border: exchange of data free of charge between Finland and Estonia. Once Only Principle: X-Road is based on OOP. The end users had to provide needed information only once into the system. Inclusion of political stakeholders: political stakeholders were involved at the beginning of the project. Re-use of existing infrastructure: existing technical infrastructure for the data exchange between the two countries. Collaborative agreement: all of the necessary agreements – whether technical, operational, or legal - to enable the transfer of data between the two business registers over X-Road have been stipulated between the two countries. Open source: Xroad is an open source solution.
Motivation for co-creation	No co-creation with end-users. The reason is related to the nature of the service itself. Xroad is a Government to Government communication channel. Business Registers (both Finland and Estonia) contribute to all the stages of this Public Service development (design, delivery, evaluation).
End-user enablers	The business registers who are also the users of X-Road, participated at all the stages of the public service development (design, testing, delivery). The businessmen of both countries, who are the main beneficiaries, did not participate to any co-creation activity.
End-user enablers in the co-creation process	Business registers had the domain knowledge that was needed for the implementation of the project.
Co-creation process enablers	A wide-ranging agreement was signed between the two partaking governments, outlining the perimeter of the project. The collaboration between the two halves of the team thus closely derived from this formal document. Throughout the process, communications between the Estonian and Finnish sides mainly transited via e-mail. Several in-person meetings were also organized. Both sides financed the Initiative, as there was no structural Fund from EU.
Public organisation enablers in the co-creation process	The following civil servants participated in the implementation of the service: Users/ Business Registers, they brought domain knowledge Business Analysts, they had the technical role. This means that, they took the information from the business Registries and wrote down as technical specification for the development Developers, who implement technical specifications Communication and Public Relations teams were dedicated to the opening of the services between the two countries.

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Dimension of analysis	Results
	Since the cooperation was regulated by a binding international agreement signed by the Estonian and Finnish governments, a lawyer was also involved to ensure the agreement was respected at all time. No additional incentives were provided to the project team.
Public organisation enablers	The X-Road initiative, and its successful completion, represents a blueprint for more cross-border interconnection between Estonia and Finland. X-Road is a do-it-all solution which scope could be virtually endless. X-Road was restricted to business registers by political decision makers. In the future, the same technical solutions could be used to make everything from civil registries to medical files interoperable between the two countries.
Contextual enablers	The legal framework for X-Road mainly consists in the cooperation agreement signed between the two countries at the start of the project. The final goal of the initiative is to go beyond mere compliance with EU legislation and render the service completely interoperable across national borders
Cultural enablers	No particular cultural enabler was noted.

The aim of this project in the context of co-creation was to include the business registers of both countries (Finland and Estonia) in the various stages of development of the service. Their contribution was crucial because of their domain knowledge in defining needs and setting up the service accordingly. The co-creation activities between public administrations across borders allowed for more efficiency and simplicity, all the while becoming seamless for end-users. Due to the collaboration of the two countries, ratified by signing a political agreement, a smooth and secure data exchange between the registers of Finland and Estonia was set up.

Although the initiative is a success story, some barriers during its implementation were still encountered. The main one regarded the initial confusion on the division of tasks and the technicalities concerning the specific terms of the cooperation. Moreover, in Estonia, the legislation stipulates that data-sharing is free of charge only between government institutions. There were many talks and debates to determine how to exchange data between the two countries free of charge. Both sides solved this problem through political collaboration.

In the end, it is important to mention that there are many opportunities to apply X-Road to other sectors like education, environment, or healthcare. The successful completion of X-Road calls for more cross-border cooperation in additional sector of public administration.

5.3.4 VARAM (Ministry of Environmental Protection and Regional Development, Rep. of Latvia)

In the recent years, Latvia has made significant progress in the use of digital technologies; and engaged in implementing a conceptually new approach in the delivery and access of public services. Today, more than 800 e-services are available to the citizenry [19], with most government digital services being accessible via the national portal of Latvia [20]. Yet, the levels of digital uptake by businesses and citizens are still moderate [21]. In this regard, the Ministry of Environmental Protection and Regional Development (VARAM), responsible for the implementation of information society and enabling e-Governance in the country, participated in a pilot project launched by Citadel (a EU Horizon2020 project) to improve

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specifically the uptake of digital services using the Lavtija.lv portal and via State and Municipal Unified Customer Service Centers (CSCs). CSCs, established in 2014, represent a network of 78 unified centres that offer advice and services from multiple state bodies, including State Revenue Services, Register of Enterprises etc., available to the public both physically and electronically [21], [22].

Throughout the pilot project it was sought to improve the public service delivery channels, change the internal processes and mindsets regarding digital services and contribute to the dissemination of knowledge and tools across other public organisations [23]. As a first step, a survey was conducted by the University of Latvia in cooperation with the employees working for the State and Municipal Customer Service Centers, which focused on identifying the reasons why citizens prefer to receive services on spot at center rather than at home, digitally on their premises.. The survey comprised both users and non-users of digital services [22]. The results of the survey showed that although 50% of state and municipal services are accessible through a digital platform, citizens rarely or never used the digital services, preferring to visit the customer service centre [23].

Based on the results of the survey, the focus shifted on gathering insights and requirements from the digital service users to improve the digital offer of the country. Specifically, the goal was to understand how the state service portal (a digital one-stop shop for citizens) could improve the service delivery in a person-oriented way and introduce a life-event based approach through several co-creation activities [24]. The sessions took place between August-October 2018, in which policymakers from across ministries, frontline staff (customer service centers employees), and various beneficiary groups were involved in separate sessions to gather insights and requirements around the use of digital public services.

The development of the State and Municipal Unified Customer Service Centers (CSCs) paved the way for the digitisation of state and municipal services through the platform provided to citizens by the CSCs. The involvement of CSCs was instrumental for understanding service users' requirements and their expectations about CSCs services and functions, as well as how can CSCs provide pro-active e-government (and physical) services towards the citizen (personalized, based on life events).

Through this portal, citizens can have access to public services in a simplified way, with less bureaucratic burden. The aspect of integration concerned mostly the fact that there was a single contact point to the different services. The focus of co-creation activities was to understand user's requirements and how these requirements could be met by CSCs.

Objective:

- Understanding user requirements
- Investigating how aware citizens are of CSC existence
- Investigating how CSCs can provide pro-active e-governmental (and physical) services towards the citizen (personalized, based on life events)

Main stakeholders:

- Public Service department
- Representatives of the Ministry
- Member of the CITADEL project consortium
- Service Providers
- Non-Governmental Organizations (NGOs), including ICT-related NGOs, representing municipalities and representing people with disabilities.

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End-users:

- Citizens

Information on aspects of the IPS and co-creation was collected from desk research and one interview conducted with the project manager from the Ministry of Environmental Protection and Regional Development of the Republic of Latvia, responsible for the coordination of the co-creation activities of the initiative. In the desk research, secondary sources, such as available case studies, reports and presentations on VARAM use case were included. This was complemented with analysis of available resources on the internet, i.e. the service portal and the ministry official webpage.

The following table provides the results of the analysis performed under the defined dimensions of analysis.

Table 5-6. Results of Varam analysis

Dimension of analysis	Results
Integrated public service enablers	Digital interaction: different services are combined and accessible through the digital portal. Reduction of administrative burdens: the one-stop shop allows citizens or legal persons to submit their requests (claims) to public law bodies and obtain the requested service in an easier way. User centricity: delivery of the services in a person-oriented way through the digital one-stop shop.
Motivation for co-creation	Understand how the state service portal (a digital one-stop shop for citizens) could improve the service delivery. The main objective in the co-creation activities was to gather insights from all the identified potential stakeholders.
End-user enablers	The following end-users of the service participated to the co-creation and in particular to the co-design: • two general citizen groups, • a group of IT students • service user's businesses group, • various NGO representatives
End-user enablers in the co-creation process	The co-creation process was voluntary for each group. The customer service employees participated in a larger seminar (workshops) to introduce them some new activities or some tasks and within this, they had this co-creation session. For the NGOs an invitation has been sent and all those who accepted to participate were engaged in the co-creation sessions. As for the cohort of citizens, they were recruited through a survey on the existing state service portal. There was a survey where people could provide their feedback (a question for satisfaction) and additionally were asked if they want to participate in any survey or group discussions. There were no specific demographical criteria for end-user selection.
Co-creation process enablers	Several co-creation sessions were organized separately for each group. The co-creation process occurred under the framework of the CITADEL project. It thus followed all of its procedures and guidelines, contained in a single framework shared with other use cases. The project was thus fully financed by H2020 funds and stimulated by this research program. During the sessions, multiple issues regarding

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Dimension of analysis	Results
	usability of the portal emerged (i.e. search functions, authentication, smartphone use etc.).
Public organisation enablers in the co-creation process	Overall, a highly positive attitude towards citizen involvement and user-centred services was observed. Additionally, during the citizens group sessions there were representatives of the ministry available to offer guidance. At the end there were professional colleagues to analyse the requirements and give feedback.
Public organisation enablers	There was no particular incentive for civil servants to take part. They participated on a voluntary basis. Thus, we can say that the pre-existing culture was relatively favourable to co-creation, as no particular resistance to co-creation was noted from civil servants
Contextual enablers	There was established a new internal policy-making guideline. This document states that co-creation with end-users shall be a requirement for each new service delivery system development project. However, it is important to keep in mind that this is not a binding regulation.
Cultural enablers	No particular cultural enabler was noted.

The initiative led by Varam analysed in this case is part of a larger national plan to foster the use of digital services among service users. Specifically, the initiative regarded the delivery of an integrated public service in a hybrid setting via the national portal and the CSCs. Different services are combined and accessible on the portal. Whereas CSCs provide services on spot while also digitally accessing services from different state institutions.

The purpose of the pilot project then was to improve the performance and boost the low rates of user acceptance of an already existent digital offering. In that regard, VARAM adopted a broad, participative, and inclusive approach to understand users' needs and offer a better user journey. Co-creation activities were organized during several separate sessions with different stakeholders to understand how the information should be provided to the digital service users and allow a seamless user experience. The number of participants in each citizen group was limited so that everyone had the chance to express an opinion about what should be improved in the digital provision of the service.

One of the main challenges experienced by project initiators was to get citizens from different groups to come in person and participate in the co-creation sessions. During those sessions, citizens received a list of tasks they were supposed to accomplish for which they needed guidance and a division of the work in operational and manageable bits. Although seldom, citizens experienced some difficulties in expressing their opinion during the group sessions, especially when seeking to give a negative feedback. In contrast, the non-governmental representatives were very active in providing input, with a very detailed scrutiny which was however expected by project leaders. From the interviews with service providers some barriers were exposed such as entrenched routines, fear of direct contact and criticism from citizens, resistance to change habits, and lack of time.

The co-creation process led to the development of a list of approximately 100 requirements, 60% of them being functional and could be used for further improving the portal. In addition, project initiators were able to collect information about existent barriers within public service organisations that can hamper digital service acceptance and need to be targeted with specific actions in the future. One of the main outcomes of the initiative was the establishment of a new internal policymaking guideline document. The document

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is the Service Environment Development Plan 2020-2023[1] adopted by the Cabinet of Ministers in early 2020, which states that future public service delivery requires a life-based, personalised and proactive service environment. In this context, the service development will use new technologies and will be refined in close cooperation and co-creation with the user. This is however a planning document with no binding force, acting as a recommendation and indicating the main strategic goals for future policies.

5.3.5 "Io Italia" App, Italy

In Italy, public service provision is highly decentralized [25]. This means that the access to public services is atomized across different levels of governance. Many of them are shared between municipalities (such as traffic regulation and foster care) and regions (i.e. health services and education), while the rest remain a prerogative of the national government and affiliated agencies (i.e. tax collection and defence). Citizens are often constrained to get to service desks physically, or to resort to intermediary communication means (i.e. e-mail, telephone and post) to access public services. These elements make accessing most public services a tedious endeavour for most Italian citizens and residents, faced with a multitude of different service providers and often antiquated and complex procedures.

On this backdrop, the IO Italia project was born as part of a wider effort of Italy's national government to modernize, and thus digitalize, the provision of public services across the country [26]. The project team of Io Italia currently operates within PagoPA, a public company tasked with developing eGovernment solutions and online payment facilities for public administrations. However, it was initially conceptualized and launched by the Team for Digital Transformation that supported the Extraordinary Commissioner appointed by the Prime Minister from 2016-2019 in leading and boosting the implementation of projects in the public sector related to the Digital Agenda [27]. The project consists in setting-up a one-stop shop online IPS, able to offer a unified, simplified, and remote interface between citizens and their public administration.

Upon completion, the project aims at covering the whole spectrum of Italian public administration, ranging from municipal to national services. IO Italia also has the ambition to offer its users a wide variety of potential applications. This will range from making payments to and from public sector entities, to getting a direct contact point of communication with any relevant public service office.

First launched in 2018, the project has gone through several different phases and is still ongoing. First, the project team focused on mapping, through research, the expectations and the essential services demanded by various users (including back office users). On top of this, the team devised an operational mock-up that was tested with a limited cohort of citizens to map at that point the user experience and their needs in accessing digital services. After the general design of the app was validated, several service prototypes were integrated, such as a single digital ID scheme (SPID) and an online credit-card payment service (PagoPA). This led to the rollout of a new demo version of the app, for which a number of officials were invited to test in real life for a few months. By the end of 2019, a full-fledged closed-beta version was made available to a larger cohort of citizens.

In this phase, various jurisdictional levels of the public administration were involved in mediating between the team and the final participants in the co-creation process. The purpose was to cover both national

[1] The Service Development Plan is available only in Latvian at https://likumi.lv/ta/id/312410-par-pakalpojumu-vides-pilnveides-planu-20202023-gadam

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level services and services at municipal level, including those of different dimensions (large metropolitan areas such as Milan, medium-sized and smaller ones). Support regarding communication and facilitation was provided to the involved actors through workshops and material. During this phase, the app was constantly enriched, with more local and national public services becoming available. In 2020, the app transited to the open-beta stage, made freely available for any citizen for use (yet testing of new functionalities is still rolling with the possibility of giving feedback). Since then, the app has constantly been adding new features and new service offers and is confidently nearing the release of its definitive stable version, which is planned for 2022. Ultimately, it will be available on the most common mobile OS (iOS and Android) and as a web app available on internet browsers.

Objectives:

- Provide a single, seamless experience
- Replace complex and atomized procedures
- Switch the traditional paradigm of citizens approaching the public administration and rather have the citizen at the centre of the services
- Provide citizens with more simple and better functionalities
- Integrate public services vertically (different administrative levels) and horizontally (different types of services)
- Allow citizens to become self-sufficient remotely, diminishing the need to physically go to overworked public desks

Main stakeholders:

- Digital Transformation Team (2016-2019)
- "PagoPa" S.p.A, state-owned company (2019-present, [28])
- Municipalities (in the pilot phase Milan, Turin, Palermo, and Rome)
- National public organizations (such as the Ministry for Public Goods and Tourisms and the Italian Automotive Club) [29]

End-users:

- Italian citizens and residents
- Public service users at large

The information on aspects of IPS and co-creation were collected from desk research and interviews with two senior managers engaged during different stages of project development in the former Digital Transformation Team and the current company. In the desk research official documents were analysed, including the national strategy, the action plan, a white paper, and legislative acts. This was complemented with an analysis of available blogposts through Medium platform and the webpages of this and related project.

Table 5-7. Results of IO Italia App analysis

Dimensions of analysis	Results

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Integrated public service enablers	Multi-channel: The services are provided through a digital channel but remain available via a physical channel. In the future, the offer will be available through a web portal version. Digital interaction: The end-users can access the app for the first time with single sign-on through e-ID (SPID) and their electronic ID card (CIE). Then, they can login with a PIN code, fingerprint, and face recognition (on compatible devices). Once only principle: IO app is not built on top of any existing database or infrastructure, yet it is meant to connect with them and avoid future duplication. Additionally, the users had to give their consent only once to the Public Administration for collecting their data. Shared infrastructure: there is a common platform for all municipal, regional, and state public administrations. Collaboration agreements: there are data processing agreement and collaboration agreement Inclusion of political stakeholders: political stakeholders were involved at the beginning of the project. Multilingualism: the IO is available in different languages Reusability: IO reuses to a certain extent some information contained in the national enabling platforms such as citizen residence, identification (identity card), digital identity and payment system for the PA
Motivation for co-creation	It was necessary to involve policymakers and the relevant civil servants in the demo phase to ensure trust and support for the evolution of the project. What is more, it was necessary to involve citizens in the mock-up, closed-beta and open-beta phases to understand their needs and preferences as the end-users of the app, as it was progressively built up and enriched.
End-user enablers	Various service users were involved throughout the co-creation process, including civil servants and policymakers. Citizens, as end-users, actively participated in the co-design, co-implementation and co-assessment phases. The participating end-users generally came from all social, economic and demographic backgrounds, with no previously required skills or digital experience. End-users' participation was not formally incentivized, they freely engaged in the process.
End-user enablers in the co-creation process	In the initial definitional phase, a selected number of policymakers were involved in collecting ideas about which services and features could be delivered through a digital channel. Based on this an initial prototype was build and tested with users, with no specific criteria followed at that stage. Public entities involved in the rollout of the second massive testing were offered support during organized workshops and communication material (short tutorials, ads, kits etc.) to use in the interaction with citizens. On the other hand, participants directly interacted through the app with the development team, communicating their experience regarding three different clusters: i) reporting bugs; ii) features experience, iii) suggestions for integrating new services. Additionally, asynchronous chat was available to testing users.

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	No challenge was encountered in the selection of participants. In certain cases, due to the high number of volunteers, a cap number for participants was established. Based on the clusters mentioned above, the development team has constantly run analysis to identify issues and improve the app. Testing is an ongoing activity since new features are added to the app. Moreover, being an open source solution, any citizen with coding skills can contribute to improve Io Italia. Likewise, it is openly available to any public entity worldwide that would decide to adopt such a solution.
Co-creation process enablers	The project was co-financed by the Italian State and the EU. However, the purpose of Io Italia is to become self-sustained and contribute to savings in the delivery of public services. End-users were involved in the following phases of the co-creation in different ways: Co-design: Testing and feedback sessions, whereby end-users would be invited to act as testers and provide their impressions on the mock-ups presented to them Co-design, co-delivery and co-assessment: wide ranging beta-testing, whereby end-users were directly involved in the rolling-out of the various services offered by IO Additionally, at a relatively early stage, policymakers and civil servants were asked to test a demo version of the app on their own mobile devices. Therefore, they also took part in the co-design and co-assessment processes in their role of citizens. The initial team was composed of 8 members with specific skills covering service design, software development, data analysis etc. No strategies were in place to solve conflicts during co-creation. No risk management processes were in place.
Public organisation enablers in the co-creation process	Elected officials and civil servants have played a key role in the development of Io Italia. In the initial phase, the team collected feedback from several national Agencies (INPS, ACI) to analyse the touch points between the citizens and the Public Administrations. Another Public organization, the digital Italian Agency, participated in the initial brainstorming phase for analysis of the needs of the citizens. Throughout the process, the team also had to ensure each local authority concerned agreed to the steps taken. Indeed, given their great level autonomy, local governments had to provide their agreement to integrate their services to the app. No particular incentive was provided to elected officials and civil servants, who participated pro-bono.
Public organisation enablers	The Io Italia project is not over yet, as it continues to be tested as an open-beta app. However, due in part to Io App project, the Team Digitale together with AgiD has developed the Guidelines for designing the digital public services. The guiding principles as well as supporting material such as kits, user journey blueprints are stored on a dedicated website for designing public services [30]. The guidelines have been included in the Three-Year Plan, a binding policy document aimed at digitalising the Italian public services.

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Contextual enablers	The project was legally determined and framed by the 2017-2019 Three-Year Plan for ICT in the Public Administration [31]. It is a document containing actions, financial needs and the model of management that guides the digitalization of Italian PA and sets out a roadmap to accomplish it. Every three years, the Plan is updated according to emergent needs. Additionally, in terms of legislation, there were two main matters for concern. First, the project had to be built around existing privacy and personal data legislation. It was necessary designing an app that requests explicit consent to users when using their data in relation to the public services provided. For this purpose, the Team has been tightly collaborating with the Italian Data Protection Authority. Second, the Italian institutional set-up (highly decentralized) made it necessary for the project team to deal with each local entity separately. Indeed, the team needed to request consent to each single local government so that their services could be integrated.
Cultural enablers	At the very initial stage, public entities were skeptical about the introduction and use of an integrated, digital channel. Their main concerns were about the possibility that such a tool could diminish their power and authority. This required engaging with them closely, trying to persuade and show the advantage of having an additional tool in the provision of services. Trailblazers were crucial at that stage as they supported the diffusion of the app further across the administration.

The 'Io Italia' project is one building block in a larger effort of the country to digitally transform the public service offer. In this process, a paradigm shift should occur whereby the concept of public services changes from having the public service provider at the centre towards having the service user at the centre. In practical terms, a process that was previously designed from the perspective of service providers' needs and split across responsible departments, should now be re-designed and reengineered along service users' needs, integrated, as to serve them with the best experience. This is the vision behind Io Italia project, which is still ongoing and continuously upgraded, and its main goal is to offer a single, seamless experience to previously complex and fragmented procedures. At the outset, the initial team adopted a co-creation approach that has gone through different waves and keeps running.

Involving the civil servants, policymakers and then citizens during several stages of implementation was crucial to understand how to develop an offer aligned with users' expectations, and conducive to a faster process of diffusion because the early adaptors could become the ambassadors of the initiative.
In the initial stages and in the roll out of the beta version of the app numerous challenges have been encountered. First among them legal barriers, which regarded respecting privacy legislation and dealing with the decentralized setup of the Italian Public Administration. The large-scale dimension of the project was also demanding. This is the first attempt to deliver a digital solution across a highly fragmented system, for which the integration of back-end infrastructures is compelling.

The project is a successful example of connecting democratic principles of service user participation and the provision of integrated, digital services. In the last years, Io Italia has upgraded and expanded its offer, with the government making a strategic choice to invest in its growth. The latest example is the use of Io Italia App to deploy the issue of the digital Covid certificate to facilitate citizens travelling across the EU.

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5.4 Cross Case Analysis

This section draws together the findings across the five case studies on co-creation activities in the development of IPS. The cases are set in different service sectors and describe different ways in which stakeholders can be engaged through co-creation activity to remodel, improve and innovate public services, and ultimately lead to public value creation. For this reason, the previous section has described some of the main findings in each case study, seen from their embedded contexts. In this final section, we shall present how the different case studies account for co-creation activity and stakeholder engagement in the context of integrated public services (IPS).

As mentioned in the section dedicated to the research design, the cross-case analysis is centred around the themes of IPS co-creation, which distinguish between end-user, government and cultural domains derived from the classification of Meijer [32] (see Chapter 3). A set of eight themes guided the analysis and reading of each case report, namely:

1. Integrated Public Service
2. End user enablers
3. End user enablers in co-creation
4. Process of co-creation
5. Public organisation enablers in co-creation
6. Public organisation enablers
7. Contextual enablers
8. Cultural enablers

The selected themes condense the more elaborate issues that guided the data collection process. In addition to these themes, the analysis regarded the motivation, barriers and outcomes of co-creating IPS. Next, we present and discuss the most relevant theme categories emerged across the cases included.

5.4.1 Integrated Public Service

Analysing the five public service initiatives regarding the principles of integrated public services (IPS) we found most of them share similar characteristics regarding the use of shared infrastructure, respecting the once-only principle and adopting collaborative agreements to ensure an enhanced experience of the services.

- Most of the cases analysed here adopted the once only principle such that various service users, including citizens, businesses need to provide only once certain standard information to the authorities, which will be then reused by administrations to reduce burden on users and increase efficiency of data gathering.
- All cases provide digital access to different public services through multiple digital channels, via single sign-on (using e-ID or other certified authentication methods), guaranteeing user-centricity. However, in most cases services are available from other access points (physical or virtual, such as CSCs).
- Most cases developed integrated public services (IPS) re-using existing infrastructure and building blocks; and adopted open source solutions (in the case of X-Road, Municipality ASP, Io Italia).
- The IPS are usually cross- border and/or cross-organisational with the aim of breaking down silos in IT governance which can enhance efficiency, effectiveness and transparency. In this context, collaboration agreements (technical, legal and organizational) are stipulated between

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parties/countries in order to establish trust between partners and to clarify their roles and responsibilities (i.e. X-Road case).

- Political stakeholders are involved to resolve disagreements especially in cross-domain, cross-border or intergovernmental IPS. Concomitantly, this can also endow a more trusted view from citizens and other stakeholders.
- Multilingualism is guaranteed in IPS to offer the possibility for the end-users to access and read the content in different languages. For instance, in the case of Io Italia, a collaboration is underway between the team and some regions and provinces to offer a German version of the app.

5.4.2 End-user involvement

The end-user involvement theme was created considering two main aspects: (1) the end-user enablers; and (2) the factors that enable their participation in co-creation activities. The first aspect considers the extent to which citizens have skills in using digital technologies, what can motivate their involvement and which user groups are involved in co-creation activities. The second aspect focuses on the strategies defined, if available, in engaging service-users and how this engagement is managed.

- The selection of end-user in most cases was random. When users were recruited actively by the public service provider (for instance in Digisos and Io Italia) it was sought to have a representative sample of potential users, combining digitally skilled citizens with others are less skilled in this respect. It is an option to ensure that no one is left out from participating and can boost the uptake of the digital solution. Furthermore, the new public service can be designed with the capacities of those less skilled in mind to maximize its accessibility.
- No particular parameters have been identified to monitor the participation of end-users in the co-creation process. Sometimes project teams might encounter difficulties in stimulating end-user participation. Thus, it can become counterproductive to restrict participation to specific demographics as this could make the recruitment process even harder.
- End-users participated voluntarily in the co-creation activity, without any prior material motivation. In one case, an incentive (gift vouchers) was provided to end-users that participated in the co-creation as a way of thanking them, but this was not advertised beforehand in order to boost their motivation to participate (Digisos).
- Often, end-users are identified and engaged through municipalities that act as intermediaries between the project team and citizens (e.g. Digisos, Io Italia, Municipal ASP).

5.4.3 Process of co-creation

The way co-creation activity was conceptualized and realized in practice across the cases was an important aspect we aimed at covering through various addressed questions. All stages from design to delivery and assessment were covered, as well as the strategies used in communicating, supporting and appraise the involvement of various stakeholders.

- In the development of IPS, end-users are mainly involved at the co-design stage with the purpose of understanding which are their needs and expectations for a certain service. In the co-assessment process, various service users test the solution and provide their feedback. In the delivery phase, various users and citizens generally, directly interact with the service provided

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through an app or a digital portal (all cases) to fill in requests, file applications, communicate with various public offices, pay fees or certificates.

- Processes and procedures have been followed during co-creation, and figures like the project manager were also considered as being responsible for coordinating the co-creation process.
- In most cases the co-creation process took place through digital tools, including remote meetings with end-users. In parallel, traditional tools were used during the co-design phase, through interviews used to discuss end-users' main expectations, and through feedback sessions during the co-assessment phase. For example, in the case of the Digisos and Io Italia projects, end-users were invited to act as beta-testers and provide their impressions on the mock-ups presented.

5.4.4 Public organisations

The aspects in this theme regard the government domain and involve: (1) the enablers in the co-creation process, and (2) enablers existents at organizational level. For the first aspect we considered what are the role and skills of civil servants involved in co-creation, what factors can influence their involvement. Whereas for the second aspect we covered the institutional design, the role of leadership, and if previous collaborative initiatives were pre-existing.

- Municipal authorities decided to start the projects and provided support throughout them. In Digisos, municipalities were an important part of the project, since they are responsible for the delivery of social welfare services, across the cases, the project team often shared responsibility for co-creation activities. In general, the project manager was the main leader of co-creation (e.g. Digisos). In some cases, specific team members were dedicated to fulfill this task (e.g. ASP, VARAM).
- Civil servants working within local authorities hold a key role. They often acted as an interface between the project team and the end-users' 'sphere'. In general, they were either asked to provide insights based on their experience (e.g. Digisos project), or they were directly the ones responsible for the exchange with citizens (e.g. VARAM use case). In the case of the ASP project, they were even asked to test new digital solutions. In the case of Io Italia, policymakers (20 members of the parliament) were involved in testing the first mock-ups of user experience for the app.
- In most cases, civil servants or frontline staff were additionally offered training sessions and workshops to get acquainted with various service functionalities and ensure their future uptake.
- In most cases, civil servants were not incentivized to take part in these projects. They often did this during their work working time, as part of their regular mission. However, in the Municipal ASP case, in contrast to the other cases, local officials who participated in the working group and the roll out of ASP received financial compensation.
- In two out of five cases examined, the co-creation of public services between different levels of governance proved somewhat tense at first because of rigid organizational structures. Specifically, in the case of the ASP project, municipalities felt as though the state's projects clashed with local autonomy principles. This led to new legislation being passed to clarify the redistribution of repartition of competences. In the case of Digisos, local actors initially perceived the project as a threat to their authority and constitutional powers.
- Once these first tensions were addressed, all the projects succeeded to fulfil their established objectives, demonstrating that good cooperation between the local and national levels of governance was both possible and profitable. In turn, in some cases, this led to further cooperation to extend co-creation further. For instance, in the case of Digisos, the successful completion of the project launched debates about welfare policy further integration between the state and municipalities (see more in 'outcomes').

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5.4.5 Contextual and cultural factors

Across the different cases we sought to reflect the context and the cultural factors that might affect initiatives seeking to adopt a co-creation approach in public services provision.

- In almost all cases, there was no pre-existing regulatory framework for co-creation. Hence, the process either followed internal non-binding guidelines (e.g. Digisos); or new general guidelines were defined and developed from existent international best practices and issued as guiding principles for future preparation of digital services (Io Italia).
- Privacy regulations (GDPR in particular) restricted the way in which citizens could be involved in co-creation. In the case of Digisos, a legal team had to be consulted regularly to ensure that no legal provision was breached. Similarly, in the case of Io Italia tight collaboration was sought with the Privacy Authority to guarantee the app fully complies with legislation.
- The extent to which dominant political and social norms and values, and organizational culture, impeded or encouraged the smooth operation of co-creation processes varies between our cases. For instance, for Digisos and ASP, the political practice of local autonomy created frictions between local governments and the project team.
- These frictions were eased differently, demonstrating diverging political cultures. For instance, in the case of Digisos, dialogue and consensus were chosen; while for ASP the state adapted the law to nudge local governments towards cooperation.

5.4.6 Motivation

- In the cases in which end-users were involved directly, this was mainly motivated by a need from the project team and stakeholders to get a better grasp of their needs and expectations. This is particularly evident in the Digisos project, Io Italia and the VARAM use cases.
- In the cases in which co-creation took place among several public administrations, the main motivation was to make the provision of public services more efficient and simpler for end-users. This is particularly evident in the cases of ASP and X-Road.

5.4.7 Challenges/Barriers

Across the cases where citizens were involved directly, several barriers were identified:

- Sometimes, citizens do not dare expressing their honest opinion because they are shy in a public setting, or because they avoid express negative feedback in front of the project team (e.g. VARAM use case).
- Recruiting citizens that are willing to give time and attention to the project teams can prove challenging (e.g. Digisos).
- Civil servants at times can be sceptical about the direct involvement of citizens. In the case of Digisos, this was perceived as an attempt to side-line them.
- Privacy protection regulations often represent an added difficulty, requiring the project team to adapt their interactions with the public to ensure compliance (in all cases where legislation concerning privacy challenges citizens participation)

Across the cases where several public organisations, and especially several levels of governance (e.g. municipality and the state), co-create services together, other several other barriers were identified:

- Not all public organisations have the same level of following the principle of co-creation (e.g. Digisos).

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- Not all public organisations agree on the methods used to achieve the modernization/integration of certain public services. Local governments felt that their autonomy was threatened by such policy objectives (e.g. Digisos, ASP). In the X-Road case, there was also a divergence in the levels of expertise, expectations, and methods employed on each side of the border.

5.4.8 Outcomes

- In all cases, co-creation proved an effective way to design innovative public services. Despite previously mentioned challenges, it was noted that al projects ended up delivering results, sometimes even ahead of schedule (e.g. Digisos).
- When co-creation was particularly successful, it provided impetus and momentum for extending this method to other public services, or other stakeholders. In the case of Io Italia, the Team together with AgID defined a set of guidelines to adopt in the phase of designing digital public services which have been included in the Three-Year Plan and can be easily accessed through a website [26]. In the case of Digisos, the successful completion of the project opened the way for similar projects seeking to modernise other types of public services. In the VARAM use case, the project led to the formulation of new internal policymaking guidelines encouraging co-creation. In the case of X-Road, the project's success inspired the Estonian and Finnish governments to think about adopting the same infrastructure and procedures to integrate the two country's administrations further.

5.5 Concluding remarks

This chapter has investigated how co-creation in IPS is understood and carried out in practice across five different cases. The cross-case analysis has provided a general picture on emerging and recurring patterns across these cases. As specified in the previous sections, all cases studied share a number of analogous characteristics. Namely, all cases rely on the once-only principle and provide multilingual digital access among other channels of communications, with user-centricity in mind. Further, they all re-use existing building blocks which they adapt to open-source solutions. They also share an ambition to bridge existing gaps between countries, levels of government or type of administration. Their development processes always occur through technical, legal and/or organizational collaboration agreements, and always involve policymaking stakeholders of various levels of government.

A great variety of approaches was noted as far as IPS and co-creation are concerned. None of the analysed cases can be described as an ideal type, rather each single case matches these ideal types to different extents. Some cases are much closer to the IPS definition (e.g. Municipal ASP) than others (e.g. VARAM). Conversely, some cases embody better the definition of co-creation (e.g. Io Italia) than others (e.g. X-Road). However, the focus of this chapter in relation to the overall aim of the project is to enrich existent accounts of IPS from a co-creation perspective and present relevant insights for the planned pilots in the InGOV project.
it was noted that IPS development can take many shapes in function of the nature of the services integrated, of the degree of integration and of the local context. For instance, the local institutional specificities of Norway and Hungary rendered the development processes of Digisos (Norway) and ASP (Hungary) very different from one another, even though the two-share similar degree of closeness to the IPS ideal-type. One way to reflect the local specificities is to actively involve municipalities (or other local authorities) in the co-creation process. Except the X-Road case, the other examples all amply relied and engaged with local organisations.

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Likewise, the degree and nature of service user involvement in the development of eGovernment services varies in function of project aims, awareness and knowledge of co-creation approach and local governance cultures. All analysed cases strived for establishing a participative approach using co-creation to either improve existent services (boost efficiency, transparency etc.) or to provide a more user-centric service. Co-creation was important during all stages, yet the design stage of the service cycle was privileged in all cases. For instance, the cases of Io Italia and to a lesser extent Digisos show that IPS should conceive user involvement throughout all phases of co-creation

During co-creation various offline and online tools were used with different stakeholders. Often these types are mixed as to get more fine-grained results and depend on the stage of the service cycle or the stakeholders: more personal interactions and direct conversations are preferred during co-design, with citizens, while digital tools such as mobile apps or portals are used for co-delivery. Finally, the initiatives involved a wide variety of actors, yet citizens played the most important role as public service users and co-creators, followed by businesses. Governmental actors (frontline staff, civil servants, policymakers) were involved in all analysed co-creation cases, most often as initiators. However, it should be noted that co-creation is still unknown or unclear among public service providers. For this purpose, workshops and training sessions can prove useful to equip civil servants with the right tools and disseminate the knowledge in the public sector. Finally, the development and design of a normative framework or operative guidelines can foster co-creation activities in the design or reengineering of (integrated) public services.

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SECTION 2

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Chapter 6. Enhanced Core Public Service Vocabulary

Acronyms and Abbreviations

Acronym/Abbreviation	Description
PS	Public Service
IPS	Integrated Public Service
PSP	Public Service Provision
CPSV	Core Public Sector Vocabulary
CPSV-AP	Core Public Sector Vocabulary Application Profile
CCCEV	Core Criterion and Core Evidence Vocabulary
CPV	Core Person Vocabulary
CBV	Core Business Vocabulary
UML	Unified Modelling Language
EC	European Commission
EU	European Union
ISA	Interoperability solutions for public administrations, businesses, and citizens
GaaS	Government as a Service
DSR	Design Science Research methodology

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6.1 Introduction

The provision of public services (PS) is the main task of most governmental entities. It is usually the main means for the implementation of a governmental policy targeting the fulfilment of citizens' needs. As PS provision is a major part of public sector activities, the opening of PSs highly contributes to the realization of the Open Government vision. Additionally, the opening of PSs promotes transparency and trust between public administrations and citizens. Furthermore, active participation of citizens in PS improvement is facilitated. The European Union (EU) eGovernment Action Plan 2016-2020 highlights that in the framework of the European Cloud Initiative, the Commission "will create a platform for public authorities to open their data and services, creating a "Government as a Service (GaaS)" base for the EU." [1].

Every single eGovernment system that provides public services is based on an underlying PS model [2]. Here, the term Public Service model is used to denote "a data model that has been developed for describing and/or developing public services" [2]. A PS model includes concepts that constitute the description of a PS. It may also include relationships between these concepts. A concept of a PS description may be its title, description, cost etc. PS models and standards are considered as main enablers for promoting interoperability and quality of PS provision.

Embracing the need for a standard PS model, the European Commission (EC) has developed recently a PS model, termed Core Public Service Vocabulary (CPSV) [3]. CPSV belongs to a series of Core Vocabularies that have been elaborated by European Commission ISA/ISA^2 programmes in order to conceptualise PSP domain, as for example Core Criterion and Core Evidence Vocabulary (CCCEV), Core Person Vocabulary, etc. The adoption of CPSV, and other EC ISA/ISA2 core vocabularies by the Member States is expected to promote semantic interoperability and the implementation of cross-border public services. The first CPSV version was released in 2014. Subsequently, a linked data application profile of CPSV, i.e. CPSV-AP, has been developed. The more recent version of CPSV-AP has published in 2019 [4].

Three dimensions of PS provision (PSP) that inGOV project focuses on, are: a) co-creation, (b) PS integration and (c) personalisation. Information on co-creation in PS provision and integrated PS (IPS) is provided in Chapter 2 and Chapter 1 respectively. Personalisation refers to customising complex PS according to a citizen's profile or other legal condition. Complex PS are those where citizens may have to submit different documents or have a different cost, i.e. have different versions, based on a citizen's profile or other legal condition. Furthermore, as IPS provision refers to the orchestration of a set of PS, in order to fulfil a citizen's life event, e.g. travelling abroad, personalisation also applies in IPS provision. More specifically, when an IPS, i.e. a set of orchestrated PS that ultimately produce a single outcome, comprises complex PS, then the customisation of the PS that are members of an IPS, to a citizen's profile or other legal condition, leads to personalisation In the provision of an IPS. Although CPSV-AP is a promising standard, recent research has shown that further enhancement is needed in order to facilitate: (a) co-creation, (b) PS integration and (c) personalisation in PS provision [2][5][6].

The aim, of this chapter is to enhance CPSV-AP in order to support, in the framework of inGOV, personalised integrated PS co-creation. In this chapter we enhance CPSV, in order to be able to facilitate co-creation in the evaluation phase of PS provision. Additionally, we enhance CPSV, in order to be able to accommodate complex PS facilitating personalisation in PS provision. Integrated PS (IPS) provision is already supported by CPSV-AP through its Event class. In order to enhance CPSV-AP, we integrate it with other EC ISA/ISA2 core vocabularies, as for example Core Criterion and Core Evidence Vocabulary. This integration is realised

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by reusing classes of other core vocabularies in order to enhance CPSV-AP. Additionally, we exploit recent research where PS models have been reviewed [2].

In the rest of this chapter, we present the methodology that we follow in section 6.2. In section 6.3 the EC ISA/ISA2 core vocabularies that will be exploited are presented. In section 6.4 we analyse the need for enhancement of CPSV in the framework of inGOV. In section 6.5 we review relevant literature. In section 6.6 the enhanced CPSV-AP is presented and in section 6.7 some conclusions and directions for future work in the framework of inGOV are presented.

6.2 Methodology

The methodology followed is inspired by the principles of Design Science Research methodology (DSR) [7]. DSR begins by identifying current problems that need to be solved or potential opportunities for improvements in an actual application environment consisting of people, organizational systems and technical systems [8]. However, we have not followed a sequence of steps that is explicitly derived from DSR. Our methodology aspires to enhance CPSV in order to be able to support personalised IPS co-creation and comprises the following steps:

a) Present the latest version of CPSV-AP (As-Is situation) and the relevant Core Vocabularies, i.e. Core Criterion and Core Evidence Vocabulary and Core Person Vocabulary (see section 6.3).
b) Present the need for enhance CPSV, in the framework of inGOV, in order to be able to support personalised IPS co-creation (see section 6.4).
c) Review relevant literature regarding PS models (see section 6.5).
d) Enhance CPSV-AP in order to be able to support personalisation in complex PS provision and co-creation activities (see section 6.6).

6.3 Core Vocabularies

In this section we present some EC ISA/ISA2 core vocabularies, namely CPSV-AP, CCCEV and Core Person Vocabulary (CPV), that are exploited for producing the enhanced CPSV-AP.

6.3.1 CPSV-AP

The use of CPSV-AP is two-fold: new PS models can be based on CPSV-AP and existing PS models can be mapped to CPSV-AP. Thus, CPSV-AP can be used as a gateway for bridging and federating systems, for example PS catalogues or eGovernment information systems, based on different PS models and thus facilitating semantic interoperability.
CPSV-AP incorporates linked data as an underpinning technology. Thus, PS descriptions can be published as linked data and becoming part of linked data cloud. Many researchers suggest that linked data paradigm is ideal for Public Sector Information (PSI) publishing, enabling the potentiality of breaking the bureaucratic silos[1]. Additionally, new web applications can be built exploiting PSI linked repositories in combination with other linked data repositories, such as DBpedia. However, CPSV-AP has not been widely adopted yet. Previous research indicated that a major reason is that linked data technology, apart from its

[1] See References [15-18]

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benefits, puts some significant obstacles [5]. For example, the management of a linked data repository (e.g. data update), is a cumbersome process [6].

The classes and properties of CPSV-AP are being classified as being mandatory or optional. In figure 6-1 the latest version of CPSV-AP, i.e. v2.2.1, is depicted. The mandatory classes has blue colour while optional classes has orange colour [4]. The minimum requirements of a PS description, in order to comply with CPSV-AP, is to provide at least information on the mandatory properties of the mandatory classes. Optional classes can still have mandatory properties for which information should be provided when the particular class is used in the description of PSs.

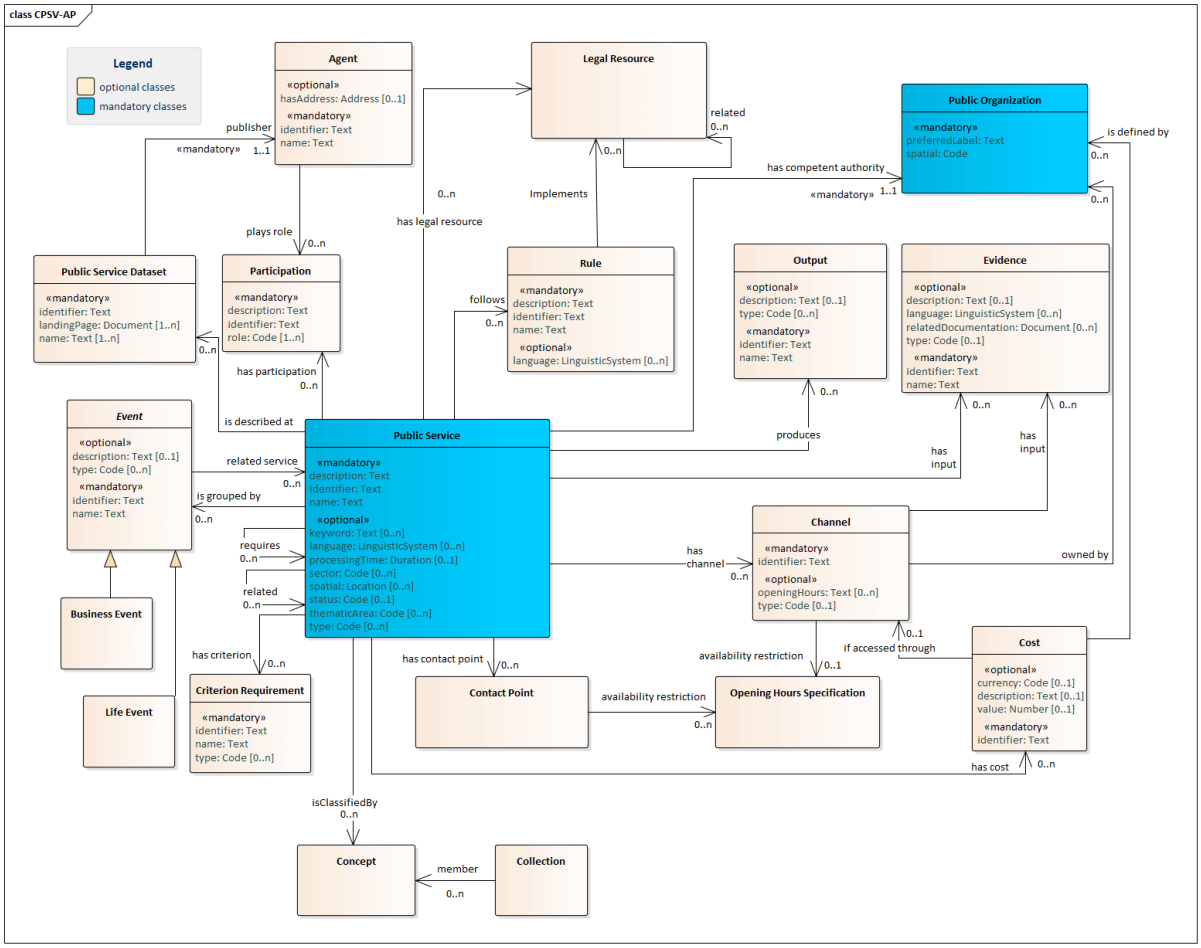

Figure 6-1. The UML diagram of CPSV-AP 2.2.1 (adopted from [4])

6.3.2 Core Criterion and Core Evidence Vocabulary (CCCEV)

The EC introduced the Core Criterion and Core Evidence Vocabulary (CCCEV) v1.0.0 by the end of 2016 [9]. At 8th of March 2021, the EC published a working draft of CCCEV v2.0.0 [10]. The Core Criterion and Core Evidence Vocabulary is designed to support the exchange of information between organisations or persons (more generally Agents) defining Requirements and organisations or persons responding to these Requirements by means of structured or unstructured Evidences. CCCEV v2.0.0 contains two basic and complementary core concepts:

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- the Requirement, a broad notion encompassing all forms of requests for information, that is often, but not necessarily, made with the objective to use it as a basis for making a judgement or decision; and
- the Evidence, the data proving or disproving that a specific Requirement is met by someone or something, and thus has been fulfilled.

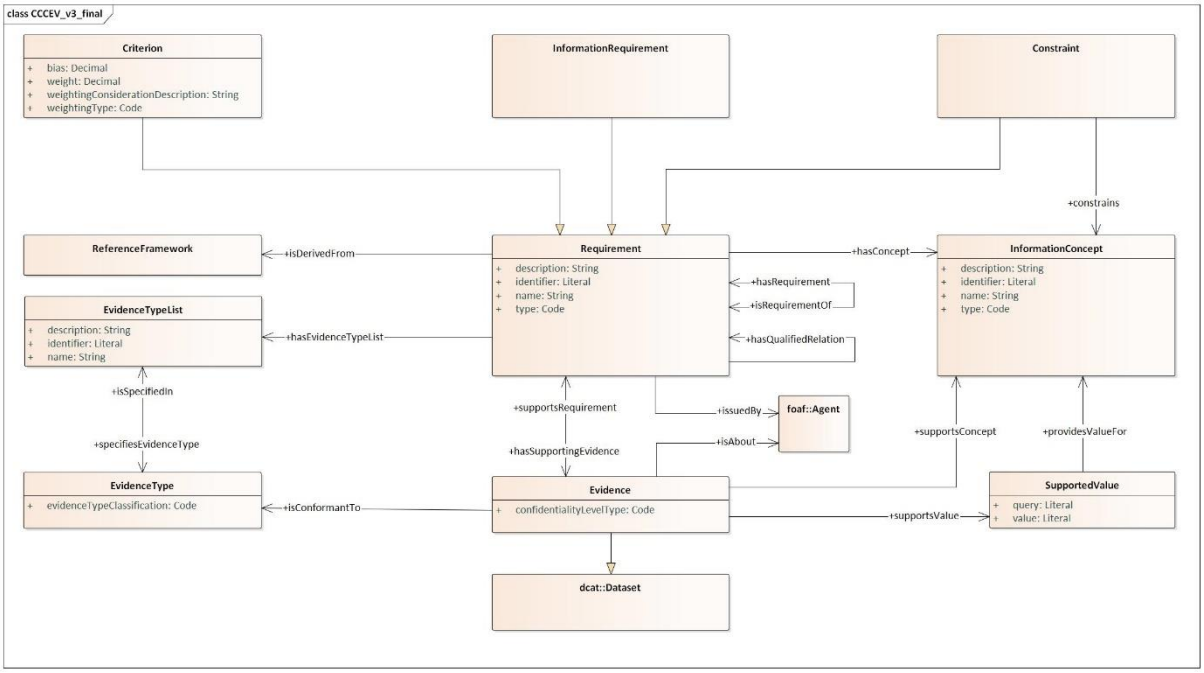

Figure 6-2. The UML diagram of CCCEV v2.0.0 (adopted from [10])

6.3.3 Core Person Vocabulary (CPV)

At 1st of April 2021, the EC published a working draft of Core Person Vocabulary [11]. The Core Person Vocabulary provides a minimum set of classes and properties for describing a natural person, i.e. the individual as opposed to any role they may play in society or the relationships they have to other people, organisations and property; all of which contribute significantly to the broader concept of identity [11].

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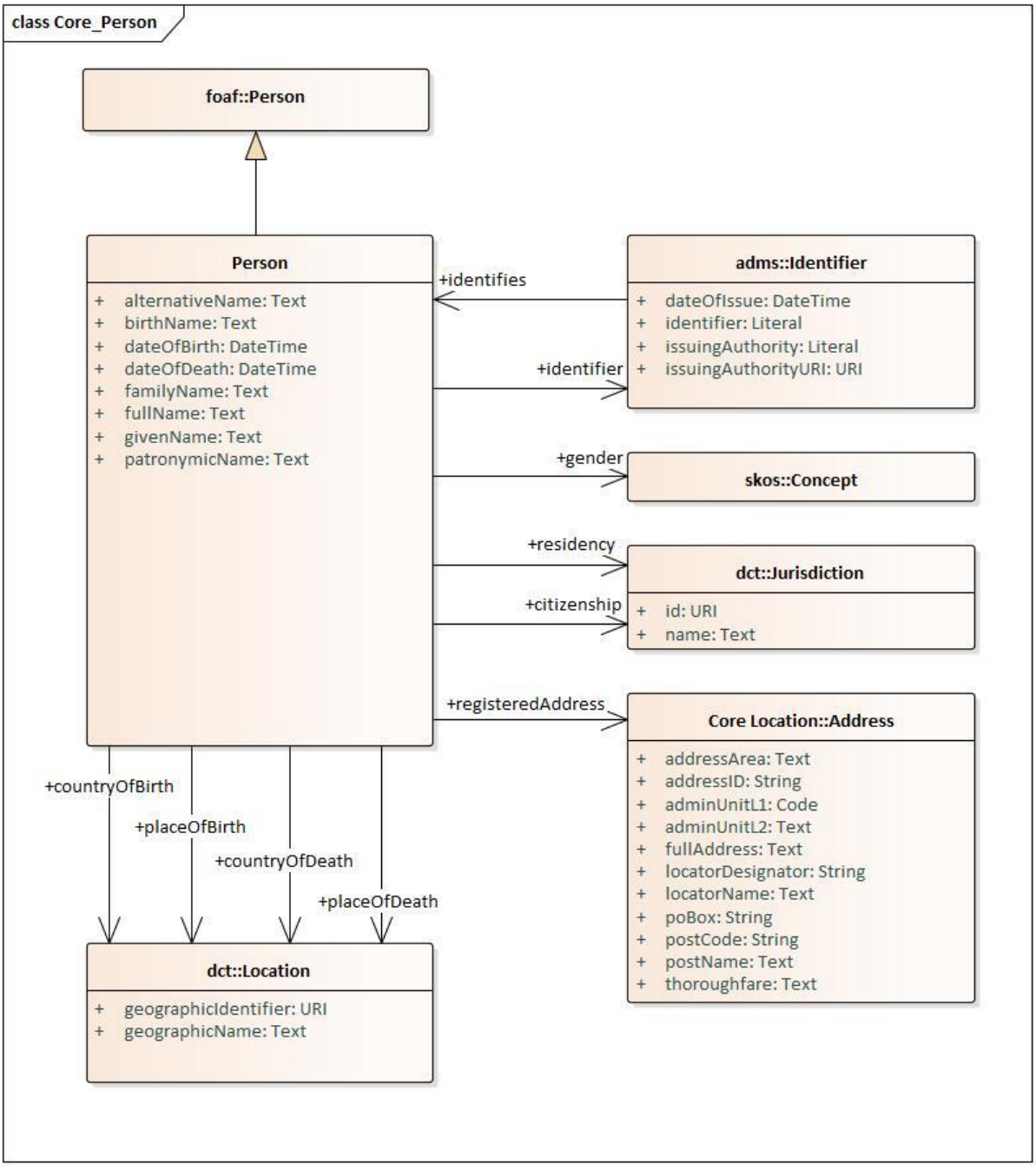

Figure 6-3. The UML diagram of the Core Person Vocabulary (adopted from [11])

6.3.4 Core Business Vocabulary (CBV)

At 1st of April 2021, the EC published a working draft of the Core Business Vocabulary [12]. The Core Business Vocabulary provides a minimum set of classes and properties for legal entities, that is, trading bodies that are formally registered with the relevant authority and that appear in business registers. This excludes sole traders, virtual organizations and other types of 'agents' that are able to do business [12].

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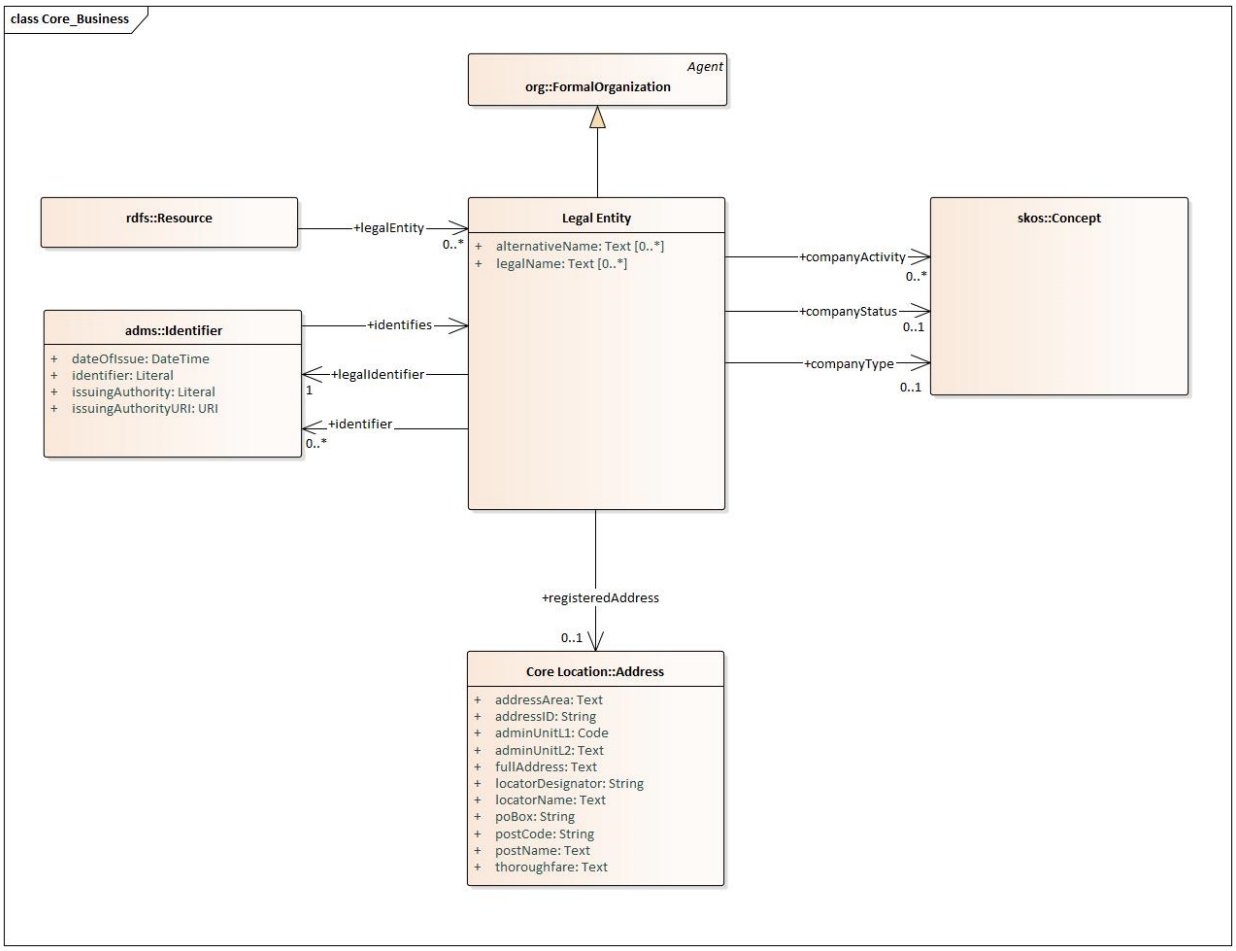

Figure 6-4. The UML diagram of the Core Business Vocabulary (adopted from [12])

6.4 Why enhancing CPSV-AP within inGOV

Studying the previous sections, we can notice the following:

- As we can see in figure 6-1, where the UML diagram of CPSV-AP v2.2.1 is depicted, the Evidence class is not related (connected) to Criterion Requirement class. Additionally, the Agent class is not related (connected) to Criterion Requirement class. Consequently, inference between Criterion Requirement Class and Evidence or Agent is not feasible. More specifically, required Evidence, for example input documents, cannot easily be correlated to specific Criterion Requirements or a citizen's profile. Thus, personalization is hampered.
- As we can see in figure 6-2, where the UML diagram of CCCEV v2.0.0 is depicted, the Evidence class has richer conceptualisation in CCCEV than in CPSV-AP. In CPSV-AP 2.2.1 the Evidence class is reused by the CCCEV 1.0.0. However, CCCEV has recently been evolved to version 2.0.0. We suggest that CPSV-AP should reuse the classes of CCCEV 2.0.0 in order to take advantage of CCCEV evolution.
- As we can see in figures 6-1, 6-3 and 6-4 the CPSV-AP is not integrated with Core Person Vocabulary (figure 6-3) and Core Business Vocabulary (figure 6-4) that has been recently released.

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Consequently, we suggest that CPSV-AP alone cannot capture the inference between the eligibility criteria for the provision of a PS and the corresponding evidence that is required based on the end-user (Agent) attributes. We presume that this hampers personalisation capability of CPSV-AP.

For example, in the Greek pilot, the eligibility requirements for issuing of Discount Transport Card for disabled citizens corresponds to specific required documents (Evidence). Using alone the CPSV-AP we cannot infer the required documents based to a beneficiary characteristic which in turn match to specific criteria. In figure 6-1, where the UML of CPSV-AP v2.2.1 is depicted, we can also observe there in not one or more classes that can be used in co-creation activities.

Additionally, we can observe, that although Core Vocabularies reuses classes and properties form each other, they are not adequately aligned. For example, CPSV 2.2.1 has the Legal Resource class, while the CCCEV v2.2.0 has the Reference Framework class. In section 6.6. we will enhance CPSV-AP in order to be used for personalised IPS co-creation in the framework of inGOV. The enhancement of CPSV-AP will be based on existing core vocabularies and on the literature review that is presented in the next section.

6.5 Related work

In this section we summarise the results of a literature review of PS models and we briefly present some research work on personalization of informational public services.

6.5.1 A brief presentation of a literature review regarding PS models

In [2] an extensive literature review regarding PS models has been conducted. In that article, both academic and applied PS models, i.e. models that have been used for building national PS catalogues, have been analysed. Initially, PS models were identified, and their concepts were extracted. As noted in the introduction of this chapter a PS model includes concepts, e.g., PS name, PS description, PS cost, PS legal framework, etc. All extracted concepts were compared to CPSV-AP v2.0 concepts. The concepts that were matched, meaning they were semantically identical, to a CPSV-AP concept, were not further processed. Subsequently, the rest of the concepts that were not matched to a CPSV-AP concept, were compared to each other. That process resulted in groups of concepts. The number of the semantically identical concepts that were included in each group of concepts is the frequency (Freq) of the group. Additionally, the groups of concepts were titled by an overarching name that usually corresponded to the majority of the concepts of a group. Consequently, every group of semantically identical concepts were considered as one new concept that is not included to CPSV-AP concepts. The selection of the concepts for the enhancement of CPSV-AP 2.0 was made based on the following criteria: (a) the frequency of a concept group, (b) a concept group should not be country specific or domain specific. The additional concepts that were finally selected, as an outcome of the analysis described above, are shown below:

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Table 6-1. The additional set of concepts (adopted from [2])

Concept	Freq	Definition/Description
Additional content	44	Includes additional sources of information, notes, FAQs and possible attachments about the PS
Appeal-Complaints	5	Information about the constituents' right to object to a governmental decision relevant to the PS
Availability	11	The time period during which the PS is provided
Base Registries	4	The URIs of the base registries that provide necessary data for the execution of the PS
Channel Address	3	The address of the channel where the PS is provided
Channel E-mail	20	E-mail address(es) for contacting the channel personnel responsible for PS provision
Channel Name	11	The name of the channel for PS provision
Channel Phone	22	Telephone number(s) for contacting the channel personnel responsible for PS provision
Comment	2	The text of any feedback provided about the PS
Consequence	1	Information about the executed PS that needs to be forwarded to interested parties
Creator	7	Information about the creator of the PS description
Deadline	7	The deadline for submission of an application for obtaining a PS
Description	10	A description of the Competent Authority of the PS
Feedback	4	Hosts any type of feedback about the PS
Last updated	12	The date of the last update of the PS description
Need	2	The need(s) of the societal group that the PS is targeting
Potential Consumer	30	Information about the potential consumer(s) of the PS
Potential Consumer Name	2	The name of the societal group(s) (ideally a value of a taxonomy) that the PS is targeting
Process	28	The steps followed during PS provision (ideally provided in machine-readable format)
Profession	3	The profession(s) that the PS is targeting
Purpose of Evidence	1	The purpose served by a piece of evidence
Rating	3	The rating of the quality of the PS description (e.g., 5-scale rating)
Service URL	15	The URL related to the execution of the PS

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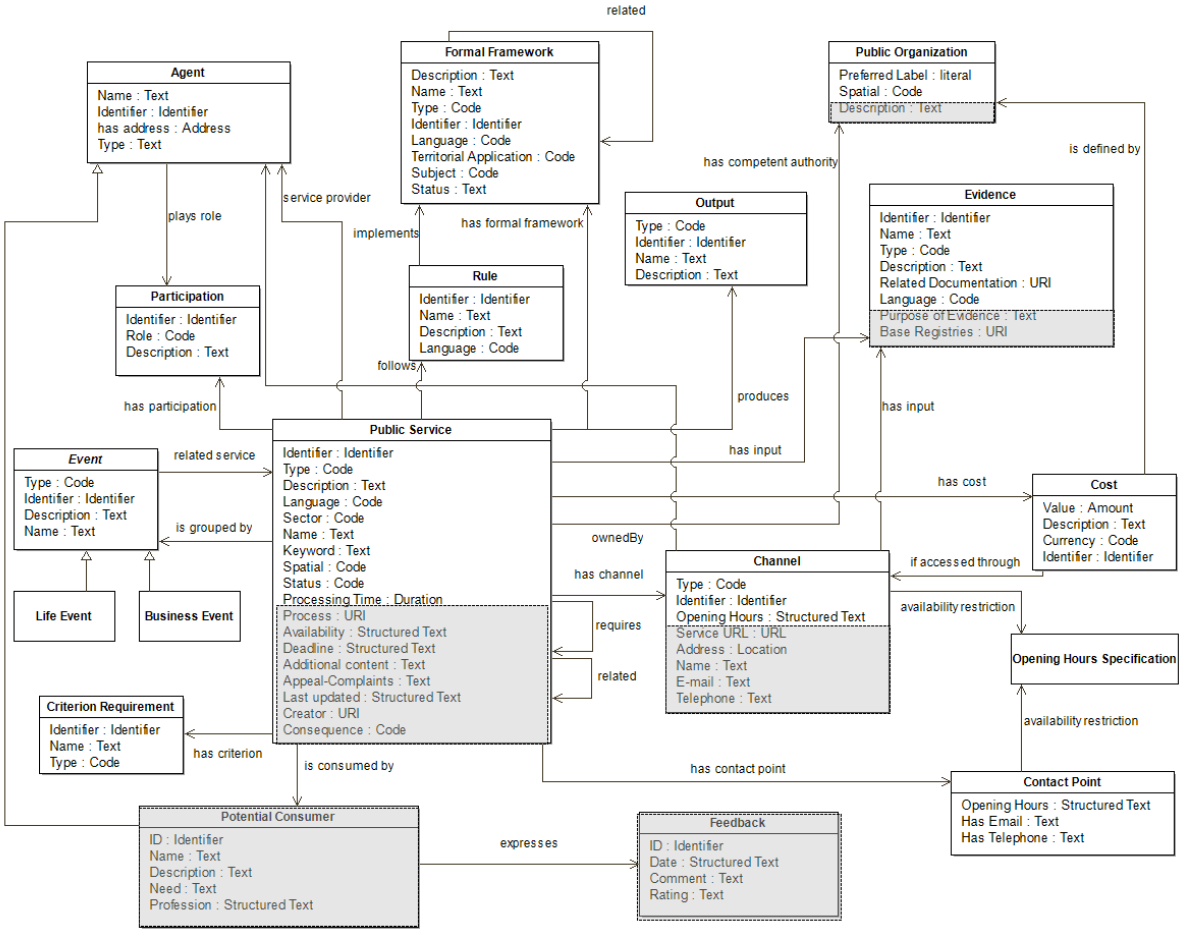

Figure 6-5. The UML diagram of the enriched CPSV-AP 2.0 model (adopted from [2])

The additional concepts, that were selected, were integrated to CPSV-AP 2.0. An additional concept was either added as a property to an existing class or as a property to a new class. New classes were formed as collections of additional concepts that could not be included in any of CPSV-AP existing classes. As we can see in figure 6-5, where the enhanced CPSV is depicted, two new classes were added, namely "Potential Consumer" class and "Feedback" class.

6.5.2 Personalisation in informational public services

Complex PSs have different versions. For example, two different versions of a PS may have different required (input) documents or different cost or even different service providers, for example different COVID19 vaccination centres for the vaccination PS. Different versions of a PS correspond to different groups of end users based on their profiles. The matching of a PS version to a group of end-users usually referred to as personalization of PS provision. Personalization in informational PSs, although very important, is very rare perhaps because it is more difficult to be achieved than it is in the transactional PSs, where personal details of end users are available. Usually, public authorities provide a general version of a PS description that is hosted in a PS catalogue. Consequently, the potential beneficiary has to read and extract the PS version that fits to their profile. This task is not always easy and results in in a higher administrative burden.

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Some attempts, both academic and applied, have been made to reach personalization in informational PSs. Most of these attempts have incorporated structured dialogues where some questions are asked by a web portal in order to match an end user's profile with a version of a PS [13]. Recently, conversational agents, i.e. chatbots incorporating AI technology have been employed in order to make such a dialogue with a potential beneficiary of a PS [6]. Relevant research regarding the integration of chatbots and CPSV-AP for the provision of informational PSs has indicated that CPSV-AP needs to be enhanced in order to facilitate its integration with chatbots [6], [14].

6.6 The enhanced CPSV-AP model

In this section we present the enhanced CPSV-AP model. The enhanced CPSV-AP model was derived as the outcome of the integration of CPSV-AP, CCCEV, CPV and CBV. Additionally, a Feedback class that was found in literature review, that was presented in the previous section, was added. The main classes of enhanced CPSV-AP model are depicted in figure 6-6. Some classes of CPSV-AP v2.2.1 are not included in figure 6-6 in order to be readable.

The classes in blue colour are the CPSV-AP v2.2.1 classes. The classes in green colour are the CCCEV v2.0.0 classes. The classes in purple colour are reused from the Core Person Vocabulary, i.e the Person class, and from the Core Business Vocabulary (Legal Entity class). Feedback class, that was found in PS models literature review, is in orange colour. The Potential Consumer class, that was found in PS models literature review, was included as Agent, which is an existing class of CPSV-AP. Person class has been reused from Core Person Vocabulary, while Legal Entity class has been reused from Core Business Vocabulary.

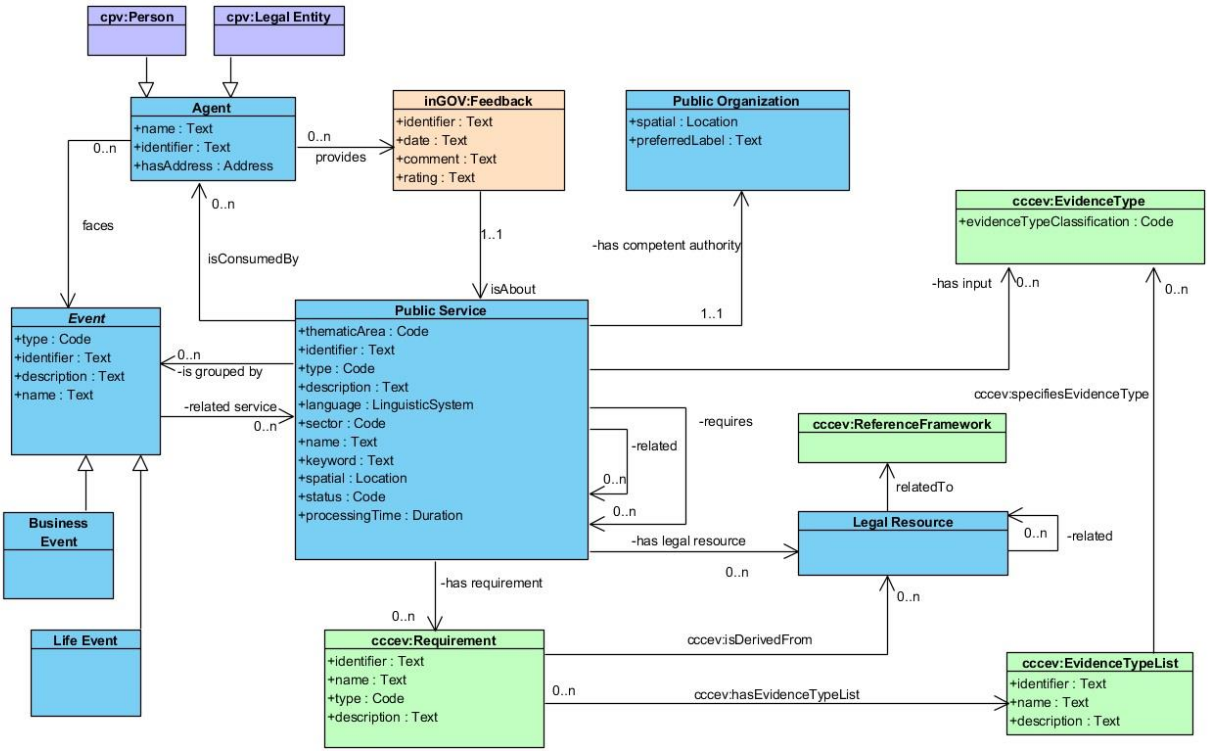

Figure 6-6. The main classes of the enhanced CPSV-AP model

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6.7 Conclusions and future work

In this chapter we develop and present the enhanced CPSV-AP that will be used in the framework of inGOV for the realisation of the Government as a Service (GaaS) vision. The enhanced CPSV-AP was derived from the integration of a set of Core Vocabularies, namely CPSV-AP, CCCEV, CPV and CBV, and one additional class, namely the Feedback class, that has been found in a literature review of PS models, including both academic and applied ones.

The enhance CPSV-AP seems a promising model to facilitate integrated PS co-creation, however this has to be proved in the implementation of the pilots of inGOV project. The enhanced CPSV-AP will provide the conceptual basis for pilot implementations employing various technologies, as for example linked data, knowledge graphs, chatbots and mobile applications.

Additionally, to the best of our knowledge, integration of EC ISA/ISA^2 Core Vocabularies will be soon attempted by the EC. We will follow closely these efforts and will probably adjust the enhanced CPSV-AP model in order to comply with EC's results. In parallel, we will conduct EC in order to present the inGOV enhanced model and collaborate with the EC in order to refine it. This effort is fully complaint with inGOV objective which is to start from European models, standards and policies, work in order to improve them and feedback inGOV results to the process of evolution of the European models, standards, and policies. Consequently, during the course of inGOV new versions of the enhanced CPSV-AP model will be produced.

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Chapter 7. Enhanced IPS Conceptual Model

Acronyms and Abbreviations

Acronym/Abbreviation	Description
AI	Artificial Intelligence
ASET	Automated Social Energy Tariff
ASP	Application Service Provider
BPMN	Business Process Model and Notation
CPSV	Core Public Service Vocabulary
CPSV-AP	Core Public Service Vocabulary Application Profile
CSC	Customer Service Centres
DCAT	Data Catalogue Vocabulary
DGEG	Directorate-General for Energy and Geology
EC	European Commission
EIF	European Interoperability Framework
EIF4SCC	European Interoperability Framework for Smart Cities and Communities
FAQ	Frequently asked questions
GDPR	General Data Protection Regulation
iAP	Portuguese interoperability platform
ICTs	Information and Communication Technologies
IPS	Integrated Public Services
IPS-Co	IPS Co-creation Conceptual Model
IPS-HF	IPS Holistic Framework
ISA/ISA^2	Interoperability solutions for public administrations, businesses, and citizens
IoT	Internet of things

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KS	Norwegian Association of Local and Regional Authorities
ML	Machine Learning
NAV	Directorate of Labour and Welfare
NGOs	Non-Governmental Organisations
NLP	Natural Language Processing
NLU	Natural Language Understanding
PAs	Public Administrators
PS	Public Service
SaaS	Software as a Services
UML	Unified Modelling Language

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7.1 Introduction to the IPS Conceptual Model Elements

Currently, the public sector is facing important challenges regarding the provision of public services. On one hand, trust from public service users is deteriorating. On the other hand, the public sector needs to provide better services with fewer resources. Users require accessible, user-friendly, personalised, and integrated public services (IPS) that match their needs and circumstances. In inGOV, we argue that the solution rests in enhancing existing relevant EU work by adopting public service co-creation[1] and by exploiting relevant technologies, in particular mobile applications, virtual assistants (chatbots), knowledge graphs, and linked data.

Against this background, the objective of this chapter is to present the IPS Co-creation Conceptual Model (IPS-Co) derived from the tailoring of the Integrated Public Service Conceptual Model proposed in the 2017 European Interoperability Framework (EIF) by including stakeholders' collaboration and IPS co-creation. IPS-Co will provide the conceptual basis for the implementation of Government as a Platform for IPS and the development of the IPS Holistic Framework (IPS-HF), in a similar way as the Conceptual Model for Integrated Public Services contributes to the 2017 EIF (Figure A-2 presents this integration). The IPS-HF will be the result of the tailoring of the 2017 EIF by including stakeholder's collaboration and IPS co-creation. To develop IPS-Co, we use the results from the research conducted in the previous chapters and build upon existing elements of the 2017 EIF. As explained in Chapter 1, the 2017 EIF includes definitions of key concepts, twelve underlying principles of European Public Services, together with six interoperability layers[2] and the Conceptual Model for Integrated Public Services (IPS) provision. Tailoring the 2017 EIF and its components is not new; the development of the European Interoperability Framework for Smart Cities and Communities (EIF4SCC) is a recent example [1].

Understanding the elements that integrate the 2017 EIF and considering that IPS-Co is a first step on the tailoring of the 2017 EIF towards the IPS-HF, IPS-Co will focus on two elements that will constitute the IPS-HF: the 1) Conceptual Model and 2) the Principles. It is important to emphasize that the conceptual model is mainly based on existing literature and relevant EU documents, so its elements and the principles can be updated in future Work Packages based on the findings and application of the pilots that are part of inGOV. The previous chapters of this deliverable provide an important contribution to IPS-Co. For example, Chapter 1, which objective was to critically evaluate Public Services (PS) and IPS models, provides the main concepts related to PS and IPS models. Chapter 2, that critically evaluated co-creation methods and approaches, contributes to the understanding of co-creation as part of IPS-Co. Chapter 3, identified and analysed EU eGovernment initiatives and policies and developed a taxonomy of both Public Values and Principles, it provides the background for tailoring the EIF Principles from a co-creation perspective. These tailored interoperability principles from a co-creation perspective directly influence IPS-Co and the overall IPS-HF. On the same line, Chapter 4, which identified and critically reviewed emerging technologies with potential in IPS considering EU values and eGovernment principles, contributes to increasing our understanding of the Technology element of IPS-Co. Chapter 5 identified and studied best IPS (co-creation) practices in Europe and their findings support the development of use cases and recommendations that can help to understand the further application of IPS-Co, and accordingly, IPS-HF.

[1] Co-creation is defined as the voluntary and active involvement of (I)PS end-users in any phase of the design, delivery, and evaluation of (integrated) public services (See Chapter 2).

[2] 1) Interoperability governance, 2) Integrated public service governance, 3 Legal interoperability, 4) Organizational interoperability, 5) Semantic interoperability, 6) Technical interoperability.

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Finally, Chapter 6, which enhanced the EU Core Public Service Vocabulary (CPSV) to accommodate complex services, values and complex life and business events, provides the base for the Catalogues and information sources elements. Figure 7-1 shows the contribution of the chapters (1 to 6) to both the IPS-Co and the Interoperability Principles from a Co-creation perspective developed in Chapter 3 and complemented here in Chapter 7 with recommendations and uses cases.

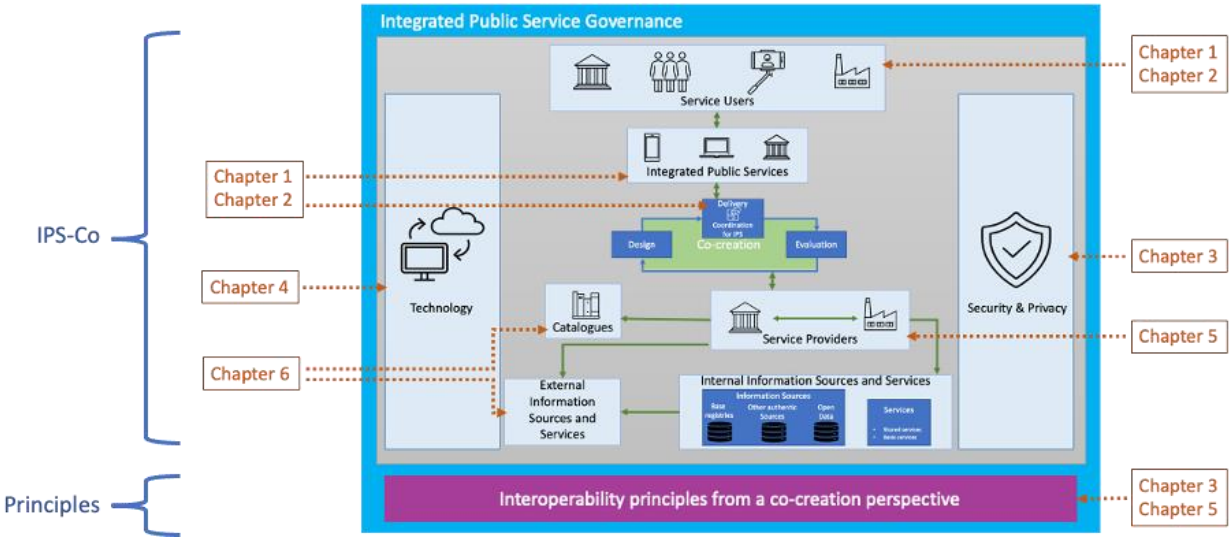

Figure 7-1 IPS-Co elements, Principles, and chapters contribution

This chapter is divided into four sections. The next Section 7.2 will explain the concepts that integrate the IPS-Co. The concept of co-creation will be enriched with use cases per phase of co-creation. Section 7.3 will explain the principles and will also provide recommendations and use cases. Section 7.4 will present the conclusions and will comment on how this model contributes to the overall IPS-HF.

7.2 Elements of the IPS Conceptual Model (IPS-Co)

IPS-Co was developed from an IPS and co-creation perspective. In order to develop IPS-Co, besides the literature review, the results from the research conducted by the different partners and presented in the different chapters of this deliverable, several meetings and one workshop took place between the partners in May and June 2021. These meetings and the workshop facilitated the agreement on the modifications of the original Conceptual Model for Integrated Public Services. In this regard it is important to highlight that some of the consulted partners have a strong experience working directly with the European Commission in projects to develop frameworks related to the 2017 EIF. This subchapter aims to explain the nine elements that compose the IPS-Co model: 1) Integrated Public Services, 2) Co-creation process, 3) Service Users, 4) Service Providers, 5) Privacy and Security, 6) Internal Information Sources and Services, 7) External Information Sources and Services, 8) Technology and 9) Catalogues. It is important to highlight that IPS-Co, when compared with the EIF conceptual model, presents a bi-directional relation between co-creation, service users and the Integrated Public Services box. This aspect is fundamental for co-creation processes, where a direct interaction between the co-creating actors is expected [2]. This aspect is illustrated in Figure 7-2, together with the nine elements of IPS-Co.

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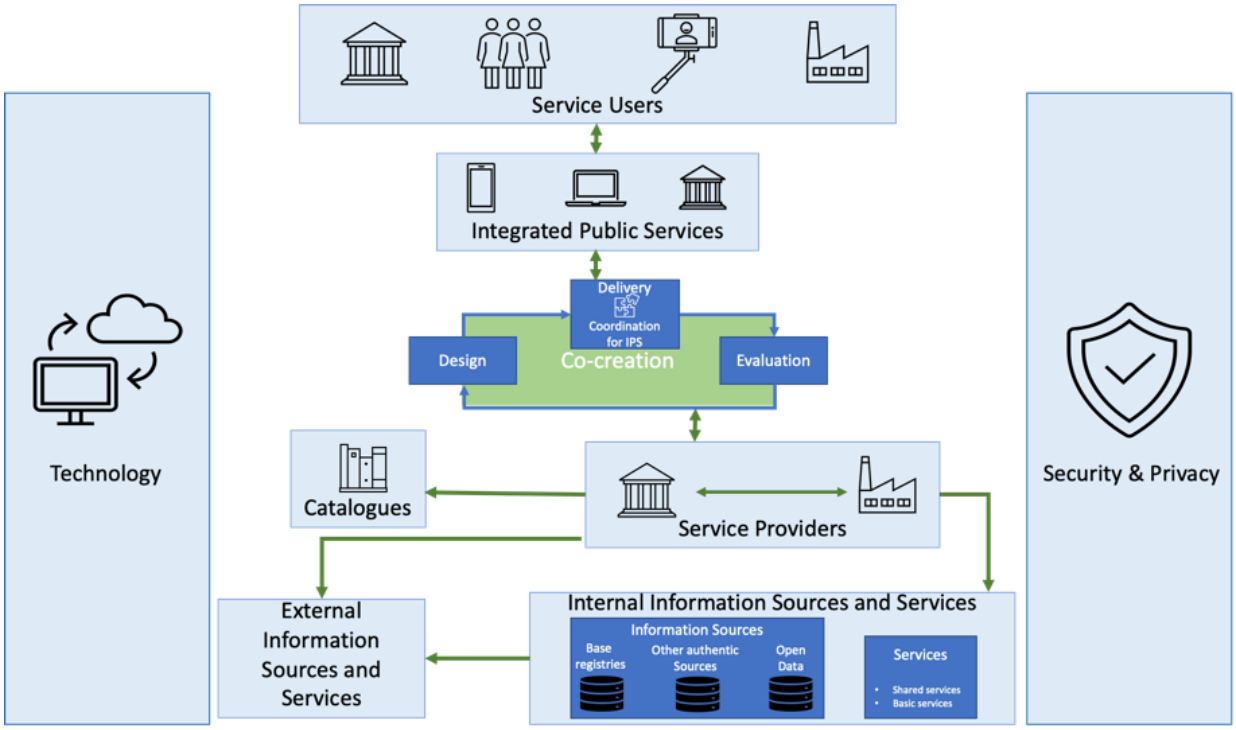

Figure 7-2 IPS-Co elements

The next subsection will explain the nine elements of IPS-Co depicted in Figure 7-2 while section 7.3 will present the tailored principles and recommendations for the IPS-Co Conceptual Model.

7.2.1 The Integrated Public Services concept[3]

The 2017 EIF defined Integrated Public Services (IPS) as "bringing together government services to end-users so that they can access them in a single seamless experience based on their wants and needs" [3]. Traditional IPS delivery was represented by a simpler model wherein the public sector is the developer and provider of a public service, and both citizens and businesses are considered the consumers. Contemporary IPS is moving towards the involvement of public service users in the provision of public services, through co-creation processes for users to bring their specific resources and talents to the design, creation, and implementation of services [4]. In this context, IPS stakeholders are not only citizens or businesses, but all possible service users and service providers, as the public sector is not the sole provider of public services. Hence IPS is being connected to the co-creation cycle which will be explained in the next subsection.

7.2.2 The co-creation concept[4]

The IPS element interacts with three co-creation phases named Delivery, Evaluation and Design. Following the original Conceptual model for IPS presented in the 2017 EIF, we have located the Integrated Public Services and the Coordination for Integrated Service Delivery inside the Delivery box of the co-creation

[3] This section is based on Chapter 1.

[4] This section is based on Chapter 2 and Chapter 5.

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cycle (See Figure 7-3). The phases of co-creation will be explained below together with a use case that exemplifies them.

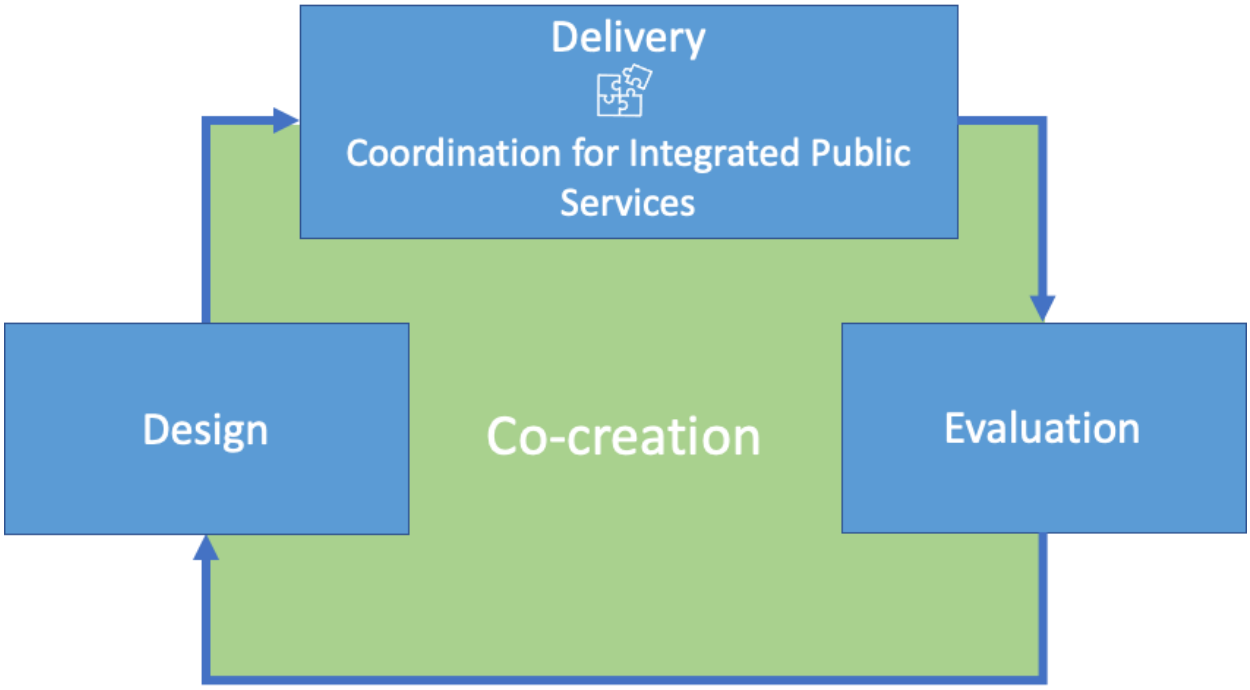

Figure 7-3 Co-creation cycle and Coordination for Integrated Public Service

7.2.2.1 Phases of co-creation

While the Delivery box (See Fig. 7-3) includes the Coordination for Integrated Public Services (explained below), evaluation and design complete the proposed co-creation cycle. The inGOV project understands the co-creation concept as the voluntary and active involvement of (I)PS end-users in any phase of the design, delivery, and evaluation of (integrated) public services (See Chapter 2). Therefore IPS-Co focuses on three stages of co-creation: co-design, co-delivery, and co-evaluation.

Co-design:
Firstly, the co-design stage entails the involvement of IPS users in consultation and ideation of service design elements that aims for a more user-centric experience. This helps create mutual trust and may increase the willingness of users to adopt the service.

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Use case – co-design:

Varam (Ministry of Environmental Protection and Regional Development, Latvia)

Since 2015, Latvia has started to implement a conceptually new approach in the delivery and access of public services. The driver of these actions has been the right to offer digital communication with the government, making all essential services available online. On this backdrop, the Ministry of Environmental Protection and Regional Development, responsible, among other policy areas, for the implementation of information society and enabling eGovernance, participated in a pilot project to improve the uptake of digital services using the National portal of Latvia and via State and Municipal Unified Customer Service Centres (CSCs). The overall aim of this initiative was to improve the user experience in public service delivery through an integrated digital solution for multiple services, i.e. the state service portal. To this end, a co-creation approach was adopted. Specifically, co-design sessions with different stakeholders were organized during August-September 2018, to identify user needs and understand their experience of digital services. The stakeholders regarded policymakers from across ministries, frontline staff (customer service centres employees), and various beneficiary groups were involved in separate sessions to gather insights and requirements around the use of digital public services. After an initial survey was carried out among non-users, the focus shifted on formulating user needs, evaluating user experience with the previous version of the portal and eventually formulate ideas about improving the service offer based on these insights.

Co-delivery:

The co-delivery stage involves IPS users in the implementation and management of IPS. This might enhance the communication between the service providers and service users allowing for an integrative user experience. The delivery phase includes the coordination function. As described by the 2017 EIF the coordination function assures that there is a proper identification of needs and of the services in an orchestrated manner to provide a European public service. The coordination of the appropriate sources and services that integrate the public service can be automated or manual [3].The Coordination for Integrated Service Delivery is composed of the following four phases: 1) needs identification, which is driven by a user's public service request, 2) planning, which implies the identification of the service and the required information sources via available catalogue and their aggregation into a single process that considers the specific needs of the user, 3) execution, that implies the collection and exchange of information (following the legislation and policy framework) to accept or reject access to a service in order to provide the requested service to the user, and 4) evaluation, which occurs through the user's feedback after the service is provided [3].

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Io Italia App (Italy)

The 'Io Italia' project is part of a wider effort of the Italian national government to modernize, and thus digitalize, the provision of public services across the country. The project consists in setting-up a one-stop shop online IPS, able to offer a unified, simplified, and remote interface between Italian citizens and their public administration.

After its initial launch in 2018, the app has gone through several stages during which users have been constantly involved in using, testing, and improving the application. This helped adding, over time, new functionalities, and services for users. Using their eID, citizens can communicate with public administration and receive messages, notifications regarding bills, fees, taxes all in a single app. The app is integrated with the national electronic payment system which allows simple transactions, and with other enabling platforms that give a complete digital identity all in a single portfolio (besides the traditional identity card information it has the fiscal code embedded, and the digital residence). Through this digital interface, citizens are able to directly interact and use various service offers, thus co-providing the service for themselves.

For instance, the app has been used by the central government during the last year for several national initiatives to provide financial aid as response to the pandemic hit (bonus for holidays in Italy, national lottery). Public service providers can use the app to customize and integrate other available services at the local level.

Co-evaluation:

The final stage of co-creation is that of co-evaluation, wherein the assessment of the provided service takes place. Therefore, the evaluation phase assesses the service after its delivery in an effort to learn from it or adapt it through possible prospective elements [5]. Linders [6] highlights citizen reporting as a possible format for this phase. The assessment helps to empower the involved stakeholders [7], allowing for additional user-centricity, and also helps further communication and understanding between the involved stakeholders.

Use case co-evaluation:

Municipal ASP (Hungary)

From 2012, the central Hungarian government has been involved in developing a new cloud Application Service Provider (ASP) to employ as the back-office IT system. Using a common platform, also available for beneficiaries through a front-end portal, the ASP is employed in the delivery of online public services that are efficient for local authorities and ensures a seamless experience to users. First with a pilot project from 2012 to 2015, and then developed into a mandatory program, today the ASP is used by 99% of Hungarian municipalities.

At the initial stage and during implementation, local government officials, with the dual role of back-office user and as end-users, participated in several workshops (training sessions) organized on-site in order to familiarize with the service and understand the needs of each locality. In these training sessions they were asked to provide feedback based on the experience they had with the service. Feedback could be provided at regular intervals throughout service implementation using multiple channels, such as the integrated service desk function in the back office of ASP portal, emails, via local government associations, and the central government hotline (service desk) for citizens to voice their concerns and provide feedback

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7.2.3 The Service Users Concept

Traditionally, users of public services are considered as passive consumers of these offerings, and only provide information on needs and requirements, and give feedback on service quality when solicited [8]. Needs identification, prompted by the request for a public service by a citizen or business, together with the collection and evaluation of user feedback following the provision of the new service, are considered as two key phases of traditional integrated public service provision that require the participation of service users [9]. The active planning, design, and execution of public services is, however, seen as being the remit of so-called experts – public servants, designers, and policymakers – who create services and tailored offerings based on input received from the public. The advent of digital public services has also resulted in the emergence of a new category of public service provider, the software developer, responsible for the active programming of service architecture according to specifications determined by public servants and the translation into digital format of requirements gleaned from user feedback exercises [10].

In contrast, when considered through the lens of co-creation, users may also be actively involved in the planning, design, and delivery of public services in partnership with government [11]. More recently, users also participate in the programming of digital services, and in related systems architecture design activities [12]. Under the IPS-Co model, therefore, service development and maintenance consequently become two-way processes, characterised by, not just uni-directional or one-time involvement, but instead a continuous interchange of ideas and feedback between service consumers and service providers. The lines between traditional roles and responsibilities are blurred, and the number of key interaction points between the state actor and other stakeholders increased. The process of co-creation leaves the door open for users to actively define and/or influence the architecture of an entire service delivery system, not just single features and/or user interfaces. Moreover, users may have the opportunity to take responsibility for the sustainability and overall maintenance of digital public service systems.

7.2.4 The Service Providers Concept

In earlier models of public service provision, service providers were seen, by default, to be the governing authority [13]. The focus was on frontline civil servants or designated bureaucrats responsible for the administration, transmission, and overall delivery of services to the public. With the advent of e-government, a new category of experts – software developers and designers – emerged, responsible for the translation of paper-based service offerings into digital formats, as well as their subsequent maintenance [14]. The first conceptual step taken to involve stakeholder groups in the creation of public services was to make their development “user centric” or “user driven”, focusing on engaging with people in their role as service users to develop public services [15].

However, it was found that these concepts were still, by and large, bureaucratic in their execution. The uni-directional approach to public service provision has changed in recent years, moving away from mere ‘people centricity’ that brought into focus the importance of listening to the ‘needs and voices of the people’[16], giving way to the bi-directional notion of ‘human centric’ system design[22] wherein the needs and opinions of service users are considered as sources of innovation, and are solicited and taken into account not only after an offering is either newly proposed or when up and running, but more proactively at different points while designing, delivering, implementing and evaluating digital public services [16] [. Broadly speaking, this implies that governments have begun to not only regularly consult service users about their needs, but instead also actively encourage their direct participation in service design and delivery.

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Another recent trend, spurred on by public spending cuts, the need to improve quality levels of existing public services, a desire to be more innovative, and/or to compensate for a lack of skills or technical know-how, is for public authorities to outsource the task of delivering public services to external organisations such as private businesses [17, 18]. This implies a change in the role of private business actors from mere consumers of government services to service providers. Hence, in many fields of operation, the public sector is no longer in competition with private service providers, but instead in collaboration with them [19]. The commissioning of external private actors to deliver public services is, by-and-large, considered beneficial to public service users as they are (in most cases) able to exercise choice about which service or provider they would like to use [20]. However, it has been argued elsewhere that involving the private sector in public service delivery may not lead either to desired outcomes or to the expectations of the various stakeholders being met [23]. Consequently, governments may, in certain cases, opt to internalise the delivery of public services rather than outsource their development and provision to private actors.

7.2.5 Internal Information Sources and Services[5]

Internal Information Sources include mainly base registries, other authentic sources, and open data [3]. A base registry is "*a trusted and authoritative source of information which can and should be digitally reused by others, where one organisation is responsible and accountable for the collection, use, updating and preservation of information.*" [3]. An authoritative source of information is the most trustworthy source for a particular piece of information, which has the correct status of that piece of information, is up-to-date, and is of the highest possible quality [3]. Base registries, other authentic sources, or open (government) data sets are usually maintained by the information steward, which is "the body (or possibly individual) responsible and accountable for collecting, using, updating, maintaining and deleting information." [3]. A public organisation should establish a data quality assurance plan in order to secure data quality and integrity [3] dedicating in parallel the appropriate resources for implementing it. It should also have a clear strategy and clear procedures for their preservation and exploitation. Additionally, it should adopt, as much as possible, common data models and standards, for example European Commission ISA/ISA^2 core vocabularies, to facilitate reusability and semantic interoperability. Data sources could be (i) master data included in base registries or other authentic sources, (ii) reference data, for example taxonomies, (iii) open data, and (iv) other data, e.g., sensor data gathered through the internet of things (IoT), data from social web applications, etc.

The IPS-Co framework focuses on personalisation, integration, and co-creation of Internal Information Sources and Services. For example, regarding the provision of public services, IPS-Co suggests promoting personalization by exploiting enhanced CPSV (See Chapter 6) in order to provide customised informational public services according to the specific characteristics of end-users. More generally, European Commission ISA/ISA^2 core vocabularies should be integrated and enhanced in order to facilitate personalization and co-creation.

Additionally, the provision of open (government) data should target the fulfilment of citizens' needs. In order to collect citizens' needs, for the provision of services and data, public organisations should incorporate mechanisms for more active participation of end-users and other stakeholders. Consequently, co-creation in the provision of data and services becomes very important. Co-creation mechanisms may include feedback collection, not only during the evaluation phase, but also during the design and the

[5] This section is based on Chapter 6.

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delivery phase of public service provision and open data publication. Furthermore, citizens should have as much power as possible over their own personal data. For example, they should be able to check their personal data accuracy and they should be also able to require the preservation only of the necessary part of it. In general, guidelines of General Data Protection Regulation (GDPR) should be followed as much as possible[6].

Integration of data is considered a prerequisite for integrated public service delivery and for a richer user experience. Data and services should be modelled based on common data models and standards, e.g. European Commission Core Vocabularies, like Core Public Service Vocabulary (CPSV), or W3C Data Catalogue Vocabulary (DCAT) in order that the produced data sets are structured, easy to locate, and easily reusable. Additionally, data and their metadata should be in machine readable format, for example in linked data format, in order to facilitate reusability and integration. Data and services should be easily integrated as building blocks in order to build user-friendly, low cost, and high-quality interoperable catalogues and information systems.

7.2.6 External Information Sources and Services[7]

Data sets, services, and other assets, such as models, used in public service provision, could be internal to a public organisation or external. External data sets (e.g. base registries, outside the boundaries of an organization, other authentic sources, open data), external services (e.g. payment services, basic services, or shared services [3] or other assets (e.g. software components) should be exploited for integrated public service provision. Additionally, external data sets available through the semantic web, the social web or the Internet of things should be exploited for a richer and more personalised user experience in public service provision.

A public administration should have a clear strategy for the exploitation of external data sources and services, and their integration with its internal data sources and services. Service Oriented Architectures, well documented APIs, and machine-readable information such as linked data, could be exploited in this direction. Additionally, an organization should establish mechanisms for assuring the accuracy and quality of data gathered from external sources. The participation of end-users such as citizens or businesses should be facilitated during the whole process, for example by suggesting useful external data sets or services and by examining their accuracy and quality. External data should be marked up with additional information, exploiting common core vocabularies or other standards, in order to facilitate findability and personalization. For example, information concerning a specific profession or societal group should be marked up accordingly in order to make the data easily findable by interested end-users or in order to facilitate personalisation in public service provision.

1.1.1 Catalogues[8]

Catalogues may include PS descriptions, open data, software components, models (e.g. PS models) and other solutions and assets [3]. They aim to empower citizens by increasing findability, transparency, and the reusability of (public) services, (government) data, software components and other assets. They could be also used to facilitate participation and co-creation. For instance, considering that the main elements

[6] See THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, "General Data Protection Regulation," 2016.

[7] This section is based on Chapter 6.

[8] This section is based on Chapter 6.

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of a public organisation operation are the public services that it provides and the data that it produces, the opening of digital data to citizens increases transparency and empowers them by eliminating the need for them to travel to a public organisation's premises in order to be served.

Catalogues should be well-structured and must exploit well-established standards such as the European Commission ISA/ISA[2] core vocabularies, or Business Process Model and Notation (BPMN) to describe public services' execution processes, etc. Ideally, information published in catalogues should also be available in machine readable format in order to increase reusability and federation with other catalogues. The IPS-Co framework suggests that catalogues should promote personalisation, integration, and co-creation. Personalisation should be promoted by facilitating citizens' acquisition of information that matches their exact needs and characteristics. For example, citizens should be able to get a version of the public service description, including required documents, cost, etc. that match their profiles. Consequently, CPSV-AP should be enhanced in order to support the provision of different versions of PS descriptions according to end-users' profiles. Additionally, in order to facilitate integration in, for example, PS provision, the life event concept of CPSV-AP should be enhanced. Moreover, co-creation elements, such as the gathering of feedback from end-users, have been incorporated in enhanced CPSV-AP (see Chapter 6) in order to promote the active participation of end-users.

7.2.7 Emerging Technologies[9]

Several technologies possessing key benefits stand out when considering co-creation and IPS. These are blockchain, mobile apps, chatbots (virtual assistants), and knowledge graphs with linked open data. In addition, the has been identified as a particularly interesting emerging technology that would greatly contribute to the quality of public services. These technologies are discussed briefly below. A more detailed description of each, together with a critical evaluation of their application, is presented in Chapter 4.

7.2.7.1 Blockchain

Blockchain is one of the more promising emerging technologies within the context of public service provision and use. In essence, blockchain is a distributed, append-only immutable ledger (database) of records. Records can be added by a group of parties, either trusting or non-trusting, on a network. The key blockchain enablers are its cryptographic background and peer-to-peer architecture. Together with the previously mentioned immutability, these characteristics make blockchain a viable technology choice in all those situations where traceability and persistence are important.

All transactions are recorded in blockchain nodes. To ensure trustworthiness and immutability, every transaction needs to pass the validation process successfully. Its content is then validated through a consensus mechanism. A consensus mechanism is essentially a collectively agreed-upon protocol accepted as such by all nodes. The security attribute is achieved through its cryptographic foundation while, at the same time, its distributed approach and peer-to-peer architecture ensure system reliability.

Blockchain use cases are numerous since, as an emerging technology, it lends itself greatly to storing and trading anything of value. Perhaps the most important blockchain benefits within the inGOV project context are its application in government public services - from anti-corruption, voting and elections, to

[9] This section is based on Chapter 4.

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public procurement and, possibly, to any sectors dependent on the immutability of recorded transactions or contracts.

7.2.7.2 Mobile apps

The requirement for presenting data and offering governmental services in a structured, accessible, and functional manner provides an excellent opportunity for the deployment of mobile applications. Mobile applications, also known as mobile apps, are software applications developed to run on mobile devices. Mobile devices include a range of devices such as smartphones, tablets, or smartwatches, excluding laptops and desktop computers.

Their technical implementation is roughly divided into native apps, hybrid apps, and progressive web apps. Native apps offer the best performance and access to low-level system APIs and functionalities, but they need to be developed separately for iOS and Android platforms, making their development more expensive. Hybrid web apps utilize web technologies and control frameworks like UIWebView to deliver cross-platform experience and utilize existing web development skills. While their performance might be somewhat lower compared to that of native apps their deployment remains, in the majority of IPS cases, excellent. The third category of mobile apps consists of progressive web apps, a special class of web apps that can run in both online and offline environments, and on mobile devices and laptops. Their use cases are somewhat specific, and they are not considered within the inGOV project and IPS co-creation contexts.

7.2.7.3 Chatbots (virtual assistants)

Chatbots (short for chatter robots or bots) are a class of Artificial Intelligence (AI) powered programs simulating human conversations. Depending on their levels of sophistication, chatbots can utilize natural language processing (NLP) and natural language understanding (NLU) to better understand and respond to user's inquiries.

The general principle is simple - it starts with capturing the user input (textual or even voice which is then transcribed using speech-to-text technology), followed by an analysis of the message received, and then finalized by the return of a response. Simpler chatbot implementations (sometimes referred to as Frequently Asked Questions (FAQ) chatbots) use basic machine learning (ML) capabilities. They can be very useful in providing the initial set of responses, triage users based on their eligibility or other criteria, and thus reduce administrative burdens. More complex and advanced chatbots make extensive use of NLP and NLU capabilities, and even continuous learning and improvement and can support wider and more complex scenarios.

In both cases, chatbots are especially useful in customer and support services. For example, a person might want to interact with their bank and obtain information about offered services. A chatbot can ask several ‘triage’ questions and provide answers. If a situation requires human intervention, chatbots can direct the person to an actual human agent who then takes over. One of the biggest advantages of chatbots is that they can be available 24/7 on the web and within mobile apps and ensure continuous delivery of the (parts of) IPS.

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7.2.7.4 Knowledge graphs and linked open data

Implementing IPS requires closing the gap between different governmental data silos by introducing standardization and interoperability of the data. Knowledge graphs (KG) are well-poised to resolve this challenge. Instead of classic database table-like or tree-like structures, knowledge graphs use graph-like structures. Data integration is accomplished by extracting meaningful information from a specific data structure and propagating its connection to other data throughout the rest of the knowledge graph. The use of ontologies (in essence, a graph schema) allows for the integration and extraction of the data's relation and meaning, thus contextualizing it while providing a structured approach. Hence, exciting scenarios are possible with the integration of linked open data (LOD).

The graph nature of KGs and the utilization of its key elements (entities, their properties, relationships, and rules) lends itself very well in contexts where different data silos need to be connected. Furthermore, valuable insights are to be derived from a critical study of their application. Within the inGOV project context, the Maltese case could prove relevant and suitable for KGs and LOD, but in essence, every IPS can benefit from a structured approach and relations derived from the KG.

7.2.7.5 Internet of Things (IoT)

The IoT represents a connection of physical objects over the internet, making a network of defined objects that communicate with each other. In practical terms, the IoT is embodied in various forms, including smartphones, sensors on smart devices, wearables, and software to communicate. IoT builds on top of that connection by creating automated processes that gather data, analyse it, and generate a response based on the analysis.

The continuous inflow of new data can be used to train the machine-learning model further. As such, IoT is appropriate for integration with chatbots and conversational AI using NLP, as seen in digital personal assistants like Siri, Alexa, and others. However, being a still young and developing technology, IoT lacks reliable standards for its working framework. Compatibility is a critical component of the IoT platform, and until there is an extensively applied compatibility standard, it is felt that the full potential of IoT cannot be seen and/or realized.

7.2.8 Security and Privacy[10]

Privacy and Security are relevant when considering IPS co-creation. For example, when considering user oriented-services privacy, the information on users should be asked once only and reused many times, taking into account the protection of personal data and maintaining privacy and confidentiality. When using Information and Communication Technologies (ICTs) in co-creation processes, preserving privacy and security is an important theme too. The technical specifications and standards that an IPS co-created service uses must assure the maintenance of privacy and confidentiality of data within the legal framework. They should also be responsive to the changing demands and requirements of users. Taking trustworthiness and security into consideration can facilitate both the adoption of technology and the engagement of users, and in turn, can enhance the trust. Maintaining privacy and confidentiality and complying with General Data Protection Regulation is paramount, especially for public services that deal with highly sensitive data, including family members, ID numbers, income, etc.

[10] This section is based on Chapter 3.

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7.3 EIF principles from a Co-creation perspective[11]

Following a similar structure comparable to the 2017 EIF construction, we have included a discussion of the 12 EIF interoperability principles here. The principles as well as recommendations for the IPS-Co have been tailored taking into account IPS and co-creation (for more information see Chapter 3). It is important to note that these principles, recommendations and use cases are based on good practices, therefore it is not part of the scope the inclusion of challenges related with the implementation of these principles and recommendations. This will be studied in the next Work Package along with the implementation of inGOV pilots.

1. Subsidiarity & Proportionality. Actions with respect to IPS co-creation must be addressed as closely as possible to the users, and in alignment with the proportionality principle[12]. Through interoperability frameworks and strategies, IPS co-creation initiatives can be aligned to support Europe's Digital Future.

Recommendation 1:
Ensure that public services are aligned with national interoperability framework and strategies and are developed close to service user needs and service providers' responsibilities.

Use case 1:
Digisos (Digital Social Services, Norway)
Digisos is a digital channel (application) by which users can apply for social security assistance at the municipal level via a national-level portal. Digisos is a programme characterized by a decentralized organizational structure, operated by the Directorate of Labour and Welfare (NAV). Municipalities as providers of social welfare services and holders of specific competencies (due to case workers direct interaction with end-users) were involved since the first stages of the project that aimed at digitalising the request for social benefits. Specifically, the Norwegian Association of Local and Regional Authorities (KS) was part of the project board from the earliest moment. Thus, besides the central authority NAV, which is a regulator and coordinator, in the process of co-creation the principle of subsidiarity was followed involving municipalities and their case workers.
The engagement of frontline staff was important to ensure their trust and goodwill throughout the project, whereas the involvement of end-users was crucial in understanding their needs and capacities of engaging with the digital channel of the service. Since 2019, Digisos became a full-fledged service operated by NAV, with over 98% of population inhabiting municipalities that have adopted Digisos in the provision of social services.

2. Openness. Data, standards, and software should be as open and reusable as possible across IPS co-creation initiatives, thereby respecting existing legal frameworks. This can contribute to adaptability, user orientation, the quality of IPS, and the lowering of the barriers to user participation.

[11] This section is based on Chapter 3.

[12] The **proportionality** principle limits EU actions to what is necessary to achieve the objectives of the Treaties [3].

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Recommendation 2:
Use commonly agreed open standards and open technical specifications to support various users' contribution in the design, development and delivery of public services or in reengineering existent ones.

Use case 2:
Municipal ASP (Hungary)
The country-wide extension of the Municipality ASP was a project, implemented from 2016 to 2020, aimed at establishing a single, universal back-office software package using a Software as a Services (SaaS) model and an e-Government platform which local government entities (municipalities and counties) could use to provide online public services to citizens in an integrated and effective way. This project adopted a pre-existing E-Administrative act.
This E-Administrative act, passed in 2015 and in force as of 2018, covers legal and organisational issues regarding the provision of e-Administration, electronic communication, electronic identification, and trust services. Thanks to this legislation, the different users can access the citizen data stored by the different Public Administrations in the base registries with a simple automated data transfer.

3. Transparency. Enabling visibility of internal processes, data, and interfaces that play a role when co-creating IPS while securing the protection of personal data. Transparency of internal administrative processes can favour co-creation with IPS stakeholders and users.

Recommendation 3:
Support effective user involvement during co-creation stages of IPS with the use of open data, visualisations, dashboards on project status, as well as publicly available documents.

Use case 3:
Schoolstraten - City of Mechelen (Belgium)
The city of Mechelen together with PoliVisu, has aimed to enhance an open set of digital tools to leverage data to monitor the traffic changes around schools during the rush hours of the day.
Within the project 'SchoolStraten' both partners created a dashboard to monitor the traffic in the different modes and a KPI chart to monitor progress versus the target set at the start of the project. The dashboard is publicly available.

4. Reusability. IT solutions that favour IPS co-creation should be easily reusable across different IPS initiatives, so that new IPS can be developed more efficiently and integrated into existing service ecosystems.

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Recommendation 4:
Reuse existing infrastructure and share digital content in the process of co-creating integrated public solutions on top of which new user functionalities can be built or can be extended and customized to other services.

Use case 4:
X-Road (Estonia and Finland)
Under the X-Road framework, a joint Estonian-Finnish government project has aimed to create a unified cross-border digital business registry in order to facilitate the seamless establishment of Finnish businesses in Estonia and vice-versa.
The automatic transfer of the two countries' business register data was set up by reusing an existing technical infrastructure. It simplified governance issues and helped organisations cooperate in developing a service. The X-Road initiative, and its successful completion, represents a blueprint for more cross-border interconnection between Estonia and Finland (or any cross-border initiative). X-Road is a 'do-it-all' solution whose scope could be virtually endless.

5. Technological neutrality & data portability. Technological neutrality implies that IPS co-creation processes should minimise technological dependencies, and that the IPS should be adaptable to new technologies. Data portability allows for data to be reused and moved across sectors, borders, and tools.

Recommendation 5:
Do not impose any technological solutions on citizens, businesses and other administrations involved in IPS co-creation that are technology-specific or disproportionate to their real needs, at any stage of the co-creation process.

Use case 5:
Io Italia App (Italy)
The components of the solution are public, and any service provider can integrate or propose improvements. In particular, the interface is designed following the method proposed by the guidelines for the design of public services. Such guidelines call for technological neutrality at different stages of the development process. For example, usability testing must follow the eGLU LG (Gruppo di Lavoro Usabilità - Linee Guida) procedure, version 2018.1. The procedure is, in its general lines, independent of technology and medium. This means that it is ready to be applied, possibly with minimal adjustments, to a variety of products and services on different distribution channels and with different technologies. More in general, the development of the solution has followed the national Guidelines on the acquisition and reuse of software in public administrations, which call for the public administrations to acquire IT solutions or parts of them in compliance with the principles of economy and efficiency, investment protection, reuse and technological neutrality.

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Recommendation 6:
Include data portability requirements in all co-creation of IPS using personal data, so that data is easily transferable between systems and applications supporting the implementation and evolution of European public services without unjustified restrictions, if legally possible.

Use case 6:
X-Road (Estonia and Finland)
X-Road is a centrally managed distributed data exchange layer between information systems that provides a standardized and secure way to produce and consume services. X-Road ensures confidentiality, integrity, and interoperability between data exchange parties.
All the evidence regarding the data exchange is stored locally by the data exchange parties, and no third parties have access to the data. Time-stamping and digital signature together guarantee non-repudiation of the data sent via X-Road. X-Road is designed to make datasets interoperable and portable between information systems and sectors.

6. User-centricity. IPS co-creation should focus on developing public services considering user needs. The development of IPS should consider the multi-channel delivery of public services, the development of a single point of contact, the incorporation of user feedback, and collection of relevant information from the user only once.

Recommendation 7:
Develop or re-design integrated public services putting users and their needs at the centre, offering solutions that are accessible, personalized and include multiple channels of interaction and assistance.

Use case 7:
Io Italia App (Italy)
From the very embryonic stage of the project, user experience was a key aspect to improve in the interaction with the public administration. Along with the collection of service providers' requirements and opinions at the national and municipal level, citizens had actively participated as co-designers of the app.
At the early co-design stage, a mock-up was tested with 20 citizens. Feedback from this testing shaped a first demo version of the app. This demo version was tested by another cohort of potential users. Their feedback was, again, considered to further tailor the following beta-version to users' needs. This version was further tested by 1000 citizens throughout the country, to add a third level of customisation to what matters to users. Currently, the app is available to all Italian citizens in a final beta version (downloaded more than 10M times at this point). Feedback and suggestions from these users will then feed into a fourth step in making sure the final version of the app is totally user-centred.

7. Inclusion and accessibility. Users – regardless of personal characteristics – should be able to easily get access to IPS as well as to IPS co-creation initiatives.

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Recommendation 8:
Ensure that accessibility for citizens, including those with special needs, people with disabilities, elderly and disadvantaged groups, are part of the process of design, delivery, and assessment of integrated public services.

Use case 8:
VARAM (Latvia)
The initiative was mindful in selecting and engaging with several NGOs to represent various needs, including those of visually impaired people. At the co-design stage, citizens with disabilities participated through several sessions to formulate their needs and requirements from the service offer. To collect their experience of digital services, NGOs ensured that representatives of these groups would bring their own adapted computers with them during the sessions.

8. Security and privacy. A common security and privacy framework, as well as procedures for secure and trustworthy data exchange across IPS co-creation initiatives, can help to achieve the maintenance of privacy and confidentiality, create trust, and ensure respect for human rights and individual freedoms.

Recommendation 9:
Create solutions respecting trusted and solid legal frameworks to guarantee the security and privacy of users and their involvement in the design, delivery and evaluation of IPS.

Use case 9:
ASET (Automatic Social Energy Tariff, Portugal)
Since 2010, Portugal created an "Energy Social Fare" to lighten the burden for low income families in relation to energy. To extend the service to a larger number of potential beneficiaries, in 2016 the Directorate-General for Energy and Geology (DGEG) took the lead in establishing an Automated Social Energy Tariff (ASET).
ASET was set up on the Portuguese interoperability platform (iAP) that favours cross-sectoral collaboration by granting exchange of data among public entities. DGEG developed an information system to process the records from private service suppliers and drew on iAP in assessing eligibility of citizens to reduced tariffs. Although ASET operates as a back-office service, out of citizens' sight, compliance with data protection legislation was followed. Back in 2016, the National Commission on Data protection had to deliberate on the compliance of data access and transmission with the principles of data protection. In addition, protocols were signed between the various stakeholders, after the Resolution of the Council of Ministers to approve them, which set the terms and conditions of selecting beneficiaries as well as the flow information between entities involved (both public and private).
In 2020, ASET received the UN Public Service Award in the 'Delivering inclusive and equitable services to leave no one behind' category.

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9. Multilingualism. In multilingual contexts or for cross-border IPS co-creation initiatives, multilingualism entails that users can access the IPS in their preferred language. Furthermore, multilingualism should be considered during each of the three stages of the co-creation process.

Recommendation 10:
Use multiple languages to enable service users' involvement during design, delivery and assessment of integrated public services.

Use case 10:
Digisos (Digital Social Service, Norway)
The project aims to provide social service users with better digital self-service through a digital platform. The stakeholders wanted solutions that made easier the interaction with NAV, more dialogue opportunities and insight into the end-user cases. Therefore, Digisos decided to assist end-users by giving them the opportunity to use the platform in different languages.
There are other instances in which service providers use the power of artificial intelligence to translate public documents in most commonly used languages to foster a more open public administration.

10. Administrative simplification. IPS co-creation initiatives should aim to reduce and simplify the administrative processes of IPS.

Recommendation 11:
Pursue simple and clear administrative procedures to facilitate user engagement during the various stages of co-creation, offering solutions that better respond to user needs and reduce administrative burden.

Use case 11:
Io Italia App (Italy)
The 'IO Italia' App has been designed to simplify the interaction with various service providers, by offering a single, integrated point for public services.
The app is designed to cover the whole spectrum of the Italian public administration, from municipal to national services. IO Italia has also the ambition to offer its users a wide variety of potential applications. This ranges from exchanging transactions between PAs and citizens through electronic payment service (PagoPA) to offering a direct contact point to get in touch with any relevant public service office, by receiving messages and notifications.
Accessible through a single digital ID scheme (SPID, Public System for Digital Identity) and relying on a simple, clear, and user-tested interface, it has the potential to simplify drastically the experience of Italian public service users.

11. Preservation of information. The observance of this principle implies that information gathered during the creation and delivery of IPS can be preserved long-term in a technologically-neutral manner for appropriate use in the future; thereby respecting the privacy of the involved co-creators.

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Recommendation 12:
Formulate a long-term preservation policy for information related to the development of IPS so that it can be reused by other stakeholders participating in the co-creation process, also at later stages of the same development process or for future developments.

Use case 12:
Schoolstraten - City of Mechelen (Belgium)
PoliVisu, the partners of the city of Mechelen in various projects, adopted a Data Management Plan which establishes precise data preservation rules for the purpose of both safeguarding project evidence and making it more visible and accessible to the scientific, academic and corporate world. This has been applied to all use cases under the project, including the case "Schoolstraten" of the City of Mechelen.

12. Assessment of effectiveness and efficiency. IPS co-creation efforts should aim to enhance the effectiveness and efficiency of public services.

Recommendation 13:
Target and encourage initiatives that through co-creation generate improved user experience, smooth and efficient processes and reach higher numbers of beneficiaries.

Use case 13:
ASET (Portugal)
To roll out the Automated Social Energy Tariff (ASET) that would grant a social benefit to low-income families, the Secretaries of State of justice, energy, tax and social security and DGEG established a governance structure, with an organizational and legal framework and standards at the technical, semantic and business process level. Overall, the purpose was to minimize the administrative burden for citizens, which was a barrier for many families in applying for a reduced tariff.
The case illustrates an effective cross-sector collaboration adopting standards and legislation in defining roles and reusing existing infrastructure. The successful adoption and implementation of ASET led to an increase of almost 400% in the number of eligible households and a more efficient flow of information between key actors. A similar business process has been considered for extension other services such as water supply and wastewater management.

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7.4 Conclusions

The objective of Chapter 7 was to revise the IPS conceptual model proposed in EIF to accommodate stakeholder's collaboration and IPS co-creation in order to provide the conceptual basis to implement Government as a Platform (GaaP) and Government as a Service (GaaS) for IPS towards the IPS Holistic Framework. This objective was achieved by developing the IPS-Co, which is the first pillar of the inGOV project.

IPS-Co resulted from the tailoring of the Integrated Public Service Conceptual Model proposed in the 2017 EIF by including stakeholders' collaboration and IPS co-creation. To do so, we have integrated co-creation within the Integrated Public Service Conceptual Model of the 2017 EIF and following the structure of the 2017 EIF, we have tailored the 12 principles considering a co-creation perspective. Furthermore, in this chapter, we have provided use cases that can facilitate our understanding and the potential role of co-creation in public service provision. The tailoring of the Integrated Public Service Conceptual Model required an extensive literature review on technologies, EU documents and academic literature related with co-creation and interoperability principles. All this supportive research can be found in the previous chapters of this deliverable.

Chapter 7 has presented the nine elements that compose the IPS-Co framework: 1) Integrated Public Services, 2) Co-creation process, 3) Service Users, 4) Service Providers, 5) Privacy and Security, 6) Internal Information Sources and Services, 7) External Information Sources and Services, 8) Technology and 9) Catalogues (See Figure 7.2). IPS-Co, when compared with the EIF conceptual model, presented a bi-directional relation between co-creation, service users and the Integrated Public Services box. The bidirectional relation is fundamental for co-creation processes, where a direct interaction between the co-creating actors is expected. Following the original Conceptual model for IPS presented in the 2017 EIF, we have located the Integrated Public Services and the Coordination for Integrated Service Delivery inside the Delivery box. Also, the principles for the IPS-Co have been tailored considering IPS and co-creation: 1) Subsidiarity & Proportionality; 2) Openness; 3) Transparency; 4) Reusability; 5) Technological neutrality & data portability; 6) User-centricity; 7) inclusion and accessibility; 8) Security and privacy; 9) Multilingualism; 10) Administrative simplification; 11) Preservation of information; and 12) Assessment of effectiveness and efficiency.

IPS-Co, its elements and the principles provide the conceptual basis to implement GaaP for IPS. GaaP "is based on a digital foundation for government to share data, software and services, and has been proposed as an efficient, effective and innovative model for government" [21]. All these aspects are being considered by the elements of IPS-Co. The digital foundation is clearly reflected not only in the key component of the model technologies but also in the relationship between service users and service providers through the co-creation of integrated public services to facilitate the efficiency, effectiveness, and innovation of public services. Furthermore, privacy and security are elements that need to be considered to enable trust and collaboration among the different stakeholders.

In the same vein, IPS-Co can provide a conceptual base for Government as a Service (GaaS). GaaS envisions public administration operations as a set of public services that are described in relevant catalogues, facilitating transparency and citizens participation, and provided by eGovernment information Systems [22]. CPSV-AP can be either used as a blueprint for new PS models development or as a gateway for both bridging and federating PS catalogues and eGovernment Information Systems, increasing reusability and quality and in parallel lowering implementation cost. Consequently, it facilitates semantic interoperability.

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Moreover, CPSV-AP incorporates linked data as an underpinning technology, enabling integration of PS descriptions to the linked open data cloud (see Chapter 6 for more information).

These GaaP and GaaS approaches will be fully developed in Work Package 2 where the development of the IPS Holistic Framework (IPS-HF) will take place. IPS-HF will enable identifying and addressing all legal, cultural, and managerial challenges. It is important to mention that this is a living document, which changes can take place as inGOV project develops.

7.5 References

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SECTION 3

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Chapter 8. Users' Needs Elicitation

Acronym/Abbreviation	Description
API	Application Programming Interface
ARMS	Automated Revenue Management Services, Malta
BPMN	Business Process Modelling Notation
CfR	Commissioner for Revenue, Malta
(e)ID	(Electronic) Identification
EFKA	National Social Security Entity, Greece (in Greek: Ενιαίος Φορέας Κοινωνικής Ασφάλισης, ΕΦΚΑ)
EIF	European Interoperability Framework
FAQ	Frequently Asked Questions
GDPR	General Data Protection Regulation
IMA	Identity Malta
IPS	Integrated Public Services
IT	Information Technology
ΚΕΠ	Citizens Service Centres, Greece (in Greek: Κέντρα Εξυπηρέτησης Πολιτών)
MFE	Ministry for Finance and Employment, Malta
MSFC	Ministry for Social Justice and Solidarity, Family and Children's Rights, Malta
NIAS	National Identification and Authentication Services, Croatia
NSO	National Statistics Office, Malta
REST	Representational State Transfer
SMS	Short Message Service
WST3	Economy and Tourism department of the Federal Government of Lower Austria

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8.1 Introduction

The aim of work reported in this chapter is to elicit the needs and considerations of the stakeholders of the four inGOV pilots. This has been performed in the form of interviews with all different stakeholder types, including citizens and businesses, public administration, and policy makers. Stakeholders' responses, including user stories, have been analysed and usage scenarios have been developed for each pilot, all of these contributing to high-level user requirements both of functional and non-functional nature.

The structure of this chapter is as follows. Section 8.2 describes in detail the methodology used for needs' elicitation, sections 8.3, 8.4, 8.5 and 8.6 report results per pilot, while section 8.7 summarises overall results and section 8.8 delivers conclusions from our work.

8.2 Methodology

For eliciting the stakeholder needs and requirements, the following steps were carried out (Figure 8-4):

1. Definition of pilot stakeholders. First, the stakeholders groups that are relevant to each pilot were identified.
2. Collection of input from stakeholders. Then the stakeholders were involved via interviews and the collected input was analysed.
3. Development of usage scenarios. Usage scenarios for the to-be situation were created based also on input from the interviews.
4. Elicitation of needs and requirements. The needs and requirements for each pilot and in total were identified.

More details on these steps are provided in the following paragraphs.

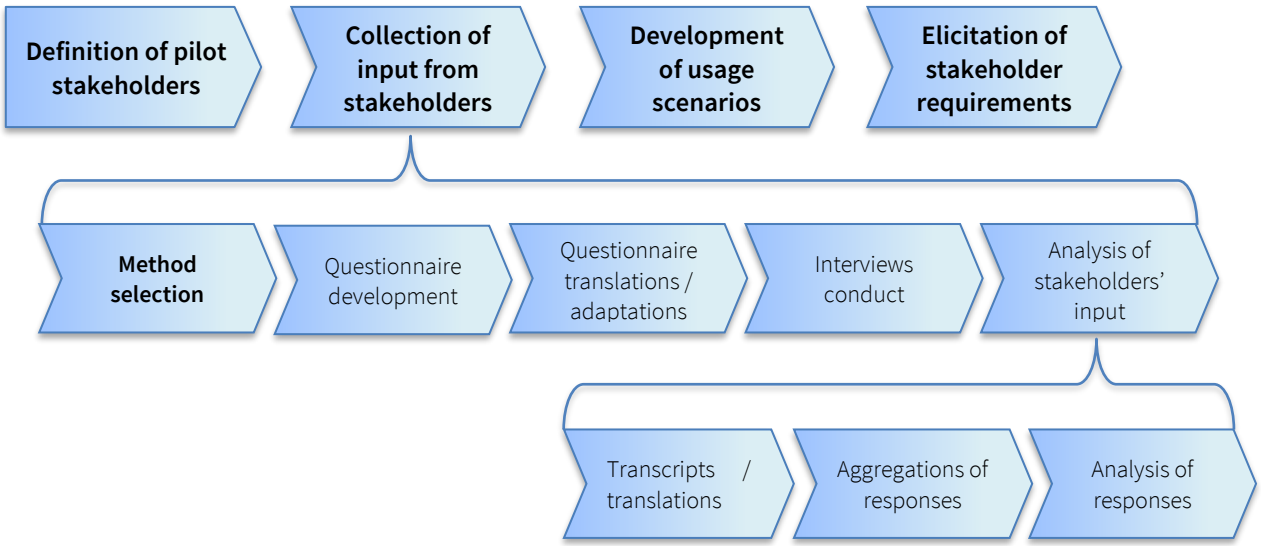

Figure 8-4. Methodology for needs elicitation

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8.2.1 Definition of pilot stakeholders

inGOV targets to actively include all different stakeholders from the start of the project. Thus, the first step was to identify the involved stakeholders in each pilot. This information is summarised in Table 8-2 below. All pilots involve stakeholders from what is traditionally called the "supply-side" of public services, i.e. public servants, and policy makers. Moreover, it became evident at this stage that public servants should not be treated as one stakeholder group, but subdivided into two subgroups: one referring to the "provider" public servants, namely the ones that are involved in the provision of the public service, calling them "provider" public servants; and the ones that are involved in the IT support and facilitation of the public service, calling them "IT provider" public servants. Furthermore, it was also recognised that the public servants to be involved in each pilot may come from different public authorities and from different administration levels (e.g. in Malta and Austria) thus there is a degree of diversity involved.

As regards, the "demand-side" of public services, there are differences among the pilots. In specific:

- Due to the nature of the public service to be addressed, Malta does not include any end users from the demand-side, neither citizens nor businesses. Citizens are the final beneficiaries of the service but not users of the service. In Maltese pilot, public servants are not only providers but also users of the public service.
- Croatia and Greece involve only citizens as end users of the service. Greece could potentially include citizens' representatives as well if deemed relevant to the project activities (e.g. if disabled people are unable / unwilling to be participate, a disabled association could represent them).
- Austria involves only businesses as end users of the service, whereas it was also recognised that business representatives should be included as well, e.g. for capturing the opinions of a varied sample of businesses.

Table 8-2. Pilot stakeholders

Stakeholder groups	MT	HR	GR	AT
Citizens (end users)		✓	✓	
Citizen representatives (e.g. NGOs, associations)			(✓)	
Businesses (end users)				✓
Business representatives (e.g. Chambers, Unions)				✓
Public servants (service providers/users)	✓	✓	✓	✓
Public servants (IT providers)	✓	✓	✓	✓
Policy makers	✓	✓	✓	✓

8.2.2 Collection of input from stakeholders

8.2.2.1 Method selection

There are many different methods for eliciting stakeholder needs and requirements, such as interviews, questionnaires, documents' analysis, observation, joint application development [1], and there is the option to utilise quantitative or qualitative research methods [2]. For the selection of the most appropriate method, we considered the focal point of inGOV project, i.e. co-creation and integrated public services (IPS), and the fact that many stakeholders would not be familiar with such concepts. Thus, it became evident that the method to be selected should:

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- allow for direct interaction with the stakeholders in order to be able to explain to them key aspects of the project;
- allow stakeholders to express own experiences, opinions and needs freely and in their own words.

It was therefore decided to use qualitative interviews as the method for approaching stakeholders and eliciting their needs.

Qualitative interviews may be unstructured, semi-structured or structured [3]. Unstructured interviews are common in qualitative research but are usually utilised for long-term field work with minimal hold on respondents' responses; hence semi-structured or lightly structured interviews are also common in qualitative research [4]. For inGOV, we selected a structured approach in order to ensure that each interview will refer to all aspects of interest to the project. Moreover, inGOV interviews would be performed in the four pilot sites by local partners as interviewers and a structured approach would provide a common way of addressing these aspects in different contexts. Hence, it was decided to perform the interviews based on predetermined interview questionnaires and protocol. However, the questions would be mostly open-ended and interviewees would be allowed to express their opinion even beyond the predefined questions.

8.2.2.2 Questionnaire development

The aim of the stakeholder interviews was to elicit the needs of different stakeholders and to use these for determining a set of high-level user requirements. Thus, the questionnaires had to ask for stakeholders' expectations, including user stories. Moreover, the questionnaires had to address stakeholders' opinion as regards the two main concepts of inGOV, i.e. co-creation and IPS, whereas stakeholders' opinion on aspects of the different layers of the European Interoperability Framework (EIF) [5] would also be useful for subsequent work in the project. Finally, and considering the attention given to sustainability within inGOV, it would also be useful to get an initial reaction from stakeholders on sustainability aspects. Hence, the questionnaires were constructed along the following five themes: user expectations; co-creation; IPS and IPS governance; EIF layers; and sustainability.

At the same time, the aim of the stakeholder interviews was to involve all different stakeholders identified in the previous step, i.e. citizens, businesses, public servants, policy makers, Chambers, etc. Evidently, the same questions could not be used for all different stakeholder groups – not all aspects were relevant to all stakeholder groups, and different stakeholders may need to be asked in different ways on the same topic. Thus, questions were developed taking into account the specific stakeholder groups they are addressing, and the same question could be rephrased depending on the targeted stakeholder group.

Another consideration during questionnaires' development was to target for interview duration of about 1 to 1.5 hours at most since longer interviews would tire respondents (potentially impacting input's quality) and discourage participation. For this reason, we have tried to keep the questionnaires short and we indicated some questions as optional, meaning to be addressed only if time permitted.

Following, we present the developed questions according to themes and stakeholders, while the full questionnaires per stakeholder group are provided as additional material to this deliverable.

User expectations. This theme includes questions on users' experiences with the public service and their expectations from the service as well as user stories [6], [7] as a way of eliciting user needs. Moreover, it

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seeks opinions as regards specific aspects of public services that are of interest to the project, i.e. regarding the communication channels and the provided information and findability of public services. In Table 8-3 we present the questions of this theme mapped to relevant stakeholder types. The questions under this theme refer only to actual users of the service (either citizens / businesses or public servants), whereas the questions on communication channels are targeted only to citizens or businesses, and the question on service's information provision and findability is targeted only to citizens (as it was considered that businesses will not seek to find a service as for example citizens do in search of a service regarding benefits).

Table 8-3. Questions on user expectations

	Questions	Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	What are your experiences with this public service? (*If negative experiences*: Have you experienced any problems and how do you cope with these issues?)	✓	✓			
	(Only for service users:) What are your experiences with this public service? What would you change to improve this public service? How would this service ideally be provided?			✓		
2	What are your expectations with respect to this new/improved public service? *(Potential follow-up question:* How crucial is this service for you?*)*	✓	✓			
	Complete the following sentence multiple times based on your expectations:	✓	✓	✓		
	• As a …(role), I would like to … in order to …(benefit) • As a …(role), I would like to … in order to …(benefit) • …					
3	To what extent would the following communication channels be useful for this public service? *(Select a value from 1 to 5, where: 1: not useful at all; 2: not useful; 3: neutral; 4: useful; 5: very useful)*	✓	✓			
	• Offering the service via a PC web browser					
	• Offering the service via a mobile application					
	• Offering the service via virtual assistants (chatbots)					
4	To what extent would you (or the people that you represent) utilise the following communication channels when using this public service? *(Select a value from 1 to 5, where: 1: not use at all; 2: not use; 3: neutral; 4: use; 5: surely use)*	✓	✓			
	• Using the service via a PC web browser					
	• Using the service via a mobile application					
	• Using virtual assistants (chatbots)					

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5	How did you get informed about this public service?	✓				
	□ I got informed by the competent public authority □ I got informed by another public authority (specify which) □ I got informed by the web □ I got informed by the social media □ I got informed by an NGO, etc. □ I got informed by a friend □ Other (specify)					
	Was the provided information, e.g. about the necessary steps or the required documents, … *(Select a value from 1 to 5, where: 1: strongly disagree; 2: disagree; 3: neutral; 4: agree; 5: strongly agree)*	✓				
	• Clear enough?					
	• Comprehensive enough?					
	• Personalised enough?					
	Do you have any suggestions towards improving the clarity, the comprehensiveness and the personalisation of the information that you got about this public service?	✓				
	How difficult was it to find information about this public service as a user, e.g. its description? *(Select a value from 1 to 5, where: 1: very difficult; 2: difficult; 3: neutral; 4: easy; 5: very easy)*	✓				
	Do you have any suggestions towards improving the findability and/or accessibility of the information about this public service, e.g. on bundling?	✓				

Co-creation. This theme seeks to understand aspects of co-creation through respondents' personal experiences and opinions. Hence, the questions refer on previous experiences with co-creation efforts, on users' expectations from co-creation activities, as well as on stakeholders' opinion on the challenges, motivating factors and barriers related to co-creation. Although handling the same concepts, questions under this theme have been differently formulated for citizens/businesses and for public servants/policy makers in order to better apply to their circumstances, as shown in Table 8-4. Question 5 intended to elicit stakeholders' idea of what co-creation is before explaining it according to inGOV definition.

Table 8-4. Questions on co-creation

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	Questions	Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	What would be your expectations from engaging in the planning, design, implementation, delivery and/or evaluation of this public service?	✓	✓			
2	What is your (or your organisation's) motivation to engage in the planning, design, implementation, delivery and/or evaluation of this public service?	✓	✓			
3	Have you engaged in co-creation processes before? Please describe your involvement. In which phase of the public service delivery? (e.g., co-planning, co-design, co-delivery, co-implementation, co-evaluation).	✓	✓			
	What were the barriers you encountered? What factors enabled/enhanced your involvement?	✓	✓			
4	Do you feel including people and organisations from outside of the public sector would benefit the delivery of these public services? If yes, who and in which ways? If not, why not?	✓[41]	✓			
5	*(Only for interview)* How would you define co-creation? *(For interview & survey)* Explain inGOV concept of co-creation			✓	✓	✓
6	Have you engaged end-users (citizens and businesses) in the planning, design, implementation, delivery and/or evaluation of the IPS (co-creation)? If yes, what did these co-creation processes entail? If not, why not?			✓	✓	✓
7	What would you consider to be the biggest challenges related to the engagement of the end-user (citizens and businesses) in the co-creation process? How can these challenges be tackled?			✓	✓	✓
8	Are there any special factors/motivations that could enable/enhance the engagement of end-users (citizens and businesses) in the co-creation of this particular public service?			✓		✓

[41] This smaller tick symbol is used in this table and in the following ones in order to indicate optional questions.

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IPS and IPS governance. Table 8-5 presents the questions of this theme. Question 1 intended to elicit stakeholders' idea of what IPS is before explaining it according to inGOV definition. The rest questions refer to aspects of IPS governance as regards coordination of IPS and reusing of potential building blocks for the integration. Questions under this theme target only public servants and policy makers as they are too specialized for citizens/businesses.

Table 8-5. Questions on IPS and IPS governance

	Questions	Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	*(Only for interview:)* How would you define integrated public services in your own words? In your organisation, does a common understanding of IPS exist? *(For interview & survey:)* Explain inGOV concept of IPS			✓	✓	✓
2	Is there efficient coordination and governance of public services in order to ensure integration and seamless execution? Which administrative entity should be coordinating the integrated service delivery?			✓	✓	✓
3	Would it be useful to reuse existing building blocks / IT artefacts of services and information resources (or develop new ones)? Which?				✓	✓

EIF layers: legal, organisational, semantic and technical aspects. Questions under this theme target to address aspects of the four different layers of EIF. The questions refer only to public servants and policy makers as they are too specialized for citizens/businesses and involve different stakeholders per layer. There is one question on legal aspects regarding legislation and potential incompatibilities and gaps, one question on organisational aspects regarding relationships, responsibilities, policies and processes needed for IPS co-creation and one question on semantic issues. However, more questions are included for the technical layer seeking to elicit the expert opinion of IT providers as regards specific technical issues useful for subsequent work in the project, e.g. systems, channels, interfaces, specifications relevant to the public service and to seamless IPS. Table 8-6 presents the questions under this theme.

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Table 8-6. Questions on EIF layers

	Questions	Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	Which EU/national legislation affects this public service? Is it sufficient for IPS co-creation? Are there incompatibilities/gaps that need to be resolved?			✓		✓
2	Are current organisational relationships, responsibilities, policies and processes clearly defined and sufficient for IPS co-creation?			✓		✓
3	Which semantic issues need to be resolved for data exchange within IPS co-creation?			✓	✓	
4	Which legacy systems need to be considered for this integrated public service? How fragmented is the current ICT landscape for the service?				✓	
5	Which technical interface(s) should be used for the service in order to interoperate with other services, e.g. APIs, Web Services, etc.?				✓	
6	Which is the most suitable channel, e.g. mobile phones, web, etc., for the provision of the service to PS consumers?				✓	
7	What kind of technical specifications are needed (e.g. for interfaces, interconnections and integration) for seamless IPS?				✓	
8	Would innovative solutions be useful for IPS co-creation? *(You may give examples such as data-driven design and linked data technologies)*				✓	
9	Are there legal incompatibilities, gaps or interoperability barriers that need to be resolved for IPS co-creation?				✓	

Sustainability. This theme targets aspects of sustainability as sustainability is of focus within inGOV (WP5 is dedicated to sustainability) and responses to these questions may be used as input for the relevant WP. Table 8-7 presents the questions of this theme. One question is addressed to citizens/businesses referring to the factors for success and barriers, and four questions are addressed to public servants and policy makers referring to additional aspects, e.g. sustainability affecting the development of services, and support to sustainability by digital tools.

Table 8-7. Questions on sustainability

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Questions		Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	What do you think is necessary for the sustainable implementation of co-created IPS? What barriers have you encountered or expect to encounter?	✓	✓			
2	How can a sustainable implementation of co-created IPS be ensured? What are the success factors?*(Continue with next questions if respondent seems to be knowledgeable on sustainability)*			✓	✓	✓
3	How does thinking of sustainability aspects impact the development of public services/IPS?			✓	✓	✓
4	How can digital tools support the sustainability of public services/IPS?			✓	✓	✓
5	What aspects of sustainability can be addressed through the co-creation public services/IPS?			✓	✓	✓

Additional questions. A few more questions were added as presented in Table 8-8. The first two were added for additional understanding of the interviewees' (and other stakeholders') role in the service and the latter was added to the end of all questionnaires to encourage any input that was not covered in the previous questions.

Table 8-8. Additional questions

Questions		Citizens (& reps.)	Businesses(& reps.)	Provider p. servants	IT p. servants	Policy makers
1	What is your function in the organisation? What is your role in this public service? *(Potential follow-up question:* What does this entail exactly?*)*			✓	✓	✓
2	Who are the other main stakeholders in the public service and what are their roles?			✓		
3	Would you like to add something? Are there important issues we haven't addressed?	✓	✓	✓	✓	✓

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Demographic questions. A few demographic questions were also included for citizens and businesses. Questions for citizens refer to gender, age, educational level and occupation status. Questions for businesses refer to interviewee's position as well as to type, size and place of business.

The questions were prepared by UOM in a collaborative manner within the consortium exploiting inputs from partners with diverse expertise, e.g. KUL, DUK. The questionnaires per stakeholder group were discussed and edited with partners in online meetings and explained in detail over an online workshop with partners involved in piloting, i.e. MITA, DUK, LAND NÖ, Thessaly, Bjelovar and RIDE. Additionally, detailed guidelines for the interviews were also developed by UOM for assisting the interviewers. These guidelines are provided as additional material to this deliverable.

8.2.2.3 Questionnaire translations / adaptations

The questions presented above are the generic questions developed for applying to all pilots. However, it was recognised that certain questions may need adjustment for addressing specific pilot's circumstances. For example, it was decided to rephrase most co-creation questions in order to apply to Maltese circumstances, i.e. not involving citizens as end-users.
Furthermore, the questionnaires were also translated to Croatian, Greek and German in order to be used for the interviews in the native languages in Croatia, Greece and Austria. During the translations the questions may have been slightly modified so as to be clearer and more understandable in native languages.

8.2.2.4 Interviews conduct

The stakeholder interviews were organised by pilots and were conducted in April, May and June 2021. Pilot partners, i.e. MITA, LAND NÖ, Bjelovar and Thessaly, made the decisions on who to invite to the interviews, how the interviews should be conducted (adhering also to local circumstances, e.g. COVID19 restrictions), etc. Moreover, pilot partners with the help of supporting on-site partners, i.e. DUK and UOM, made sure that all required ethical measures were taken before the conduct of interviews. This includes the acquisition of ethical approvals by the native ethical authorities, the collection of signed consent forms prior to interviews' start, and pseudonymisation of responses. More information on the approach followed in each pilot site is reported per pilot in the respective sections below, whereas details on the ethical assurance are reported in the project's ethical deliverables.

8.2.2.5 Analysis of stakeholders' input

Stakeholders' input collected via the interviews has been analysed following a three-step approach as explained below.

Transcripts / translations
First, stakeholders' input has been transcribed and or translated where relevant. In specific, the Austrian pilot has used transcripts by an external company as well as translations, the Greek and Croatian pilots needed only to translate inputs to English, whereas the Maltese pilot did not perform neither transcripts nor translations, but recorded inputs directly in English.

Aggregations of responses
Second, and as an initial step before inputs' analysis, stakeholders' responses were aggregated per theme so that relevant responses provided from different stakeholder types and collected via different questionnaires were gathered together. In order to facilitate this aggregation, UOM produced detailed

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guidelines on how this aggregation should be performed by the partners in each pilot site. In specific, for each pilot and for each theme the relevant questions from each stakeholder questionnaire were referred to as placeholders where pilot partners added the relevant responses. This method had a twofold advantage. First, it helped streamline the work within the consortium for analysing the responses, and second, it allowed for increased privacy of responses since stakeholders' interview sheets remained with the partners who collected the input.

Analysis of responses
Third, based on aggregated responses, we were able to perform the analysis of stakeholders' input per theme and stakeholder type. The analysis has been mostly of a qualitative nature as most questions were open-ended; however, there have been a few quantitative questions as well in the citizens' questionnaires.

8.2.3 Development of usage scenarios

The usage scenarios refer to the envisioned (to be) situation of the public services addressed by inGOV. A usage scenario is a text-based story of a user attempting to achieve some goal, and it is useful because it describes user interactions with a system in order to capture the context and goals of the user; captures full end-to-end user flows; unites the fragments of functionality (e.g. user stories) into a cohesive unit; and helps understand user's motivations and expected usage of the product [8]. The main features of a usage scenario usually include a user (or persona or actor); a setting (or background); a goal; a narrative; activities (or tasks); decisions; bounded timeframe.

For inGOV, we have selected the following template for recording the usage scenarios, which is simple yet descriptive enough for our purposes:
Title: *<Title of the described scenario>*
Involved stakeholders (and types): *<the stakeholders involved as actors in the scenario>*
Background and goal: *<the context of the user and the desired outcome>*
Scenario: *<the narrative of consecutive activities and decisions>*

Apart from textual descriptions, the usage scenarios have been graphically depicted as well according to the Business Process Model and Notation (BPMN) standard version 2.0 [9]. BPMN diagrams are useful for facilitating understanding of the scenarios in a standard manner that is easily understood both by business and technical professionals. BPMN diagrams of usage scenarios were developed using the academic version of Signavio Process Manager[42] Software.

8.2.4 Elicitation of stakeholder needs and requirements

The last step of the methodology has been the elicitation of user needs and requirements based on both the responses provided in the stakeholder interviews and the developed usage scenarios. The diversity of inGOV pilots, e.g. in terms of targeted public services and stakeholder types, made us expect differences in elicited user needs, thus it was decided to analyse the user needs on a per pilot basis and to reach overall conclusions on needs at the very end.

[42] https://www.signavio.com/products/process-manager/

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According to Information Systems bibliography [10], user requirements are defined as "statements, in a natural language plus diagrams, of what services the system is expected to provide and the constraints under which it must operate" and system requirements as "the system's functions, services and operational constraints in detail". System requirements may be further classified to functional and non-functional requirements; referring to what the system should do (functional) and the characteristics the system should have (non-functional). The objective of the analysis at this early stage of the project has been on user requirements, and not on system requirements as these will be studied within subsequent work packages. However, we find it useful to classify the elicited user requirements to functional and non-functional ones for clearer depiction and summarisation of needs. Therefore, after eliciting user needs, these have been classified to functional and non-functional user requirements. Non-functional requirements have been further classified under the four categories proposed by Dennis et al [1], i.e. Operational, Performance, Security, Cultural & Political. Moreover, we provide a suggestion for requirements' prioritisation, highlighting the ones that emerged the most crucial for a viable and effective solution.

8.3 Pilot #1: Malta

8.3.1 Background

8.3.1.1 Problem statement and aspiration

The Malta Information Technology Agency (MITA) supports the government implementation of various Information Systems within many business domains in the public sector, such as Taxation, Social Security and Healthcare. These domains operate under the stewardship of different governmental bodies, ministries, or departments, thus resulting in data silos which are not interoperable in an agile way. Currently any efforts that require the use of multiple registries (databases), such as integrated public services, require a considerable logistical operation in order to obtain the relevant information.

A recent use case required the identification of family units in households in Malta for the government to issue a one-time payment to compensate for the increase of bread and milk prices registered in 2020, as announced in the Malta Government Budget 2020. The service required the merging of multiple siloed and non-interoperable datasets owned by different governmental bodies, ministries, or departments, containing data on social security, taxation, citizen identity, and utility retail and supply. Due to the detached nature of these datasets, as well as the interchangeable use of data written in Maltese, English and Maltese and English, and the use of different schemas for each dataset, the effort to integrate them in order to deliver the social benefit in question requires a considerable logistical operation. Apart from being an administrative burden, such challenges result in a public service that is not efficient and accurate, therefore requiring the need of further corrective measures, such as the setting up of a Government customer service where the citizens can communicate any non-received social benefits. Moreover, there is a high risk on the timeliness of the implementation, and a major restriction to the provision of proactive services by the Government of Malta. Lastly, given that the created dataset is of a temporary nature, this is not constantly updated and maintained, thereby resulting in the dataset not providing an added value to cross-domain stakeholders for other initiatives, such as the implementation of new tax incentives, improving data maintenance and cleaning processes, improving the eligibility criteria for existing social benefits, introduction of new social benefits, effective payments of social benefits to citizens in need, and reduction of payments (social benefits or otherwise) to non-eligible citizens. To solve these interoperability issues and administrative burden, it is vital to have the capability of extracting and defining

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household units in an agile manner, where information from various entities will be used in line with specific requirements for provision of the IPS.

The modernisation and Integration of the Digital Common Household Unit public service in Malta involves the creation of an IPS through the development and co-creation of a common register that integrates Taxation, Social Security and Public Registry datasets that are currently siloed. This IPS shall be used to identify unique household units, which are currently relevant to the provision of a number of public services, including to determine all social security and taxation entitlements being consumed by each family. Through this register, the IPS will then enable stakeholders to exploit the relevant data as required. This IPS will also aid towards achieving Once Only Principle goals through the sharing and re-use of data between public entities.

8.3.1.2 The "Identification of household units" public service

The service currently operates on an ad-hoc basis and requires the identification of Maltese household units (e.g. family households). The current service operates through the merging of multiple siloed and non-interoperable datasets owned by different governmental bodies, ministries, or departments, containing the following data:

- Social security records;
- Citizen identity records; and
- Utility Retail and Supply records.

Since there are active data processing agreements with the relevant data controllers, the public servants already had access to the relevant citizen data, and there was also a legal basis for the required data processing. They could therefore proceed to process this data, including analysing its quality, transforming, normalising, pre-processing, matching and merging, and cleaning the data. Due to the information on household units not being explicitly available, the extracted information had data quality limitations, in terms of completeness, correctness, consistency, and accuracy. The one-off bonus was delivered to the household units, and a Government customer service was set up for citizens who either felt that they did not receive the appropriate bonus which is dependent on the number of residents in a household unit, or else did not receive the bonus at all. Any suggestions and/or complaints by citizens were manually analysed and relevant action was taken to correct any mistake in the public service delivery.

8.3.1.3 Stakeholders

The stakeholders involved in this public service include the respective government entities who own the datasets relevant to the family household, namely the following entities:

- Ministry for Finance and Employment (MFE), handling the taxation records;
- Ministry for Social Justice and Solidarity, Family and Children's Rights (MSFC), handling the social security records;
- Automated Revenue Management Services (ARMS), a private limited liability company, handling the Utility Retail and Supply records;
- Identity Malta (IMA), handling the citizen identity records; and
- Malta Information Technology Agency (MITA).

Citizens of Malta (200,000 households made up of approximately 0.5M individuals) are not directly involved stakeholders (not users) but the beneficiaries of the family household public service.

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8.3.2 Stakeholder interviews

8.3.2.1 Collection of responses

The study consisted in carrying out sessions in the form of interviews or focus groups with key personnel and relevant staff from the stakeholders listed above, with the goal of identifying stakeholder needs. These sessions were based on a questionnaire that was prepared specifically for the elicitation of requirements by the pilots in the project. The questionnaire was modified in order to better cater for the stakeholder types to be interviewed for the Maltese pilot. Due to the active COVID-19 measures at the time of data gathering, sessions were carried out through online calls.

The selection process for the participants in the study involved contacting and inviting individuals who are currently using the various resources / databases / services to be used in providing the new IPS, based on their involvement level and expertise. This process was facilitated through the ongoing collaborations and work relationships between MITA and the target stakeholders. Sessions were then organised based on the participants' consent to participate in the study. A number of eligibility criteria were defined for the participants as follows:

- Target age: Minimum 18 years, no maximum age.
- Target gender: Diverse.
- Inclusion of children and/or vulnerable persons: No children or vulnerable persons have been included in the study. Participants were all be able to give their consent personally.

The interviews were organised based on the entity in question, that is, an interview was organised for one or more participants who consented to be interviewed from each entity. For each entity, an information session was first organised, followed by the interviews. Depending on the type of stakeholder, the interview consisted in responding to a specific set of questions targeting service providers and users, IT service providers, and policy makers respectively. Due to the nature of the participating entities, as public administrations, the stakeholder types of the interviewees were usually of the same nature, so each interview generally consisted of the same type of stakeholders. In the case of this pilot, most of the stakeholders were actually both service providers, in that they were involved in the collecting and processing of the required data, and also service users, in that they used this data to provide a public service. On the other hand, IT service providers assisted the service providers on the technical delivery of the service. Table 8-9 below shows a breakdown of participants who participated in the study. Within IT service providers, the roles varied between consultants, project managers, enterprise architects and heads of departments, whilst for the service users the roles included data protection officers, legal officers, heads, directors, and chief information officers. The roles for policy makers consisted of chief information officers and heads of unit.

Table 8-9. Entities and stakeholders that participated in the study

Domain	Entity	Stakeholder Type	Target Groups	Number of People	Date
Taxation	Ministry for Finance and Employment (MFE) / Commissioner for Revenue (CfR)	Public Officers	Service User, Service Provider	1	25/04
	MITA Taxation Team		Service Provider	4	21/04
Social Security	Ministry for Social Justice and Solidarity, Family and Children's Rights (MSFC)	Public Officers	Service User, Service Provider	5	27/05

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	MITA Social Security Team		Service Provider	1	20/04
Citizen	Identity Malta (IMA)	Public Officers	Service User, Service Provider	2	05/05
	MITA Identity Team		Service Provider	2	19/04
Utility Retail and Supply	Automated Revenue Management Services (ARMS)	Public Officers	Service User, Service Provider	1	26/05
National Statistics	National Statistics Office (NSO)	Public Officers	Service User	3	27/05
Members of Parliament / Ministries	Office of the Prime Minister (OPM)	Policy Makers	Service User (for data-driven decision making)	3	10/06

8.3.2.2 Analysis of responses

We provide below the analysis of responses categorised per theme.

User expectations

The questions related to user expectations gathered interviewee responses on the current state of the public service, as well as any issues or desired improvements in the new IPS.

A vital point which was raised is that the different stakeholders have different definitions of household compositions. For instance, for the Automated Revenue Management Services (ARMS) who manage water and electricity consumption, a household is defined as one or more persons residing in an address. It does not matter if the individuals[43] have any relationships, whether familial or otherwise. On the other hand, the Ministry for Social Justice and Solidarity, Family and Children's Rights (MSFC), had other different household definitions based on familial relationships. For example, two parents and two children as a family are defined as a household. In the case of this stakeholder however, multiple forms of households exist to cater for the real-life complexity of the domain. In fact, another example of a household is when two siblings live together. In certain cases, there might also be multiple households living in the same address. In some cases, such as in the Taxation domain, the Commissioner for Revenue (CfR) does not officially have a household definition; however they still require identifying households for certain services, such as identifying cohabitating couples for calculating tax and respective applicable tax rates.

In light of the various definitions of household units, stakeholders noted that it is important that a "one-size-fits-all" approach might not be ideal as it would put at risk the operation of tasks within different entities that have different definitions of household units. Additionally, the exposure and alignment of the different definitions and applications of household units would aid in mitigating the issues stemming from the existence of the various definitions of household unit compositions, even within the same entity or stakeholder. The ideal Household IPS should thus provide a single interface where all household unit compositions can be accessed.

All the participants highlighted the currently siloed state of the various datasets and registers contributing to the information required for the identification of household units. Their disconnected state results in changes not being propagated to the other systems, and data would become outdated. This issue also creates a large burden on both the citizen, who in certain instances has to contact the various stakeholders

[43] Note that for the purposes of the Maltese pilot, an individual can refer to a Maltese citizen and/or foreign national.

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to update the necessary data, and also on the public administrations to keep their information up to date. The various household definitions within the domain also brought up a relevant issue related to the siloed state of the registers; whereby the multiple registers storing information related to household units might hold different values for the same field (e.g. address) as is relevant for the particular stakeholder. This creates discrepancies in the data when merged together to obtain the household unit information, therefore resulting in quality issues such as lack of reliability and information that is not accurate. A related issue is when individuals exploit the siloed state of datasets to provide information which is not necessarily correct or accurate but enables them for example to collect additional social benefits. Similarly, sometimes the data does not accurately represent the real-life situation. For example, for tax purposes an individual might provide their accountant's address information for correspondence (mailing purposes), instead of their own personal address. An integrated household unit base register, acting as ground truth, would be a means to mitigate these issues.

In addition to the above, a problem that was frequently brought up in the interviews was the lack of coordination between the relevant stakeholders who own the datasets. This is mostly evident where data requests by service users are made on an ad-hoc basis. This makes it very labour intensive to integrate the data, as it has to be done manually or via the use of rudimentary basic data matching techniques. The dependencies between the systems in question further complicate the situation. This is especially problematic where data which is not validated is re-used in other systems, therefore propagating data with quality issues.

In respect of the silos and lack of coordination issues, the interviewees all indicated their desire for better coordination between the stakeholders, as well as the connection and/or integration of the registers where any changes in one system would be automatically propagated to the rest. This integration effort was also seen as an opportunity to better represent the real-life household complexities, and also to extract new information from existing data. Examples include exposing individuals who provide non accurate data to abuse of certain services, such as social services they might otherwise not be eligible for, or possibly identifying humanitarian cases in order to provide social assistance.

The interview and focus group sessions exposed a number of important limitations of the existing state of the household units as collected and used by the various stakeholders, which revolve around the completeness and consistency of the relevant data. For example, not all children under fourteen years of age are registered with an associated address. Moreover, in the case of foreign nationals, there are instances where such individuals are not registered in any system; therefore there is no record of their identity and address within Malta. Another limitation is the inconsistent use of identity documents, for example use of identity (ID) cards and passports interchangeably. This results in consistency issues when merging data between systems.

An interesting point raised by a couple of stakeholders was the possibility of exposing at least some of the information stored by the various systems to the citizen as the end beneficiary. In this way, the citizen can validate the existing information and correct any details. In this case, the legal implications would need to be thoroughly evaluated.

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The policy makers specifically mentioned that the proposed household unit IPS can be beneficial in enabling the implementation of the Citizen Twin concept[44] being proposed at a Government level. This concept aims to build a repository for holding all public data stored by Government about an individual throughout their lifetime. This opposes the current approach utilised by most of the entities, whereby each have their own separate repositories for storing data.

Lastly, the interviewees listed multiple use cases of how the Household Unit IPS can be used and where it can prove to be beneficial, with the following ones being the most relevant:

- identification of double registrants for tariff subsidies/rebates;
- identification of correct and reliable residential information for official mailing purposes;
- investigation purposes, such as social benefit compliance and identification of unregistered taxpayers;
- improvement of data maintenance and cleaning processes for validation and verification purposes (for entities in the public and private sector based on their needs);
- health emergency services; and
- for the provision of services by the private sector (e.g., for insurance purposes).\

Co-creation

Whilst the participants in the interviews or focus groups were not familiar with co-creation as a term, they were indeed familiar with its concept and practice. In fact, particularly the IT service providers had engaged with the relevant stakeholders, including service users and other service providers, in the co-creation of services. The interviewees described various instances of co-creation where the stakeholders were involved throughout the creation of new services. Whilst not always applicable, citizens were also sometimes involved in the co-creation process through the carrying out of pilots or workshops (serving different needs such as requirements elicitation, software validation, etc.). In certain cases, individuals from the service providers evaluated the system on behalf of citizens as service-users, e.g. to ensure that the service is user-friendly and easily accessible.

In all cases of co-creation, the requirements for data provision (including compliance to relevant legislation), as well as technical requirements, are considered based on the project in question and type of collaboration. In the case of the NSO, they participate in co-creation of services only as an end-user, however certain data sharing requirements are mandated by legislation, so the capturing of these requirements is enforced. In general, the implementation level and data level were identified by most interviewees as being the aspects that proved to be the most challenging, particularly due to the siloed nature of the registers and the lack of communication and coordination between the stakeholders. This was found to be especially challenging when there was the need for ad-hoc collaborations and data sharing. One particular service provider also noted issues with systems being modernised which do not have input validation, and therefore result in low quality data and interoperability issues.

In all cases, the Once Only Principle and One-Stop-Shop concept were shown to be common goals between the stakeholders.

IPS and IPS governance

[44] https://publicservice.gov.mt/en/institute/Documents/IPS%20Journal.pdf

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Similar to the co-creation concept, the interviewees were not familiar with Integrated Public Services as a term, however they had collaborated with other stakeholders in providing IPSs.

Due to the dependencies on third-party sources, a number of interviewees identified the need of a governing body to manage the coordination and data sharing, as well as the maintenance of data and the use of standards, and to manage any funding available for the delivery of the service in question. This would also contribute towards solving the issue of discrepancies in data between different registers, through the establishment of a 'ground truth' register.

A number of interviewees, in context of the delivery of IPSs, pointed out that interoperable data sharing and reuse is crucial, particularly as enabled through the use of standards and specifications such as the use of Core Vocabularies[45] and APIs.

EIF layers: legal, organisational, semantic and technical aspects

As regards the **legal aspects**, and since the interviewees belong to different entities, they each had different national and EU legislations that applied to their domain. Most of this legislation concerned life events, i.e. birth, marriage or divorce, and death. An important legislation that is relevant to all domains is of course EU's General Data Protection Regulation (GDPR)[46], which affects all the stakeholders participating in the pilot. In fact, it was recommended to establish communication with the Maltese Data Protection Commissioner in order to ensure the service is designed and implemented in line with GDPR.

A very important point that was raised here is the need for a legal basis when stakeholders require sharing of data between them. In such cases, the relevant agreements, such as data sharing agreements and Memoranda of Understanding, need to be set up. Here, some interviewees noted a gap in legislation, where some stakeholders, such as third-party users, are not obliged or enforced to update relevant registers with changes made on their end. In most instances, this obligation currently rests on citizens, who have the responsibility to separately contact all relevant entities and update the relevant information. As discussed previously, this issue results in outdated information and discrepancies in a number of datasets. Interviewees all note that in all instances of IPS delivery, the data owners and stakeholders or contributors should be identified, and their roles clearly defined. Preferably, the legal basis for the household unit register should define the relevant roles and cater for any required data sharing, including any obligations, what specific data should be shared, and when. This would avoid the need to set up separate agreements or legal documents on an ad-hoc basis, which requires substantial effort and overhead.

Related to the above, policies and or legislation should be appropriately defined to cater for real-life complexities and align the requirements for the collected information. This would cater for issues stemming from inconsistencies such as use of different identification documents (e.g. ID cards vs. passport documents), and nature of address provided (e.g. personal residence vs. address of representative such as an accountant, or address of a holiday residence).

A stakeholder noted a gap in legislation with regard to foreign nationals who are not legally required to have a registered address. Unless such individuals register with a specific entity, for example with the

[45] https://ec.europa.eu/isa2/solutions/core-vocabularies_en

[46] https://gdpr-info.eu/

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Department of Social Security, to receive social benefits, household data on such individuals is not available.

As regards the organisational aspects, and as already mentioned under the user expectations theme, a frequent problem identified by most of the interviewees was the lack of coordination between the relevant stakeholders who own the datasets. This issue is further exacerbated by the dependencies between systems and the services offered by the stakeholders, and also by the lack of clear definition of the roles and responsibilities of all stakeholders with respect to the service in question.

As regards the semantic aspects, the major challenge identified by all interviewees is the different definitions and representations of household units. Whilst this doesn't directly affect data exchange, the IPS is affected through the resulting discrepancies in household unit representations. Another challenge, stemming through the lack of a base register for Maltese addresses, is the inconsistency in representation of addresses by the different stakeholders, since they would have different representations and/or references for the same address or parts of it, such as the post code. The Address base register, which is part of an ongoing modernisation project, will aid in this regard. Another issue here is when individuals do not use the correct address in certain systems. For example, when for taxation purposes individuals provide their accountants' address for direct correspondence (for mailing purposes), as opposed to their personal address, or when a holiday residence address is provided instead of the permanent residence.

As regards the technical aspects, the siloed nature of the different registers and the lack of coordination between stakeholders result in a number of technical challenges in the provision of public services in Malta. A major issue is the ongoing use of legacy systems, which of course result in interoperability issues. Although there are ongoing modernisation efforts, the interviewees are still experiencing issues with data integration and in most cases this process is still being done manually through the use of data files. An important aspect that emerged from the interviews is the dependencies between systems and/or registers. If there are any dependencies between the Digital Household Unit public service and other registers or systems, they might affect or hinder any updating or modernising efforts. For example, if the dependent system is a legacy system, the Digital Household Unit public service might not be modernised as required as this would result in the said systems not being interoperable due to compatibility issues.

The issue of legacy and non-interoperable systems also means that currently there is no automatic propagation of changes between the systems, which of course results in data that is not up-to-date and therefore not reliable or accurate. In these cases, the use of APIs would be a solution to mitigate this challenge, even though in certain cases they would need to be created ad-hoc to cater for the specific requirements at hand. Moreover, in context of the Digital Household Unit public service, some interviewees pointed out that there should be the identification of events (e.g. life-events such as birth, marriage, and death) which would trigger an update to the relevant registers. In case of discrepancies, these should be flagged to the appropriate stakeholder and addressed.

From the technical aspect of registers and systems relevant to the Digital Household Unit public service, most interviewees identified a number of data quality issues that need to be tackled. First of all, relevant systems use different languages (Maltese, English, and mix of Maltese and English – known as Maltese-English). The use of Maltese language was encouraged through the availability of Maltese characters on

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local systems, introduced in December of 2020[47], however, especially in cases of non-Maltese names, there are still issues with representing other characters. Other important data quality issues include incompleteness and incorrectness of data, and syntactic errors, sometimes stemming from lack of validation measures.

Sustainability

With respect to the sustainability of the IPS implementation, the interviewees here also expressed the importance of integration of the different registers, including the automatic propagation of changes. This would enable the relevant registers to be up to date and stay relevant. Better coordination and communication between stakeholders, as well as the definition of appropriate legislation, and establishing a governing body, would also help in this regard. On a related note, the establishment of a base register to act as a gold standard would help mitigate any discrepancy issues between the various registers contributing to the IPS. Otherwise, if relevant systems cannot be integrated, at least the information can be linked, therefore mitigating any issues stemming from siloed data sources.

A stakeholder also identified the importance of a sustainable management of implementing changes or system updates, especially in case of dependencies between systems. In such cases, communication is essential to identify any impact of changes or enhancements, and the latter should be thoroughly evaluated before being implemented.

A number of technical aspects were put forward by different interviewees in context of the sustainability of the Digital Household Unit IPS, including the importance of the accuracy, completeness, and correctness of the data. In this regard, the standardisation of fields across data sources and stakeholders would be helpful. Most of the interviewees pointed out that interoperability between systems and data sources is vital for a sustainable implementation of the IPS. Moreover, the availability of skills for the maintenance of the developed IPS are also important for its sustainable implementation.

The implemented technology was also identified by an interviewee as being vital for the sustainability of the IPS. The interviewee here pointed out that the IPS needs to be current and agile, and needs to be updated on a regular basis. Moreover, dependencies between systems and services will affect their updating and/or modernisation. The use of knowledge graphs for representing the household unit data was also supported by certain interviewees, including policy makers, who identified their benefits, such as flexible representation of heterogeneous data and enablement of advanced visualisations of the various household unit definitions that can be available within the data.

As pointed out multiple times by most of the interviewees, ownership of the Household Unit register should be determined for the IPS to be sustainably delivered. Most of the entities interviewed were both service users and service providers (e.g., MSFC, ARMS). However, ownership of the Household Unit register can also be claimed by entities that are solely service users. Responsibilities of all the involved stakeholders should be clearly defined, and a legal basis needs to be established for all data processing required, including data collection and data sharing.

[47] https://timesofmalta.com/articles/view/ganni-becomes-first-baby-named-using-maltese-fonts-after-it-system.840896

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Finally, an interviewee made a very valid point towards the sustainable delivery of the IPS; there needs to be a demand for the service otherwise the stakeholders will be unwilling to contribute efforts and provide data for the Digital Household Unit public service.

8.3.3 Envisaged TO BE situation

8.3.3.1 Short description

The modernisation and integration of the Digital Common Household Unit public service in Malta involves the creation of an IPS (see Figure 8-5) through the development and co-creation of a common register that integrates Taxation, Social Security and Citizen Identity, and Utility Retail and Supply datasets that are currently siloed based on the respective entities' willingness to participate in this pilot. This IPS shall be used to identify unique household units, which are currently relevant to the provision of a number of public services, including determining all social security and taxation entitlements being consumed by each family. Through this register, the IPS will then enable stakeholders to exploit the relevant data as required. This IPS will also aid towards achieving Once Only Principle goals through the sharing and re-use of data between public entities.

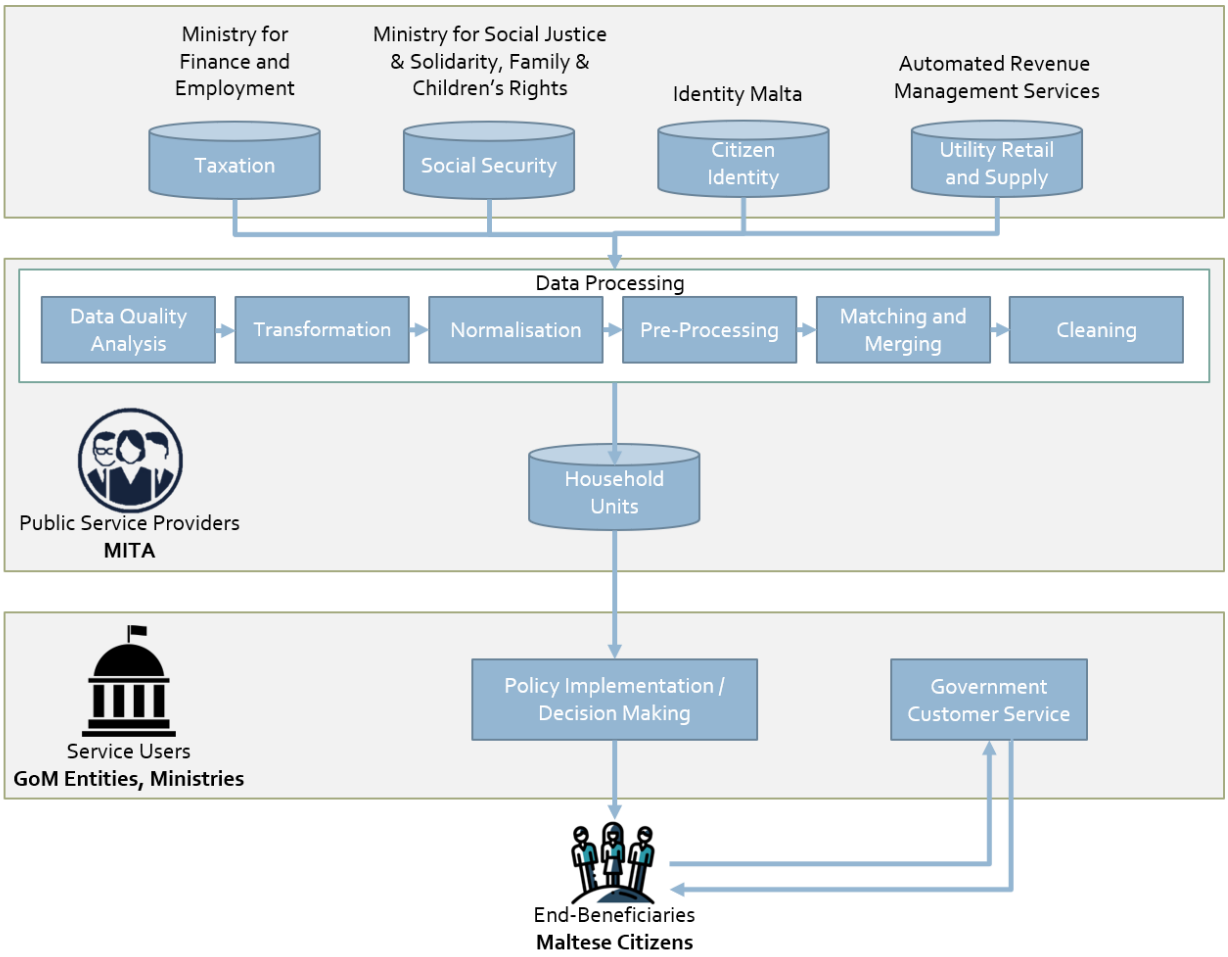

Figure 8-5. Identification of household units in Malta

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We envisage two usage scenarios for the identification of household units' public service, one based on residence and one based on familial relationships. Both these scenarios integrate information from the various data registers required to identify household units in Malta, namely:

- Taxation records;
- Social security records;
- Citizen identity records; and
- Utility Retail and Supply records.

8.3.3.2 Usage scenarios

Scenario 1:
Title: Identification of household units based on residence
Involved stakeholders (and types):

- Lilly, a Project Manager working with the MFE (service user)

Background and goal: The Government of Malta has promised a one-off bonus to household units to boost the economy in the aftermath of the COVID-19 pandemic. The number of persons in each household unit determines whether a €15 (single persons) or a €35 bonus is given (household units with more than one person). Lilly has been tasked with identifying Maltese household units and the number of people in each household unit, so that the appropriate bonus amount is issued per household.

Scenario: Having the necessary legal basis for the processing of household data in place, Lilly can authenticate to the Digital Household Unit public service and is able to query the system based on the authorisation access levels provided. Lilly selects the composition of a household that is appropriate to this use case, i.e. an address-based household, and queries the Household Register for the required information, i.e. identifying the household units based on residency, and the number of people living in each address. Other query options are also available, for example familial households (i.e. made up of family members). The complexity of the data integration is hidden from Lilly, who is provided with a simple and intuitive interface which requires only minimal domain knowledge to operate. Lilly then selects the appropriate categorisation of households, e.g. categorisation to single individual households and multi-person households, in order for a bonus of the appropriate value to be issued to each relevant address accordingly and be sent through traditional mail.

Scenario 2:
Title: Identification of household units based on familial relationship
Involved stakeholders (and types):

- Ġanni, a Director working with the MFCS (service user)

Background and goal: Children's Allowance is awarded to married couples; civil union couples; cohabiting couples; single parents; separated parents or returned migrants, having the care and custody of their children under 16 years of age. Parents are eligible to receive Children's Allowance for all children. Hence, if a beneficiary is receiving Children's Allowance, upon birth or adoption of a child the Children's Allowance claim and payment will be updated automatically. The Children's Allowance rate is based on the household income 2 years prior to the claim and/or revision of claim. In order to deliver this social benefit

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accurately, Ġanni needs to identify the household members in every household unit and determine their eligibility[48].

Scenario: Having the necessary legal basis for the processing of household data in place, Ġanni can authenticate to the Digital Household Unit public service and is able to query the system based on the authorisation access levels provided. Ġanni selects the composition of a household that is appropriate to this use case, i.e. a familial relationships-based household, and queries the Household Register for the required information, i.e. identifying the members of the household units based on familial relationships. Other query options are also available, for example households based on residence. The complexity of the data integration is hidden from Ġanni, who is provided with a simple and intuitive interface which requires only minimal domain knowledge to operate. Based on the eligibility criteria, Ġanni can use the Digital Household Unit public service to categorise the household units according to the eligible children's allowance rates in order to deliver the children's allowance to the respective identified household units.

8.3.3.3 BPMN diagrams

The processes described in the usage scenarios are graphically depicted in Figure 8-6 and Figure 8-7 below.

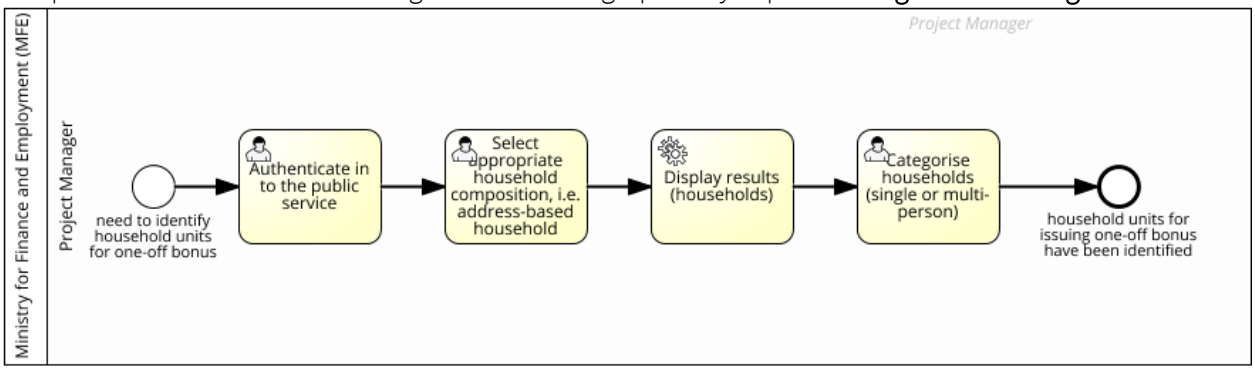

Figure 8-6. BPMN diagram for "Identification of household units based on residence"

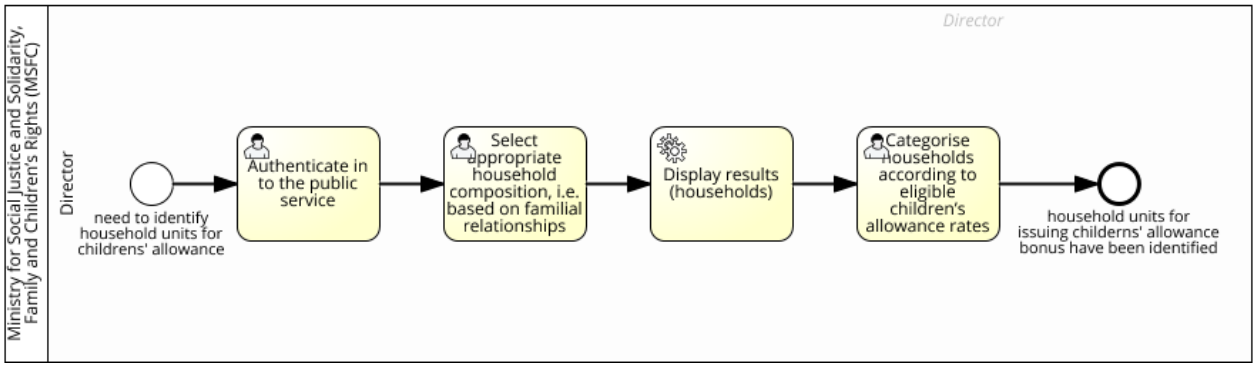

Figure 8-7. BPMN diagram for "Identification of household units based on familial relationship"

[48] Link with details of eligibility criteria: https://www.servizz.gov.mt/en/Pages/Inclusion_-Equality-and-Social-Welfare/Social-Solidarity/Benefits-and-Services/WEB2382/default.aspx

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8.3.4 User requirements

Based on the interviews and the usage scenarios, the functional and non-functional user requirements have been derived and are presented respectively in Table 8-10 and Table 8-11 below.

Table 8-10. Functional requirements of the Maltese pilot

No	Requirement	Service providers	Service users	Policy makers	Interviews	Usage scenarios
MT-F01	Ability to query over and view (i.e. through different visualisations) different household compositions (e.g. familial relationships-based, address-based)		✓	✓	✓	✓
MT-F02	Ability to categorise households according to different criteria		✓		✓	
MT-F03	Exporting of results in different data formats (preferably using standards)		✓		✓	

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Table 8-11. Non-functional requirements of the Maltese pilot

Category	No	Requirement	Service providers	Service users	Policy makers	Interviews	Usage scenarios
Interoperability	MT-NF01	Expose all functionality of the household unit public service via REST APIs to enable interoperability with other systems within public administrations, especially systems where source household data needs to be extracted from	✓	✓	✓	✓	
Integration	MT-NF02	Integrate data from the Person and Address base registers, when they are made available (currently a work in progress)	✓	✓	✓	✓	
	MT-NF03	Integrate data from multiple entities who agree to participate in pilot	✓	✓	✓	✓	
Usability	MT-NF04	Simple and easy to use user interface that hides back-end complexity		✓	✓	✓	✓
	MT-NF05	Enable the representation of different household compositions		✓	✓	✓	✓
	MT-NF06	Enable the representation of household changes over time	✓	✓		✓	
Compliance	MT-NF07	Use of established standards and specifications such as Core Vocabularies and APIs	✓	✓		✓	
	MT-NF08	Compliance with GDPR	✓	✓	✓	✓	
	MT-NF09	Household register should have a legal basis for data collection / processing	✓	✓	✓	✓	✓
Ownership	MT-NF10	Household register should have a defined owner	✓	✓	✓	✓	
Data integrity	MT-NF11	Address data inconsistencies, i.e. registers holding different values for the same field, records in different languages, etc.	✓	✓	✓	✓	
	MT-NF12	Enable the use of Maltese characters	✓	✓		✓	
Security & Privacy	MT-NF13	Public Administration access control (user authentication and authorisation)	✓	✓			✓

Moreover, we should mention a few additional user needs that emerged from the stakeholder interviews and could not be recorded as specific user requirements for the solution. These needs fall into two categories as follows:

- Establishment of a governing body for the IPS responsible to manage the coordination and data sharing among entities, as well as the maintenance of data, the use of standards, and the use of funds.
- Resolving data discrepancies and limitations:
    - Establishment of a 'ground truth' register, i.e. a base register to act as a gold standard

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- Including input validation in systems in order to avoid low quality data and interoperability issues
- Standardisation of fields used across data sources and stakeholders
- Automatic propagation of changes in data between the systems
- Establishing policies / guidelines for addressing real-life complexities in data gathering (e.g. the use of different identification documents interchangeably, the nature of address provided).
- Addressing legislative gaps that hinder data completeness, e.g. all foreign nationals and small children to have a registered address.
- Implementation of the Once-Only Principle, data should be entered only once and transferred among systems
- Exposing at least some of the information stored by the various systems to the citizens in order to validate it and correct any details.

8.4 Pilot #2: Croatia

8.4.1 Background

8.4.1.1 Problem statement and aspiration

The City of Bjelovar is a digital champion in Croatia, offering a range of communal services to its citizens, ranging from social services, and getting approvals for benefits payments, to the ability to see every payment from the city budget to any other party. However, the offered public services are disparate, require relatively advanced computer literacy skills and shaped in a way that is not inclusive towards the people of lower educational levels, people with accessibility issues and especially older population (which in many cases include people with lower education and accessibility/disability challenges). Moreover, when citizens try to interact with existing services, each with different interface and requirements, they often give up, ask for help from their relatives and friends or reach out to official helpdesk. This presents an additional friction factor in the delivery of public services and hampers the level of inclusion and usage of those services.

Consequently, this pilot aims to deliver a universal Virtual Assistant for the public services of the City of Bjelovar that would serve as a platform for existing services but also a framework on top of which all future services would be developed and integrated. The pilot envisions a mobile app developed to interact with existing disparate services and encompassing them in a uniform, simple, accessible, and enjoyable to use experience, providing to citizens more time, more security, more efficiency and more convenience.

On average, 25 people a day come with inquiries to the city administration premises, which accounts to approximately 6,250 meetings a year. If telephone calls are added to this number, the figure is about 9,150 meetings (on-site or by phone) per year and 5,600 people on average (taking into account that some come more than once). If the average distance they have to cover is 9km, the element of defining the impact on reducing CO^2 emissions, we come to the figure of 14.5t CO^2 (which varies from using a car to using public transport). Regardless of the approach of the interested subject (personal arrival or telephone call), on average 20min / person is spent on a daily basis. In summary, this amounts to an average of 2,830 hours / year that city administration employees spend on solving simple citizens' inquiries. The implementation of the Virtual Assistant will increase the efficiency of City administration employees, solve requests more

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efficiently, reduce energy consumption (the need for overtime to solve business tasks) and improve the quality of service to citizens - information at the same time at your fingertips.

8.4.1.2 The “City of Bjelovar” public services

The city has identified 114 processes and digitised 88, and there are active discussions and ideation for development and addition of future services. Some examples of the digitised public services are described below.

- eInvoice: Citizens can pay all bills connected to the City via the mobile e-mail application, as well as all orders that go from the City Administration to users. In order for citizens to receive such a service, it is necessary to sign an application form for the e-mail service at the Post Office. Citizens are using the public service, on the level of 30% of overall invoices, while city administration use the public service in 100%.
- eNewborn: Citizens can apply for the registration of their newborn baby. Citizens are using the public service, slowly, having the opportunity as of 2020.
- City Eye Mobile App: This is a public service on communal infrastructure and environment. Community wardens, on citizen reaction, supervise the maintenance of cleanness, the protection and use of public areas, community waste collection, transport and treatment, settlement development and removal of illegally installed objects. CITY EYE allows the inclusion of a wide variety of participants in simple creation of central issue repository of communal problems. Through various ways of reporting perceived problems in the field, it allows all participants to create systematic issue tracking with possibility to assign them to person in charge, without further effort and technical knowledge. Such a wide "mobilization" and the synergistic effect of all participants (municipal employees, local committees, etc.) achieves additional efficiency and fully justifies the introduction of system in environments where traffic problems fluctuate with their intensity (throughout the season). Citizens are using the public service with approximate 3 inputs per week.

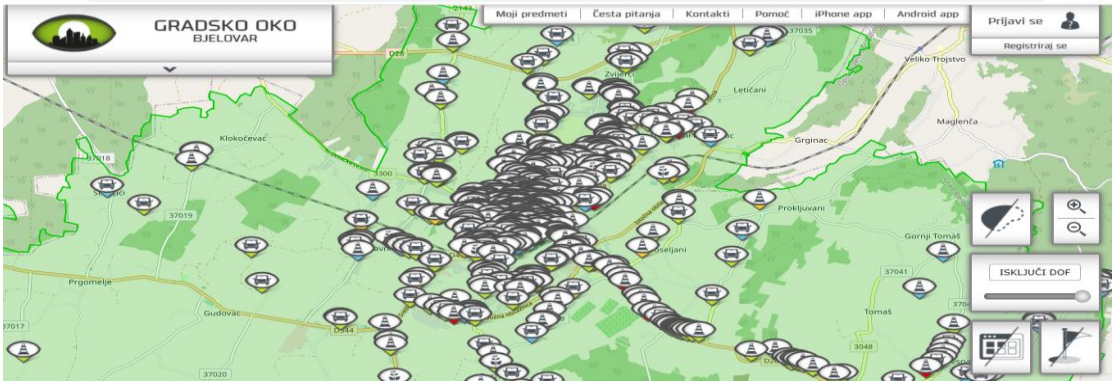

Figure 8-8. City Eye Mobile App

- City Guard App/Pazigrad: This is a new public service, it is an IT platform which combines activities of municipal traffic service, vehicle relocation service and parking services, and thus maximizes the work processes of local municipalities and companies in the segment of traffic at rest and parking payment and control.

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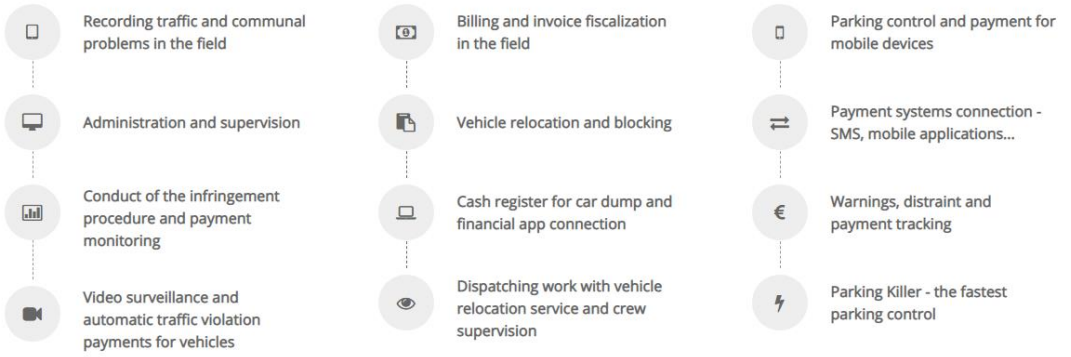

Figure 8-9. City Guard App

- Budget Transparency App: This public service facilitates full disclosure of all relevant fiscal information in a timely and systematic manner. The combination of Budget Transparency App and public participation in budget processes has the potential to combat corruption, foster public accountability of government agencies and contribute to judicious use of public funds. The visual budget public service allows residents to see where our revenue comes from and how it is spent. Citizens are using the public service with approximate 1,000 searches per month.

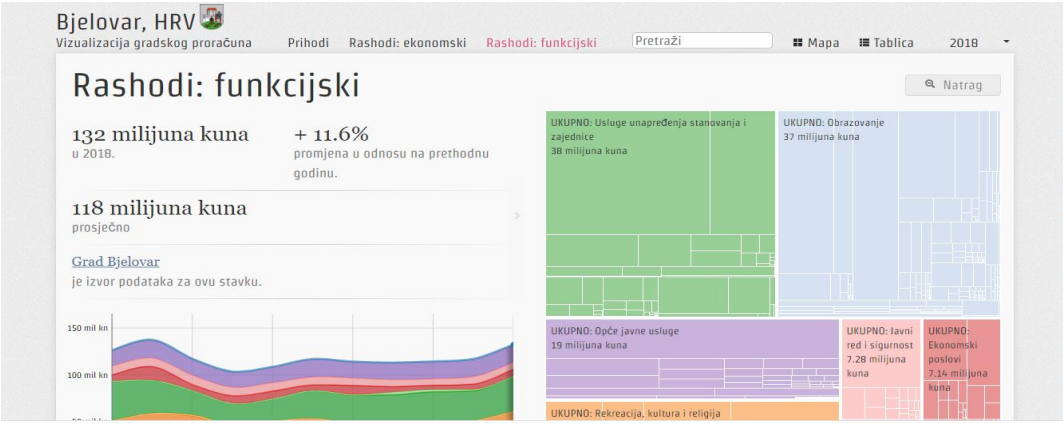

Figure 8-10. Budget Transparency App

8.4.1.3 Stakeholders

The stakeholders involved in this public service include the:

- citizens of Bjelovar, i.e. a general population of 32,000 individuals and in particular those with lower levels of computer literacy, lack of access to laptops and computers, but with access to mobile phones;
- City of Bjelovar, including City agencies and service providers / administrative bodies as well as the Mayor himself;
- County agencies; and
- Ministry of Public Administration.

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8.4.2 Stakeholder interviews

8.4.2.1 Collection of responses

In total, all four types of questionnaires were used - those for citizens, for policymakers, and two types for public servants - one type for those with a more technical background and the other for those who are interacting with services and citizens but not necessarily related to the IT provision.
The method used is a direct interview with a respondent with the ability for users to ask questions if they need additional clarifications and explanations.

Before their distribution to respondents, questionnaires were translated into Croatian and delivered to respondents to familiarise themselves with the interview structure. Some content changes were required - mostly because the initial version of translated interview forms was translated using machine translation, so it was inaccurate and confusing. Therefore, DPO's opinion was followed that the questionnaires must be simple, written in proper Croatian, and translated by an actual person.

All interviewees signed their consent forms before the interview. Only after it was established that their consent is filed, the interview proceeded. Following the information sheet and established protocol, respondents were informed about their right to revoke their consent and to cancel their participation for any reason at any time without the need to provide any explanation.

Respondents were also informed on the pseudononymization approaches taken, and that their full names would never been entered into the questionnaire forms. Instead, coded labels (HR01, HR02...) were used.
Interviews were not recorded but notes of responses were recorded on the spot. In most of the cases, respondents added some of their responses directly to a questionnaire sheet. Following that, responses were collected and organised in an Excel sheet to simplify data analysis and insights gathering.
All interviews were conducted at the Technology Park Bjelovar premises by Andrea Posarić and Dajana Vukmanic as a coordinator (BJELOVAR) and, in a number of interviews, Vibor Cipan (RIDE) as an analyst and transcriber.

In total, 32 interviews have been conducted. The breakdown per stakeholder group is represented below:

- Citizens - 25
- Provider public servants - 3
- IT public servants – 2
- Policymakers - 2

As regards the roles of the policy makers and public servants that were interviewed, a policymaker's role was related to management and leadership of economic, property, and agriculture policies and activities within the city administration. The two IT public servants were both in communication with citizens to have insights into actual inquiries and complaints from the citizens. One of them is related to budget and finance applications, and the other one is in charge of city property and real estate apps management. The provider public servants are from various backgrounds and roles. One of the respondents deals with local and communal issues (public lighting, parks, fixes), another one is in charge of schools and education (from elementary to higher education) and sports, and, lastly, the third one deals with roads and other infrastructure domains.

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As regards citizens, interviewees were selected to be both male and female and of different age and education level. Around one third of interviewed citizens are over sixty years old and this was intentionally selected as the elderly are regarded a main target group for the City' services. In specific, the majority of respondents were female (14 female, 11 male), most of them are employed (7 are in retirement), 6 with an MSc/PhD level of education, 8 with a Bachelor's or an equivalent degree, 9 with high school degree and 2 persons did not want to disclose their education level. In terms of age, 2 citizens were between 18 and 24 years old, 10 citizens between 25 and 39 years old, 5 citizens between 40 and 59 years old, and 8 citizens over 60 years old.

8.4.2.2 Analysis of responses

We provide below the analysis of responses categorised per theme.

User expectations

Most citizens (13 out of 25) reported that the current website for using and interacting with services' apps is complex, unclear and that available services are difficult to discover. Two citizens claimed that this is the main reason they do not want to use the services offered by the City. Another citizen appeared frustrated with the fact that even when they are using a specific service and entering data in long forms, the application does not support the ability to save the current progress and then continue the process later on - rather - everything needs to be done in a single take, and those forms can be very long and require much time. Seven citizens are retired and have no experience with the city's public services, but they would like to use them, and it would be easier for them to use these services via mobile phones. They also believe that education on the use of City's public services would be very useful for them to really use public services.

When discussing their expectations regarding future and improved services, ten citizens expect them to be friendlier to the elderly and people with lower educational and literacy levels. Ten citizens expect better user experience and simpler navigation with the ability to save and resume their work (similar to the earlier mentioned case when dealing with the form filling in one go). Moreover, eleven citizens explicitly said that they would love to see more, and better-connected services offered by the City of Bjelovar administration and not be asked to bring documents that City administration already has.

The following table summarises the user stories provided by citizens of Bjelovar who are beneficiaries of the public service.

Table 8-12. User stories by citizens, beneficiaries of this public service

As a …	I would like to …	In order to …
citizen	be able to submit all paperwork and documentation without the need for me to come to the offices	save my time and efforts (mentioned by 2 citizens)
	be able to access different city data and tenders from my phone or a computer	know what forms are required, what are the dates and deadlines involved and to be able to find all more easily (mentioned by 3 citizens)
	take an active part in decision-making	contribute to the well-being of the community (mentioned by 2 citizens)
	all documentation to be in one place and to be able to submit all paperwork and documentation online	save my time (mentioned by 3 citizens)

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	gain insights into all documents published by the city administration related to NGOs and all data on those NGOs	know the results of tenders and grants given to NGOs, as well as future tenders, requirements, and expectations.

Citizens utilize different ways of getting informed on the public services, in specific:

- ten citizens are being informed by the competent public authority,
- nine citizens are being informed via the internet and the and the social media, and
- six citizens from their friends.

Overall, they find that the provided information is relatively clear (10 positive, 12 neutral and 3 negative opinions) and comprehensive (13 positive, 9 neutral and 3 negative opinions), although maybe not that personalised (9 positive, 13 neutral and 3 negative opinions). Half of the citizens suggested that the City services should be simpler and more personalised, one citizen would like to see less MS Word and PDF documents as instructions for the services, and another citizen pointed out that the IT support personnel in the city should be better equipped both in terms of infrastructure (better servers, better internet connectivity, better computers/laptops) and in terms of better skills, i.e. training.

Citizens are not satisfied as regards easiness to find information on the public services (1 positive and 24 neutral opinions). Five citizens reported that the documentation provided for some services is vast and can be confusing, and another seven citizens pointed out that the current website lacks accessibility and that it is very difficult for elder citizens to use it. Half citizens recommended that more active promotion on website and social media channels could possibly motivate more people to use the services and share their feedback.

As regards communication channels, most citizens would like to use PC web browsers and mobile applications. Citizens were mostly neutrally positioned on digital assistants with only a few positive and one negative opinion towards their usage in this public service.

Public servants / service providers did not have previous experiences to report since the public service is yet to be built. Thus, public servants were asked to envision such a situation and try and make connections with their experiences using similar and/or existing City services. All three public servants said that they want to ensure that citizens are more independent so that they have fewer citizen inquiries related to mundane tasks or administrative requirements. For example, two public servants stated that they find themselves relatively often in situations where they are repeatedly answering the same citizen question. This is something that could be automated or otherwise improved within the inGOV project context, e.g. via FAQ chatbots.

The following table summarises the user stories provided by public servants.

Table 8-13. User stories by public servants

As a …	I would like to …	In order to …
public servant	have a smaller number of vendor inquiries about their statuses and unpaid obligations	use the saved time for other things that might require more of my time and effort instead of these administrative time-wasters
	have a way to let citizens know that they should report their major issues through different	focus on solving and acting on those reported issues and not waste my time explaining citizens

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	channels and not use the existing solution, which is intended for smaller issues	that this is not the proper channel for reporting that kind of issues
	interact with citizens much faster	be more efficient and act upon their reports and make the information needed to them more available
	enable citizens to apply for time-slots to use public spaces and areas without calling and sending emails to ask me about their availability	help citizens with tasks that require human attention and cannot be solved through a web form or an app

Co-creation

None of the citizens was closely familiar with the concepts of co-creation or co-design. After a detailed explanation by the facilitator, they made connections with focus groups they had attended. However, the idea of the broader involvement of different stakeholders was somewhat new to them. Nonetheless, several citizens expressed their concerns on such activities that their inputs were not considered and that they never got any feedback following their participation in focus groups or interviews and research.
All 25 citizens expressed their desire to participate in different co-creation activities and are motivated to help project development. Eleven citizens stated that there is a lack of information about opportunities for citizens' involvement, thus they would expect an increase in awareness. Another citizen suggested that NGOs and different advocacy groups should also be engaged in planning and co-creating activities. When discussing motivation, half citizens find their motivation in taking part "for the greater good" and help the city and its inhabitants have better and more accessible public services. The other half citizens find their motivation in improving specific features or capabilities of existing services.

Only two citizens have previously participated in co-creation and co-design activities. One citizen was involved as a representative of an NGO to provide feedback while creating the City of Bjelovar's development and growth strategy. The citizen's experience was that of a smooth process with many comments and proposals taken into account. The other citizen was involved in a public consultation during the creation of the City's strategy for people with disabilities. The citizen's experience was negative due to the fact that it was "crowded, with too many people and too many requests", therefore the citizen would be in favour of an engaging online consultation process.

As regards the inclusion of people and private organisations in the delivery of the public services, citizens had a positive opinion and believe that this would improve the quality of services and the lives of citizens.

Similarly, to citizens, none of the public servants and policymakers was familiar with concepts of co-creation or co-design. They had vague representations of it, but that was based on their deduction, not stemming from their real-life and first-hand experiences. Again, similarly to citizens, their closest resemblance with anything related to the concept of co-creation relates to organised focus groups and occasional surveys. In fact, two public servants mentioned that this actual activity (these interviews) was the closest they were involved in anything resembling the co-creation or involvement of different stakeholders. Both policymakers mentioned that they have not so far utilised the active involvement of citizens or other stakeholders. One policymaker said there was no need for such an approach, while the second policymaker expressed their hopes that this could be changed via the inGOV project and that citizens and other stakeholders could be involved. Both policymakers assumed that co-creation for IPS would entail the involvement of more diverse stakeholders.

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As regards the challenges for co-creation, most provider public servants mentioned the same challenge; that citizens are not interested or informed enough about the chance to participate in co-creation or similar activities. An IT public servant mentioned that because there is no specific organisational unit to inform citizens about their options to participate, this translates to fewer people responding and being actually engaged. Moreover, another IT public servant mentioned that the current application for e-consultations is discouraging because it is complex and asks too much information from users. Thus, as motivations for co-creation, the public servants focused on the same aspects. First, that citizens would be more motivated to participate if they were more informed and knew about these opportunities. Second, that the relevant digital tools have a good set of features and be easy to use by citizens. Furthermore, it was suggested that there are some incentives that could be used as motivators, e.g. discounts for parking passes.

Policymakers recognised the potential and added value of stakeholder involvement for co-creation and that it is a challenging process as regards its organisation. One policy maker mentioned that involving too many people with different opinions makes it difficult to consider all of them and results in a lengthy process. However, a key motivation would be the result of having more targeted public services and subsequently this would lead to increased engagement.

IPS and IPS governance

Regarding IPS and their definitions, none of the public servants or policymakers had previous knowledge of the concept. However, they all had a vague idea of what it might mean, again, after it was explained to them within the inGOV context. All respondents recognised the value of IPS for their organisations and units - public servants mostly see it as a means of being more efficient and save more time, while both policymakers see it as a strategic benefit and as a potential for future improvement.

As regards IPS coordination, policy makers pointed out that there is no governing or coordinating body in charge of such efforts. They emphasised that each organisation unit has its own ways of working, and while there is some informal coordination going on, a formalised coordination approach is not defined. Moreover, policy makers stated that there are parts of developed applications and services that could be re-used in larger applications, e.g. the budget planning app.

In the same lines, provider public servants reported that each organisation unit works separately and there is no formal coordination of efforts and resources for IPS. One public servant pointed out that better IT support could enhance the coordination process and that inGOV might be used as a showcase for that.
IT public servants agreed that a more formal approach to IPS coordination would be beneficial and that having a separate coordination entity would improve IPS provisioning, creation, and deployment. Moreover, they said that some existing elements could be potentially reused, but they were uncertain how feasible that would be given the current infrastructure. They believe that having modularity and upgradeability in mind could prove to be efficient and save costs. However, none were familiar with existing EU-backed integration services and existing tools and frameworks like CEF building blocks.

EIF layers: legal, organisational, semantic and technical aspects

As regards the legal aspects, policy makers and public servants mentioned GDPR and Croatian Freedom of Information Access law as two critical pieces of legislation affecting current and future (integrated) public services. Policy makers see GDPR as a challenge that can be successfully applied with careful planning. As for the Freedom of Information Access law, one policy maker mentioned that this law is

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problematic because sometimes citizens and NGOs have requests for large amounts of data that cannot be easily produced. However, they do not foresee that inGOV will be able to help in that respect.

As regards the organisational aspects, policymakers believe that current legislation is sufficient for IPS co-creation efforts and that the current level of citizen and stakeholder engagement through public consultations is sufficient. However, one policy maker mentioned that inGOV may teach new ways of engaging with more stakeholders. Public servants had diverse opinions are regards the sufficiency of current policies and relationships for IPS co-creation, two out of three believe the current situation is not good, whereas the rest believe that it is.

As regards the semantic aspects, no relevant responses were gathered by the respondents.
As regards the technical aspects, IT public servants reported that the current situation is relatively fragmented, using several SharePoint portals and forms to cover many offered services and support internal processes. This fragmentation and the fact that current services are not integrated will challenge building more integrated experiences, although they believe that APIs and possibly micro services could be utilised to ensure better connectivity. Mobile phones and websites are considered the most efficient channels for service provision and good integration of virtual assistants on either website or mobile phones can be useful. However, detailed specifications would be required for third-party integration, especially if there is a need for integration with national identification and authentication services (NIAS). As regards advanced technologies, neither respondent was familiar with linked open data or knowledge graphs. They have general knowledge and familiarity about blockchain, chatbots but they do seem to appreciate the potential benefits of advanced technologies. Finally, neither respondent was able to discuss legal incompatibilities or data gaps, possibly since the current services were developed without shared architecture, standards, or approaches, and some solutions were built "in-house" on top of SharePoint and similar solutions.

Sustainability

Half citizens believe that securing financial means is crucial for enabling sustainability and the long-term exploitability of created solutions. Another two citizens focused on the ability to continuously improve the services, e.g. add new features and follow user requirements, as crucial for sustainability. However, both of them related this kind of improvements with the need for securing financial means. Another citizen suggested that political support from the local authorities is important for ensuring that such implementation projects will be supported and last for long.

The financial considerations were again mentioned by half the public servants as important for sustainable implementation. Other factors provided by public servants include the involvement and active engagement of key stakeholder groups; the realisation of promotional campaigns and visibility activities which have the ability to reach more people and thus increase the usage of services; the public authorities' commitment for long-term upgrades, maintenance, and adjustments to the legal framework; and the offering of all such services fee-of-charge to citizens.

The policy makers suggested as crucial sustainability factor the ability to ensuring constant updates and providing new information and services in a user-friendly manner. However, one policy maker referred additionally to the financial dimension of this factor, i.e. that financing directly affects maintenance and potential service upgrades. When thinking of sustainability, policy makers mentioned that development of public services should focus on addressing users' actual needs and requirements and that digital tools should provide fast, efficient, and user-centered solutions that are easily accessible by the citizens.

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8.4.3 Envisaged TO BE situation

8.4.3.1 Short description

Currently, citizens struggle to find available services on the City of Bjelovar web pages. Even when they find them, they struggle to understand what documentation is needed to be submitted to apply for different grants, scholarships, tenders, and more. The goal is to provide a simple solution that would enable all citizens, especially the elder and those with lower levels of computer literacy, to find relevant services and gain information about them.

We envision the use of two different, but complementary, approaches for facilitating citizens' access to the offered services of the City of Bjelovar. The first approach is utilising a chatbot / virtual assistant that would help users and let them obtain relevant information. The second approach is to offer a more structured access to all available services and the planned ones using knowledge graph and service description metadata with associated technologies. All existing and future services will be accessible through the aforementioned approaches both via a website and a mobile device providing assistance to users in various tasks such as filling out application forms; answering citizens' inquiries, helping stakeholders (citizens, etc.) find the exact information they are looking for. Such automated communication with citizens will make city administration services / information available 24 hours a day, informing users when they need it, without waiting for information by phone, e-mail or physical arrival at the city administration building.

8.4.3.2 Usage scenario

Title: Obtain information on available services
Involved stakeholders (and types):

- Vanesa, a citizen in City of Bjelovar
- A public servant of the City of Bjelovar

Background and goal: Vanesa is a student and is searching for information on offered scholarships.

Scenario: Vanesa visits the City's services either via a web browser or via a mobile application (both options offering the same functionality). Vanesa may select to search for the available services by using FAQ chatbots and virtual assistants or by browsing the structured descriptions of services (which are utilising knowledge graphs and CPSV/CPSV AP) or both.

Option A: Using FAQ chatbots and virtual assistants
Vanesa is presented with a greeting and an example of simple questions she can ask the chatbots, e.g. "Is there a scholarship tender available now?". The chatbot will then provide her with answers or ask any additional sub-questions. To simplify the experience, in cases when users can provide simple answers like "Yes" or "No," those will be shown as a button that can be easily clicked instead of typing in those answers. This logic is to be applied to all cases where it makes sense or when the number of possible inputs is already known. Moreover, users will have the ability to ask for the chat transcript to be sent to their email address for future reference. If Vanesa receives a satisfying answer to her question, the scenario ends. If not, Vanesa has the option to re-start asking a question to the chatbots. Another option, where the chatbot cannot provide a good answer to a complex question, is that the user's inquiry is forwarded to a relevant

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public servant who can intervene and help users via email or phone. Those complex inquiries should be saved in a knowledgebase, and the chatbot can be upgraded with the ability to provide answers to those questions as well, thus making it smarter and more relevant the more it is being used.

Option B: Structured descriptions of services utilising knowledge graphs and CPSV/CPSV AP

For this option, and since the current website lacks structured descriptions of available services, a knowledge graph and structured service descriptions should be implemented using the CPSV, and CPSV APs integrated with knowledge graphs. Although most of this work is done in the background, Vanesa should be able to access a website or a mobile app with services displayed in a more structured way, e.g. explaining the service role, its abilities, and more relevant data, and to identify the needed public service. It is expected that a service description and structure template and guidelines will be developed so that all future services will be designed with that in mind. This will allow for a better structure, discoverability, and, generally, better user experience on all channels (websites, mobile apps).

8.4.3.3 BPMN diagram

The process described in the usage scenario is graphically depicted in Figure 8-11 below.

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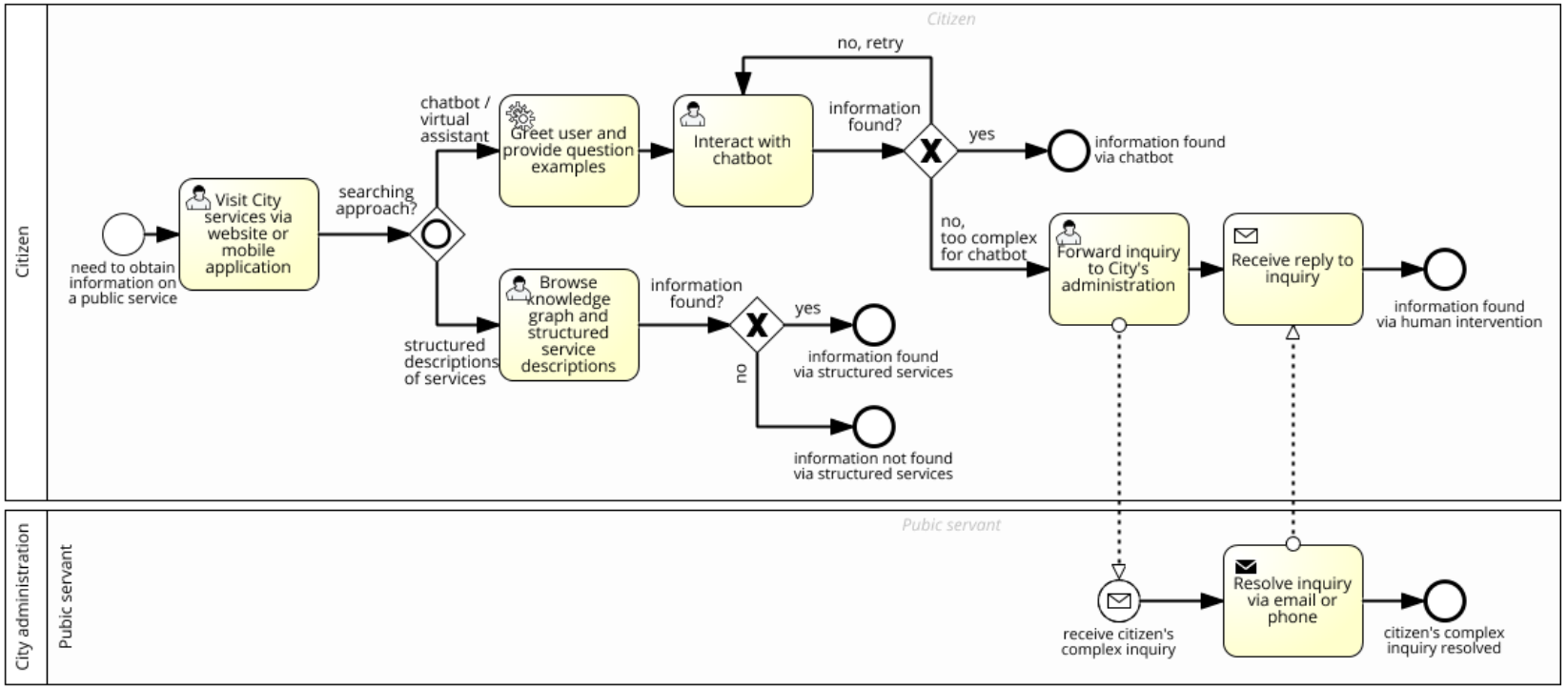

Figure 8-11. BPMN diagram for “Obtain information on available services”

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8.4.4 User requirements

Based on the interviews and the usage scenario, the functional and non-functional user requirements have been derived and are presented respectively in Table 8-14 and Table 8-15 below.

Table 8-14. Functional requirements of the Croatian pilot

No	Requirement	Citizens	Prov. p. servants	IT p. servants	Policy makers	Interviews	User stories	Usage scenario
HR-F01	Identification of (information on) available public services via a (FAQ) chatbot / virtual assistant		✓			✓		✓
HR-F02	Browsing through available public services in a structured, coherent manner	✓				✓	✓	✓
HR-F03	Ability to obtain the chat transcript via email							✓
HR-F04	Forwarding of complex inquiries to City's administration							✓
HR-F05	Ability to browse through all documents published by the City administration	✓					✓	

Table 8-15. Non-functional requirements of the Croatian pilot

Category	No	Requirement	Citizens	Prov. p. servants	IT p. servants	Policy makers	Interviews	User stories	Usage scenario
Efficiency	HR-NF01	Fewer citizen inquiries related to mundane tasks or administrative requirements		✓			✓		
Usability	HR-NF02	Simple, user-friendly interface	✓		✓	✓	✓	✓	✓
	HR-NF03	Simpler navigation to available services	✓				✓	✓	✓
	HR-NF04	Easily accessible and usable by all citizens, even elderly and digitally illiterate	✓		✓	✓	✓	✓	✓
Channels	HR-NF05	All functionality accessible via both web browsers and a mobile application	✓		✓		✓		✓
Extensibility	HR-NF06	"Becoming smarter" chatbot / virtual assistant, i.e. learning from previous inquiries							✓
Compliance	HR-NF07	Adoption of structured templates and guidelines for services' description using knowledge graph and service description metadata with associated technologies (CPSV and CPSV AP)							✓

Moreover, we should mention a few additional user needs that emerged from the stakeholder interviews and could not be recorded as specific user requirements for the solution. These are the following:

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- Simpler, more personalised digital public services implementing the Once Only Principle, i.e. not being asked to bring documents that City administration already has.
- Better infrastructure (e.g. servers, computers, internet connectivity) and better skills (e.g. through training) for City administration personnel
- a more formal approach to IPS coordination would improve IPS provision, creation, and deployment
- more active promotion and visibility activities (e.g. on website and social media channels) would increase usage of services and citizens' engagement
- public authorities' long-term commitment (e.g. for upgrades, maintenance, and adjustments to the legal framework) is crucial for ensuring sustainability

8.5 Pilot #3: Greece

8.5.1 Background

8.5.1.1 Problem statement and aspiration

Disabled low-income citizens, suffering over 67% disability, are eligible for being granted a card from the Greek Regions in order to travel free with inner-city public transportation means and to pay half price of the price of all tickets of inter-city public transportation. For issuing the discount card, a disabled citizen must submit a list of required documents to the competent department of the Regional Unit Authority where she/he lives. Additionally, the discount card must be renewed every year according to the relevant annual Ministerial Decision. Thus, disabled citizens have to visit every year the premises of the competent department of the Regional Unit where they live in order to renew their card. Considering that (a) some of these citizens may live far away from the premises of the competent public authority, (b) some of them may be quite old and (c) some of them may have serious health issues, it is evident that this annual renewal procedure introduces significant administrative burden. Additionally, some disabled citizens may not be aware of this benefit and consequently they do not even apply for a discount card, although they may be eligible.

The aim of this pilot is to reengineer and simplify this public service in collaboration with all stakeholders and to offer it proactively as a co-created integrated public service exploiting emerging technologies, especially mobile apps, thus reducing administrative burden.

8.5.1.2 The "Issuance of disabled citizen's discount card for public transportation" public service

Every year, a relevant Ministerial Decision is issued. After that, every discount card owner must visit the competent department of the Regional Unit where she/he lives in order to renew her/his card. In case her/his certificate of disability has expired, she/he has to bring the renewed disability certificate to the competent department.

In order for the disabled low-income citizen to be registered as beneficiary, she/he brings the necessary input documents to the competent offices of the regional units they live. In specific: (a) a filled application form, (b) a valid health committee decision certifying the degree of disability, (c) her/his identity card, (d) a signed declaration of her/his permanent postal address (in parallel they must declare that she/he has not applied for a discount card to another Regional Unit or a Citizen Service Centre, i.e. a one-stop shop of

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Greek public administration), (e) two recent photographs, (f) a document from the tax registry certifying her/his income, provided that their annual income does not exceed 23,000€ if it is an individual income and 29,000€ if it is a family income.

The competent offices receive and check the input documents. In case there is insufficient data in the supporting documents, then they are returned to the interested citizen and it is not possible to issue or renew the card. When data is complete, the interested citizen has to revisit the competent department in order to reoffer all the essential documents. In case the data is complete and valid, the department completes the electronic application, creates a new record in an Office application file (e.g. MS Word) and issues the appropriate card. The travel card is issued and delivered to the interested citizen. It is valid for the current year and for the following year for as long as it is needed until the issuance of the new ministerial decision.

In case of renewal, if the card is damaged, a new one is provided. In case of loss, the competent offices check the information system. If it is confirmed that this is the first time that the beneficiary requests a reissue of a card due to loss, then they proceed to reissue it.

Moreover, every year, the competent authority must send a table including anonymized statistical data, concerning the beneficiaries of this benefit, to the Ministry of Labor, Social Insurance and Social Solidarity.

8.5.1.3 Stakeholders

The immediate stakeholders involved in this public service include the:

- disabled citizens, currently over 8,000 beneficiaries in Thessaly;
- IT Providers from Region of Thessaly
- Policy Makers in Region of Thessaly
- Public Servants, Department of Social Welfare and Solidarity from Region of Thessaly

In addition, we have identified a number of public authorities involved as the providers of the supporting document of this public service:

- Ministry of Digital Governance;
- Ministry of Civil Protection;
- Ministry of Health, including:
    - Organisation of Welfare Benefits & Social Solidarity;
    - National Social Security Entity (EFKA);
    - Health Certification Committee;
- Ministry of Finance;
- Ministry of Labour, Social Insurance and Social Solidarity;
- Ministry of Interior (owning the Citizens Registry).

These public authorities are already providing or are in the process of providing solutions for offering the supporting documents to other public organisations, thus, interconnections with these stakeholders will be sought out within the project.

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8.5.2 Stakeholder interviews

8.5.2.1 Collection of responses

The interviews have been conducted in Greek; therefore, the questions were first translated in Greek and slightly modified to be clearer and more understandable to the interviewees.

The interviews concerning the categories of Policy Makers, Provider Public Servants and IT Public Servants were conducted face-to-face, in order to have direct contact with the respondents, so as to clarify any questions due to the specificity of the topic. Initially, we sent the questionnaires with the consent forms via e-mails, in order for the respondents to first get an idea of the topic and questions and then we set up a live, one-to-one appointment to conduct the interview. More specifically, 5 women and 3 men participated in these interviews, 2 Policy Makers at the regional level, 4 Provider Public Servants who are responsible for the discount card's issue and 2 IT Public Servants who are responsible for the Region's IT infrastructure.

The interviews with citizens - end users were conducted either live or online. As the competent service of the Thessaly Region keeps a non-digital file and it was difficult to find suitable citizens through a huge volume of physical files with different diseases, disorders, illnesses, and disability rates. Thus, for the identification of citizen interviewees, we have been in contact with organisations and associations for disabled people, through which we came in touch with discount card beneficiaries who were willing to conduct an interview. Overall, 13 live interviews and 9 online interviews were conducted, with citizens with different disabilities such as Physical Disability, Sensory Disability, Mental Disability, Other Disabilities (chronic health problems) were selected, while no people with intellectual disabilities were selected. Regarding the demographics, in total we interviewed:

- 22 citizens with disabilities, 14 men and 8 women;
- 5 were 25-39 years old and 17 were 40-59 years old;
- 3 are elementary education graduates, 13 are secondary education graduates, 5 are higher education graduates, and 1 holds a Master / PhD holder;
- 14 are retired, 3 employed, and 5 unemployed (3 in search for work)

8.5.2.2 Analysis of responses

We provide below the analysis of responses categorised per theme.

User expectations

The citizens reported both positive and negative experiences with this public service. On the positive side, two citizens claimed that currently the issue of the discount card is an easy and short process, while one citizen was clearly in favour of maintaining the current off-line process so that human contact is available for delivering this service. As regards public servants' behaviour differing opinions were provided; five citizens found that the public servants were very supportive and polite, while three citizens were dissatisfied with the public servants' behaviour. On the negative side, citizens with mobility or vision problems reported that they experience difficulties travelling to the premises of the competent public authority. Although, they have the option to authorise another person to execute the public service on their behalf, they prefer to execute the service themselves. An additional negative issue that was raised is the overcrowding at the public authority's premises resulting in high waiting time and a danger of bacterial infection. Nonetheless, respondents' majority (six citizens) mentioned as an important problem the difficulty they face in gathering the necessary supporting documents for the service, and another two citizens mentioned they experience anxiety before missing the deadline due to lack of sufficient

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information. Finally, it was mentioned that in case the discount card is lost there is long waiting period involved for re-issue.

Citizens reported the following expectations from this public service:

- online issue of discount card (mentioned by seven citizens)
- flexibility and inclusion in the issue process (mentioned by four citizens)
- up-to-date information provision on deadlines
- ease of transaction
- possibility for automatic renew (while the certificate of disability is valid)
- better behaviour by public servants
- accessibility with no waiting lines

The following table summarises the user stories provided by citizens who are beneficiaries of the public service.

Table 8-16. User stories by citizens, beneficiaries of this public service

As a …	I would like to …	In order to …
beneficiary	Save time and effort	not burden my already burdened mental and physical health
	speed up the time it takes for my card to be validated in the bus	save time and mental peace
	be able to use my mobile phone to verify my condition	be serviced with discretion
beneficiary	not have to gather the same supporting documents every year for my card renewal	save time
	avoid bureaucracy	save time
	show my card with discretion	not receive negative comments from other passengers
beneficiary	be able to proceed with the public service as I do now	not be involved with technology
beneficiary	be able to perform the public service online	make my life easier
	have a training session	evolve technologically
	have my card as valid for a longer period of time	not deal with a renewal every year
beneficiary	access the public service from home	service myself
beneficiary	Easily download an app on my mobile phone	Not have to visit the Citizens Service Centres (КЕП)
	be able to use the mobile app to locate the necessary documents	renew my card
	for everyone, especially people with movement problems, to be able to operate this new public service	properly execute the service
beneficiary	renew my card on my own	properly execute the service

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	not wait in line	save time
	not constantly have to gather documents and photos	save time
beneficiary	for people with vision problems to renew the card by themselves	properly execute the service
	authorize the system to retrieve the necessary information (e.g. certification of my home address), where it is possible	avoid searching for some information on my own
	for the system to recognize my disability type	Automatically issue the corresponding documents and information (e.g. for people with vision problems the service issues also a card for the disabled person's companion)
	use a system that is friendly to screen readers	use the system without problems
	use a system that has notifications, either as a newsletter or as an SMS, etc.	be informed about new dates and necessary information
beneficiary	for all disabled people to access the service themselves	to perform the service
	use a system that can send my card through mail	be able to use my card without having my phone with me
beneficiary	upload the supporting documents in the system	
	use a system that is reliable and sustainable	use it without problems
	use a simple system	be able to use it without having much knowledge on technology
beneficiary	use a public service that is compatible with all forms of disabilities	avoid exclusion of some disabilities
beneficiary	use an app that will be my only certificate of disability	show it to different services as proof of my disability
	use a system that is safe	be secured in case for example someone steals my phone
beneficiary	use an app that will be a form of proof for my disability	not have to constantly keep with me the certificate in paper
	use an app that will be compliant with people with vision problems	be able to use it
beneficiary	use a smart card, so that I don't have to have my phone or a computer with me	be able to use it
	be able to renew my card easily, even though I don't have any technical knowledge	be able to enjoy its benefits

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beneficiary	not gather the same supporting documents every year	Save time
	renew my card for the duration that my disability certificate is valid	make my life easier
beneficiary	Simplify this public service, so that especially people with permanent disabilities can benefit	improve their lives
	use this disability card in other sectors as well	improve their lives

Citizens utilize different ways of getting informed on this public service, in specific:

- one citizen is being informed via the internet,
- two citizens are being informed by the corresponding public authority,
- six citizens from their friends,
- thirteen citizens from another source of information, six of them reported being informed via their association for disabled.

Overall, they find that the provided information is clear (eighteen positive opinions) and comprehensive (sixteen positive opinions) although not that personalized (five positive opinions). There were a lot of suggestions by citizens for improving information provision as well as clarity, completeness, and personalization of the public service, as follows:

- The public servants should be better informed on the service and serve better the citizens
- More comprehensive, better organised and up-to-date information should be available online, as well as a Frequently Asked Questions (FAQ) page on this service. The website should be simple, easily accessible and easy to use for disabled people (even with vision problems) and should appear high in the search engines' results list
- Better communication and updates via the media and websites on disability
- Beneficiaries should be able to subscribe to a notification service in order to get direct and personalised briefing, e.g. via newsletters or SMS for important information
- The discount card's duration should be personalised (e.g. different expiration date) depending on the disability certificate.

As regards communication channels, most citizens would like to use PC web browsers and mobile applications. There were differing opinions on digital assistants, as ten citizens were quite negative towards using them and only a few citizens considered them to be useful for this public service.

The public servants / service providers reported negative experiences with this public service. They consider it difficult to perform, time consuming and with a high bureaucracy. They also mentioned that they have experience frequent conflicts with the service's beneficiaries, and thus they feel it is necessary that the service becomes digital.
The following table summarises the user stories provided by public servants who are providing this public service.

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Table 8-17. User stories by public servants

As a …	I would like to …	In order to …
public servant / service provider	make sure that citizens are informed through the internet	limit phone communications
	receive all supporting documents (coming either from another public authority or from a citizen) via the internet	avoid time consuming communication with other authorities, potential miscommunication, etc.
	receive information online about who is entitled to the service, or be able to cross-check and verify his/her eligibility easily online	ensure the process' transparency

Co-creation

Citizens' main expectations from co-creation is contributing towards the development of a tool that is useful and operational for all disabled people, limiting or abolishing all necessary movements, improving the public service without completely losing human contact. They would expect as a result a website or mobile application that will ensure up-to-date information, ability to renew citizens' data, renew the discount card and send documents such as photos and other supporting documents in different file formats. Applications for co-creation should be easy to use by everyone, well-maintained and frequently updated as well as continuously monitored in order to ensure proper operation, and technical training is also needed.

Citizens mentioned as their main motivation to engage in co-creation their willingness to help themselves, other citizens, and the next generations. They want disabled people to be facilitated for leading a higher quality life (e.g. limit their transfers across different locations in order to perform a public service) and that they want their opinions to be heard and taken into consideration. They consider co-creation important and believe that all stakeholders, and especially people with disabilities, should immerse themselves in the co-creation process and not be discouraged by any limitations that may come up.
The majority of respondents have not been previously engaged in co-creation activities; only three citizens reported previous experience in co-creation. A citizen has been engaged in a telephone interview regarding accessible infrastructures, and another citizen has been engaged as a user tester in a pilot application on the access of visually impaired people to supermarkets. A third citizen was engaged in a program of the Ministry of Health which concerned people with disabilities. The barriers reported in that programme were that the real problems of disabled were not heard, and that the involvement of the private sector undertaking certain responsibilities was problematic.

Most citizens are in favour of external parties being involved in the public service, and believe external parties could manage the information, training and briefing of all stakeholders. They would be able to operate collaboratively with the public sector and undertake to provide whatever the citizen cannot provide him/herself. They can also help with the organisation, the technological know-how, the provision of personnel and funding, as long as transparency is ensured. However, a couple of citizens reported that there is no reason for the private sector to be involved, and that the service can be improved if it interconnects with e-government. Volunteering was also mentioned as a third party that could offer assistance.

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Public servants and policy makers recognize that there has been very limited previous engagement with co-creation. Only public servants that are providing the service have been previously involved in co-creation and only in the needs' analysis phase. The IT public servants are also aware that end users do not participate in the lifecycle of the process; according to them, the cause is the lack of a clear legal framework. The policy makers attributed the lack of engagement also to the pandemic. Interviewees also stated that citizens' and businesses' involvement would be more useful during a later stage with an aim to improve and upgrade the application.

As regards challenges for co-creation, the following were identified by the respondents:

- lack of digital familiarization;
- limited information and knowledge of citizens and implementing authorities on co-creation;
- difficulties in communicating with the users;
- technical difficulties;
- potential lack of interest from the end users to participate;
- unclear legal framework.

It was suggested that these issues could be addressed through training and informing the citizens on co-creation processes. The public authority should involve citizens in co-creation projects by setting up specific actions that require their participation and decision making.

IPS and IPS governance

As regards IPS coordination, the policy makers reported that such processes are coordinated by the Ministry of Digital Governance and / or the Ministry of the Interior. They also emphasized that artefacts' reuse is important, and that this has been already implemented in the case of Citizens Service Centres (ΚΕΠ).

However, the provider public servants believe that there is no efficient coordination and governance of public services and that this should be ensured by the corresponding Ministry, e.g. for interconnection with the Greek taxation system (TAXISnet) in order to check beneficiaries' financial status. There are obviously legal barriers to be overcome for fully applying IPS in Greece.

The IT public servants believe that the legal framework should be clarified and that the IT department should undertake the coordination of IPS as regards the technical part of the processes, in collaboration with the corresponding public authority. They also recommend the creation of a coordinating group that will address all administrative entities and become a communication channel between internal and external users of an application. They also mention that new service artefacts are constantly being developed, especially applications, since existing solutions cannot solve newly developed problems. Cloud usage for service provision is also considered particularly useful.

EIF layers: legal, organisational, semantic and technical aspects

As regards the legal aspects, policy makers mention that bureaucracy and the Data Protection Authority determine the legal aspects of co-creation processes. However, a policy maker noted that there are legal gaps, as concepts such as IPS and co-creation are not clearly specified and described. The provider public servants mentioned legal incompatibilities that can be addressed with the creation of the necessary legal framework to clarify and inform people on concepts such as co-creation and IPS.

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As regards the organisational aspects, policy makers provided different opinions. One policy maker stated that the current relationships are clear, and have improved because of the pandemic, which caused the processes to accelerate. The other policy maker noted that current relationships are not clear as many of them overlap. Provider public servants also mentioned that current relationships regarding organisational structure, tasks, policies and processes are not clearly determined and sufficient for IPS co-creation. This is due to the fact that many sectors with the same jurisdiction are involved, leading to confusion and mistakes.

As regards the semantic aspects, the provider public servants mentioned that semantic aspects that should be solved regard the clarity of exchanged data (e.g. supporting documents) as well their proper gathering and identification. An IT public servant mentioned that semantic aspects and current needs should be analysed and recorded. Communication with the involved parties is important, so that everyone has the same understanding of the used concepts.

As regards the technical aspects, IT public servants emphasize that it is important to record existing ICT, the different formats and files that are used and can be accessed via web or cloud, as well as the needs that the public services are required to fulfil. This will allow determining which technical aspects should be modernized or redesigned. Existing interoperability challenges are related to the lack of a clear legal framework, and the legal frameworks as well as employees' views on the public services also need to be recorded. Collaboration and unity between public authorities is important, in order to ensure IPS provision. Interfaces provided should vary, according to the needs they have to cover, while APIs and web services are considered useful for the support of new applications that will interconnect public authorities. At the same time, applications should be available on the Cloud, as in that way they are easily accessible and allow for co-creation.

Sustainability

The policy makers believe that co-created IPS application can be sustainable with constant information provision to the end users and funding of relevant efforts. Thinking of sustainability aspects can support the IPS evolution, as in this way IPS is constantly upgraded and improved and processes are accelerated. Digital tools underpin these actions, as digitalization fosters the creation of innovative solutions. Moreover, co-creation IPS allow for direct servicing and information provision to the end user which has the potential to enhance sustainability.

Provider public servants believe that sustainability can be achieved through funding, so that end users can be provided with digital tools and the project can be supported financially in order to evolve. Moreover, and along with the necessary resources, training of the public servants is necessary. Finally, digital tools can act as a lever of growth and development, as a connecting link between theory and practice.

The IT public servants agree that funding and training for the interested parties is important for sustainable co-creation processes. Feedback to users is also important, so that they can also participate during decision making processes. For being sustainable, IPS should be easy to use, simple and understandable, cover any emerging need and re-use existing user information. This will increase users' willingness to use the IPS. IT public servants mentioned also that digital tools can support sustainability when being updatable so as to facilitate operation and satisfy modern needs. Moreover, digital tools are considered the only solution for delivering IPS to the end users.

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8.5.3 Envisaged TO BE situation

8.5.3.1 Short description

The envisioned digital solution for issuing and renewing the disabled discount card involves the creation of both a web page and a mobile application. That should operate in parallel to the current non-digital process as there are still citizens who do not prefer using new technologies.

The functionality to be offered will be the same via the web page and the mobile application. User authentication should be possible via email, or through the User Authentication service Auth2.0, using TAXISnet[49] credentials. Unified user access should be used so that users log in to both the web page and the mobile applications with the same credentials. Moreover, there should be classified access according to different user roles, i.e. citizens, public servants, administrators.

In terms of accessibility, the web page and the mobile application should be accessible to everyone, including users with impairments to their vision (blind, partially sighted or colour blind people), hearing (people who are deaf or hard of hearing), mobility (people who find it difficult to use a mouse or keyboard), thinking and understanding (people with dyslexia, autism or learning difficulties).

8.5.3.2 Usage scenario

Title: Issuance of disabled citizen's discount card for public transportation
Involved stakeholders (and types):

- Nikos, a disabled citizen, beneficiary of the discount card
- A public servant of Region of Thessaly, Department of Social Solidarity

Background and goal: Nikos wants to issue the discount card for public transportation, however and due to his disability, he prefers to issue the card digitally, without visiting in person the offices of the Region of Thessaly.

Scenario:
Nikos logs in to the web page or mobile app for the discount card. By clicking a button, the web page or app collects all supporting documents from the Information Systems of Public Authorities that provide these documents. Alternatively, Nikos can also upload the necessary supporting documents as scanned files (e.g. .pdf, .jpg) or mobile phone photos. Once all the supporting documents are complete, Nikos will request the issue of the discount card, e.g. by clicking a button. The system will then automatically send an email to the authorised public servant of the competent department within the Region of Thessaly in order to evaluate Nikos' request.

After receiving the email, the public servant will log in to the system and proceed with the evaluation of the data submitted by Nikos. The public servant will examine one-by-one each supporting document coming either from Nikos or from another public authority, cross-check and verify citizen's eligibility online, if

[49] TAXISnet is an initiative of the Greek State to collect and digitize the financial and insurance information of citizens into one service. Thus, through the TAXISnet codes you may check your insurance clearance as well as other more detailed official data relating to your financial employment status. The TAXISnet credentials are considered secure and widely utilized in Greece; they are therefore now used for accrediting access to other services as well.

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necessary, and register the validity date of each document in the system (i.e. the date until which the document is valid and may be accepted as supporting document). Then, if the supporting documents are sufficient, the public servant will record the issue of the discount card in the system as well as its expiry date. The system will then automatically send an email / SMS to Nikos notifying him/ that the discount card is digitally available. By login in, Nikos should have access to the digital card and be able to download it or print it. The card should appear in the mobile phone screen as in print in order for Nikos to be able to show the mobile phone to the bus driver instead of the physical card. Furthermore, the public servant will manually issue the (physical) discount card and send it to Nikos via post. If the supporting documents are not sufficient, the public servant will record the rejection of the card's issue in the system as well as the final date for re-requesting the card issue (after renewing the supporting documents). The system will then automatically send an email / SMS to Nikos notifying him on the rejection and the final date for re-submission.

In case of card renewal, Nikos still signs into the web page or mobile app as previously. Nikos views the supporting documents used for last year's card issue. The documents with a future validity date may be used again for this year's card issue. The documents with a past validity date need to be updated. By clicking a button, the web page or app collects all current supporting documents from the Information Systems of Public Authorities, or alternatively, Nikos uploads the updated supporting documents. Then, Nikos requests the renewal of the discount card, e.g. by clicking a button. From this point on, the same process as in the case of card's first issue is followed. An additional functionality for the renewal process is that the web page and mobile application provide information about the due date for the submission of new supporting documents and provide the possibility to send an email / SMS to all registered citizens with this information.

It should be noted that citizens will still have the choice to follow the current offline process and submit their documents directly to the competent offices of the Region of Thessaly. In this case, the public servant should be able to cross-check and verify citizen's eligibility online, if necessary, and to record that the citizen has applied for and has acquired (or not) the discount card. Finally, the system should be able to produce a report of beneficiaries' anonymised statistical data which is sent at an annual basis to the Ministry of Labour, Social Insurance and Social Solidarity.

8.5.3.3 BPMN diagrams

The process described in the usage scenario is graphically depicted in Figure 8-12 below.

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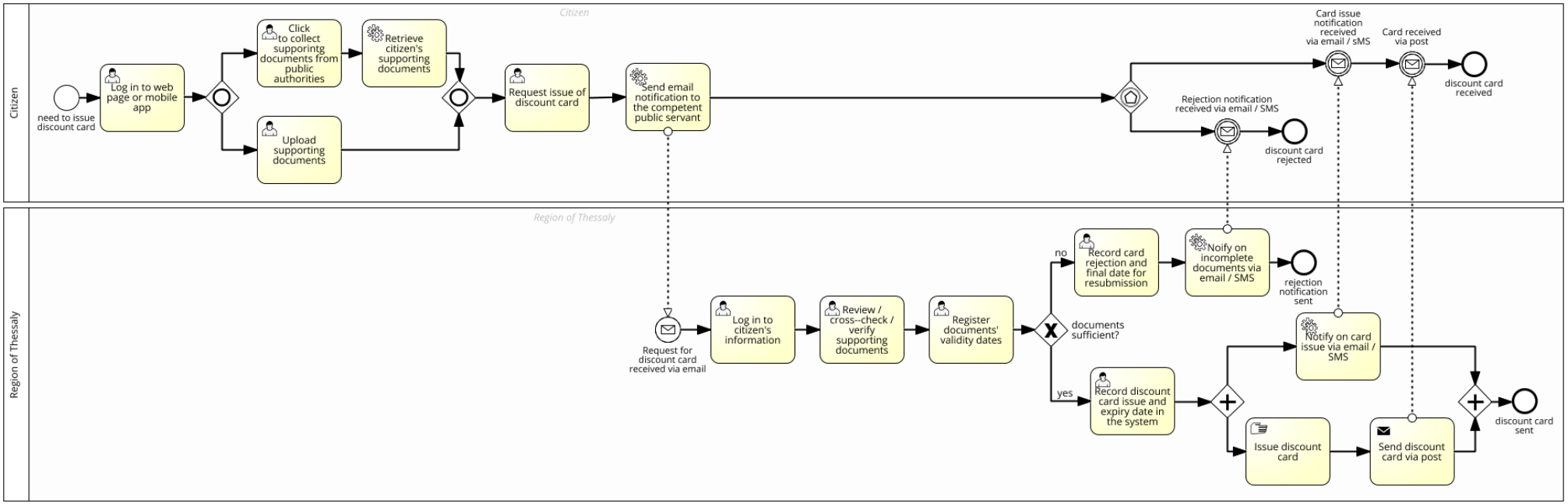

Figure 8-12. BPMN diagram for "Issuance and renewal of disabled citizens discount card for public transportation"

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8.5.4 User requirements

Based on the interviews and the usage scenario, the functional and non-functional user requirements have been derived and are presented respectively in Table 8-18 and Table 8-19 below.

Table 8-18. Functional requirements of the Greek pilot

No	Requirement	Citizens	Prov. p. servants	IT p. servants	Policy makers	Interviews	User stories	Usage scenario
GR-F01	The system should be able to retrieve the necessary citizen information if available elsewhere (e.g. certification of home address)	✓					✓	
GR-F02	By clicking a button, the citizen should receive his/her supporting documents that are available in issuing authorities' information systems							✓
GR-F03	The supporting documents should be uploaded by the citizen, either as scanned files (e.g. .pdf, .jpg) or photos taken via the citizen's mobile phone and be easily replaced / re-uploaded if needed			✓		✓		✓
GR-F04	There should be an automatic email notification to the authorised public servant of the Region's competent department when a citizen's request for card is submitted.							✓
GR-F05	The public servant of the Region should be able to view/receive online all supporting documents (coming either from a citizen or from another public authority)		✓				✓	✓
GR-F06	The public servant of the Region should be able to cross-check and verify citizen's eligibility online (even if supporting documents are provided non-digitally)		✓				✓	✓
GR-F07	The validity date of each document should be recorded by the public servant in the system (i.e. the date until which the document is valid and may be accepted as supporting document)							✓
GR-F08	There should be an automatic email notification / SMS to the citizen notifying him/her on the availability of the digital discount card or its rejection							✓
GR-F09	The citizen should be able to download the digital card, print it or show it directly via the mobile phone screen when getting in the bus (instead of the physical card); however, the physical card will also be sent by post as now	✓					✓	✓
GR-F10	Recognise user's disability type in order to automatically issue the corresponding documents and information (e.g. for people with vision problems the service issues also a card for the disabled person's companion)	✓					✓	
GR-F11	The system should maintain the supporting documents of the previous request and make them available for card renewal, so	✓					✓	✓

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	that the citizens has the option to keep some of these document (if still valid) and replace only the expired ones.							
GR-F12	More comprehensive, better organised and up-to-date information should be available via the website and mobile application	✓		✓		✓	✓	
GR-F13	Include a Frequently Asked Questions (FAQ) page on this service	✓				✓		
GR-F14	Minimise the chance of missing important deadlines (e.g. due dates for applications) through better communication and updates via the media as well as other websites on disability	✓				✓		✓
GR-F15	Subscription to a notification service in order to get direct notifications, e.g. via newsletters or SMS	✓				✓	✓	✓
GR-F16	The notification service should provide personalised briefing	✓				✓		
GR-F17	The system should produce a report of beneficiaries' anonymised statistical data for the Ministry of Labor, Social Insurance and Social Solidarity							✓

Table 8-19. Non-functional requirements of the Greek pilot

Category	No	Requirement	Citizens	Prov. p. servants	IT p. servants	Policy makers	Interviews	User stories	Usage scenario
Efficiency	GR-NF01	Minimise the time needed to re-issue the discount card (e.g. when lost)	✓				✓		
	GR-NF02	Minimise the effort needed for card's annual renewal, e.g. facilitate automatic renew if there is a valid certificate of disability	✓				✓	✓	
	GR-NF03	Perform the service fully digitally so that beneficiaries do not need to visit the public authority	✓				✓	✓	
Usability	GR-NF04	Accommodate all forms of disabilities, including users with impairments to their vision (blind, partially sighted or colour blind people), hearing (people who are deaf or hard of hearing), mobility (people who find it difficult to use a mouse or keyboard), thinking and understanding (people with dyslexia, autism or learning difficulties)	✓				✓	✓	✓
	GR-NF05	The website and mobile application should be simple and understandable, easy to use it without having much technological knowledge	✓		✓		✓	✓	
Data integrity	GR-NF06	Re-use existing user information			✓		✓		
	GR-NF07	Address semantic aspects regarding the exchanged data (e.g. supporting documents)	✓					✓	

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Security & Privacy	GR-NF08	User authentication via TAXISnet credentials							✓
	GR-NF09	Unified user access so that users log in to both the web page and the mobile applications with the same credentials							✓
	GR-NF10	Classified access according to different user roles, i.e. citizens, public servants, administrators							✓
Channels	GR-NF11	The service should be offered both via PC web browsers and mobile applications, with both channels offering the same functionality	✓				✓	✓	✓
Findability	GR-NF12	The website should appear high in search engines' results list	✓				✓		
Interoperability	GR-NF13	Address the lack of a clear legal framework for interoperability			✓		✓		
	GR-NF14	Interlink with the information systems of the public authorities that are providing the supporting documents for the service							✓

Moreover, we should mention a few additional user needs that emerged from the stakeholder interviews and could not be recorded as specific user requirements for the solution. These are the following:

- A clear and facilitating legal framework for co-creation and IPS is needed
- Technical training for citizens and public servants is needed both for the specific digital service and for engaging in co-creation processes
- Citizens would like to hold the card for a longer period (not having to perform renewal every year but when the disability certificate expires) and be able to use the disability card in other sectors as well as a proof of their disability
- Citizens ask that public servants are better informed on the service and serve better the citizens

8.6 Pilot #4: Austria

8.6.1 Background

8.6.1.1 Problem statement and aspiration

Tourists in Lower Austria pay a fee to the accommodation provider for each overnight stay, and this fee includes a tourism tax. The accommodation provider has to pay this tax to the local council on a monthly basis that then has to pay a part of it to the regional government (Lower Austrian Regional Government). The local municipality keeps 35% of the tax, 65% is paid to the Regional Government of Lower Austria. There are 573 local councils in Lower Austria (in German, "Gemeinden") that receive data from approximately 3,200 accommodation providers. Currently, the necessary data is submitted using Excel forms that is then manually read and re-entered by public employees. This might lead to (human) errors such as entering wrong figures and locations that may result in wrong financial transactions and requires the allocation of human resources for these tasks. The objective of this pilot is to digitalise the workflow of this public service and simplify public employees' and service users' everyday work through the use of a web-based solution.

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8.6.1.2 The “Tourism overnight stay tax collection” public service

Currently, the public service is performed as follows:

1. The accommodation provider reports the collected overnight stay tax manually to the local council using an Excel form and at the same time pays it to the local council (manual bank transfer).
    - Reporting: different intervals, normally monthly (but there are exceptions)
    - Total number of overnight stays, exempted number of overnight stays, etc. (no personal information about the guest is provided)
    - Depending on the local council, the amount of tax varies according to the local classification scheme
    - Reporting by Excel form (available for download at noel.gv.at);via e-mail.

2. The local council must evaluate, check and consolidate all reports and notify the Federal Province of Lower Austria (WST3 Department) via another Excel form and carry out a manual bank transfer.
    - Payment is made quarterly; any exceptions/subsequent notifications must be reported.
    - 65% of the overnight tax goes to the Federal Province of Lower Austria, 35% remains with the local council.
    - Info: Only payments actually received from accommodation providers are transferred from the local council to the Federal Province of Lower Austria.
    - Info: Additional payments from previous periods are also partially added and then transferred from the local council to the Federal Province of Lower Austria on a pro rata basis.

3. The Federal Province of Lower Austria - F1 Finance Dept.:
    - Manual recording of the transfers and regular provision of this data in an Excel list for WST3 department (clerks).

4. Federal Province of Lower Austria - WST3 department – administration (“Kanzlei”):
    - Public employees from WST3 collect data from the Finance department and enters it in the Excel list stored in "Lakis" (=Government main data management software)

5. Federal Province of Lower Austria - WST3 department:
    - Specialist opens and checks Excel list in "Lakis" (Government main data management software)
    - Specialist checks excel list in Lakis and then imports data to "Tourism Tax Administration Tool".
    - The "Tourism Tax Administration Tool" (based on Microsoft Access database) is the general tool used to handle all reports from the local council, is a good tool and can be used also in the future.
    - Any corrections or payment reminders must be agreed manually with local councils.

6. If everything has been reported and paid correctly, this will be recorded in the tool.

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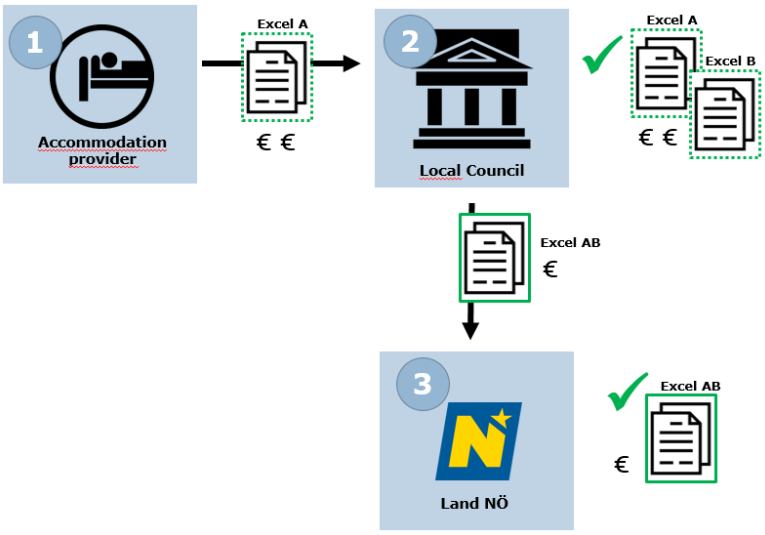

Figure 8-13. Tourism overnight stay tax collection

8.6.1.3 Stakeholders

The stakeholders involved in this public service include the:

- 3,200 businesses (hotels / B&Bs / accommodation providers) in Lower Austria;
- the 573 local councils;
- the Federal Government of Lower Austria, Finance department; and
- the Federal Government of Lower Austria, Economy and Tourism department (WST3).

8.6.2 Stakeholder interviews

8.6.2.1 Collection of responses

Interviewees were contacted by Land NÖ. If they agreed to be interviewed, Noella Edelmann (Principal Investigator at the Danube University Krems, Austria - PI) would get in touch with the interviewees and set the date for the interview.

14 interviews were held in the period 07.04. – 28.04.2021, 11 were conducted using the online video-conferencing tool Zoom, 3 by telephone. At the beginning of the interview, the interviewer went through the consent form and asked for permission to record the interview. All interview partners consented, and all interviews were recorded. The interviews were recorded using either the functionality provided by Zoom or using a hand-held recorder if the interview was conducted on the telephone. The interviews lasted between 30 and 60 minutes.

The anoynmous audiofiles are stored on a DUK file repository with limited access managed by the PI. For the transcription of the interviews, access to the audiofiles was given for a limited period to an external transcription company in Austria. The transcription company uploaded the transcription to the DUK server (access was then stopped once all transcripts were made). The transcripts were translated into English and used for the analysis by the PI/DUK. The 14 transcripts were analysed during the period 3-7.05.2021.

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The PI/DUK is the sole owner of the list of participants that includes the pseudonyms used for the management of the audio files and transcripts. Signed consent forms and data protection agreement forms are stored by Land NÖ.

Overall, 14 interviews were conducted, with the following stakeholders:

- Public Sector (Administrative Staff/Regional Government): 2
- Public Sector (Legal/Regional Government): 1
- Public Sector (IT/Regional Government): 2
- Public Sector (Policymaker/Regional Government): 1
- Local Councils: 2
- Businesses (Hotels): 3
- Business Representatives (Chamber of Commerce, Regional Association): 3

All interviewees come from the pilot region, Lower Austria. The selection of interviewees was performed in a way as to engage all of the different roles and stakeholders involved in the overnight stay tax service. Thus, public servants from both the local councils and the regional government were selected that are involved in all the steps of the process. As regards the hotel owners, different-sized hotels were selected (small, medium-sized, and large), whereas representatives of different types of accommodation providers (Chambers of Commerce, Bed & Breakfast / Farm-holidays) were also interviewed in order to ensure that the diverse needs were included.

8.6.2.2 Analysis of responses

We provide below the analysis of responses categorised per theme.

User expectations

The businesses (hotels) have relatively positive experiences with this service; however, this also depends on the relevant local council and whether paper or digital processes are offered in each location.

Their expectations for this public service refer mostly to digitalisation and systems' integration. They expect that the most practical solution would be to fully digitalise the process among hotels and all local councils, to interlink/integrate the currently existing systems and tools, and to use a centralised platform for all stakeholders (hotels, guests, local councils, regional government). At the same time, they expect a reduction of the workload both for hotels and local councils, a reduction of the complexity, as well as paperless solutions (no more print-outs to be needed/no need to physically go to the local council). A few mentioned the importance of ensuring "good" records/data, to show what the tax is used for (e.g. for tourism purposes) and to offer additional benefits to the guests paying tax (e.g. admissions or discounts to tourism destinations, use of public transport in tourism resorts).

Some barriers were mentioned by businesses. They recognised that information systems can have high maintenance costs and that appropriate interfaces between hotels and local councils are needed, since such interfaces can be error-prone, and the existence of errors will lead to more work by staff. Finally, it was also mentioned that there are currently differences at the general competences and knowledge about the processes as well as the digital skills' level held by different accommodation providers.

The local councils regard the "overnight tax" service as more advanced than other services, although complicated and prone to calculation errors, including errors by individuals that need to be corrected

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afterwards and technical errors/problems with the interfaces between the involved stakeholders. Just like businesses, local councils, too, find that there are different levels of knowledge and digital competences regarding those involved. It was also mentioned that their regional legal frameworks prevent the full use of digital infrastructures. Smaller councils have a more positive experience of this service as they are in a better position to help their customers.
The local councils (mostly the bigger ones) expect this service to allow online submission by all stakeholders and to digitally link up the whole process, from accommodation providers to the regional government. However, it would be easier if the legal basis were adjusted accordingly or be more up-to-date, in order to be able to use the advantages of digital media.

The regional government officials reported some negative experiences with this service, for example that the accounting department still has to enter payment receipts manually and furthermore, the fact that this service is not fully digital increases the amount of time needed to execute it. Moreover, this service involves different federal and regional laws.

The expectations from regional government include: the full digitalisation of the process (from the guest paying the tax to process completion in the regional government); the implementation of the Once-Only Principle on re-use of data and the use of forms with pre-filled data; the maintenance of the existing checking function of data and finances; the use of a coding system for customers (local councils) that is already used in other services; reduction of time and human resources needed for the service; and finally, that regional and federal governments agree on a change/integration of the relevant laws.

The following tables summarise the user stories provided by interviewees.

Table 8-20. User stories by businesses

As a …	I would like to …	In order to …
Hotel owner and/or manager	see what the money is used for because it's a big contribution.	Whenever I have to pay taxes, I expect that I will get something in return or at least that the money will be used in the region and in the municipality.
	support the municipality on its way to digitization	The expectation is more that it reduces work (…) the winner is the municipality because they no longer have to do the nationality statistics and the manual recording of reports.
	use digital opportunities.	It would be practical if I could, send my statistics always at the push of a button, from there to the next authority or municipality. Without a printout, without filling out anything and sending it away.
Representative of businesses	see what analog alternatives can be offered.	Some members (accommodation providers) are on a different technical or digital level. How do you solve that? I have a lot of people in my area who run a hotel out of nostalgia and are miles away from e-

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		government. Analog loopholes or stopgap solutions are still needed.
	see the different levels of competences addressed (some accommodation providers and local councils lack basic knowledge about the accommodation industry and taxation).	The accommodation providers want to have a certain amount of work saved and spend less time on administration. If it is automated then it somehow works by itself and then I get my bill from the municipality once a month or something, as you imagine modern billing somewhere. I certainly expect that everything will work out as soon as possible, of course, so not like with the tax office that two years after the decision you still haven't heard anything from them.
	avoid parallel systems that pass each other, so that accommodation providers do not have to enter data twice and three times but have more time for their guests.	Entering data twice and three times is actually not an improvement, i.e. if the person has to enter his booking separately and then he has to enter it again in his accounting that he can write an invoice and then he has to enter it again with the local tax, then of course he is annoyed because then he sits longer at the PC for a guest like what he has time for the guest.
	use the once-only principle.	Why do I have to keep re-entering my things, the basic data does not change. Or I log-in for the ten thousandth time, what do I know, at a funding application point, why do I have to re-enter my basic data over and over again, that is, so to speak, not understandable for the companies.

Table 8-21. User stories by public servants (local councils & Federal Province of Lower Austria)

As a …	I would like to …	In order to …
public employee of a local council	have everything digital.	The system can then find something more easily and assign it, so that everyone can access it. (…) Above a certain size [of the local council], this is certainly time-saving, full digitalisation is more time-saving and saves work.
	an interface to the hotel software.	Because there are two interfaces in between there is the potential that something does not work, when overnight stay reports do not "arrive" then we have to stop to troubleshoot, is the error with the local council, is it with the reporting client, or is it with the provider of the hotel software? So the potential for improvement that you really say okay, you see that you have as few interfaces as possible and yes, you can minimize an error rate, (…) and that all accommodation

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		providers would switch to digital reporting, then we would have the least amount of work at all…
public employee of the Federal Province of Lower Austria	have everything electronic, the guest registry, the new guest registry sheet. In Lower Austria there are still many analog services (paper-based forms).	If the federal government and the provinces were willing, this could all be done digitally in one programme.
	to bring in more electronic and digital information.	Sometimes, when you arrive, the data is already typed into the guest register sheet, just by booking. All you have to do is sign it. The Tourism Statistics Ordinance, the reporting municipalities have to submit the overnight stay data to Statistics Austria on a monthly basis. If all this were to be digitally connected and then also digitally connected, that would be desirable.
	have an interlinking between the currently existing systems and integrated tools.	If there were any portal or platform, then virtually all actors could access it and import their data there and if you could do the whole thing. Thinking a little further, this could perhaps also be a platform through which the guest has some advantages or which the guest can also use himself.
	continue improving the process and application.	To massively improve the process. I see the whole thing as a prototype to sharpen the requirements. It is often the case that such prototypes are stable enough to be used in everyday life for decades.
	provide the integration of administrative services from the customer's point of view.	This is the path that we as an administration have to take. In the private sector, too, there is a strong move in this direction, namely in the direction of integration and in the direction of presenting. It is certainly something that should be included in all strategic decisions. On the other hand, you have to be careful that you don't just do it because it sounds so pretty. But really where it makes sense for the citizen. Or for the entrepreneur.
	ensure that local councils are required to use codes.	If it would be automatic, I would then also no longer be needed. I wouldn't have to do anything. The local council would then write down the right number and it would automatically be entered into the system. That personnel and time will be saved. From my side there is nothing more to be done.

Co-creation

As regards co-creation, businesses were not familiar with this term or had a different understanding of this term than that of inGOV. One respondent stated that co-creation is about bringing together several organisations, universities, institutions for collaborations and projects, although it was noted that a better term for creation would be collaboration. Another respondent understands co-creation in relation to product development such as customer journeys and user-centeredness, while another one sees co-creation as creating synergies of accommodation providers with other tourism domains, e.g. car rental.

Co-creation is seen as a means for qualitative development of the tourism domain in contrast to Tourism policy that is interested in quantitative development. However, it was also noted that although it seems that external stakeholders may highly contribute to tourism processes, they cannot easily intervene in this process as it is mostly an internal process within the public sector. As regards the phases, co-creation should be sought for at the beginning for agreeing on the aims to be achieved, but also before, during and after implementation for providing feedback on the system (e.g. via events, consultations or questionnaire

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surveys). The motivation for engaging in co-creation activities cannot be via an incentive system based for example on rewards, benefits or competitions, because that would spoil honest participation. Motivation should stem out of personal conviction and the need to shape one's own environment.

Not all interviewees had experiences with co-creation. Co-creation has been used in the past to help develop tourism policy agendas and strategy development in Lower Austria and to help the Chamber of Commerce design their strategies and portfolios. Most of the systems currently available are set up for a pre-digital era, but the system/principle of involving participants and members is not outdated. The methods used need to be adapted to the new reality and integrated with digital tools, which will also help reach more participants. The way the information is conveyed is always very important. There aren't that many possibilities: digital, by physical presence and in printed form. An external agency can provide support to disseminate information.

Time is always seen as one of the big barriers to participating in this kind of process. Some interviewees wondered how it is possible to aggregate the different opinions from a variety of companies and given their technical possibilities/limitations. Another identified barrier is losing the overall picture or being even more disoriented at the end. A further barrier is the stakeholders' very different technical or digital skills. Some accommodation providers are unable to provide up-to-date data or an email address. This is a problem that becomes particularly acute when processes, reporting requirements and information (and other issues such as financial support or funding programmes) are a legal requirement but only available digitally. This makes clear that "analog loopholes or stopgap solutions" are still needed.

Local councils were unable to define co-creation. They have limited experiences with co-creation and smaller local councils would not have the human resources for participating.

Respondents agree in principle that it is important to involve as many as possible in such processes. But co-creation has to create value and be valuable, e.g. it has to produce tangible results such as simplified administration, save on human resources or lead to meaningful developments. The advantages for all stakeholders must be visible and involve the stakeholders on matters of importance to them. There is currently scepticism within local councils for such initiatives as recent administrative reforms are note seen as particularly effective but rather as a shifting of the burden from the regional government to the local council.

Not all interviewees from the regional government were able to define co-creation. Some described it as "joint generation, to create something together in a collaborative process" and as "bringing people from a wide variety of specialist fields together in one format in order to be able to meet challenges that are becoming more and more complex". IT specialists described co-creation as jointly working on an implementation, e.g. on requirements or solutions to be used by everyone.

There has been previous experience with procedures where the citizens can provide their opinions as by law, every legal amendment can be commented within a given deadline. Furthermore, some departments have conducted participatory processes such as dialogues with businesses and local councils. IT specialists have previous experiences with the development of the business development portal rolled out four years ago. In that case, external partners were involved towards the end of the roll-out for fine-tuning since the IT specialists feared that early stakeholder involvement would slow down the process and prevent the development of a good solution.

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Overall, regional government regards co-creation as important as it provides the opportunity to address different matters and has the potential for optimisation or for solving problems. Openness within public administrations is an important element in co-creation. Even if participants may disagree on an idea, issue or solution, they should be involved in the process.

Challenges mentioned for co-creation refer mostly to its organisation and coordination, i.e. the "when", "what", "who" and "how" questions. The beginning of the process has been identified as challenging in order to decide on the goal, expected results and added value of the initiative. Another challenge mentioned is identifying and reaching out to the people who know enough about the topic (instead of inviting everyone who may then not be interested in the topic at all). The format of co-creation is an important aspect as it determines the process to be followed and how participants and opinions are integrated. Resources are another challenge, as co-creation takes time and resources which not everybody is willing to contribute.

IPS and IPS governance

The local councils found it hard to define IPS. They assumed that it means that several administrative areas are covered with one service or the use of one electronic form only (Elak-system). As local councils have started taking on additional services outside their core activities (e.g. selling train tickets) and becoming a local supplier of services, coordination of the different services emerges as an important issue for them. IPS would be an advantage if it can lead to time savings. Efficient governance of services is not yet achieved and coordination may be affected by local political figures, e.g. mayors, who have their own understanding of administration and the way services are to be offered.

Most regional government officials suggested that IPS refers to all services being offered within one system, on one platform, or through one point of access, as for example the platform of the Austrian Ministry of Finance, FinanzOnline, which gathers all taxation services, and the Austrian business service portal, which gathers all information available for companies. For IT public servants, IPS is understood as digital services that are to be integrated in the processes and applications of public organisations, which also address the points of contact / overlaps between citizens, companies, and public administrations. The regional government employees believe that IPS needs to be developed in a customer-centred way and be included in all strategic decisions made by public administrations. IPS should aim to reduce the administrative burden and costs, and to include the use of digital or mobile signatures.

There is already some coordination of services among departments, but there is definitely room for improvement regarding the coordination between regional and federal government and the legal framework or laws. In Austria, the same services draw on different regional laws so that the same service has different names in different Austrian regions, is offered in different ways and by different public sector organisations at different administrative levels, with no common understanding of how the services can or should be consumed. IPS needs to be addressed at high administrative levels, and the federal and regional governments need to such integration efforts jointly. However, the Chamber of Commerce representatives feel that the coordination and control of digitization in Lower Austria should remain within the regional government, as digitizing an organisation or an administrative unit can only work if this position is close to the decision-making level.

The regional government employees believe that it would be useful to re-use existing building blocks, concepts, ideas, paperwork, standards and that the implementation of specific applications are agreed upon by the Austrian authorities and the EU. Although some departments with old personnel structures

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find it difficult to adapt to new digital solutions, the electronic files (Elak-system) are now used extensively in Lower Austria and should continue to be used. Such solutions that have already been developed in the Austrian regions should be used as a blue-print and experiences made should be provided as lessons-leaned.

EIF layers: legal, organisational, semantic and technical aspects

As regards the legal aspects, regional laws and federal laws affect the service, and different regions develop their own procedures (e.g. use of emails on a regional level). Moreover, the Chamber of Commerce and Regional Associations urges to consider the integration of these laws as they have an impact on data collected, made accessible and integrated by the different organisations involved (e.g. Statistics Austria, regional government, etc.).

The current legal framework is not always suitable for the use of digital tools, making it difficult to be business- or citizen-oriented, so that certain administrative procedures do not appear to be service-oriented. Moreover, the legal framework needs to be clarified and unified in order to avoid a dichotomy at the regional level. Further legal issues that need to be addressed are administrative and private services that clash or overlap, the outsourcing of particular administrative services to private organisations, or public sector organisations that take over new services that are not their core services (e.g. selling train tickets or concert tickets in citizen bureaus, taking over post–office functions as these are shut down). This leads to a difficult balancing act between being service-oriented, providing administrative services and ensuring legal provisions.

As regards the organisational aspects, small local councils are responsible for all services provided and it is felt that they can neither provide insights into the public sector nor that management levels are aware of what they need in order to complete the tasks. Particularly, local councils demand that more digital solutions are needed in order to make the work of smaller offices more effective given the (human resource) limitations. Regional government employees feel that the organisational structure fits well, although the IT department is overwhelmed with the many requirements, making short notice demands challenging.

No input was provided by interviewees on semantic aspects. Many technical aspects were discussed by the IT employees of the regional government.

First, the need for appropriate digital authentication was identified. In principle, the public sector wants individual people and businesses to authenticate themselves with an e-card or with a mobile phone signature. Challenges include user administration, the right system, granting the right people with access to the data, and overarching projects/IPS. A citizen portal, where authentication issues have already been resolved, could help future projects.

Another aspect mentioned is the once-only principle, where a common understanding on data use/re-use needs to be established. From a technical point of view, it would be ideal to link data, but this is not legally permissible. There is a need to decide on customer data ownership.

IT officials are in favour of an open-source concept, where technical modules are provided according to certain standards and can be used by everyone. Currently such re-use among administrations does not happen at all. Existing IT modules mostly use agile software development methods, hence the specialist application is intensively involved in the entire life cycle to keep them up-to-date.

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There are legacy systems that can be re-used for the integration of public services. The most important registry is the central Austrian registry, Zentrales Melderegister (ZMR), used to compare names and draw the corresponding address information from. Moreover, Austria and the regional government of Lower Austria are highly networked and one of the core systems is the Elak-system. Almost all specialist applications have interfaces with Elak, with middleware in between, in order to be protected against version changes and not have to rebuild everything immediately. There are also interfaces to the specialist applications, where the application data is imported into the specialist application. As regards the Finance Department, accounting is based on a very old legacy host-based system and is currently in the process of converting to SAP.

Sustainability

The businesses regard sustainability as an important dimension that needs to be addressed more in the future and should be understood as an iterative and constant process. Factors to support sustainable implementation include the following:

- showing the added value of the tax in the context of the tourism industry (also considering the many different types of accommodation);
- making the hotel industry more effective and efficient, e.g. reducing time / paperwork needed for administrative procedures;
- linking programmes, systems and procedures;
- improving current systems, developing user-friendly systems, using agile methods, and avoiding tailor-made solutions ;
- investing in training / competences' building.

The local councils regard sustainable implementation in relation to the following factors:

- legislative processes need to be faster and more efficient, a lot of "old" laws are no longer suitable;
- digitisation is seen on the one hand as means to improve sustainability, but on the other hand, digital processes are not sustainable because of their fast pace and the ongoing innovation involved (e.g. it is difficult for decision-making processes to keep pace with digital change, and relevant apps, websites, and social media are almost obsolete after they have been implemented);
- digital competences (for all citizens and from an early age) and digital equality (e.g. broadband across the country in same terms for rural / urban areas).

The regional government feels that sustainability thinking should have a stronger influence on decisions. The factors they identified as important for sustainable implementation relate to:

- resource savings (cost-effectiveness for public administrations; reduction of people involved; increase of efficiency; careful handling of tax-payers' money)
- better IT coordination (need of a large IT department, faster implementations through in-house resources or external IT support; use of interfaces; fast adaptation)
- service maintenance (the service / product has to be maintained digitally and be up-to-date; continuity must be guaranteed)
- assessment of sustainability (data-based evaluations, data-based decisions)
- social justice (e.g. less CO2 emissions)

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8.6.3 Envisaged TO BE situation

8.6.3.1 Short description

With the envisioned integrated web-based solution, the citizen continues to pay the tourist tax together with the hotel fee, but subsequently the accommodation provider, the local council and the regional government will use digital, automatic solutions to the largest possible degree. Data should be transferred via APIs, online forms, web tools and using graphical interfaces. Moreover, functionality for automatically pre-filling parts of online forms will be used, e.g. with information such as the name of the local council that will collect the tax, location of accommodation, date of application, type of tax, etc., in order to avoid errors during entry. Furthermore, human errors will be eliminated since tax will be automatically calculated and the data will be transferred in a structured format to a database instead of being sent via Excel forms that is re-entered manually. The web service tool to be used will be based if possible on open source solutions and APIs and could be open to be connected to private company service (e.g. Gemdat, https://www.gemdat.at/).

There was originally an intention to utilise geo-spatial data and mobile communications, in order to recognise the location of the accommodation provider, and subsequently to record the relevant geographical data. However, this has been abandoned after the stakeholder interviews as it became evident that such a solution that refers to big accommodation providers would not bring much added value to them as they are already using hotel software to facilitate this service.

8.6.3.2 Usage scenario

Title: Tourism overnight stay tax collection
Involved stakeholders (and types):

- Christina, an accommodation provider in Lower Austria;
- the local council;
- the Federal Government of Lower Austria (Land NÖ), Finance department;
- the Federal Government of Lower Austria (LAND NÖ), Economy and Tourism department (WST3).

Background and goal: Christina has to pay the tourism tax that is included in each overnight stay at the hotel to the local council. The local council keeps a part of this tax (35%) and the remaining part (65%) is paid to the Federal Government of Lower Austria.

Scenario:
Part A: The accommodation provider reports and pays the overnight stay tax to the local council
This process is performed every month; however, some smaller accommodation providers do this at other, individual intervals (e.g. quarterly).

Christina calculates and reports the overnight stay tax to the local council digitally. Big hotels with hotel software may report the tax automatically by connecting the hotel software to the local council's web service, or, alternatively, by exporting the relevant data from hotel's software and uploading to local council's web service. If there is no hotel software, Christina can insert the data to a web form connected to local council's web service. Then, Christina pays the reported tax via online transfer to the local council. This may be performed via the same web form of the local council (similar to the pay option of an e-commerce solution) or through a typical manual online bank transaction. Either way, a unique identification ID is needed per overnight stay tax report in order to easily associate reports and payments.

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For small accommodation providers (e.g. not digitally savvy owners), there is the option to report overnight stay tax non-digitally. In this case, Christina visits the local council and provides the overnight stay data. Then, the local council inserts this data in the web service and calculates the overnight stay tax. Christina pays the tax on the spot and the local council updates the web service with the payment.

Part B: The local council collects all overnight stay tax of accommodation providers
This process is performed every month. The local council first performs a check for all non-automatic payments in order to verify that the overnight stay tax amounts reported and paid are the same. In case of differences in the amounts, these are being manually resolved with the relevant accommodation providers. Then, all collected tax is automatically added up and then, tax shares (65% for Land NÖ, 35% for the local council) are automatically calculated.

Part C: The local council reports and pays overnight stay tax share to Land NÖ
This process is performed every quarter. The tax report file is automatically created by the local council and automatically sent to Land NÖ via a web service. Then, the local council pays the relevant tax share to Land NÖ. This is performed if possible, automatically, via an automatic bank transfer, or via a manual online bank transaction. Here, a unique identification ID is needed per tax report file in order to easily associate tax reports and tax share payments.

The tax report file is received by Land NÖ and the Tourism Tax Administration Tool is automatically updated with tax report information.

After 2-3 working days, the Finance department of Land NÖ checks their bank account and inserts the payment details (amount paid for the specific tax report) to their software. This information is automatically sent to the Tourism Tax Administration Tool which automatically compares the amount paid with the amount reported. If the amounts are the same, the process ends here. If not, the WST3 department is responsible to communicate with the local council to resolve this difference.

8.6.3.3 BPMN diagrams

The processes described in the usage scenario are graphically depicted in Figure 8-14, Figure 8-15 and Figure 8-16 below.

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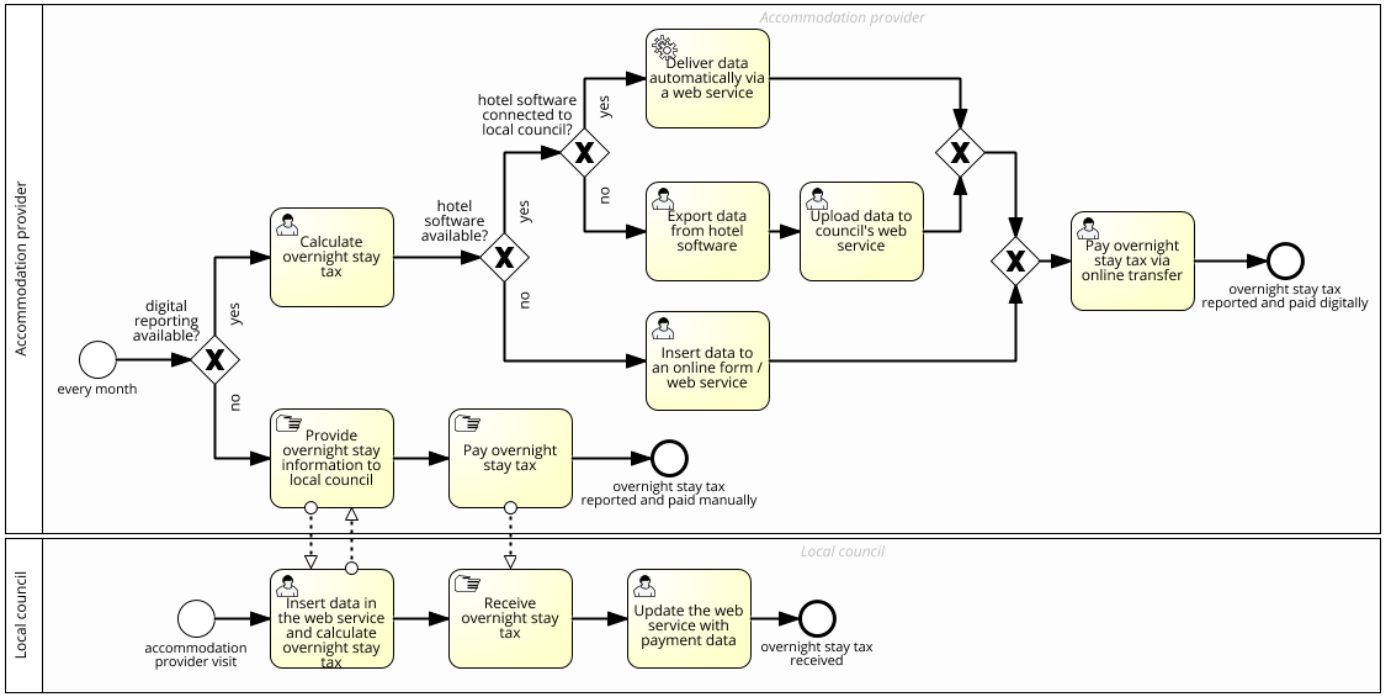

Figure 8-14. BPMN diagram for "Tourism overnight stay tax collection, Part A"

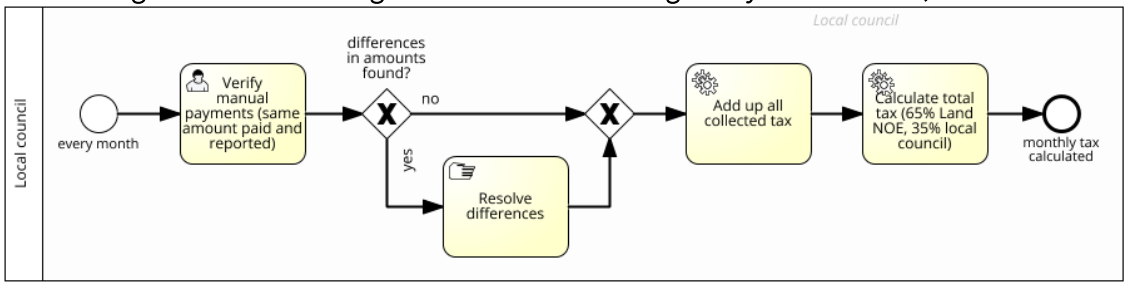

Figure 8-15. BPMN diagram for "Tourism overnight stay tax collection, Part B"

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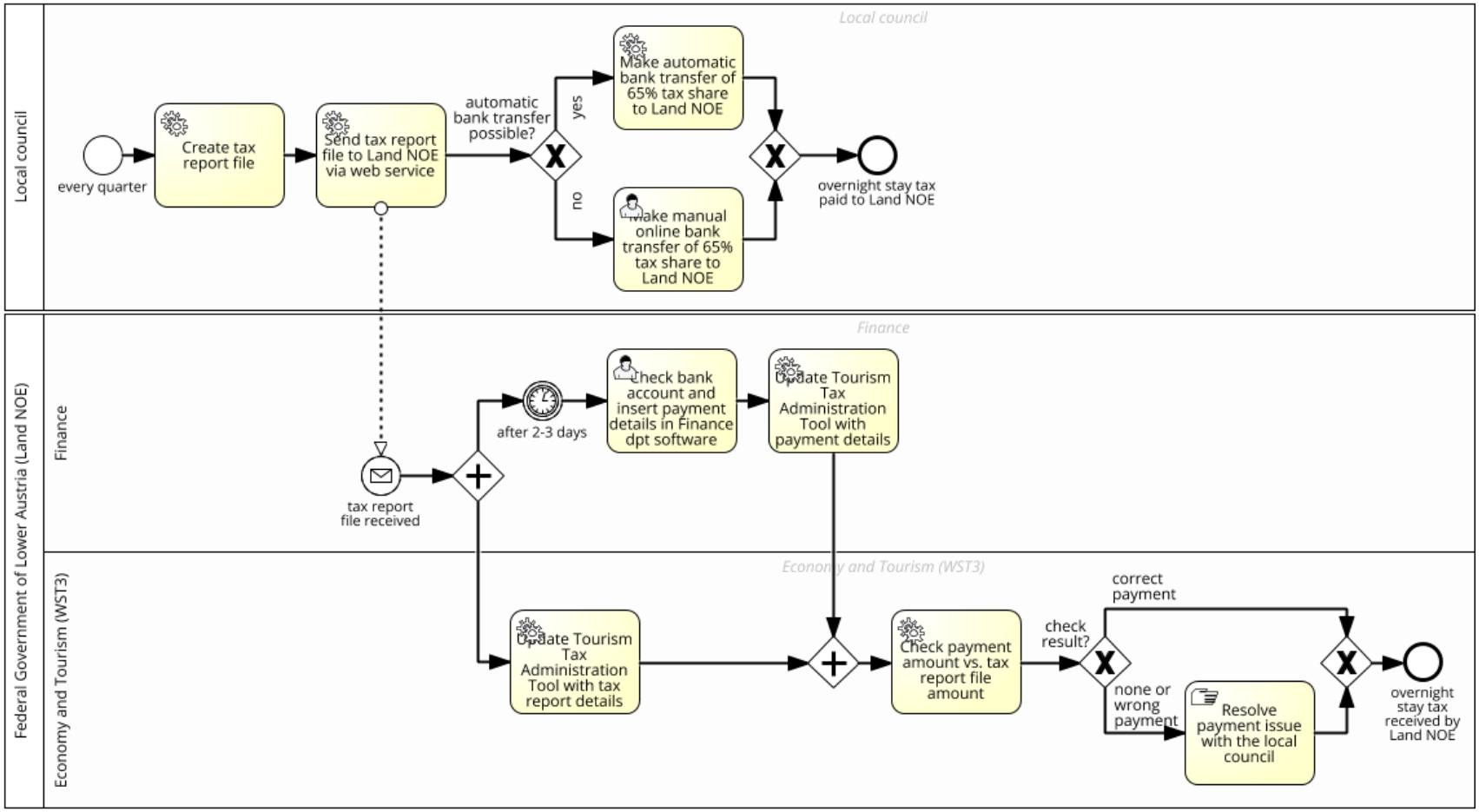

Figure 8-16. BPMN diagram for "Tourism overnight stay tax collection, Part C"

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8.6.4 User requirements

Based on the interviews and the usage scenario, the functional and non-functional user requirements have been derived and are presented respectively in Table 8-22 and Table 8-23 below.

Table 8-22. Functional requirements of the Austrian pilot

No	Requirement	Businesses	Local councils	Reg. government	Interviews	User stories	Usage scenario
AT-F01	Upload / import of data exported from hotel software and/or connectivity to hotel software						✓
AT-F02	Web form for the accommodation providers to insert overnight stay tax data						✓
AT-F03	Automatic tax calculations						✓
AT-F04	Accommodation providers should be able to pay via the web form						✓
AT-F05	There should be feedback to the accommodation provider that everything worked out ok with tax submission to the local council	✓				✓	
AT-F06	The solution should facilitate the possibility of non-digital submissions of tax by accommodation providers	✓				✓	✓
AT-F07	The existing checking function on data and finances should be maintained			✓	✓		✓
AT-F08	Automatic creation of tax report file						✓
AT-F09	Automatic dispatch of tax report file to Land NÖ and update of Land NÖ systems (the Tourism Tax Administration Tool)						✓
AT-F10	Automatic bank transfer for paying tax share to Land NÖ						✓

Table 8-23. Non-functional requirements of the Austrian pilot

Category	No	Requirement	Businesses	Local councils	Reg. government	Interviews	User stories	Usage scenario
Data integrity	AT-NF01	Minimum chance of errors during user entries	✓	✓		✓		✓
	AT-NF02	Utilisation of forms with pre-filled data (e.g. name of the local council that will collect the tax, location of accommodation, date of application, type of tax, etc.)			✓	✓		✓
	AT-NF03	A unique identification ID should be used for each overnight stay tax report in order to easily associate reports and payments						✓

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	AT-NF04	A unique identification ID should be used for each tax report file in order to easily associate tax reports and tax share payments						✓
	AT-NF05	Utilisation of a coding system for local councils that is already used in other services			✓	✓	✓	✓
	AT-NF06	Implementation of the Once-Only Principle, data should be entered only once and transferred among systems	✓		✓	✓	✓	✓
Efficiency	AT-NF07	Minimisation of paper printouts	✓			✓	✓	
	AT-NF08	Reduction of workload, i.e. of time and personnel needed for the service	✓		✓	✓	✓	
Usability	AT-NF09	Graphical interface for user entry						✓
Interoperability	AT-NF10	Eliminate technical errors at the interfaces between stakeholders; minimise interfaces to consequently minimise interface error rates		✓		✓	✓	
	AT-NF11	Data transfers should be made according to agreed structured formats						✓
	AT-NF12	The solution should be interlinked with current existing systems and integrated tools, e.g. with hotel software, the Tourism Tax Administration Tool, Gemdat.			✓		✓	✓
Security & Privacy	AT-NF13	User authentication is needed; individual people and businesses in Austria should authenticate themselves with an e-card or with a mobile phone signature (eID)			✓	✓		
Compliance	AT-NF14	The solution should be based on open-source concepts			✓			✓

Moreover, we should mention a few additional user needs that emerged from the stakeholder interviews and could not be recorded as specific user requirements for the solution. These are the following:

- Improvement of the process and reduction of complexity
- Dealing with the current legal barriers, i.e. as regards full use of digital infrastructures and as regards change/integration of relevant laws across regions
- Enhancement of digital skills and industry's knowledge of involved stakeholders (e.g. accommodation providers and local councils)
- Provision of information on how tourism taxes have been used and rewards for guest paying tax

8.7 Overall needs and requirements

This section summarises the needs and requirements that have been elicited from the stakeholders of all four inGOV pilots.

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As the inGOV pilots are different in terms of the addressed public services and the involved stakeholders, there are also differences in the user requirements that have been elicited, especially in the functional requirements. However, there are some common underlying high-level user needs as follows.

- Need for simplification, reduction of complexity and efficiency, e.g. minimisation of time needed, reduction of workload) was discussed in all four pilots (MT, HR, GR, AT)
- Need for full services' digitalisation in order to minimise interactions between public administrations and citizens / businesses (e.g. phone calls, emails, visits to the administration's premises) was discussed by both the public servants and the citizens and businesses (HR, GR, AT)
- Need for secure transactions via authentication and authorisation protocols (MT, GR, AT)
- Need for interoperability and exchange of data/information among public administrations (MT, GR, AT)
- Need for a more formal approach to IPS coordination would be beneficial, even to countries where there is already a certain degree of IPS coordination (MT, HR, GR, AT)
- Need for addressing legal barriers and changes/adjustments to relevant legislation (MT, GR, AT)
- Need for simple, easy-to-use interfaces (MT, HR, GR, AT) that are inclusive to all, including elderly, digitally-illiterate and disabled citizens (HR, GR).
- Need for simple and personalised digital public services implementing the Once Only Principle (HR, GR, AT)
- Need for better information provision on public services, i.e. better structured and up-to-date information (HR, GR)
- Need for enhancing the digital skills and domain knowledge of public administration personnel (HR, GR, AT) and of citizens/businesses (GR, AT)
- Need for extroverted public administrations performing visibility activities and proactive communications to citizens and businesses, e.g. promotion of opportunities for citizen engagement (HR), notifications regarding due dates (GR), information on how tourism taxes have been used (AT).

Following, in **Table 8-24** and **Table 8-25**, we summarise the functional and non-functional user requirements of all inGOV pilots. The requirements with coding in bold fonts are the ones of priority, i.e. considered the most crucial ones for delivering an acceptable solution by the stakeholders.

Table 8-24. Functional requirements of all inGOV pilots

Type	No	Requirement	MT	HR	GR	AT
Finding public services and information	**HR-F01**	Identification of (information on) available public services via a (FAQ) chatbot / virtual assistant		✓		
	HR-F02	Browsing through available public services in a structured, coherent manner		✓		
	HR-F04	Forwarding of complex inquiries to City's administration		✓		
	HR-F05	Ability to browse through all documents published by the City administration		✓		
	GR-F12	More comprehensive, better organised and up-to-date information should be available via the website and mobile application			✓	
	GR-F13	Include a Frequently Asked Questions (FAQ) page on this service			✓	

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	GR-F14	Minimise the chance of missing important deadlines (e.g. due dates for applications) through better communication and updates via the media as well as other websites on disability			✓	
Importing of information	GR-F01	The system should be able to retrieve the necessary citizen information if available elsewhere (e.g. certification of home address)			✓	
	GR-F02	By clicking a button, the citizen should receive his/her supporting documents that are available in issuing authorities' information systems			✓	
	GR-F03	The supporting documents should be uploaded by the citizen, either as scanned files (e.g. .pdf, .jpg) or photos taken via the citizen's mobile phone and be easily replaced / re-uploaded if needed			✓	
	GR-F11	The system should maintain the supporting documents of the previous request and make them available for card renewal, so that the citizens has the option to keep some of these document (if still valid) and replace only the expired ones.			✓	
	AT-F01	Upload / import of data exported from hotel software and/or connectivity to hotel software				✓
	AT-F02	Web form for the accommodation providers to insert overnight stay tax data				✓
	AT-F06	The solution should facilitate the possibility of non-digital submissions of tax by accommodation providers				✓
Processing	MT-F01	Ability to query over and view (i.e. through different visualisations) different household compositions (e.g. familial relationships-based, address-based)	✓			
	MT-F02	Ability to categorise households according to different criteria	✓			
	GR-F04	There should be an automatic email notification to the authorised public servant of the Region's competent department when a citizen's request for card is submitted.			✓	
	GR-F05	The public servant of the Region should be able to view/receive online all supporting documents (coming either from a citizen or from another public authority)			✓	
	GR-F06	The public servant of the Region should be able to cross-check and verify citizen's eligibility online (even if supporting documents are provided non-digitally)			✓	
	GR-F07	The validity date of each document should be recorded by the public servant in the system (i.e. the date until which the document is valid and may be accepted as supporting document)			✓	
	GR-F10	Recognise user's disability type in order to automatically issue the corresponding documents and information (e.g. for people with vision problems the service issues also a card for the disabled person's companion)			✓	
	AT-F03	Automatic tax calculations				✓
	AT-F04	Accommodation providers should be able to pay via the web form				✓

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	AT-F05	There should be feedback to the accommodation provider that everything worked out ok with tax submission to the local council				✓
	AT-F07	The existing checking function on data and finances should be maintained				✓
	AT-F08	Automatic creation of tax report file				✓
	AT-F09	Automatic dispatch of tax report file to Land NÖ and update of Land NÖ systems (the Tourism Tax Administration Tool)				✓
	AT-F10	Automatic bank transfer for paying tax share to Land NÖ				✓
Outputs and exports	MT-F03	Exporting of results in different data formats (preferably using standards)	✓			
	HR-F03	Ability to obtain the chat transcript via email		✓		
	GR-F08	There should be an automatic email notification / SMS to the citizen notifying him/her on the availability of the digital discount card or its rejection			✓	
	GR-F09	The citizen should be able to download the digital card, print it or show it directly via the mobile phone screen when getting in the bus (instead of the physical card); however, the physical card will also be sent by post as now			✓	
	GR-F15	Subscription to a notification service in order to get direct notifications, e.g. via newsletters or SMS			✓	
	GR-F16	The notification service should provide personalised briefing			✓	
	GR-F17	The system should produce a report of beneficiaries' anonymised statistical data for the Ministry of Labour, Social Insurance and Social Solidarity			✓	

Table 8-25. Non-functional requirements of all inGOV pilots

Type	No	Requirement	MT	HR	GR	AT
Operational						
Interoperability	MT-NF01	Expose all functionality of the household unit public service via REST APIs to enable interoperability with other systems within public administrations, especially systems where source household data needs to be extracted from	✓			
	GR-NF13	Address the lack of a clear legal framework for interoperability			✓	
	GR-NF14	Interlink with the information systems of the public authorities that are providing the supporting documents for the service			✓	
	AT-NF10	Eliminate technical errors at the interfaces between stakeholders; minimise interfaces to consequently minimise interface error rates				✓
	AT-NF11	Data transfers should be made according to agreed structured formats				✓
	AT-NF12	The solution should be interlinked with current existing systems and integrated tools, e.g. with hotel software, the Tourism Tax Administration Tool, Gemdat.				✓

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Integration	MT-NF02	Integrate data from the Person and Address base registers, when they are made available (currently a work in progress)	✓			
	MT-NF03	Integrate data from multiple entities who agree to participate in pilot	✓			
Data integrity	MT-NF11	Address data inconsistencies, i.e. registers holding different values for the same field, records in different languages, etc.	✓			
	MT-NF12	Enable the use of Maltese characters	✓			
	GR-NF06	Re-use existing user information			✓	
	GR-NF07	Address semantic aspects regarding the exchanged data (e.g. supporting documents)			✓	
	AT-NF01	Minimum chance of errors during user entries				✓
	AT-NF02	Utilisation of forms with pre-filled data (e.g. name of the local council that will collect the tax, location of accommodation, date of application, type of tax, etc.)				✓
	AT-NF03	A unique identification ID should be used for each overnight stay tax report in order to easily associate reports and payments				✓
	AT-NF04	A unique identification ID should be used for each tax report file in order to easily associate tax reports and tax share payments				✓
	AT-NF05	Utilisation of a coding system for local councils that is already used in other services				✓
	AT-NF06	Implementation of the Once-Only Principle, data should be entered only once and transferred among systems				✓
Channels	HR-NF05	All functionality accessible via both web browsers and a mobile application		✓		
	GR-NF11	The service should be offered both via PC web browsers and mobile applications, with both channels offering the same functionality			✓	
Usability	MT-NF04	Simple and easy to use user interface that hides back-end complexity	✓			
	MT-NF05	Enable the representation of different household compositions	✓			
	MT-NF06	Enable the representation of household changes over time	✓			
	HR-NF02	Simple, user-friendly interface		✓		
	HR-NF03	Simpler navigation to available services		✓		
	HR-NF04	Easily accessible and usable by all citizens, even elderly and digitally illiterate		✓		
	GR-NF04	Accommodate all forms of disabilities, including users with impairments to their vision (blind, partially sighted or colour blind people), hearing (people who are deaf or hard of hearing), mobility (people who find it difficult to use a mouse or keyboard), thinking and understanding (people with dyslexia, autism or learning difficulties)			✓	

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	GR-NF05	The website and mobile application should be simple and understandable, easy to use it without having much technological knowledge			✓	
	AT-NF09	Graphical interface for user entry				✓
Extensibility	HR-NF06	"Becoming smarter" chatbot / virtual assistant, i.e. learning from previous inquiries		✓		
Findability	GR-NF12	The website should appear high in search engines' results list			✓	
Performance						
Efficiency	HR-NF01	Fewer citizen inquiries related to mundane tasks or administrative requirements		✓		
	GR-NF01	Minimise the time needed to re-issue the discount card (e.g. when lost)			✓	
	GR-NF02	Minimise the effort needed for card's annual renewal, e.g. facilitate automatic renew if there is a valid certificate of disability			✓	
	GR-NF03	Perform the service fully digitally so that beneficiaries do not need to visit the public authority			✓	
	AT-NF07	Minimisation of paper printouts				✓
	AT-NF08	Reduction of workload, i.e. of time and personnel needed for the service				✓
Security						
Authentication & Authorisation	MT-NF13	Public Administration access control (user authentication and authorisation)	✓			
	GR-NF08	User authentication via TAXISnet credentials			✓	
	GR-NF09	Unified user access so that users log in to both the web page and the mobile applications with the same credentials			✓	
	GR-NF10	Classified access according to different user roles, i.e. citizens, public servants, administrators			✓	
	AT-NF13	User authentication is needed; individual people and businesses in Austria should authenticate themselves with an e-card or with a mobile phone signature (eID)				✓
Cultural & Political						
Legal compliance	MT-NF08	Compliance with GDPR	✓			
	MT-NF09	Household register should have a legal basis for data collection / processing	✓			
Scientific compliance	MT-NF07	Use of established standards and specifications such as Core Vocabularies and APIs	✓			
	HR-NF07	Adoption of structured templates and guidelines for services' description using knowledge graph and service description metadata with associated technologies (CPSV and CPSV AP)		✓		
Technical compliance	AT-NF14	The solution should be based on open-source concepts				✓
Ownership	MT-NF10	Household register should have a defined owner	✓			

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8.8 Conclusion

Work reported in this chapter set out to elicit the needs and requirements of all stakeholders involved in inGOV pilots. This was performed in the form of interviews, conducted physically or online, based on a questionnaire template. Overall, 98 stakeholders have been interviewed in all four pilot countries, including 8 policy makers (Malta, Croatia, Greece and Austria), 37 public servants (Malta, Croatia, Greece and Austria), 47 citizens (Croatia and Greece), 3 businesses and 3 business representatives (Austria). Analysis has been reported on a per pilot basis, including detailed analysis of interview responses; of provided user stories; of usage scenarios in textual and graphical format; and of the resulting user needs and requirements, followed with a summarisation and prioritisation of user needs and requirements.
Work reported in this chapter will be feeding into the upcoming inGOV work packages as follows:

- WP2 referring to IPS holistic framework, will find useful the elicited user needs, especially as regards aspects relevant to co-creation and IPS and the different elements of the IPS-Co.
- WP3 on ICT architecture and tools, will take advantage of the usage scenarios and the elicited user requirements for developing system specifications of the solution.
- WP4-Pilots planning and evaluation, will exploit first, the pilots' envisaged to-be situation in order to start detailed planning of the piloting activities, and second, the relations formed with interviewees for involving them further in the project, e.g. in user workshops and testing.
- WP5-Sustainability and policy recommendations will get as input the stakeholders' responses regarding sustainability aspects.

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WP1 General Conclusions: Towards a IPS Holistic Framework

This deliverable has addressed two scientific and innovative objectives in an integral and comprehensive manner:

- S.I.O. 1: to understand stakeholders needs and state of play in IPS co-creation within the EU value ecosystem.
- S.I.O. 2: to construct the GaaS and GaaP conceptual models, meaning the development of the IPS Co-creation Conceptual Model (IPS-Co) and the enhanced Core Public Service Vocabulary (CPSV).

Addressing both objectives required the development of our understanding on the co-creation concept. This involved the development of our own definition of co-creation. In inGOV we have defined co-creation in Chapter 2 as *the voluntary and active involvement of (I)PS end-users in any phase of the design, delivery, and evaluation of (integrated) public services.* This was one of the main bases to construct the GaaP conceptual model meaning the development of IPS-Co. The IPS-Co framework is based on Chapter 1, Chapter 2, Chapter 3, Chapter 4, Chapter 5 and Chapter 6 which included the CPSV-AP model. IPS-Co presented in Chapter 7 is composed by 9 elements: 1) Integrated Public Services, 2) Co-creation process, 3) Service Users, 4) Service Providers, 5) Privacy and Security, 6) Internal Information Sources and Services, 7) External Information Sources and Services, 8) Technology and 9) Catalogues.

Integrated Public Services is moving towards the involvement of public service users in the provision of public services, through co-creation processes for users to bring their specific resources and talents to the design, creation, and implementation of services [4]. Therefore, in IPS-Co and inGOV, we see IPS stakeholders not only as citizens or businesses, but as service users and service providers. The public sector is not the anymore the sole provider of public services. IPS-Co encompasses three stages of the public service cycle in the co-creation process: co-design, co-delivery, and co-evaluation. Co-design stage entails the involvement of IPS users in consultation and ideation of service design elements that aims for a more user-centric experience. The co-delivery stage involves IPS users in the implementation and management of IPS. The delivery phase includes the coordination function. In co-evaluation is where the assessment of a provided service can take place.

Regarding the service users, when seeing through the co-creation lens, users can be actively involved in the design, delivery, and evaluation of public services in collaboration with government and other stakeholders. Under the IPS-Co model, therefore, service development and maintenance consequently become two-way processes, characterised by, not just unidirectional or one-time involvement, but instead a continuous interchange of ideas and feedback between service users and service providers. Meanwhile, in terms of the service providers concept, when seeing from a co-creation perspective implies that governments have begun to not only regularly consult service users about their needs, but instead also actively encourage their direct and active participation in service design, delivery and evaluation.

When considering internal information sources and services, we can conclude that the IPS-Co framework focuses on personalisation, integration, and co-creation. For example, regarding the provision of public services, IPS-Co suggests promoting personalization by exploiting enhanced CPSV-AP in order to provide customised informational public services according to the specific characteristics of end-users. Additionally, the provision of open (government) data should target the fulfilment of citizens' needs. In

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order to collect citizens' needs, for the provision of services and data, public organisations should incorporate mechanisms for more active participation of end-users and other stakeholders. Integration of data is considered a prerequisite for integrated public service provision and for a richer user experience. Regarding the external information sources and services, we consider that should be exploited for integrated public service provision. Therefore, external data sets available through the semantic web, the social web or the Internet of things should be exploited for a richer and more personalised user experience in public service provision. A public administration should have a clear strategy for the exploitation of external data sources and services, and their integration with its internal data sources and services.

The IPS-Co framework suggests that catalogues should promote personalisation, integration, and co-creation. Personalisation should be promoted by facilitating citizens' acquisition of information that matches their exact needs and characteristics. Several technologies possessing key benefits stand out when considering co-creation and IPS. In IPS-Co, we are analysing blockchain, mobile apps, chatbots (virtual assistants), and knowledge graphs with linked open data and IoT.

Privacy and Security are relevant when considering IPS co-creation. For example, when considering user oriented-services privacy, the information on users should be asked once only and reused many times, taking into account the protection of personal data and maintaining privacy and confidentiality. Taking trustworthiness and security into consideration can facilitate both the adoption of technology and the engagement of users, and in turn, can enhance the trust.

The principles for the IPS-Co have been tailored taking into account IPS and co-creation: (1) Subsidiarity & Proportionality; (2) Openness; (3) Transparency; (4) Reusability; (5) Technological neutrality & data portability; (6) User-centricity; (7) inclusion and accessibility; (8) Security and privacy; (9) Multilingualism; (10) Administrative simplification; (11) Preservation of information; and (12) Assessment of effectiveness and efficiency.

IPS-Co as described above can provide the conceptual basis to implement Government as a Platform (GaaP) for IPS. GaaP "is based on a digital foundation for government to share data, software and services, and has been proposed as an efficient, effective and innovative model for government" [21]. All these aspects are being considered by the elements of IPS-Co. The digital foundation is clearly reflected not only in the key component of the model technologies but also in the relationship between service users and service providers through the co-creation of IPS in order to facilitate the efficiency, effectiveness, and innovation of public services. Furthermore, privacy and security are elements that need to be taken into account to facilitate trust and collaboration among the different stakeholders.

In the same vein, IPS-Co can provide a conceptual base for Government as a Service (GaaS). GaaS envisions public administration operations as a set of public services that are described in relevant catalogues, facilitating transparency and citizens participation, and provided by eGovernment information Systems. CPSV-AP can be either used as a blueprint for new PS models development or as a gateway for both bridging and federating PS catalogues and eGovernment Information Systems, increasing reusability and quality and in parallel lowering implementation cost. Consequently, it facilitates semantic interoperability. Moreover, CPSV-AP incorporates linked data as an underpinning technology, enabling integration of PS descriptions to the linked open data cloud (See Chapter 6 for more information). This GaaP and GaaS approaches will be fully developed in Work Package 2 of the inGOV project where the development of the IPS Holistic Framework (IPS-HF) will take place. IPS-HF will enable identifying and addressing all legal, cultural, and managerial challenges. Figure A-2 below depicts a general scenario of this future integration.

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Yet, it is important to mention that this is a living document, which changes can take place as inGOV project develops.

Chapter 8 has focused on understanding the needs of the stakeholders of the four pilot sites of inGOV project and in relation to the public services addressed in these pilots. Nonetheless, feedback from pilot stakeholders is in line with the aforementioned theoretical findings and proposals of IPS-Co elements as follows.

- IPS and co-creation: stakeholders agree on the importance and value of co-creation and gladly see themselves as part of co-creation processes; however, most stakeholders (especially citizens) still see themselves relevant not to be "providing" but to be "consulting" on the services and mainly in the co-design and co-evaluation phases.
- Service users demand for two-way processes and when they get a unidirectional or one-time involvement, they feel disappointed and demotivated to re-engage. Some service users reported being already involved in co-creation processes, however it seems that this needs to be strengthened more
- Catalogues and Information sources and services: personalisation, integration and co-creation are aspects desired by stakeholders who now expect a richer user experience in public services provision allowing them to save time and effort, e.g. not resubmitting documents that government has available elsewhere.
- Technology: Pilot stakeholders confirmed interest to use innovative technologies and in specific mobile apps, chatbots (virtual assistants) and knowledge graphs. Especially mobile apps are requested by citizens as they find it a convenient means to perform public services.
- Privacy and security aspects are required in inGOV pilots, without however losing the conveniences of personalisation and integration, such as implementation of once Only Principle.

As regards the principles of IPS-Co, most came up in the requirements discussions as well, i.e. user-centricity; inclusion and accessibility; transparency; administrative simplification; reusability; technological neutrality & data portability; security and privacy; multilingualism; effectiveness and efficiency.

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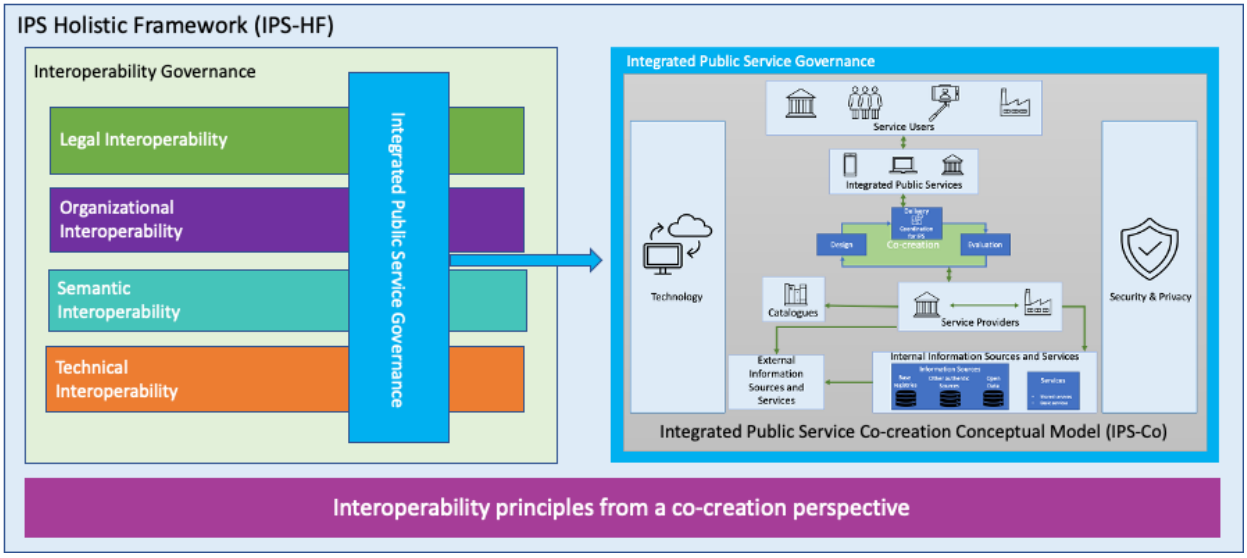

Figure A-2. Towards an IPS Holistic Framework

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