D1.6 Updated EU Building Blocks supporting Once Only and standard data sharing patterns

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List of Acronyms

Abbreviation / acronym	Description
API	Application programming interface
AS4	OASIS Applicability Statement 4
BB	Building Block
SMP	OASIS Service Metadata Publisher
CEF	Connecting Europe Facility
DE4A	Digital Europe For All
DESI	Digital Economy and Society Index
DG DIGIT	European Commission's Directorate-General for Informatics
DG GROW	European Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DSI	Digital Service Infrastructure
Dx.y	Deliverable number y, belonging to WP number x
EBP	European Blockchain Partnership
EBSI	European Blockchain Service Infrastructure
EEA	European Economic Area
eID	Electronic Identity
eIDAS	Electronic Identification, Authentication and Trust Services
EIF	European Interoperability Framework
ESSIF	European Self-Sovereign Identity Framework
EU	European Union
EC	European Commission
eID	Electronic Identity
GDPR	General Data Protection Regulation
ICT	Information and Communication Technologies
ISA^2	Interoperability Solutions for Public Administrations, Businesses and Citizens
OOP	Once Only Principle
PEPPOL	Pan European Public Procurement Online
SDG	Single Digital Gateway
SDGR	Single Digital Gateway Regulation
SEMPER	Secure Electronic Marketplace for Europe

Abbreviation / acronym	Description
SML	PEPPOL Service Metadata Locator
SSI	Self-sovereign identity
TOOP	The Once Only Project
WP	Work Package

Executive Summary

The project Digital Europe for All (DE4A) was launched in January 2020. It is the result of collaboration of 23 organizations from 9 countries of the European Union. The project is funded by the EU Horizon 2020 research and innovation Framework Programme and is aimed to create an inclusive digital Environment in Europe ensuring the Single Digital Market rights of citizens and businesses by building on secure, privacy-preserving and trustworthy realization of fundamental once-only, relevant-only and digital by default principles. The DE4A large-scale pilot reinforces the connectivity of national digital endeavors and, building upon the existing infrastructure, it attempts to contribute to an overarching eGovernment network for Europe supporting parallel efforts from the EC and the Member States to realize the Once-Only Principle Technical System in compliance with Single Digital Gateway and aligned with the EU eGovernment Action Plan 2016-2020 [1], the Tallinn Declaration [2] and the EIF Implementation Strategy [3].

The purpose of this study is to take stock of the existing reusable Building Blocks supporting data sharing, Once Only Principle and interoperability, enabling the implementation of services for citizens and business in the European Union. This study is one of four studies designed to chart the current landscape of digitalization in Europe. The initial studies in this series were: D1.1 Member State eGovernment Baseline, which elaborated on the advancement of the existing eGovernment landscape at the beginning of the DE4A; D1.3 Member State Once Only and data strategy baseline, which analyzed the Once Only capabilities at regional and national level in the same period in terms of Once Only capabilities related to cross-border services, national data strategies and generic access to base registry services, and D1.7 Legal, technical, cultural and managerial barriers, which elaborated on the drivers and barriers to the implementation of OOP.

Together with the D1.2 “Update of Member State eGovernment Baseline”, D1.4 “Updated Member State Once Only and Data Strategy Baseline” and D1.8 “Updated Legal, technical, cultural and managerial risks and barriers”, this set of updated deliverables serves as both a testament for the DE4A contribution in the development of eGovernance services from design and implementation perspective, and as an experience-based list of relevant recommendations and lessons learned that may be used to guide future developments in the area.

The EU programs ISA^2 [4] and CEF Digital [5] are the main contributors of generic building blocks, supplemented with results from the EU projects “The Once Only Project” (TOOP) [6] and SEMPER [7]. TOOP has developing and piloted building blocks intended to support the SDGR [8] implementation actions, whereas and SEMPER has developed and piloted extension to eIDAS [9] supporting “Powers and Mandates”.

An initial selection of building blocks deemed relevant for DE4A was made in the report preceding this one, in 2020 (D1.1). The current study accounts for the current EU digital service infrastructures and building blocks implemented across the Member States. Moreover, in a collaborative effort with WP2 and WP4, it provides the intermediate and the final list of building blocks relevant for DE4A, discussed both from the perspective of the architecture design and of the DE4A pilots’ implementation.

The result of the survey data has identified more than 30 use cases across different cross-border EU projects and initiatives, in which the responding Member States participates. 42% of these use cases are an ongoing effort, while additional 29% are planned for implementation. This demonstrates a highly increasing trend of cross-border OOP efforts, but also calls for immediate addressing of the barriers identified through these efforts in order to provide reusability of the results. Such effort is in fact DE4A itself – as the results of this study also show, it does not only reuse existing building blocks, but it also aims to provide reusability of its results. In that context, the current study also shares experiences from the design and implementation efforts within the project.

The report also observed that up to 81% of the responding countries have a national strategy of reusing public sector data and a positive trend in that regard, considering that with the first phase of data gathering, this number was ~50%. Moreover, there is a specific strategy for Open Data in 69% of the respondents' countries.

However, with only 34% of the countries providing positive answer for regional implementation of the OOP, the overall OOP implementation is still low, especially considering the 2023 deadline for SDGR implementation.

Finally, the study finds that most of the Member States have an e-Delivery infrastructure in place, implemented with one more access points from the list of EU recommended profiles. However, there are still concern over the national (infrastructure) parts of the OOP technical system, the biggest of which are the concern over the adaptation of data sources (shared by 67% of the respondents), as well as the adoption of SDGR procedures to the national context (expressed by 60% of the respondents).

1 Introduction

1.1 Purpose of the document

The present report is conducted under the Digital Europe for All (DE4A) project and constitutes the deliverable D1.6. The purpose of this study is to provide an overview of the Digital Service Infrastructures and Building Blocks at EU-level, their implementation and adoption practices across the Member States, and their relevant from a DE4A perspective. Thus, the report takes stock of the existing reusable Building Blocks supporting data sharing, Once Only and interoperability, which enable the implementation of services for citizens and businesses in the European Union (EU). It is an updated study of the D1.5 report that delivered in initial overview of building blocks available and relevant for reuse by the DE4A.

In order to document the DE4A contribution on infrastructure reuse, as well as the common practices for internal partner liaisons, notably with the architecture and piloting tasks, this study is one of four reports designed to chart the current landscape of digitalization in Europe. Thus, the current text is complemented by the following deliverables:

- D1.2 Update of Member State eGovernment Baseline, which elaborates on the current advancement of the European eGovernment landscape;
- D1.4 Updated Member State Once Only and Data Strategy Baseline, which takes stock of the existing Once Only capabilities at regional and national level, Once Only capabilities related to cross-border services, and national data strategies including generic access to base registry services; and
- D1.8 Updated Legal, technical, cultural and managerial barriers, which elaborates on the benefits of, barriers to and the enabler for OOP implementation, as well as the perceived willingness towards adoption of available digital services.

Describing the existing infrastructures, practices, expected benefits, encountered barriers and recommended enablers, this set of updated deliverables serves as both a testament for the DE4A contribution in the development of eGovernance services from design and implementation perspective, and as an experience-based list of relevant recommendations and lessons learned that may be used to guide future developments in the area.

1.2 Structure of the document

This document is divided into six main sections:

- Section 1 gives introductory context to the matter of the research;
- Section 2 elaborates on the utilized methodology and data sources for the analysis;
- Section 3 presents a catalogue of Digital Service Infrastructures and use case participation in EU projects and initiatives of the Member States, as well as empirical analysis of their national data strategies and overall OOP implementation;
- Section 4 discusses these topics in view of the DE4A project activities and provides lessons learned by the architectural design and the pilot implementation;
- Section 5 discusses the results from the survey data analysis and from overall EU DSI perspective, putting them in prospect of the Europe's digital strategy; and finally
- Section 6 provides concluding remarks.

The document additionally includes an Annex – DE4A Survey, providing a view on the entire questionnaire distributed to the member states' CIOs. The responses to the survey fed into the major part of the data analysis of the report.

1.3 Background

In order to understand the (importance of the) idea of architecture components and building blocks' reusability, it is important to get a glimpse into the historical context leading to that idea.

With the initiation of the large scale pilots (LSPs) proceeding from the STORK [10], PEPPOL [11], and epSOS projects [12], the idea of launching projects together gained momentum, especially accelerating the development of new building blocks with the start of the eSENS project [13]. This, in and of itself, represented a paradigm shift in the offering of digital and cross-border public services. However, in order to deliver user-centric, yet efficient digital public services, a change of common practices between the different corners of the administration was also needed. Thus, both the administrations and the European Commission realized the need and the opportunity to reuse common services and common architectural building blocks.

Effective eGovernment can provide a wide variety of benefits: more efficient public services, less administrative burden for both the public and the private sector, and greater transparency of the digital procedures, ultimately increasing the trust in the institutions, which is a prerequisite for a flourishing economy. With that realization came the idea of the once-only principle (OOP), as a concept that in the broader context of eGovernment would ensure that business, citizens, and other organisations will provide specific information to administrations and governmental authorities only once. The principle was defined as one of the key enablers for eGovernment in Europe by the Tallinn Declaration on e-Government at the ministerial meeting during the Estonian Presidency of the Council of the EU on 6 October 2017 [2], succeeding the earlier eGovernment Action Plan 2011-2015 [14] and coinciding with the new Action Plan 2016-2020 [1]. With the start of the OOP activities in Europe, the initiation of the TOOP project also came, which, unlike the previous LSPs, was a horizontal and highly policy-driven effort, with the aim to make the implementation of OOP in a cross-border and cross-sector a reality [6].

Ever since the launching of the implementation efforts surrounding the OOP principle, the increase of online interactions and the emergence of new needs for organizing daily lives (e.g. working and doing business), has also been growing steadily. The need for online availability of public services has especially been accelerated by the COVID-19 pandemic, during which digital interaction had to become the norm. Although this has brought to light the tremendous facilitating power of digital technologies, the technologies, in turn have require appropriate digital connectivity infrastructures in order to function. With that, new demands and expectations have been placed on all actors that are in the interplay of providing digital services, of which the public sector plays a key role.

Thus, Europe unrolled it Digital Decade Agenda, setting as a target for all key public services for businesses and citizens to be fully online by 2030 [15]. Although studies on eGovernment benchmarks have found that many of Member States are already close to that target, the progress is uneven across and within Member States [16]. Moreover, services for citizens are less likely to be available online when compared to services for businesses. Thus, one of Europe's objectives for furthering the digital transformation is to boost access to and uptake of digital public services by both individuals and businesses, with key reforms proposed on the integration of eID solutions in all government processes, and on the implementation of the Once Only Principle. In that regard, the Connecting Europe Facility – Digital (CEF Digital), together with other funding instruments, aims to support the investments in safe, secure, and sustainable high-performance digital infrastructure, through both funding and a rich repository of reusable digital infrastructure services [17].

In light of the goal of creating a single digital space of Europe, the DE4A project aims to create an inclusive digital environment for the EU citizens and businesses, ensuring widespread availability and adoption of the public administration services, while the exercising their fundamental rights and freedoms. Supporting the EU Public Administration in addressing the existing challenges in the

implementation of the digital cross-border initiatives, the DE4A contributes to the realization of the above-mentioned Single Digital Gateway Regulation (SDGR), the EU eGovernment Action Plan 2016-2020, the Tallinn Declaration and the European Interoperability Framework (EIF) Implementation Strategy.

The present report will examine the availability of reusable building blocks and digital service infrastructures, and analyze them in light of the reusability for implementation of public services both nationally and cross border between Member States, as well as from a project (design and implementation) perspective. The building blocks are considered to be an important enabler of interoperability of services and efficient secure data sharing infrastructures supporting the Once-Only Principle (OOP).

The main sources and repositories of the generic building blocks considered in this report are the EU programs "Interoperability solutions for public administrations, businesses and citizens" (ISA^2) [4] and the Connecting Europe Facility - Digital (CEF Digital), together with the EU projects "The Once Only Project" (TOOP) and "Secure Electronic Marketplace for Europe" (SEMPER).

The ISA^2 Programme is the successor of the Interoperability Solutions for European Public Administrations programme. It has been supporting the development of digital solutions that enable public administrations, businesses and citizens in Europe to benefit from interoperable cross-border and cross-sector public services since 2016. In addition, CEF Digital have supported the finalization of the Digital Single Market Agenda by connecting Europe through 'digital bridges' (Digital Service Infrastructures) for the benefit of citizens, businesses and public administrations. It has promoted the vision of public services being not only digital by default but also cross-border by default. There are two types of Digital Service Infrastructures (DSIs):

- **Sector-specific DSIs** that deploy complex trans-European digital services based upon mature technical and organisational solutions: eProcurement, Cybersecurity, eHealth, eJustice, Online Dispute Resolution, Europeana, Safer Internet and Open Data;
- **Architectural building blocks,** which provide basic and re-usable digital services and can be integrated with other DSIs, LSPs and IT projects to produce efficient cross-sectoral and cross-border architecture solutions.

In addition to providing a proof that the exchange of business-related data or documents with and between public administrations without administrative burden is a viable solution, TOOP has also designed new building blocks available for reuse. These, together with SEMPER's eID solutions on authorization, have also provided a valuable source for reusable solutions considered by the DE4A.
The remainder of this report shares the results from the analysis of the European eGovernment ground in terms of digital service infrastructure and building blocks' (re)use, as well as the state of OOP implementation and national data strategies that support it. It then approaches the topic from e DE4A perspective, in order to provide a project-specific picture of the advancements made throughout its lifespan, and to share relevant experiences and insight that serve to the general aim of reusability.

2 Approach and methodology

2.1 Approach and objectives

In its first phase, the study on the Baseline EU Building Blocks (BBs) investigated the availability of generic building blocks from the EU programs and projects in order to facilitate the design of advanced services provisions and data sharing solutions as part of the DE4A solutions (the project start architecture, the pilots, and the technical components). As a result, it provided a catalogue of 26 BBs divided into 4 types: CEF, ISA2, TOOP and SEMPER. This list was obtained primarily based on desktop research, and was then assessed for project-relevance.

In the course of the project, however, a wider list of BBs was considered for implementation as part of the DE4A reference architecture in WP2 (see D2.4 [18]). These BBs were systematized and assessed from several aspects, producing a project-relevant baseline for EU BBs to be reused by DE4A project start architecture.

This study reconciles the two approaches, establishing strong interdependence with WP2 and WP4. In addition, it widens the scope with analyses that go beyond project relevance, investigating the state on EU BBs as part of the member states' digital services infrastructures and their involvement into relevant EU initiatives. Finally, a thorough desktop research complements this analysis with a rich set of monitoring and evaluation data obtained from other projects and initiatives (CEF dashboards [19], DESI [16], NIFO [20], etc).

2.2 Scope

The study covers the main European programs supporting digital interoperability building blocks, ISA^2 and CEF Digital. In addition, relevant EU projects, such as TOOP and SEMPER, are included among the relevant repositories of reusable architectural solutions.

For all of the programs and projects included in the study, priority is given to the identification of generic reusable building blocks that support specific functions or capabilities relevant across domains and use cases. This refers to the building blocks enabling interoperability and reusable implementation of services, and excludes some building blocks that are mainly domain specific (such as the CEF domain specific DSIs).

The geographical scope of the research was covering the 27 Member States of the European Union and was additionally complemented by the EFTA states (Iceland, Liechtenstein, Norway, and Switzerland). The survey questionnaire (see Annex) was sent out to 31 state representatives, covering the aforementioned eGovernment initiatives. The responses were received from 18 countries (17 member states and 1 EFTA country) - Austria, Belgium, Bulgaria, Croatia, Ireland, Italy, Latvia, Liechtenstein, Luxembourg, Malta, Netherlands, Portugal, Romania, Slovenia, Spain, Sweden, Hungary, and the Czech Republic – amounting to a representativeness of 58% of all (EU+EFTA) countries, and 63% of the member states.

For the second phase of data gathering, several changes were made prior to survey submission:

- First, the survey was revised to lower the amount of subjectivity inserted by the answers in the first phase;
- Second, the topics of interest were revised to match the current EU trends on eGovernance. Thus, the existing survey chapters were revised in terms of redundancy, and an entirely new chapter on Digital Identity Wallets was added.
- Third, the methodology was revised to allow for simpler, yet less subjective data analysis;

Finally, the overall approach was revised based on the reviewers' comments, the experiences from the first phase of data gathering, and the remarks obtained from internal and external project partners.

It is important to note that the present report should not be seen as an isolated WP1 deliverable, but as piece of a deliverable set whose parts complement each other. Thus, it is advisable that all four deliverables: D1.2, D1.4, D1.6, and D1.8 are read as a single document.

2.3 Data collection and analysis

Combining both qualitative and quantitative research methods, the study used following data sources for the assessment of the eGovernment baseline:

- *Data collection survey*. The survey was targeted at the current eGovernment advancement of European states and consisted of 5 major subjects: Electronic Identification and Trust Services, European Digital Identity Wallets, Single Digital Gateway, Digital Service Infrastructures and Once-Only Principle and Data Strategy. The online survey was distributed to the Member States' CIOs of and EFTA countries and the data was collected between March 31st and August 22nd, 2022. The respondents were suggested to also evaluate the performance of their countries with respect to the indicated topics. The questionnaire offered the respondents a possibility to supplement the submitted data with additional comments illustrating country-specific context relevant for understanding the particular eGovernment initiative.
- *Desk research*. The insights derived from the survey are supplemented by the analysis of the existing policies and reports relevant for comprehension of the general eGovernment domain, as well as its advancements along the five topics of interest in the context of reusable Digital Service Infrastructures and Building Blocks. The EU policies stipulating development of the shared European digital space have been used as a guideline for survey design and analysis. At the stage of the response analysis, the data obtained via the survey was supported by contextualization of the EU MS' eGovernment development through research of relevant national strategies and legislative frameworks. The results from the survey provide the basis for rich context analysis of the respected country, but more important – for drafting policy recommendations supporting each stakeholder in the process of digital transformation through policy compliance.
- *Semistructured experts interview*. One of the distinguishing traits of this study compared to the more general overview reports (such as the eGovernment Benchmark reports, the Digital Economy and Society Index (DESI) and NIFO (National Interoperability Framework Observatory), is the ability to obtain information at a more granular level. This information comes from several sources: the DE4A pilots, the architecture iterations in relation to the implementation practices within DE4A, the contextual know-how obtained from the shared experiences with related initiatives (TOOP, SEMPER, BRIS, mGov4EU, etc.), and the dedicated experts interviews on the topics of interests. The results from the later are integrated into each of the major themes of the survey, enriching the contextual analysis of the survey results. More importantly, the insights from these interviews allow us to view the results from several different perspectives and address the whole specter of eGovernance stakeholders.

During pre-processing, survey data was cleansed and checked for consistency. Moreover, contextual information was extracted from the respondents' comments to add relevance to the analysis and to allow for a more granular view of the discussed issues. If needed, direct communication with the respondents was established to clarify the point of either the question or the position response of interest.

One major point that distinguishes this report from the previous (the one delivered from the first phase of data gathering) is the removing of the calculation methodology. The employment of this

methodology was deemed as an inappropriate effort for several reasons: first, the methodology was applied to a data containing too subjective answers, making it both inaccurate and inadequate. Second, it was applied to an incomplete dataset and for the purpose of scoring and ranking, which leads to incorrect results.

- *Meaningfulness of the responses*. For the survey targeted at the member sates' CIOs, it suggested the respondents to complete the questionnaire to the best of their knowledge, leaving out the possibility for abstaining from the answer if the information was not available. Unlike in the first phase, when the answers or choices of "Do not know" and "Not applicable" were not included in the quantitative analysis, these answers are included and considered as relevant to be shown in this phase. The reason for this is to get the impression about the respondents' engagement with the respective questions as a form of feedback that can trigger additional methodological revisions.

The results of the study reflect the current advancement of eGovernment of Europe, but it relies to a great extent on the information provided by the CIOs of the European countries. Acknowledging the challenge of gathering multifaceted information on eGovernment performance aggregated at the national level, such approach influences the impartiality of the study. Furthermore, the fact that the survey achieved a response rate of 58% (63% among the member states), requires to complement the analysis with information from additional sources. Moreover, this data should be consistent methodologically in order to provide relevant back up with information. For similar reasons, the study cannot be assumed to be representative for the complete geographical scope as well. These drawbacks have been partially overcome by the exhaustive desk research, the context analysis based on the free-text comments in the survey, as well as the semi-structured experts' interviews. The latter is also an argument towards mitigating the risk of biased representation of survey information.

This report has a few limitations. The main one relates to comparability of the country analysis that results both from the second phase and between the two phases. The reason is mainly the incompleteness of data obtained through the surveys and the low quality of the obtained feedback. In addition, not all countries that provided responses are the same in both phases. However, even if such feedback was perfect in both of the phases, it is not reasonable to draw conclusion about the contributions of DE4A for such outcome, as DE4A is not the only initiative that has been supporting the realization of Europe's eGovernment agenda. Therefore, where available, we support out results with data from other reports as well, but we abstain to make any comparative analysis, as data comes from different sources and is based on different methodologies.

3 Digital Service Infrastructures and Building Blocks

3.1 General overview of EU DSIs implementation

The OOP Technical System (OOTS) is not a monolithic system. Instead, it is a technical framework for data exchange, governed by the Member States and the European Commission. The OOTS data space is a fully distributed data space for trusted sharing between the independent systems of the Member State. To achieve this, the OOTS creates an interoperability layer based on common and mature building blocks (BBs) coming from various Europe Programmes that are part of the Europe's digital agenda. For example, the OOTS relies heavily on the eID BB (eIDAS cross-border electronic identification building block), as well as the eDelivery access points, to create a virtual secure network on top of the public Internet. It is also envisaged to be fully compatible with the (currently only proposed in the eIDAS revision) European Digital Identity Wallet as a new means of authentication to public services offering the 'once only' option.

The successful implementation and adoption of the OOP system by all relevant eGovernment stakeholders across Member States would mark a key milestone in the progress towards a shared European cross-domain and cross-border data space. In this data space, citizens and businesses will no longer have to supply the same data to public authorities more than once. Clearly, in order to become a reusable template for other data spaces, the OOTS needs to ensure that data flows securely within the EU, and to set privacy preserving functionalities in place, supporting the European data strategy.

By consolidating reusable blocks of infrastructure, the Connecting Europe Facility (CEF) establishes a set of sector-specific building-blocks and DSIs, which can later be deployed by Member States in their national eGovernment initiatives. To improve cross-border interoperability, the EU digital programme recommends reusing the developed building blocks in the respective national solutions, and also producing new reusable solutions themselves. With varying degree and purpose of employment, the EU DSIs and BBs have been implemented across different sectors and domains in the European countries. Table 1 provide a reference point for the use and significance of the DSIs implementation by the European countries and projects. The data in the table has been extracted from information obtained from the CEF monitoring dashboards.

Table 1: Implementation of Digital Service Infrastructures across countries

EU DSI	Implementation
eArchiving	**4** projects / **11** countries, **22** implementations or proofs of concept, 10 countries' national archives
eDelivery	**23** projects in **20** countries, **680** access points across **39** countries
eID	**72** projects / **26** countries, **25** countries deployed an eIDAS-Node that passed the interoperability readiness test
eInvoicing	**49** projects / **27** countries, **72** B2G solutions which successfully passed the EU Testing validation (conformance test)
eSignature	**72** projects **/ 26** countries
eTranslation	**29** projects / **29** countries
European Blockchain Services Infrastructure (EBSI)	**29** countries, including the **27** Member States, Norway and Liechtenstein, signed the EBP declaration.
Public Open Data (including both Big Data Test Infrastructure and Context Broker)	**40** projects / **27** countries, **20** organizations / **17** countries at the time of data collection

EU DSI	Implementation
Business Registers Interconnection System	**10** countries, **16** agreements have been awarded to BRIS
Cybersecurity	**100** projects / **28** countries, **More than half of all Member States** are involved with a given area of the EU Cybersecurity Strategy
Digital Skills and Jobs Platform	**26** countries, National Coalitions are present in **23** Member States
eHealth	**26** countries, **953** healthcare providers actively participating in European Reference Networks
Electronic Exchange of Social Security Information	**28** countries, **All the Member States** are connected to the Central Service Node through access points
eProcurement	**20** countries, **89** ESPD or eCertis service implementations
Europeana	**26** countries, **24** Generic Services Projects
European Digital Media Observatory	**18** countries, **8** Generic Services Projects
European e-Justice	**27** countries, **All Member States** participate in the European Court Database
EU Student eCard	**17** countries, **8** Generic Services Projects to promote student mobility
Online Dispute Resolution	**3** projects / **3** countries
Safer Internet	**30** countries / **114** Generic Services Projects **158 countries**, including **26 Member States**, participated in the **Safer Internet Day (SID) 2019**
Broadband	**3** Broadband infrastructure projects
WiFi4EU	27 Member States, 2 European Economic Area (EEA) countries and the United Kingdom. More than **8,800 European municipalities** participate in WiFi4EU

The two major initiatives that DE4A benefits from are OOP and SDG, whereas the projects with whom the most interdependencies can be established are: TOOP, SCOPP4C, the Estonian Catalogue of Public Sector Information, CODEX (Evidence2E), e-SENS and STORK. All of these rely on the use and reuse of the EU Digital Service Infrastructures enlisted in Table 1.

The implementation and maintenance of the DSIs, in turn, depends on the types of building blocks that are being (re)used for the various sectorial needs. The reuse and uptake data for each of the building blocks was until recently maintained and updated by the CEF (see Figure 1), but has now been migrated to EC premises [21].

Figure 1: Reuse matrix of CEF Building Blocks across Digital Service (and Sub-service) Infrastructures

The results from the first phase of the data gathering within WP1 showed high access (from 90 to 100%) to reusable public sector information, eInvoicing, eDelivery demonstrating one of the highest implementation scores, along with sector-specific DSI such as BRIS, eProcurement, and e-exchange of social security. On the other hand, EU student card, Online Dispute Resolution (ODR) and Automated translation showed considerably lower level of advancement. However, within their relevant contexts, the employment of the latter DSIs have also been on the rise, with eTranslation being employed in 29 projects across 29 countries and EU student card across 17 countries. ODR is slowly getting pace, with 3 countries using it as part of 3 projects.

Please note that the implementation of DSIs relevant for DE4A will be discussed later, in a separate section. At this point, we are only providing an overview of the general European state, so as to provide a baseline for the discussion on the survey data analysis.

On Figure 2, the analysis of the WP1 survey data shows that more than half of the countries report participation in use cases led by EU funded efforts for cross-border OOP implementation.

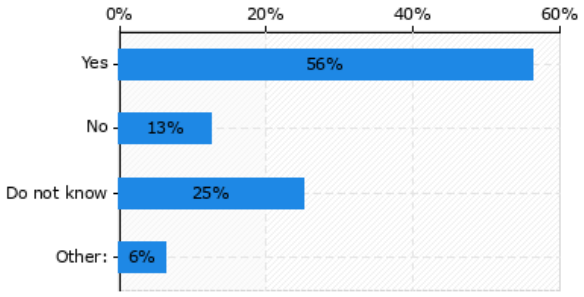

Figure 2: Countries' participation in EBSI, H2020, CEF Digital or RRF projects' use cases

A list of some of the projects is provided in Table 2, while the particular use cases related to those efforts are catalogued in

Table 3. The table was compiled based on the direct inputs of the countries' respondents and contains duplicate entries to point out the extent to which OOP is present across the different Member States.

More detailed analysis of a wide list of use cases and good practices for OOP implementation in Europe has been provided by the SCOOP4C project in [22]. In addition, studies on the implementation of DSIs across the Member States is available on EC-level as open data [23].

Table 2: List of EU projects in which responding countries participate

Country	Participating projects
Liechtenstein	BRIS, ECRIS, CEF, SPOCS, ISA2, DE4A, usw.
Austria	*None reported*
Sweden	TOOP, BRIS, CEF, ISA2, DE4A, ESENS, SCOOP4C, BRIS, CEF, BORIS, SD, eIDAS, SPOCS, eCODEX
Italy	TOOP, CEF, APIs4DGOV, APIs4IPS.
Republic of Bulgaria	TOOP, SCOOP4C, ECRIS, CEF, SPOCS, ISA2, DE4A
Hungary	TOOP, BRIS, EUCARIS, ISA2
Latvia	TOOP, ACROSS, INTERLINK
Spain	BRIS, SCOOP4C, ECRIS, CEF, ISA2, DE4A, EUCARIS, EESSI, etc.
Portugal	SCOOP4C, EESSI, ISA2, DE4A, SPOCS, CEF
Republic of Slovenia	TOOP, CEF (several projects, like SEMPER and NOBEL, and several more national), SPOCS, ISA2 (not a project, but a commitment program involving all MSs), DE4A, eSENS, STORK, STORK2, EUROPASS, INSPIRE, BRIS, EUCARIS, EESSI, PEPPOL, CODEX
Ireland	*None reported*
Belgium	BRIS, CEF, ISA2, STORK 1&2, PEPPOL,EIDAS, SDG, DE4A, SCOOP4C, Blockchain, etc.
Malta	ISA2 - Interoperability of European Public Services Expert Group
Romania	*None reported*
Netherlands	TOOP, DE4A
Czech Republic	*None reported*
Luxembourg	TOOP, BRIS, eCODEX, CEF, ISA2, DE4A, SDGR, EESSI, etc.
Croatia	TOOP, BRIS, ECRIS, CEF, ISA2, DE4A

Table 3: Use cases in which responding countries participate (with implementation status)

#	Name of use case	Status	Operational context
1	Document traceability	Planned	Expert
2	Horizon 2/2/ project ACROSS: VARAM use cases Study Abroad and Work Abroad	In production	Cross-border public and private services
3	EBP Technical and Political Group	/	/
4	BRIS	Implemented	/
5	Digital common household unit public service (Malta Pilot as part of the inGOV H2/2/ funded project, Grant agreement number 962563)	Planned	Public service provision
6	Diplomas	/	/
7	eDelivery network for Croatian crafts	In production	Exchange business data and documents in interoperable way in Croatia and to interact cross-border.
8	Diplomas	Planned	Expert
9	Horizon 2/2/ project INTERLINK: VARAM use case of Service Description Refinement	In production	Public services' co-production and co-delivery
10	EBSI Diploma group, EBSI Early adopters Diploma, EBSI Social Security group, EBSI Identity group, EBSI SME group, EBSI refugee group, EBSI notarization group	/	/
11	Cybersecurity	Implemented	/
12	Application of the Malta Natural Language Technology Platform (NLTP) in the legal domain (Malta Pilot as part of the NLTP CEF-Telecom funded project, Agreement number INEA/CEF/ICT/A2/2//2278398)	Planned	Public administration, SMEs, researchers, citizens and residents of Malta.
13	ESSIF	/	/
14	eINVOICING For Croatian Public Authorities (eICPA)	In production	eInvoice
15	ESSIF	Planned	Expert
16	CEF project Diploma pilot	/	/
17	eHealth	Implemented	/
18	In-LoRe (Croatian eInvoicing for Local and Regional Authorities)	In production	eInvoice
19	Social Security number	Planned	Expert
20	DEP project DC4EU	In production	Diploma and Social Security

#	Name of use case	Status	Operational context
21	eID	Implemented	/
22	Multilingual Resources for CEF.AT in the legal domain	In production	Language translation In domain European Digital Service Infrastructures
23	SME Financing	Planned	Expert
24	H2/2/ DE4A project	/	/
25	eInvoicing	Implemented	/
26	Improving Electronic Delivery of Court Documents in Croatia (G2B and G2C)	In production	Legal domain
27	EESSI	Implemented	/
28	eS&S - eSeal & Signature Validation Service Croatia	In production	Public services
29	eProcurement	Implemented	/
30	ePIC - Electronic Public Identification Croatia and Cross-border eProcurement notifications	In production	Public services

The distribution of the current implementation status of the use cases in which responding countries participates (shown in Figure 3) shows that most of the use cases (42%) are ongoing, while the share of implemented and planned use cases is 29% for each. This speaks of the high amplitude of current efforts on cross-border OOP implementation, but more importantly, provides a reason to believe that the overall state of the OOP implementation across Europe will significantly improve in the upcoming period.

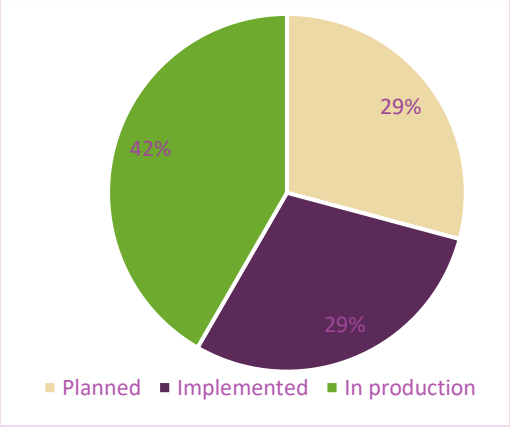

Figure 3: Status of implementation of the cross-border use cases

3.2 Blockchain-based solutions

The adoption of blockchain technologies is associated with a considerable potential for public sector transformation. Aiming to increase transparency and accountability of the interactions among the government, businesses and citizens, the EU Digital program acknowledges blockchain technologies as one of the underlying building blocks [24]. The joint efforts of the European Commission and the European Blockchain Partnership resulted in the creation of the European Blockchain Service

Infrastructure (EBSI), which connects the nodes across Europe and provides reusable solutions to support the adoption of blockchain-based solutions by European public authorities.

Several pilot blockchain projects on Notarization, Diplomas, European Self-Sovereign Identity and Trusted Data sharing were launched in 2019. Notably, Self-Sovereign Identity (SSI) is among the most frequent blockchain solutions among the respondent countries. There are still legal hurdles reported by some of the respondents surrounding the use of SSI. For instance, even though Spain has been the leader of some of the EBSI groups and pilots, the Spanish law does not support self-sovereign identity means. However, it is being considered as a desirable approach for the near future.

Aimed at changing the centralized approach of managing one's identity data, SSI provides the users with the possibility to store this information at their side. The European Self-Sovereign Identity Framework coordinated by the European Blockchain Service Infrastructure and by the European Blockchain coalition, sets governance frameworks for national implementation of the SSI by its Member States. The Netherlands, being one of the pioneers in the domain of SSI, has developed its solutions under the EU project on European Self-Sovereign identity Framework (ESSIF), which has been joined with the existing eID schemes (e.g. DigiD [25]). The changes introduced by the blockchain solutions go well in line with the revision of the eIDAS framework, in which user control over data is of paramount importance [26].

Although the blockchain solutions reported by the respondent countries are domain-specific and nationally bound, they are being developed across consistent domains. Housing markets, supply chains and university certificates are among the most spread areas for blockchain implementation. For instance, in December 2019, Spain launched the BLUE project, which incorporates blockchain-based validation of certificates for 76 Spanish universities. Reducing the possibility for altering the certificates via distributed tamper-proof ledger, the Spanish government ensures integrity of the issued diploma and facilitates countrywide and cross-border recognition of national education. Similarly, the Maltese Ministry of Education and Employment has been providing blockchain-based education certificates since 2017. Ensuring the validity of the issued academic certificates for the students and enabling receipt of blockchain accreditation certificates for education institutions, the Blockcerts project has been a useful practice for the DE4A Studying Abroad pilot.

3.3 Data strategy

In order for the OOP to be successfully implemented, the prerequisite is that member states address the reuse of data within their administrations in one way or another. The survey showed that all responding countries report having adopted a national digital transformation strategy that is already in line with the EU digital agenda 2030 and the Digital Compass principles. This sets forth a set of strategic and tactical measures to support eGovernment development. Figure 4 illustrates the different strategic instruments used by the respondents in their data strategies within the OOP system. It can be observed that up to 81% of the responding countries have a national strategy of reusing public sector data. This implies that only 19% of the respondents do not have a respective strategy for data reuse in place. However, there is an increasingly positive trend on setting up a strategy for reusing data in the public sector, especially if we consider that the above ratio (81:19) obtained from the results in the first phase of data gathering was 50:50. In this stage, even the implementation of Open Data by default is as high is 44%, aside from the existing strategy for Open Data in 69% of the respondents' countries.

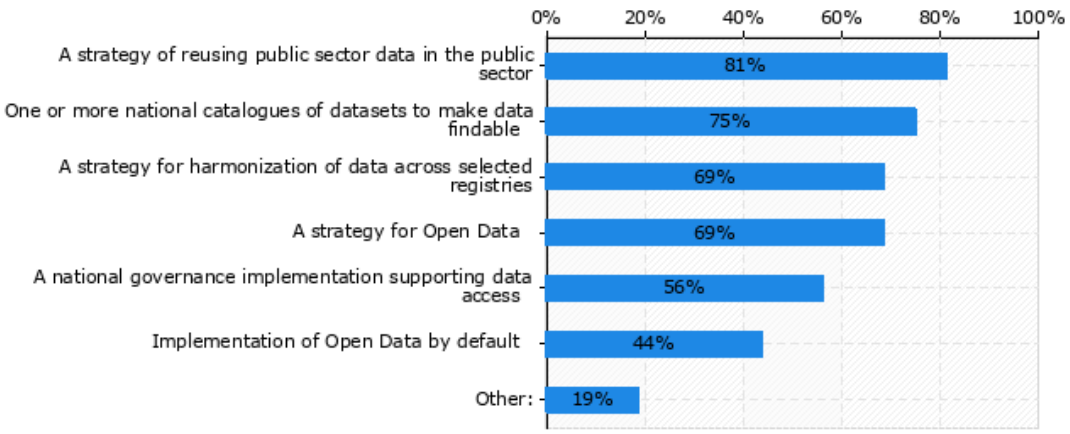

Figure 4: Adoption of a national data strategy

Most respondents use either between 2-3 (42%) or 4-5 (25%) of the mentioned instruments in Figure 4, while 17% have strategic focus on all instruments. As few as 17% of the responding countries employ only one instrument in their digital transformation efforts.

It should also be noted that 75% of the respondent countries have a strategic focus on making data findable as part of their strategy for harmonization and reuse of data. Somewhat less (56%) is the extent to which countries have a national governance implementation supporting data access as a strategic focus. This is still a largely positive trend compared to the results from the first phase, when this number was around 40%.

For example, in Bulgaria, the policy for data and management of data is also embedded in the national e-government development strategy 2020 – 2025. The Registry Information Exchange System in Bulgaria (RegiX) has been developed (in 2014) as part of the central eGovernment system with the aim to provide integrated administrative services. Thus, it enables automated interconnections between multiple Bulgarian authorities (currently 30) and the registers maintained by them (a total of 62), as well as information systems, in the form of machine-to-machine services. It provides the possibility to access the registers through a central component that ensures compliance with the requirements for interoperability and data exchange and is managed by the State eGovernment Agency. It is also responsible for preventing an institution from requiring citizens or organizations to provide data more than once. Instead, administration must collect the necessary documents officially from the primary administrator of the data. It is also possible for the authorized users of information to automatically retrieve data from basic registers. Furthermore, although Portugal has been working on its National Data Strategy and National Open Data Strategy for the PA, its Action Plan is defined in the Strategy for the Digital Transformation of the Public Administration 202106, addressing several data dimensions. Some examples are: governance, streaming real-time open data, High-Value Datasets, Cross-sector Public Administration data catalogues and data interoperability.

3.4 Status on the overall implementation of once-only

As shown in Figure 5 below, the overall implementation of the OOP is still at an early stage. Less than a third of the countries have responded that the OOP is implemented either broadly at the national or at all levels of power. Surprisingly, only 34% of the countries have implemented the OOP broadly at the regional level. This result may also be due to the high uncertainty and the lack of data obtained for this particular answer. Analysis of the results from the first phase shows that up to 46% of the responding countries have implemented the OOP in some areas at regional level, which may be closer to the real picture, considering the survey response rate of above 77% in the first phase.

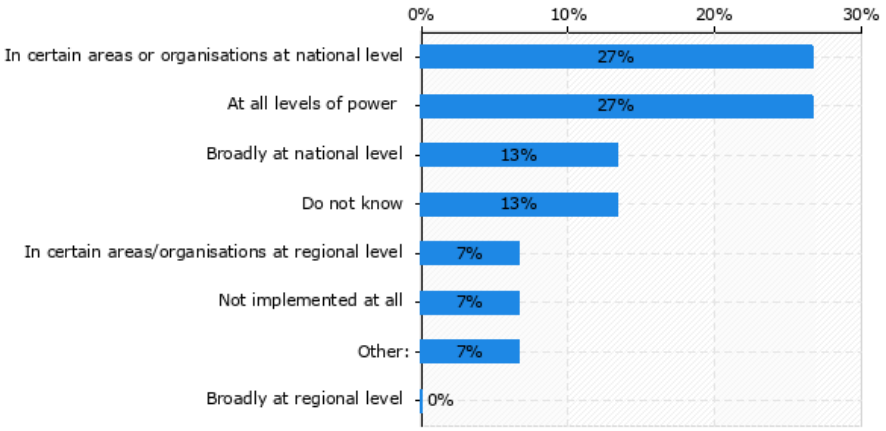

Figure 5: Implementation of the OOP

Overall, implementation in certain areas looks more promising both at the national and regional levels, with approximately half of the countries replying positively for each level of power. In total, 93% of the countries have replied that the OOP is implemented to some extent at the national level, and 67% have to some extent implemented at the regional level.

Those countries that have indicated a broad implementation at the national level, also report a broad implementation at the regional level. However, two countries have replied not having any implementation of the OOP at all.

The results indicate that the overall implementation levels of the OOP are very heterogeneous across countries, regardless of the fact that the distribution is skewed towards a small group of countries with very high implementation levels.

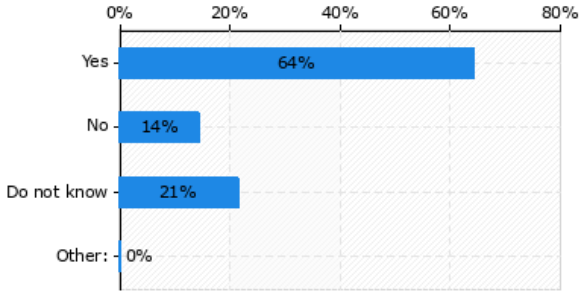

Figure 6: Existing eDelivery infrastructure

The CEF eDelivery Access Point (AP) implements a standardized message exchange protocol that ensures interoperable, secure and reliable data exchange [27]. There are several open source APs that have been developed by different EU projects, some of which have been adjusted to vendor-specific AP solutions. For instance, Domibus is the Open Source project of the AS4 Access Point maintained by the European Commission, but third-party software vendors offer alternative implementations of the e-SENS AS4 Profile (commercial or open-source). Each software vendor also provides different added-value services from integration to the support of day-to-day operations. For safeguarding interoperability, CEF eDelivery encourages implementers to consult the list of software products that have passed the conformance tests by the European Commission of the eSENS AS4 profile [28].

From Figure 7a) and b), we see that respondent countries mainly envisage one eDelivery gateway for the SDG and OOP system, but most of them (67%) have not opted for a specific solution yet. Those that have (17%), opted for Domibus. The 17% that responded with “Other” provided comments that they are unaware of the specific eDelivery gateway, or that all three (Domubus, Holodeck and Phase4)

were in use, as there is more than one access point in the country. All solutions are part of the list of recommended profiles by the European Commission.

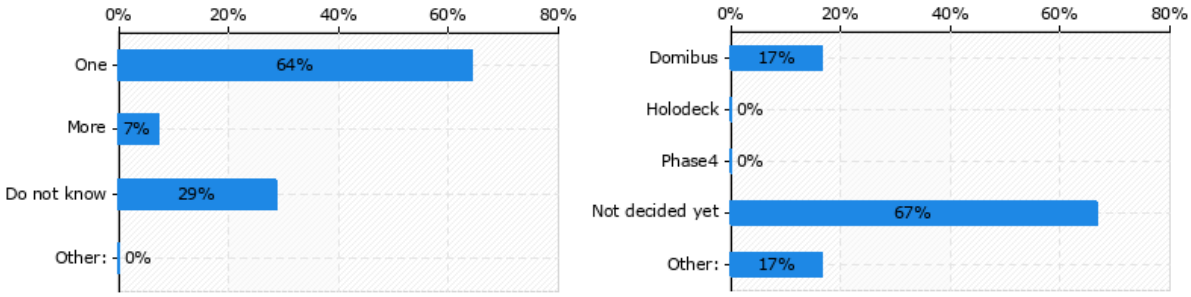

Figure 7: a) Number of eDelivery Gateways foreseen to use for the SDG and OOP System; b) Type of gateway to be used for the SDG

In order to inquire the specificities around the technical barriers for the implementation of the OOTS (which, although not deemed critical, have been claimed as barriers that require most improvements), we asked the respondent about their concerns over specific parts of the OOTS (Figure 8).

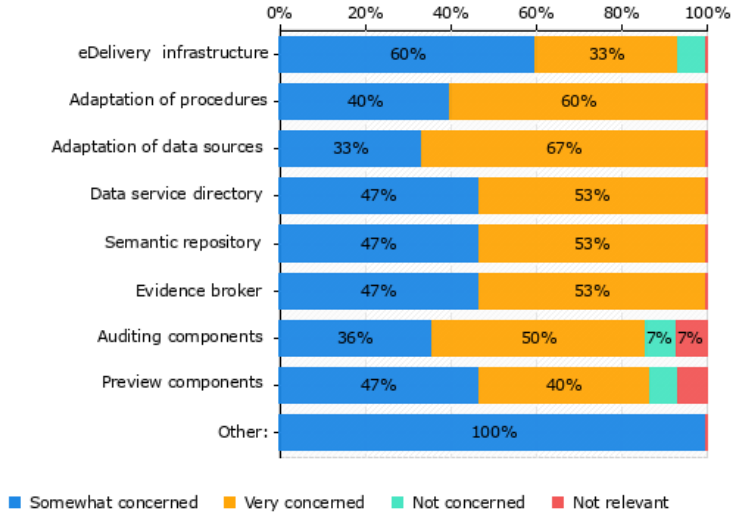

Figure 8. Concerns over implementation of the national parts of the OOTS

The results demonstrate great concerns over most of the parts and components, the biggest of which are the concern over the adaptation of data sources (shared by 67% of the respondents), as well as the adaption of SDGR procedures to the national context (expressed by 60% of the respondents). The eDelivery infrastructure itself is mainly a moderate concern, while the auditing and preview components invoked various extent of concern – from no concern (in 7% of the cases) to Very big concern, in 40-50% of the countries.

4 Digital Service Infrastructures and Building Blocks (Re)Use in DE4A

4.1 EU DSIs Considered for Implementation in the DE4A

The CEF program supports the digital transformation in Member States and the provision of digital services for citizens and businesses by providing reusable building blocks and cross border digital infrastructures and services. CEF offered a number of building blocks and infrastructure services that hold the potential to support the implementation of interoperable key digital enablers, such as electronic identity management, as well as Trust and secure data sharing services. The first round of WP1 deliverables provided a catalogue of building blocks estimated to have the potential for deployment in the DE4A context. They were to be re-assessed by the architecture task on BB assessment together with the pilot leaders, and employed as generic enablers for digital service provision and support for OOP implementation and data sharing. The interaction between WP1 and WP2 have strongly supported and facilitated the Building Blocks assessment, and established an iterative methodology for architectural assessment as part of the overall DE4A governance model. While the assessment itself is out of the scope of this report, the iterative interaction methodology that served to calibrate the assessment criteria, and the assessment results are important to share. They as they serve as a proof-of-concept of the successful internal alignments between the DE4A partners and work package activities. The entire approach is documented in the WP2 deliverable on the second iteration of the project start architecture - D2.4 [18].

The overall approach consisted of four steps:

- Preparatory step -> Assessment step -> Fine-tuning -> Recommendation step

At a more granular level, each step integrated the following actions:

- BB-to-Expert matching -> BB-assignment
  - Initial evaluation criteria -> Initial BBs assessments -> Assessment presentation/ group discussion
    - Fine-tuning of evaluation criteria -> Fine-tuning of BBs assessments -> Fine-tuning of methodology
      - Final assessment -> Gap analysis -> Recommendations

In the **Preparatory step**, the building blocks were matched to the experts' experience and expertise with respect to the capabilities provided by each BB and the architecture principles outlined by the DE4A objectives. One or more groups of BBs with shared capabilities were then assigned to each expert for assessment.

In the **Assessment step**, the initial evaluation criteria were agreed upon and integrated into the basic assessment framework (Table 4). Then, the results from the initial assessments for each BB were

presented in front of the BB Assessment group. This allowed for a constructive discussion on the need to fine-tune the evaluation criteria and to revise the evaluation results. These considerations are part of the **Fine-tuning step**, which is essentially an iterative procedure on its own, until the complete set of evaluation criteria is obtained, and the BB scores are approved by all experts of the BB Assessment group.

In the **Recommendation step**, the final scores for each BB were provided for all three maturity aspects: Technical, Administrative and Operational. These are then analyzed in view of the piloting requirements and the DE4A objectives as part of the Gap analysis, enabling the extraction of a single Recommendation as an output from the overall process.

The output of the preparatory step is the Taxonomy of BBs, whereas the output of the Assessment step is the conceptual framework – further whose criteria, aspects and semantics were fine-tuned in the third step. The scores and recommendations are obtained as an output from the final (Recommendation) step, supported by the argumentation given in the Gap Analysis.

Clearly, during this process, some BBs from the initial D1.1 catalogue have been left out, while others were added to the list, leading to a new catalogue of 31 building blocks to be assessed. The BBs were first categorized by a taxonomy based on the five-layered CEF Digital Services Model. Figure 9 shows the result of the first assessment phase of the BBs according to their fitness for DE4A purposes and their classification by the five-layered model.

The coloring serves as an additional result (dimension) that denotes the final recommendation based on level of fitness to DE4A purposes, according to the criteria shown in Table 4.

Table 4: Conceptual BB assessment framework

Maturity Score	Technical	Administrative	Operational
3 (Highest)	Cutting-edge	Completely aligned with current EU policies	EU infrastructure, broadly accepted
2	Implemented and running	Aligned with national policies, but is yet to be aligned with the EU	runs in production in EU (one or more MS)
1	Not stable/ under development	Acceptable, but subject to improvement	Piloted
0 (Lowest)	Antiquated/to be phased out	Conflicting with current policy/no-GO	Concept

Legend

Recommended	Acceptable	Useful	Discarded

The colour dimension may easily become a parameter of a formalized assessment methodology for BB reuse. Such formalization would enable a semi- and, ultimately, a fully automatic maturity and quality attributes assessment of both a set of desired (reusable) BBs, as well as a solution architecture representing a Common Service Platform or a General Service per se.

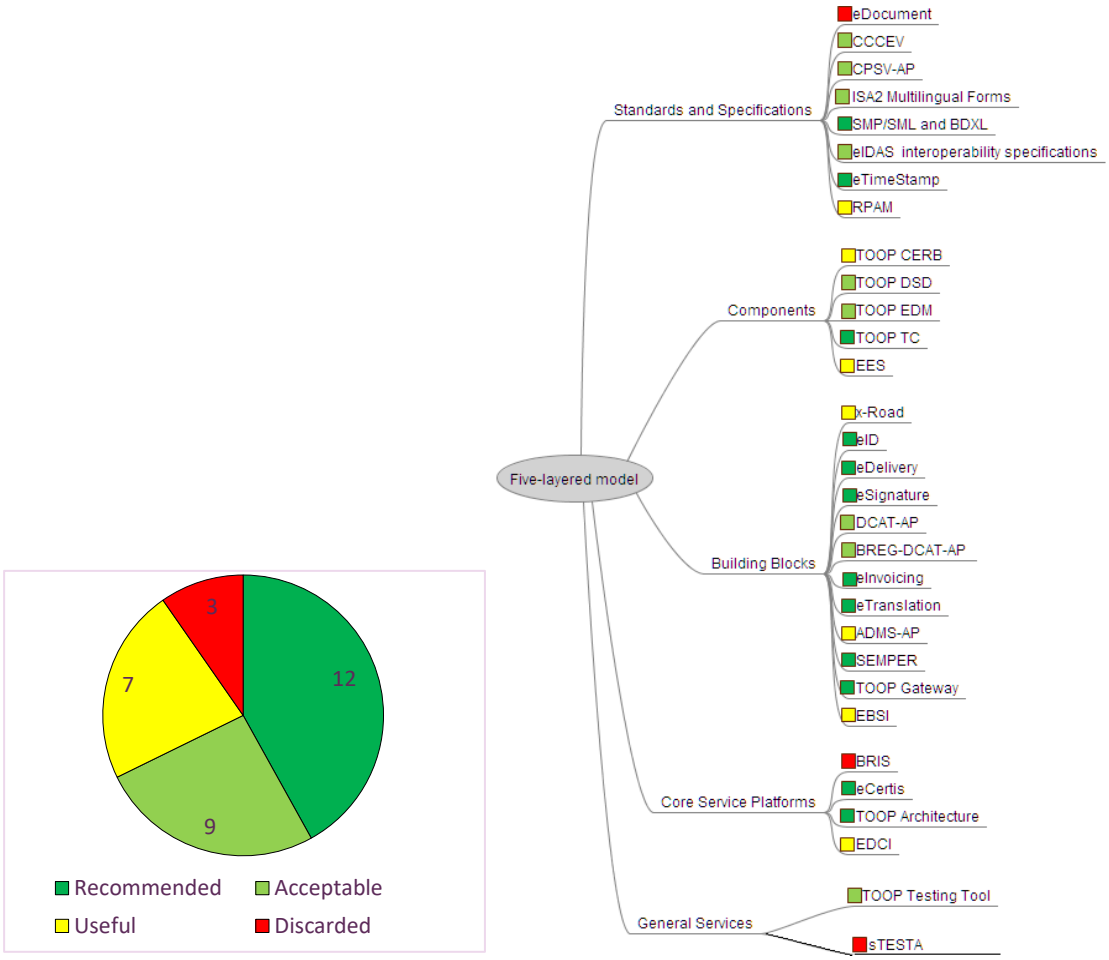

Figure 9: Taxonomy of assessed BBs with their recommendations

In order to get a relevant perspective of the current state of use and reuse of building blocks with DE4A, additional re-aligning was needed with the other project partners, especially with the WP2 task on BB assessment. The results from these consultations have produced a further refined set of BBs employed within the DE4A project, that have resulted from the continuous interactions between the architecture development team and the DE4A pilots. The refined catalogue of BBs is summarized in Table 5 (showing the use/reuse of building blocks in view of the relevant project stakeholders) and is briefly discussed in continuation.

It is important to note that the overall analysis provided by this study will provide a valuable input for the second phase of the BB assessment, maintaining the natural systemic dependency that exists between the two work packages.

Table 5: Reuse of building blocks in DE4A

#	Building Block	Used	To be assessed by
1	**Common Components**		
2	eDelivery	yes	WP5/MSs
3	SMP/SML	yes	MSs via pilots
4	DE4A Connector	yes	MSs via pilots
5	DE4A Playground	yes	WP5/DBA/SA/MA
6	**Semantic**		
7	Information Exchange Model	yes	DBA/SA/MA
8	Canonical Data Models	yes	DBA/SA/MA DE and DO pilot partners
9	ESL (implemented as part of SMP/SML)	yes	WP5
10	IAL	yes	WP5
11	MOR	yes	WP3/WP5/MA pilot partners
12	**eID/PoR**		
13	SEMPER	yes	DBA
14	**TOOP**	no	(only parts of the TOOP Connector software architecture was reused as a shared library)
15	**VC Pattern**		
16	SSI Authority agent	yes	SA
17	SSI User agent (mobile)	yes	SA
18	EBSI-ESSIF (CEF Blockchain)	yes	WP5

Although we discuss in another section the piloting experiences in relation the DSIs and the BBs considered by the DE4A, here we share one unexpected result from the assessment regarding the Business Registers Interconnection System (BRIS). BRIS enables cross-border functioning of the companies, allowing them to benefit from the Digital Single Market. Envisaged by the Directive 2012/17/EU, the European Commission stipulated obligatory interconnection of companies' registers in order to create a more adaptive environment for businesses. Introduced in June 2017, BRIS registers the information on companies – e.g. legal form, representatives, annual accounts – and makes it accessible within the EU shared market. Being closely connected to eDelivery and eJustice DSIs, BRIS conditions the development of the associated building blocks. As such, it was the natural choice for a BB to be used in the DE4A. Moreover, in the first phase of the DE4A Survey, it was found that all respondent countries have to a certain extent initiated technical implementation of the BRIS at their national scope. However, in the context of DE4A, BRIS has some overlap with the use cases in the Doing Business Abroad (DBA) pilot, both in relevant authorities (i.e. business registers) and in exchanged information. Even if BRIS can only be used by (a subset of) business registries themselves, it already provides today an operational exchange of company information across Europe. A reuse of (an extended) BRIS is understandable in the interest of the participating business registers, however, the possibility of DE4A to create legal and technical changes on the existing BRIS system is very limited. Analysis of the DBA pilot shows that the potential of reuse of BRIS is limited for the pilot, i.e. will remain at the level of the reuse of data definitions[1].

[1] For more information, see: https://wiki.de4a.eu/index.php/Doing_Business_Abroad_Pilot

4.2 Blockchain-based solutions in DE4A

In the context of using Blockchain technology, there were several legal concerns related to the use of Self-Sovereign Identity, such as the storage of personal data in distributed ledgers or the validity of a decentral identifier. This led Spain to entirely ban blockchain from application in eGovernment. By RDL 14/2019, it is forbidden to use a blockchain infrastructure to offer any identification or signature process (until a European or national law regulates the use of these technologies). Ongoing research, discussions, and progress in context of EBSI and ESSIF are clearly relevant for DE4A. It cannot be ascertained yet whether piloting use cases applying distributed ledger technology can go live in production or would remain exploratory, running in acceptance environments.

Electronic Exchange of Social Security Information (EESSI) is a domain specific, sectoral network that has some overlap with one of the use cases in the DE4A Moving Abroad (MA) pilot, i.e. Request Pension Information & Claim Pension - both in regard to relevant authorities and to exchanged information. The MA pilot had been assessing some EESSI capabilities for reuse. This reuse can take different forms - from full adoption of EESSI for the use case to the adoption of harmonized data models and definitions.

4.3 DE4A pilots' experiences

As part of the internal project consultations and alignments with the other DE4A work packages, important implementation practices and lessons learned regarding the (re)use of DSIs and BBs were shared by the pilots. One of the areas that brought valuable lessons was the use of sector specific systems, which entailed limiting the reuse of BRIS (in the Doing business abroad - DBA pilot) and of EESSI (in the Moving abroad – MA and the Studying abroad - SA pilots). Thus, integration of the OOTS with sectoral systems has proven not to be straight forward as initially expected. As a result, a lot of time was spent on workshops, desk research and analysis, leading to the realization that reuse of information flows, building blocks, etc. was not possible due to difference in legal framework, governance, authorities involved, solution implemented, etc.

Second area brining valuable know-how is the design process. Notably, the SA pilot encountered a barrier in the national integration, which required in-depth knowledge of both eIDAS and OOTS. This knowledge (especially the combination of both) is not broadly available in the Member States, as integration with eIDAS and eDelivery infrastructures normally involves different experts. Thus, the knowledge of both domains should be brought together, which requires additional human and organizational resources.

As another aspect of reusability, the DBA pilot reused building blocks like eIDAS and SEMPER, SMPs and internal - DE4A building blocks. As a results, users from Member States that have a notified eID, appreciated the usability of the familiar eID instead of having to obtain a specific account to use in the e-procedure for cross-border use. Furthermore, the procedures in the SA-pilot reuse CEF building blocks, standards, and infrastructure (e.g. eIDAS and authentic evidence sources), as well as DE4A building blocks (the DE4A Connector and Authority agent). The EBSI/ESSIF building blocks were also used at their current stage of development by the Authority Agent to implement the functionalities of the DE4A SSI supporting framework.

Finally, in terms of technological neutrality and data portability, which is an important aspect of DSI and BB reuse, it is important to note that the majority of the service infrastructure in the SA pilot does not depend on vendor-specific technologies (e.g. specific AS4 gateway implementation) or specific technical implementations, but rather on the re-use of open source software, which further enables the ease of data sharing/free movement of data. The only exception is a DE4A digital wallet that has only been developed for Android-based mobile phones given resource limitations, but which can be

used with different Android versions. Similarly, the DBA-pilot used software provided by the technical work package in the DE4A project. However, Member States are free to choose an AS4 gateway

An extensive list of lessons learned that are to a lesser or greater extent related to the reuse of DSIs and BBs is provided in the pilot reports: D4.3 (for the SA pilot), D4.7 (for the MA pilot) and D4.11 (for the DBA pilot).

5 Discussion

Any implementation of the once-only principle implies the existence of trust models. In addition to trust among stakeholders, trust in the underlying infrastructure is not only of paramount importance for the uptake of OOP, but it is also a key enabler of the trust among stakeholders. As the principal operational requirement for a user-centric eGovernment services is that one public administration can request information pertaining to a citizen or business directly from another public administration, (instead of going back to citizen or businesses), trust in the infrastructure is among the default properties of the OOP and the SDGR. The reuse and uptake of already trustworthy and mature solutions is thus an important and facilitating practice of an efficient and effective technical implementation. While legal safeguards are usually built in to avoid unlawful behavior and provide legitimacy of the overall process, these safeguards too depend on the implicit or explicit mechanisms for establishing and maintaining trust. For instance, the technical model which is suggested by the Single Digital Gateway Regulation ensures that each Member State maintains control over national components of the infrastructure. However, in order for the once-only exchanges to be viable, a trust in the infrastructure of other Member States, and in their compliance with the requirements of the Regulation becomes critical.

As part of the SDGR, the infrastructural trust has been addressed by reliance on the technical and functional building blocks, which are in use across the Member States and which offer basic capabilities, such as electronic identification (the eID building block) and exchange of documents (eDelivery building block). As the SDGR notes, *"…those building blocks consist of technical specifications, sample software and supporting services, and aim to ensure interoperability between the existing information and communication technology (ICT) systems in different Member States so that citizens, businesses and administrations, wherever they are in the Union, can benefit from seamless digital public services"*. Provided that Member States can be trusted not to modify these building blocks in a manner that introduces legal uncertainty, the infrastructural trust provides critical bases for the trustworthiness among the various eGovernment stakeholders. Clearly, the building blocks themselves do not comprise the entire technical system, and new components and protocols may be introduced via the implementing acts. With the digital transformation of all sectors, it will become increasingly difficult to strictly delimit the technical from the other (organizational, legal, business and human components). A holistic approach and a multi-stakeholder dialogue is thus critical to establish and maintain throughout the entire value chain of eGovernment.

This study provides an overview of the available Digital Service Infrastructures and Building Blocks at an EU-level, as well as their implementation and adoption practices across the Member States. It puts the results in the context of the latest regulatory and infrastructural developments and the national data strategies. Furthermore, it approaches the topic from e DE4A perspective, in order to provide a project-specific picture of the advancements made throughout its lifespan, and to share relevant experiences and insight that serve to the general aim of reusability. For the purpose of the analysis, strong alignments with WP2 and WP4 have been made regarding the architectural principles and the implementation practices. The implementation has provided strong empirical arguments for revision of the initial solution architecture templates, resulting in limited use of the BRIS and the ESSIF building blocks. The interaction between WP1 and WP2 have strongly supported and facilitated the Building Blocks assessment, and even established an iterative methodology for architectural assessment as part of the overall DE4A governance model.

The reports on EU Building Blocks Baseline within WP1 (D1.5 and D1.6) have not presented the maturity analysis of the individual building blocks. However, through the above-mentioned internal interdependencies, it has shared a methodological good practice, and results from an architectural assessment that denoted a significant number of the building blocks as "work in progress" (see Section 4.1). Further assessment and evaluation of the building blocks, including specific functionality,

maturity and relevance for use in the DE4A is expected to be undertaken in "WP2 Architecture vision and framework" related to architecture as well as "WP3 Semantic Interoperability Solution" for semantic interoperability, "WP4 Cross-border Pilots for Citizens and Business and Evaluation" related to Pilot execution and "WP5 Common Component Design & Development" for software development.

With results showing high participation of Member States across different cross-border EU projects and initiatives, both as an ongoing and as a planned effort, the report demonstrates a highly increasing trend of cross-border OOP efforts. However, it also detects some barriers through the shared MSs' experiences, requiring immediate action and provision of enabler to facilitate the further OOP implementation. This is especially important in the provision of future reusable results. Such effort is in fact DE4A itself – as the results of this study also show, it does not only reuse existing building blocks, but it also aims to provide reusability of its results.

The report also observes increase in the implementation of national strategies of reusing public sector data, especially since the first phase of the WP1 survey data gathering (from 50% to 81%). The positive trend also refers to the availability of a specific strategy for Open Data across the countries. However, there is still low extent of regional implementation of the OOP (in only 34% of the respondent countries), speaking of an overall OOP implementation, especially considering the 2023 deadline for SDGR implementation.

In order not to fall short on a prospective view of the eGovernment developments in Europe, we make the following concluding observation: in spite of the steady and progressive roll-out of the basic digital public services (e.g., access to online forms, online documents exchange, online booking of appointments, following the progress of certain procedures online, etc.), it would also be important to investigate and bootstrap the availability of more advanced public services, that would employ the latest technological advancements of innovative means (artificial intelligence coupled with big data, process automation, targeted dissemination, etc.). Such efforts would in turn dictate further revisions of the current Regulations as well that will provide the fertile ground for a symbiotic and beneficial interplay of the technological, legal, organizational, business, political and human factors.

6 Conclusions

The purpose of this study was to take stock of the existing reusable building blocks available for developing solutions for service provision and data sharing across the European eGovernment landscape.

The study accounted for the current EU digital service infrastructures and building blocks implemented across the Member States. Moreover, in a collaborative effort with WP2 and WP4, it provided an iterative collaboration methodology for building block assessment that produced an intermediate and a final list of building blocks relevant for DE4A. This effort was discussed in the current report from the perspective of both the architecture design and the DE4A pilots' implementation.

The results of the survey data have identified more than 30 use cases across different cross-border EU projects and initiatives, in which the responding Member States participate. 42% of these use cases are an ongoing effort, while additional 29% are planned for implementation. This demonstrates a highly increasing trend of cross-border OOP efforts, but also calls for immediate addressing of the barriers identified through these efforts in order to provide reusability of the results. Such effort is in fact DE4A itself – as the results of this study also show, it does not only reuse existing building blocks, but it also aims to provide reusability of its results. In that context, the current study also shares experiences from the design and implementation efforts within the project.

The report also observed that up to 81% of the responding countries have a national strategy of reusing public sector data and a positive trend in that regard, considering that with the first phase of data gathering, this number was ~50%. Moreover, there is a specific strategy for Open Data in 69% of the respondents' countries. However, with only 34% of the countries providing positive answer for regional implementation of the OOP, the overall OOP implementation is still low, especially considering the 2023 deadline for SDGR implementation.

Finally, the study found that most of the Member States have an e-Delivery infrastructure in place, implemented with one more access points from the list of EU recommended profiles. However, there are still concern over the national (infrastructural) parts of the OOP technical system, the biggest of which are the concern over the adaptation of data sources (shared by 67% of the respondents), as well as the adaption of SDGR procedures to the national context (expressed by 60% of the respondents).

Together with the D1.2 "Update of Member State eGovernment Baseline", D1.4 "Updated Member State Once Only and Data Strategy Baseline" and D1.8 "Updated Legal, technical, cultural and managerial risks and barriers", this set of updated deliverables serves as both a testament for the DE4A contribution in the development of eGovernance services from design and implementation perspective, and as an experience-based list of relevant recommendations and lessons learned that may be used to guide future developments in the area.

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Annex: DE4A Survey

Digital Europe for All (DE4A) survey

Purpose of the survey and data protection

Dear member state representative,

On January 1st 2020, the EU member state-driven project Digital Europe for All (DE4A) was launched. DE4A is dedicated to creating an open and comprehensive environment and platform to support public administrations in delivering secure, high quality and fully online cross-border procedures for citizens and businesses. In addition, it will provide insights into the barriers to cross-border interoperability and the enablers for overcoming them. You can read more about the project on the project website, https://www.de4a.eu/.

The survey that we kindly ask you to fill in is a second phase of the data gathering process within the project that takes stock of the deployment of cross-border services. The results and analysis of the first phase of data gathering can be found here, under D1.x deliverables.

We will use the data collected in the second phase to analyze the implementation of specific eGovernment action points in the member states and to get insight into the progress of implementing the technical architecture and the eGovernment environment since the previous stock-taking. The derived insights and good practices will serve as practical guidelines for the development and deployment of digital public services for other EU member states, as well for self-evaluation (together with own experience) of the DE4A architecture development.

The survey consists of several blocks: (1) eIDAS National ID schemes, (2) eIDAS Nodes and trust services, (3) (European) Digital Identity Wallets, (4) Single Digital Gateway Regulation: Life Events, (5) Digital Service Infrastructures, (6) Once-Only Principle and Data strategy. Each of them aims to gather insights into the current state, the implementation process, barriers and enablers, which are to be compiled into separate reports on the elaborated topics.

We kindly ask you to provide your feedback on the current status of eGovernment in your country for each of the blocks mentioned above. With the data collected in this phase, we will compile detailed aggregated reports depicting the overall eGovernment landscape of the EU member states. We encourage you to make use of the comment boxes at the end of every subchapter of the survey in order to indicate legal, technical, or other particularities relevant for understanding the national context.

Please note that the responses obtained through the survey will not considered as the official positions of the EU Member States, and that data gathered will mainly serve to support qualitative analysis of the EU governance landscape.
No individual survey will be published in its entirety, and in case an individual response is found useful for publication, it may only be done through a consent by the responder.

Data protection statement

This survey is performed in the frame of the Digital Europe for All Project (DE4A - https://www.de4a.eu/), which has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870635.

Please note that your participation in this survey implies processing of your personal data. Personal data will be processed in compliance with the Regulation (EU) n° 2016/679 on the processing of personal data (the GDPR). The input you provide will only be shared outside of the DE4A consortium in the form of aggregated data. Within the DE4A consortium, we will process your data in order to analyse your answers as foreseen in accordance with the grant agreement, on the basis of our public interest tasks. For further information or to exercise your rights, you may contact our project DPO via privacy@de4a.eu. These rights include requesting copies, correction, or deletion of your personal data, or restricting/objecting to further processing (all within the constraints of the grant agreement). You have the right to lodge a complaint with the competent data protection authority. Do you give consent to processing the information for the purposes of this analysis under the above condition?

- ○ Yes
- ○ No

Member State Information

Please state the name of the country you are representing: _____

eIDAS: National eID-schemes

This part of the questionnaire takes stock of the implementation of national eID scheme under eIDAS Regulation (EU) No 910/2014. To fill it in, you can also consult the available information on your national eID scheme at the eID User Community.

1. Please insert below the required information regarding the status of your national eID scheme(s).

	Pre-notified	**Notified**	**Peer reviewed**
Number of eID schemes			

Remarks: _____

	Level of assurance			
	Low	Moderate	High	Not relevant / Do not know

Number of **eID schemes** with the shown level of assurance				

Remarks: _____

	Level of implementation			
	Necessary national legislation adopted	Implemented for national use only	Implemented for cross-border use	Not relevant / Do not know
Number of **notified eID** schemes with the shown level of implementation				

Remarks: _____

	Official issuer			
	Public entity	Private entity	Public-private partnership	Other
Number of eID schemes whose official issuer is:				

Remarks: _____

2. The eID scheme(s) grant(s) access to the following services (please specify the concrete sectorial services):

☐ National public services
☐ Public services by regional / local authorities
☐ Non-governmental services
☐ Private entities
☐ Do not know
☐ Other: _____

3. Please indicate possession rate for all of the notified eID schemes. (*Possessions rate is the ratio of total number of eID holders to total number of inhabitants expressed as a percentage (citizens + foreign residents).*

eID scheme (1) _____
eID scheme (2) _____
eID scheme (3) _____
eID scheme (4) _____

eID scheme (5) _____
eID scheme (6) _____

4. Please, if available indicate the activation rate for all of the notified eID schemes where applicable. (*Activation rate is the ratio of activated eIDs to the total number of eIDs expressed as a percentage.)*

eID scheme (1) _____
eID scheme (2) _____
eID scheme (3) _____
eID scheme (4) _____
eID scheme (5) _____
eID scheme (6) _____

5. Please indicate the use rate for the notified eID schemes (for cross-border use and, where available, for domestic use). (*Use rate is the ratio of eIDs which have been used at least once to access a public service to the total number of eIDs expressed as a percentage.*)

eID schemes	Use rate	
	Domestic use	**Cross-border use**
eID scheme (1)		
eID scheme (2)		
eID scheme (3)		
eID scheme (4)		
eID scheme (5)		
eID scheme (6)		

6. Please provide the following information, if available. If not available, mark N/A:

- Number of citizens issued with notified eID-s: _____
- Number of businesses issued with notified eID-s: _____
- Number of businesses actively using notified eID-s: _____
- Number of national online service providers accepting notified eID-s: _____
- Number of online transactions by notified eID-s (total and cross-border):
  Total: _____ Cross-border: _____

7. If there are any documented good practice experiences related to the implementation of eIDAS in your country, please provide a link/reference to the document(s).

_____
_____

8. Please provide additional information which, in your opinion, is important for the understanding of your country's context regarding the topics elaborated in this subchapter.

_____
_____
_____.

This part of the questionnaire takes stock of the implementation of national eID scheme under eIDAS Regulation (EU) No 910/2014.

eIDAS: eIDAS node and trust services

1. State the version of the eIDAS Node proxy and/or the profile supported:

_____
_____
_____.

2. Does your eIDAS-node support using your national eID(s) abroad?

○ Do not know

○ Yes

○ No (if known, please specify expected date of production): _____

If Yes, please respond to the following question:

2) As a **Sending** Member State, which countries is your eIDAS Node interoperable with to provide cross-border authentication of your national eID(s)?*

_____

3. Does your eIDAS-node support the use of foreign eIDs for services in your country?

○ Do not know

○ Yes

○ No (if known, please specify expected date of production): _____

If Yes, please respond to the following questions:

3a) How is the use of foreign eIDs enabled?

☐ Allowed only for identification and authentication in public services
☐ Possible for private sector services wihtout restriction
☐ Possible for private sector services with fee, legal or other restriction
☐ Other: _____

*3b) As a **Receiving** Member State, which countries is your eIDAS Node interoperable with to send authentication requests of foreign eIDs?*

_____

5. Please identify (mark with ***X*** the appropriate field) the advancement level of the following means/services in your country:

	Do not know	Not implemented	Necessary (national) legislative procedures adopted	Implemented for national use	Implemented for cross-border use
Electronic signature					
Advanced electronic signature					
Qualified electronic signature					
Qualified certificate for electronic signature					
Electronic seal					
Advanced electronic seal					
Qualified electronic seal					
Electronic timestamp					
Qualified electronic timestamp					
Electronic registered delivery services					
Qualified electronic registered delivery services					
Certificate for website authentication					
Qualified certificate for website authentication					
Electronic ledgers					
Qualified electronic ledgers (if available)					

6. Is there any framework or a mechanism to monitor the implementation of the Regulation in your country?

○ Yes

○ No

○ Do not know

7) **If Yes**, state the purpose of the implementation, i.e. the functionality of the monitoring mechanism at a national level. Check all that applies.*

☐ To ensure implementation of the necessary changes to the relevant national systems
☐ To overview the extent to which the necessary changes have been implemented in line with the adopted measures
☐ To check whether the necessary changes to the compliance obligations by the regulated entities have been adhered to
☐ Other: _____

7. Indicate the types of barriers that the implementation of the eIDAS elements (nodes, schemes, trust services) has encountered in your country (See the provided examples below):

Legal	***Inconsistency with current legislation, hindering regulatory frameworks, inter-dependence with other regulatory acts or codes of conduct***
Organizational	***Weak or inconsistent management practices, lack of common language among organisational entities***
Technical	***Underdeveloped systems infrastructures, expert scarcity, hindering innovation***
Business	***Market disruptions, lack of market opportunities, closed business pathways***
Political	***Lack of state involvement, political frictions among state players, general political turbulences***
Human factor	***Lack of user awareness, lack of personnel training, expert reluctance to involvements***

(a) Legal: _____
(b) Organisational: _____
(c) Technical: _____
(d) Business: _____
(e) Political: _____
(f) Human factor: _____
(g) External: _____
(h) Other: _____

8. In view of the national context, please denote (with *X*) the level of criticality to address each of the barriers enlisted above.

Type of barrier	Not critical	Irrelevant	Can benefit from some improvements	Necessary improvements should be made	Critical to address immediately
Legal					
Organizational					
Technical					
Business					
Political					
Human factor					
Other					

9. Please provide any further information, which in your opinion is important for our understanding of your country's context about the topics mentioned in this subchapter.

_____
_____
_____.

eIDAS v2: (European) Digital Identity Wallets

Enshrined in the Revised eIDAS Regulation is a recommendation for Member States to work towards the development of a Toolbox to support the implementation of the European Digital Identity framework. The scope of the toolbox should cover all aspects of the functionality of the European Digital Identity Wallets and of the qualified trust service for attestation of attributes as proposed by the Commission's proposal for a European Digital Identity framework. As the revised eIDAS is still not enacted, the aim of this section is to inspect the current state of the Member States in terms of existing Digital Identity Wallets solutions and readiness to act towards the implementation of the revised eIDAS Regulation.

1. Are there existing Digital Identity Wallets (DIWs) at this moment in your state, when eIDAS v2 has not been adopted yet?

- ○ Yes
- ○ No
- ○ No, but it is envisaged

Other: _____

If **Yes**, proceed with answering the next questions. Otherwise, move to the next section of the questionnaire.

Please name them and provide a reference accordingly:

	Name	Reference (Link, document, etc.)
DIW (1)		
DIW (2)		
DIW (3)		
DIW (4)		
DIW (5)		

2. Who is issuer of the DIWs in your country?

	Public entity	Private entity	Public-private partnership	Other
DIW (1)				
DIW (2)				
DIW (3)				
DIW (4)				
DIW (5)				

3. (Mark all that applies) The state provides validation mechanisms for the Digital Identity Wallets:

☐ To ensure its authenticity and validity can be verified
☐ To allow relying parties to verify that the attestation of attributes are valid
☐ To allow relying parties and qualified trust service providers to verify the authenticity and validity of attributed person identification data
☐ The State does not provide such mechanisms
☐ Other: _____

4. Are there means to ensure that the DIW is free of charge to natural persons?

○ Yes
○ No
○ Do not know

5. Please provide information on the following, if available:

- Number of citizens issued with DIWs: _____
- Number of businesses issued with DIWs: _____
- Number of citizens actively using DIWs: _____
- Number of businesses actively using DIWs: _____
- Number of issued identity credentials (attestations of attributes): _____
- Number of online service providers accepting DIWs and identity credentials (attestations of attributes): _____
- Number of online transactions by DIWs (total and cross-border):
  Total: _____ Cross-border: _____
- Share of online transactions requiring strong customer identification: _____
- % of individuals doing e-commerce (ratio of users of DIW doing e-commerce vs. total number of users of DIW x 100): _____
- % of individuals accessing online public services, if available (ratio of users accessing online public services vs. total number of users of DIW x 100): _____

6. Are there accredited bodies that certify the conformance of the DIWs with the requirements laid down in the relevant paragraphs of article 6a) from the eIDAS v2?

○ Yes
○ No
○ Do not know

If **Yes**, please state how many of them are private, and how many are public:

Private: _____
Public: _____

7. Indicate the types of drivers that you see important for the implementation of the DIWs in your country:

(a) Legal: _____
(b) Organisational: _____
(c) Technical: _____
(d) Business: _____
(e) Political: _____
(f) Human factor: _____
(g) External: _____
(h) Other: _____

8. In view of the national context, please denote (with *X*) the level of importance for each of the drivers listed above.

	FOR NATIONAL PURPOSES			**FOR CROSS-BORDER PURPOSES**		
Type of driver	***Desirable to exploit***	***Important to exploit***	***Critical to exploit***	***Desirable to exploit***	***Important to exploit***	***Critical to exploit***
Legal						
Organizational						
Technical						
Business						
Political						
Human factor						
Other						

9. Please provide any further information, which in your opinion is important for our understanding of your country's context about the topics mentioned in this subchapter.

_____
_____
_____.

1. Single Digital Gateway: Life Events

The Single Digital Gateway Regulation specifies a list of 21 procedures, covering the major life events of the EU citizens: Birth, Residence, Studying, Working, Moving, Retiring, Running a business. Please provide the current status of the digital presence and mobile availability of the 21 procedures in your country.

1. Please insert the required information on the mentioned procedures:

	Online authentication	Implementation of the OOP (data reuse)	Digitalised	Depends on procedure(s)[2]:
1.Requesting proof of registration of birth	Choose an item.	Choose an item.	Choose an item.	
2.Requesting proof of residence	Choose an item.	Choose an item.	Choose an item.	
3.Applying for a tertiary education study financing	Choose an item.	Choose an item.	Choose an item.	
4.Submitting an initial application for admission to public tertiary education institution	Choose an item.	Choose an item.	Choose an item.	
5.Requesting academic recognition of diplomas, certificates or other proof of studies or courses	Choose an item.	Choose an item.	Choose an item.	
6.Request for determination of applicable legislation in accordance with Title II of	Choose an item.	Choose an item.	Choose an item.	

[2] Denote by entering the number of the relevant procedures.

Regulation (EC) No 883/2004 (1)				
7.Notifying changes in the personal or professional circumstances of the person receiving social security benefits	Choose an item.	Choose an item.	Choose an item.	
8.Application for a European Health Insurance Card (EHIC)	Choose an item.	Choose an item.	Choose an item.	
9.Submitting an income tax declaration	Choose an item.	Choose an item.	Choose an item.	
10.Registering a change of address	Choose an item.	Choose an item.	Choose an item.	
11.Registering a motor vehicle originating from or already registered in a Member State	Choose an item.	Choose an item.	Choose an item.	
12.Obtaining stickers for the use of the national road infrastructure	Choose an item.	Choose an item.	Choose an item.	
13.Obtaining emission stickers issued by a public body or institution	Choose an item.	Choose an item.	Choose an item.	
14.Claiming pension and pre-retirement benefits from compulsory schemes	Choose an item.	Choose an item.	Choose an item.	
15.Requesting information on	Choose an item.	Choose an item.	Choose an item.	

the data related to pension from compulsory schemes				
16.Business activity: Notification, permission for exercising, changes and termination	Choose an item.	Choose an item.	Choose an item.	
17.Registration of an employer with compulsory pension and insurance schemes	Choose an item.	Choose an item.	Choose an item.	
18.Registration of employees with compulsory pension and insurance schemes	Choose an item.	Choose an item.	Choose an item.	
19.Submitting a corporate tax declaration	Choose an item.	Choose an item.	Choose an item.	
20.Notification to the social security schemes of the end of contract with an employee	Choose an item.	Choose an item.	Choose an item.	
21.Payment of social contributions for employees	Choose an item.	Choose an item.	Choose an item.	

2. Please insert the required information on the mentioned procedures:

	Mobile accessibility	**Online availability for cross border use**
Requesting proof of registration of birth	Choose an item.	Choose an item.

Requesting proof of residence	Choose an item.	Choose an item.
Applying for a tertiary education study financing	Choose an item.	Choose an item.
Submitting an initial application for admission to public tertiary education institution	Choose an item.	Choose an item.
Requesting academic recognition of diplomas, certificates or other proof of studies or courses	Choose an item.	Choose an item.
Request for determination of applicable legislation in accordance with Title II of Regulation (EC) No 883/2004 (1)	Choose an item.	Choose an item.
Notifying changes in the personal or professional circumstances of the person receiving social security benefits	Choose an item.	Choose an item.
Application for a European Health Insurance Card	Choose an item.	Choose an item.
Submitting an income tax declaration	Choose an item.	Choose an item.
Registering a change of address	Choose an item.	Choose an item.
Registering a motor vehicle originating from or already	Choose an item.	Choose an item.

registered in a Member State		
Obtaining stickers for the use of the national road infrastructure	Choose an item.	Choose an item.
Obtaining emission stickers issued by a public body or institution	Choose an item.	Choose an item.
Claiming pension and pre-retirement benefits from compulsory schemes	Choose an item.	Choose an item.
Requesting information on the data related to pension from compulsory schemes	Choose an item.	Choose an item.
Business activity: Notification, permission for exercising, changes and termination	Choose an item.	Choose an item.
Registration of an employer with compulsory pension and insurance schemes	Choose an item.	Choose an item.
Registration of employees with compulsory pension and insurance schemes	Choose an item.	Choose an item.
Submitting a corporate tax declaration	Choose an item.	Choose an item.
Notification to the social security schemes of the end of	Choose an item.	Choose an item.

contract with an employee		
Payment of social contributions for employees	Choose an item.	Choose an item.

3. What is the approximate percentage of procedures available digitally as compared to overall number of public, administrative services? (State N/A if not available)

at national level _____
at regional/local level _____
at cross-border level: _____

4. What is the approximate percentage of digital-only services (*services available exclusively online*)? (State N/A if not available)

at national level _____
at regional/local level _____
at cross-border level _____

5. Are there digital means of redress or appeal available in the event of disputes with competent authorities (as per Article 10(e) of Regulation (EU) 2018/1724)?

- ○ Yes
- ○ Yes, both at national and cross-border level
- ○ No
- ○ Do not know

If **Yes**, add a link or a reference to the service, if known: _____

6. What is the type and format of evidence to be submitted?

	Type	**Language**	**Format of the evidence**	**Origin of the evidence**
Requesting proof of registration of birth			Choose an item.	Choose an item.
Requesting proof of residence			Choose an item.	Choose an item.
Applying for a tertiary education study financing			Choose an item.	Choose an item.

Submitting an initial application for admission to public tertiary education institution			Choose an item.	Choose an item.
Requesting academic recognition of diplomas, certificates or other proof of studies or courses			Choose an item.	Choose an item.
Request for determination of applicable legislation in accordance with Title II of Regulation (EC) No 883/2004 (1)			Choose an item.	Choose an item.
Notifying changes in the personal or professional circumstances of the person receiving social security benefits			Choose an item.	Choose an item.
Application for a European Health Insurance Card			Choose an item.	Choose an item.
Submitting an income tax declaration			Choose an item.	Choose an item.
Registering a change of address			Choose an item.	Choose an item.
Registering a motor vehicle originating from or			Choose an item.	Choose an item.

already registered in a Member State				
Obtaining stickers for the use of the national road infrastructure			Choose an item.	Choose an item.
Obtaining emission stickers issued by a public body or institution			Choose an item.	Choose an item.
Claiming pension and pre-retirement benefits from compulsory schemes			Choose an item.	Choose an item.
Requesting information on the data related to pension from compulsory schemes			Choose an item.	Choose an item.
Business activity: Notification, permission for exercising, changes and termination			Choose an item.	Choose an item.
Registration of an employer with compulsory pension and insurance schemes			Choose an item.	Choose an item.
Registration of employees with compulsory pension and insurance schemes			Choose an item.	Choose an item.

Submitting a corporate tax declaration			Choose an item.	Choose an item.
Notification to the social security schemes of the end of contract with an employee			Choose an item.	Choose an item.
Payment of social contributions for employees			Choose an item.	Choose an item.

7. Can the procedures be carried out in other (than the MS national) language(s)?

○ Yes

○ No

○ Do not know

If Yes, please state in which language(s):

_____

_____

8. Are there applicable fees for carrying out any of the 21 procedures?

○ Yes (provide info): _____

○ No

○ Do not know

9. What online methods for national use canbe employed to pay the applicable fee?

☐ National banking solution
☐ Paypal
☐ Credit/debit card
☐ Do not know
☐ Other: _____

9. What online methods for cross-border use can be employed to pay the applicable fee?

☐ National banking solution
☐ Paypal

☐ Credit/debit card
☐ Do not know
☐ Other: _____

10. Does your MS make use of the Internal Market Information System (IMI), established by Regulation (EU) No 1024/2012? [for the purposes of notification and explanation of why physical presence might be required for the "fully-online" procedural steps (Article 6(4)) and for the Verification of evidence between Member States (Article 15)].

- ○ Yes, only for the purposes of notification and explanation of why physical presence might be required for the "fully-online" procedural steps
- ○ Yes, only for the Verification of evidence between Member States
- ○ Yes, for all relevant purposes
- ○ No
- ○ Do not know

Describe any specificities if IMI is being used: _____
_____
_____

11. Indicate the types of barriers that the implementation of the SDG procedures has encountered so far in your country and explain its implications:

(a) Legal: _____
(b) Organisational: _____
(c) Technical: _____
(d) Business: _____
(e) Political: _____
(f) Human factor: _____
(g) External: _____
(h) Other: _____

12. In view of the national context, please denote (with *X*) the level of criticality to address each of the barriers enlisted above.

Type of barrier	Not critical	Irrelevant	Can benefit from some improvements	Necessary improvements should be made	Critical to address immediately
Legal					
Organizational					
Technical					
Business					
Political					

Human factor					
Other					

13. Please provide any further information, which in your opinion is important for our understanding of your country's context concerning the topics mentioned in this subchapter.

_____
_____
_____.

Digital Service Infrastructures

The aim of this subchapter is to identify the advancement of Digital Service Infrastructures (DSIs). The DE4A project will be implemented in compliance with the existing DSIs, with the goal of delivering a network of public services available for citizens, businesses and public administrations.

1. Do you already have an eDelivery infrastructure set up in your MS?

- ○ Yes
- ○ No
- ◉ Do not know

Other: _____

3. How many eDelivery Gateways do you foresee to use for the SDG and Once-Only Technical System?

- ○ One
- ○ More
- ○ Do not know

Other: _____

4. Which type of gateway will you use for the SDG?

- ○ Domibus
- ○ Holodeck
- ○ Do not know
- ○ Not decided yet

Other: _____

5. Does your country participate in some of the European Blockchain Services Infrastructure (EBSI), H2020, CEF Digital or Recovery and Resilience Fund projects' use cases?

- ○ Yes
- ○ No
- ○ Do not know

Other: _____

If **Yes**, please indicate the name, status (planned, implemented, in production) and operational context (e.g. public procurement, internal financial audit etc.) of each of the use cases:

Name of use case	Status	Operational context

Other remarks: _____

6. Briefly explain the types of barriers that the implementation of the DSIs and the subservices have encountered in your country:

(a) Legal: _____
(b) Organisational: _____
(c) Technical: _____
(d) Business: _____
(e) Political: _____
(f) Human factor: _____
(g) External: _____
(h) Other: _____

7. In view of the national context, please denote (with *X*) the level of criticality to address each of the barriers enlisted above.

Type of barrier	Not critical	Irrelevant	Can benefit from some improvements	Necessary improvements should be made	Critical to address immediately
Legal					
Organizational					
Technical					
Business					
Political					
Human factor					
Other					

5. Please provide any further information, which in your opinion is important for our understanding of your country's context with regards to the topics mentioned in this subchapter.

_____
_____

Once-Only Principle and Data strategy

This part of the questionnaire inquires about the member states' implementation of the Once-Only Principle (OOP) and reuse of data principle. The OOP envisages reduction of administrative burdens for the EU citizens, businesses, institutions and public administrations by allowing them to provide a certain type of information once and implying the reuse of the collected data upon the consent of all parties.

1. Is there any national digital transformation strategy to push forth a set of strategic and tactical measures to support eGovernment development?

○ No

○ Do not know

○ Yes (please provide a link/reference to any relevant documentation):

_____

2. To what extent has your country adopted a national data strategy? Check all that apply.

☐ A strategy of reusing public sector data in the public sector
☐ A strategy for harmonization of data across selected registries
☐ A strategy for Open Data
☐ Implementation of Open Data by default
☐ One or more national catalogues of datasets to make data findable
☐ A national governance implementation supporting data access
☐ Other (please specify): _____

3. Which base registries implemented for national use can be accessed by private legal entities?

☐ Persons/citizens
☐ Vehicle
☐ Tax
☐ Businesses
☐ Addresses
☐ Building and housing
☐ Cadasters
☐ Geographical data
☐ Higher Education
☐ None
☐ Other (please specify) _____

4. What types of private companies can access base registries?

For personal data: _____
For non-personal data: _____

5. What are the access conditions?

_____

6. Please, indicate how the access to base registries is implemented. Check all that applies.

☐ Replication of registries to authorities that need access
☐ Data lookup supported by APIs
☐ Subscription of data for public services
☐ Access to base registries is subject to transactional fees
☐ Access to data services under authorization processes
☐ Other (please specify) _____

7. From the drop-down menu below, denote if there are any fees introduced for access to cross-border registries.

	Public organizations	**Private organizations**	**Citizens**
Fees for national transactions	Choose an item.	Choose an item.	Choose an item.
Fees for cross-border transactions	Choose an item.	Choose an item.	Choose an item.

Other (please specify) _____

8. What communication patterns are supported in the offering of public services in your country?

○ Synchronous (direct response to a request, typically within seconds)
○ Asynchronous (delayed response, hours or even days)
○ A mix of both
○ Do not know
Other: _____

9. Please check (with *X*) the types of personal information citizens can examine and verify the access to by public officials:

	Not implemented	Citizens can access their own data	Citizens can change (request a	Citizens can verify access to	Not applicable in my country	Do not know

			change of) their data	their data by others		
Personal file						
Tax declarations						
Medical file						
Cadasters (private property)						
Personal mandates						
None						

Other (please specify) _____

10. Mark (with *X*) the base registries for the relevant procedural requirements or preconditions for an exchange under the respective legislation:

	Persons/ Citizens	Vehicle	Tax	Businesses	Addresses	Building and housing	Cadasters	Geographical data	Higher Education	Other
No conditions[3]										
Prior request from the user										
Authorization must be written into the law										
Authorization must be obtained from an authority designated in the law										
Agreement between the sending and the receiving										

[3] Any party may receive and use our data as-is without restrictions or prior authentication (data is shared as open data)

administrations										
Obligation to use certain data formats										
Obligation for certain intermediary authorities to organise the exchanges										
Obligation to use certain security measures in relation to the data										
Limitations on the permitted use of the data										
Identity matching										
Record matching										

Other (please specify) _____

11. To what extent is OOP implemented in your country? Check all that applies.

- ○ Broadly at national level
- ○ In certain areas or organisations at national level
- ○ Broadly at regional level
- ○ In certain areas or organisations at national level
- ○ At all levels of power
- ○ Not implemented at all
- ○ Do not know

Other (please specify): _____

12. In what cross-border OOP initiatives is/has your country been involved? (E.g. TOOP, BRIS, SCOOP4C, ECRIS, CEF, SPOCS, ISA2, DE4A, etc.)

_____
_____

13. Do current national laws allow direct data exchange with a public administration from another Member State?

- ○ Yes
- ○ No
- ○ Do not know

If **Yes**, please provide answers to the following:

13a) Can this exchange happen directly based on the request from the foreign public administration without additional interaction with the user from the authority providing the evidence?

- ○ Yes
- ○ No
- ○ Do not know

13b) Is there a legal distinction between requests coming from public administrations in your own country as opposed to such from other countries?

- ○ Yes
- ○ No
- ○ Do not know

14. What other sources of OOP regulation exist in your country? Check all that apply.

☐ None
☐ Non-legislative measures (strategies, green / white papers, etc.)
☐ Written guidelines or recommendations
☐ OOP is an unwritten rule / practice
☐ Other (please specify): _____

15. How would you evaluate the general attitude and willingness in your country towards the following aspects of OOP?

	Public organizations	Private organizations	Citizens
Sharing data with public	Choose an item.	Choose an item.	Choose an item.

organizations within the country			
Sharing data with private organizations within the country	Choose an item.	Choose an item.	Choose an item.
Sharing data with other countries	Choose an item.	Choose an item.	Choose an item.
Sharing personal data with public organizations in the country	Choose an item.	Choose an item.	Choose an item.
Sharing personal data with private organizations in the country	Choose an item.	Choose an item.	Choose an item.
Sharing personal data with other countries	Choose an item.	Choose an item.	Choose an item.
Changing existing organizational processes, procedures and structures to enable OOP nationally	Choose an item.	Choose an item.	Choose an item.
Changing existing organizational processes, procedures and structures to enable cross-border OOP	Choose an item.	Choose an item.	Choose an item.
Changing existing technological solutions (information systems, architectures), etc. to enable	Choose an item.	Choose an item.	Choose an item.

OOP nationally			
Changing existing technological solutions (information systems, architectures), etc. to enable cross-border OOP	Choose an item.	Choose an item.	Choose an item.

16. How concerned are you with the effort and financial costs of adapting or implementing the following national parts of the OOP Technical System (mark the relevant choice with *X*):

	Not relevant	Very concerned	Somewhat concerned	Not concerned
eDelivery infrastructure				
Adaptation of procedures				
Adaptation of data sources				
Data service directory				
Semantic repository				
Evidence broker				
Auditing components				
Preview components				
Other:				

17. Please specify and assess the beneficial outcomes that have been observed so far for the national and the cross-border implementation of OOP.

	National implementation	Cross-border implementation
Increased efficiency	Choose an item.	Choose an item.
Administrative simplification	Choose an item.	Choose an item.
Automation of practices and processes	Choose an item.	Choose an item.
Time savings	Choose an item.	Choose an item.

Cost savings	Choose an item.	Choose an item.
Increased collaboration between agencies	Choose an item.	Choose an item.
Better governance	Choose an item.	Choose an item.
Avoidance of task duplication	Choose an item.	Choose an item.
Better data quality and reliability	Choose an item.	Choose an item.
Improved interoperability	Choose an item.	Choose an item.
Increased transparency and accountability	Choose an item.	Choose an item.
Fraud reduction	Choose an item.	Choose an item.
Increased digitalization and digitization	Choose an item.	Choose an item.

Other (please specify) _____

18. Indicate the types of barriers that the implementation of the OOP system and the data strategy have encountered in your country:

(a) Legal: _____
(b) Organisational: _____
(c) Technical: _____
(d) Business: _____
(e) Political: _____
(f) Human factor: _____
(g) External: _____
(h) Other: _____

19. In view of the national context, please denote (with *X*) the level of criticality to address each of the barriers enlisted above.

Type of barrier	Not critical	Irrelevant	Can benefit from some improvements	Necessary improvements should be made	Critical to address immediately
Legal					

Organizational					
Technical					
Business					
Political					
Human factor					
Other					

20. Please provide any further information which, in your opinion, is important for our understanding of your country's context with regards to the topics mentioned in this subchapter.

_____
_____.

Contact information

Please provide contact details of people (name, email and/or phone number) who we could contact in case we would need some additional clarification or for the purpose of a personal interview:

_____
_____.