D4.12 Moving Abroad - Final running phase

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List of Acronyms

Abbreviation / acronym	Description
AS4	Applicability Statement 4
CET	Canonical Evidence Types
DE	Data Evaluator
DE4A	Digital Europe 4 All
DNS	Domain Name System
DO	Data Owner
DPO	Data Protection Officer
DR	Data Requestor
DT	Data Transferor
Dx.y	Deliverable number y, belonging to WP number x
EESSI	Electronic Exchange of Social Security Information
eID	Electronic Identity
eIDAS	Electronic Identities and Trust Services (infrastructure)
ESSPASS	European Social Security Pass
GDPR	General Data Protection Regulation
IdP	Identity Provider
MA	Moving Abroad
MOR	Multilingual Ontology Repository
MVP	Minimum Viable Product
MS	Member State
NUTS	Nomenclature of territorial units. Territorial Units for statistics
OOP TS	Once Only Principle Technical System
S&N	Subscription and Notification pattern
SDG	Single Digital Gateway
SDGR	Single Digital Gateway Regulation
SME	Small and Medium-sized Enterprises
SML	Service Metadata Locator
SMP	Service Metadata Publisher
UCx	Use Case x
EUDI	EU Digital Identity or Identifiers
USI	User-Supported Intermediation
UX	User Experience
WP	Work Package

Executive Summary

This document is the final report on the DE4A Moving Abroad pilot, providing conclusions and lessons learnt from piloting the cross-border exchange of information in the context of the Single Digital Gateway Regulation (SDGR). The Moving Abroad (MA) pilot implements fully online electronic procedures for moving and living abroad realising across borders the principles of "Once Only" and "Digital-by-default" between Luxembourg, Portugal, Slovenia and Spain[1], aiming to demonstrate tangible benefits for citizens and administrative users.

MA pilot has defined and implemented two use cases related to the SDGR[5] Annex II Life Events for citizens of the above Member States:

▶ "Registering a change of address" (UC#1), which includes implementation of mechanisms for deregistration previous domicile in country of origin linked to new domicile registration in country of destination) and

▶ "Requesting civil status certificates" (UC#2) with focus on birth and marriage certificates.

This was tested by two Data Evaluators (DE) in Luxembourg and Spain and four Data Owners (DO) from Luxembourg, Slovenia, Spain and Portugal in the period running between October 2022 to April 2023. The pilot has been integrating, configuring and testing updated common building blocks and components (including successful customization and integration of the DEs and DOs with the eIDAS infrastructure and the DE4A Once Only Technical System (OOTS)) before the launch of the procedures in the pilot's running phase, where they have been validated gathering experience and lessons learnt from running the pilot in realistic environments.

MA successfully piloted combinations of the above two use cases, including advanced functionalities based on Multilingual Ontology Repository (MOR) and supporting multi-evidence exchange scenarios, based on the User Supported Intermediation (USI) pattern (with improved way of user redirection) with DE portal in Spain and DOs from Slovenia and Portugal with 28 end-users from these Member States (MS). It has used real and test eIDs and additional cross-border combinations were achieved and verified at testing (Playground) environment level, significantly including the Deregistration sub-use-case also involving Luxembourg as DE. Four evidence types were used for cross-border piloting and testing (Birth, Marriage, Domicile Registration and Domicile Deregistration test evidences) and additional models were also defined covering Pensions, Unemployment and Working Life for a third use case that could not be implemented due to changes in partners' participation over the course of the pilot. All this was achieved in close collaboration with other Work Packages responsible for semantic interoperability solutions and common components design and development..

The pilots' cross-border combinations have been launched in testing and/or piloting environments and the goals achieved despite multiple and significant challenges, like prioritization and availability of resources and the ongoing shaping of the SDGR Implementing Act. These, and other challenges posed risks for DE4A pilots progress and timeline, and unfortunately resulted in some partners terminating their involvement in the MA Pilot and/or DE4A project. Various strategies to avoid infrastructure delays have been defined and applied throughout the two piloting iterations overcoming significant challenges in this process (see Section 2.2 and D4.11 [3]). Nonetheless, interoperability between four MS (Luxembourg, Slovenia, Portugal and Spain) has been achieved and multiple cross-border combinations were proven to work with real end-users in piloting environments or in testing environments by the involved MS teams.

The citizens, as end-users, reported in online questionnaires and interviews the online cross-border services valuable in terms of duration and reduced effort to complete them, with most valued aspects

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[1] Romania also participated in the pilot in Data Evaluator role although internal issues in that MS finally prevented it from participating in pilot combinations.

being overall user experience (e.g. multi-linguality), clarity and simplicity of procedures (including steps like Explicit Request to use OOTS or the Preview of evidence) but with the possibility for User Interface improvements (see Section 3.2.1). They find the services to be secure and privacy preserving but sometimes overwhelming eg. with too much or complicated information to ensure a proper understanding of the underlying mechanisms.

Data Evaluators do appreciate the improved quality of the data (confirming fitness of the data models with respect to their evidence requirements), which comes from authentic sources (MS competent authorities) providing guarantees for its being up to date and is relevant for procedural requirements in the need to stay informed about the citizen situation and changes. They estimate that the services will greatly reduce the time spent on the procedures from months and days to minutes (actual times typically ranging from 2 to 5 minutes were recorded with the end-users) especially when leveraging multiple evidences exchange in a single request, while also reducing effort to process evidence thanks to it being harmonized in electronic format and to correct errors. Both Data Evaluators and Data Owners assessed positively the cost-benefit balance of integrating DE4A components and solutions and valued with good levels their satisfaction with OOTS components including record matching, the Preview and the Explicit Request.

The MA pilot specifically focused on getting the services integrated completely with the existing national portals to ensure sustainability beyond the project in the context of the implementation of the SDG. This also gave rise to the Deregistration procedure and the concept of informed proactive citizen services. Further the semantic component MOR was tested by two MS and was deemed to be of further interest to any SDGR procedure.

MS feedback covered relevant aspects of the lessons learnt by the pilot, including estimation of efforts for the various tasks involved to customize endpoints and to integrate with common components in the context of the USI pattern and also to produce two important success stories (see Section 3.2.4). Important lessons learnt also relate significantly to USI pattern, which can be considered to be almost equivalent to the evidence exchange pattern in OOTS Implementing Regulation and which the pilot advises to use in the context of evidence exchange for online procedures and data services holding citizens data (SDG Moving Life Event), considering important MS requirements and guarantees that are satisfied thanks reduced errors in record matching, increased user control and transparency of the process having Preview and user interactions at DP side. For implementation and integration phase lessons learnt emphasize the importance of strong internal coordination and commitment /prioritisation for needed technical activities, explanation of design details to implementation teams involved with easy to access, clear and detailed documentation through mechanisms like Wiki and instant communication tools for solving of issues between technical teams. MA Pilot also confirmed usefulness of approaches like phased testing and launching of services to cope with varying speeds of development between MS or the use of Playground environment and the importance of stability in certain external infrastructures (eIDAS nodes).

The pilot highlighted the difficulties in drawing the lines between architecture and solution as well as the need for proactive interaction between Semantic experts and Technical experts. This is something that the pilot participants find experts in corresponding DE4A work packages really achieved.

Further, there remain several integrations to be made to achieve the Moving Abroad as an OOTS. The pilot could not integrate "Means of living data": the Canonical Evidence Types (CET) were created but not implemented due to factors (projects and services) outside of the control of the project and due to missing Stakeholders/Beneficiaries for that basic registry data.

The pilot did achieve to exchange maybe the most fundamental canonical evidences, which will lead to the possibility of increased trust and accuracy in data across other services within and outside of the currently agreed list of SDGR services.

1 Introduction

The Moving Abroad (MA) pilot of the "Digital Europe for All" (DE4A) project aimed at demonstrating in practice the benefits for citizens when it comes to mobility in the EU, realizing across borders the principles of "Once Only" and "Digital-by-default". By the combination of two use cases (UC#1 – Domicile Address change, UC#2 – Request for civil status certificates), the pilot validated DE4A outcomes by means of cross-border piloting (in realistic operational environments) online processes/electronic procedures for citizens of the four participating Member States: Luxembourg, Portugal, Slovenia, and Spain.

In the project's final running phase, realising progress from the initial Minimum Viable Product to fuller extended scopes (Deregistration and multiple evidences), the pilot partners focused on achieving integration into regular use portals, gathering data and feedback from stakeholders, Data Evaluators, Data Owners, Member States, and citizens.

This document is related to the previous pilot deliverables (D4.9, [1], D4.10[2] and D4.11 [3]) and assumes that the reader is somewhat familiar with their content, as more details on use cases, architecture, and pilot objectives were provided there. It also provides updates on the three documents where relevant.

1.1 Purpose of the document

This document is the final report about the DE4A MA pilot. It covers the final status of the pilot, the lessons learnt and the final assessment of results in the piloted Use Cases.

In coordination with "WP3 Semantic Interoperability Solutions" and "WP5: Common Component Design & Development", the MA-pilot updated common building blocks and components that have been integrated and tested before the launch of the procedures in the pilot's final phase. Especially the finalization of the deregistration needed by some Member States (MS) was specified and implemented.

The document has been prepared in close cooperation with all MA pilot partners. In the current project phase, the pilot partners attended weekly pilot meetings, carried out customization and integration activities, participated in regular weekly Connectathons, assessed the common components and benefits of the integrated procedures, and actively participated in multiple project-wide alignment meetings. Recommendations given to the pilot in "D4.13 Methodology and Mid-term Evaluation report" [4] have been considered and this deliverable serves also as input for the final evaluation of the pilot ("D4.14 Pilots Final Evaluation Report").

1.2 Structure of the document

This document is divided into four main sections:

▸ Chapter 1 – Introduction of the document and pilot running phase.
▸ Chapter 2 – Describing the final status and interoperability of the pilot.
▸ Chapter 3 – Review of goal-achievement and benefits, and reflection on success-criteria and pilot-dimensions, based on actual metrics and findings.
▸ Chapter 4 – Explanation and reflection of pilot procedure execution.
▸ Chapter 5 – Conclusions and major achievements.

2 Final achieved status of pilot

The Moving Abroad pilot has been completed in April 2023 by MA partners in Spain, Portugal, Slovenia and Luxembourg. Romania in the end did not succeed to achieve piloting due to internal prioritizations of the involved agencies that prevent them to allocate resources for the DE4A integration in their national infrastructures.

2.1 Catalogue of services and status

2.1.1 Use cases and pilot scenarios

Previous deliverables already defined the use cases and pilot scenarios for the pilot. During the customization and integration phase of the pilot these have been refined and a use case on information on pensions and labour status had to be abandoned due to pilot partners having to leave the consortium. Thus, the final use cases of the MA-pilot are:

▶ Use case 1 (UC1): Registering a change of Address
  - The use case also covers deregistration of the old Domicile for some combinations
▶ Use case 2 (UC2): Request and extract of a Civil Status Certificate (Birth and Marriage)
  - The core of this use case includes also the exchange of multiple evidences

The following combinations in green of Data Owners and Data Evaluators were piloted (marked with *) or fully tested across-borders in DE4A Playground:

Table 1: Overview of piloted combinations and Use Cases

| UC-1 | | | UC-2 | |
| Request Address change to another Member State | | | Request Civil State Certificates | |
Data Evaluator	Data Owner	De-registration	Data Evaluator	Data Owner
LU-CTIE	PT-AMA	(Yes)[2]	ES-SGAD*	SI-MPA*
LU-CTIE	ES-SGAD	(N/A)	LU-CTIE	ES-SGAD
LU-CTIE	SI-MPA	(N/A)	LU-CTIE	SI-MPA
ES-SGAD*	PT-AMA*	(No)		
ES-SGAD	SI-MPA	(N/A)		

Other planned combinations between Data Evaluators and Data Owners were not piloted due to resource availability and prioritisation, as national agencies acting as DOs and DEs had to address the needs of other national projects or were faced with an unexpected reduction in resource availability.

To complete UC-1 the Deregistration sub-use case was introduced. The Deregistration UC can be explained as follows:

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[2] Being finalised until the end of the project.
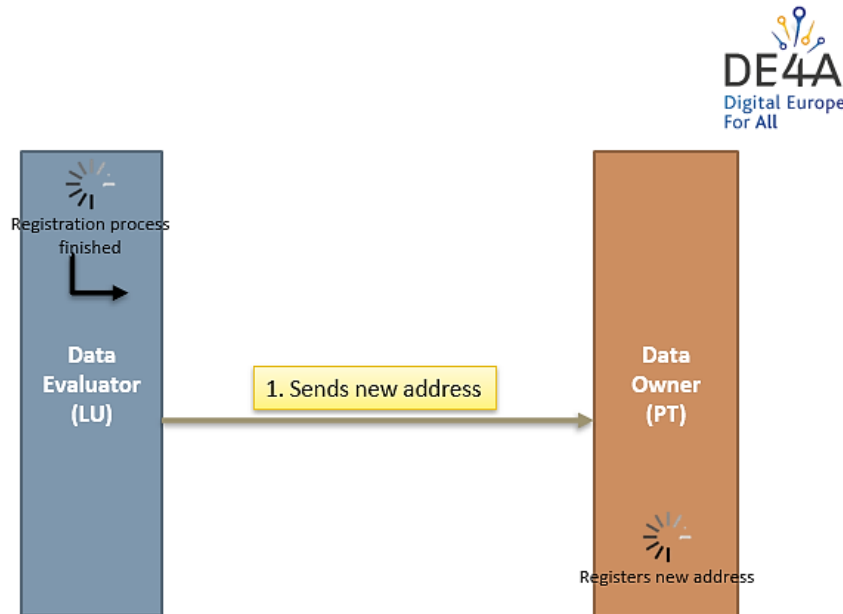
Figure 1: Deregistration the final step in evidence exchange

Portugal (AMA) and Luxembourg (CTIE) use the DE4A Connector component to push (technically using a response message defined for Lookup pattern) to the Country of Origin (Portugal in this case) the message (encrypted message with the AS4 protocol) containing the new address details needed for deregistering the old address. Through the communication structure with the entities that AMA provides, they play the role of Middleware delivering the request to the entity that manages the addresses in Portugal. After the process confirmation, AMA can return it via a back office communication to the requester (not implemented for the pilot), which in this case is MyGuichet in Luxembourg.
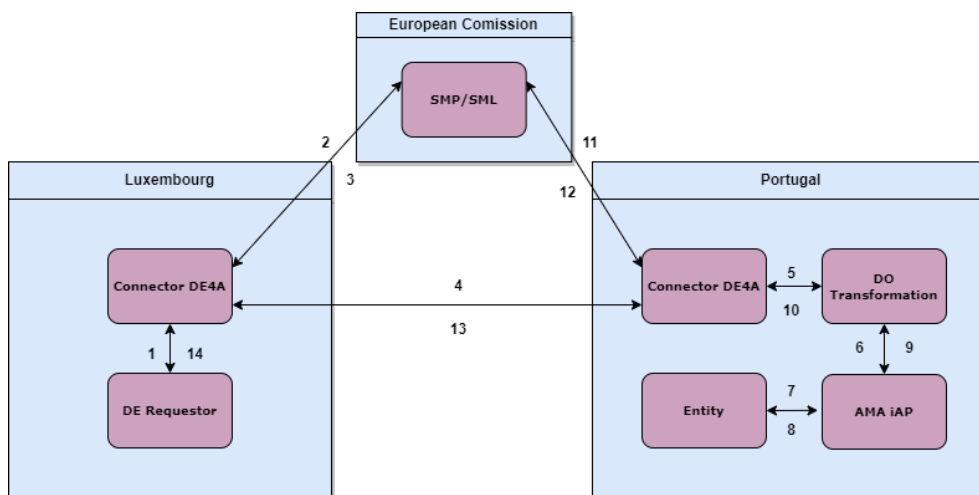
Figure 2: Internal Deregistration flow

This is the internal flow representation of how the Deregistration process works within the AMA structure (steps 10 to 14 were agreed by LU and PT to not be finally implemented for technical reasons).

1. The MyGuichet portal makes the Deregistration request to the DE4A Connector
2. The Connector interprets the message in the AS4 protocol and goes to the SML directory to know where to send the request, in this case to Portugal.
3. The endpoint information from the Portugal Connector is returned from SML Directory to the Luxembourg Connector.
4. The message is sent to the Portuguese Connector.
5. The message goes through a transformation to be interpreted by the Interoperability Platform (iAP).
6. Prepares the message with the citizen's new address.
7. The address is sent to the entity responsible for managing the address change.
8. Return with the answer to the iAP.
9. Returns to the DO where it will be validated if the request was successful and prepared to respond to the Portuguese DE4A Connector.
10. Sending the response to the Connector as OK or NOK.
11. The Connector does the same process as in step 2.
12. SML does the same process as in step 3.
13. The Connector sends the response message in USI format to the Luxembourg Connector.
14. The Connector delivers the message to the Requestor, finishing the process.

Currently, to make a change of address, citizens must contact the entities that manage the domicile address attribute in the two countries involved, namely the Country of Origin (old address) and the Country of Destination (new address). This change of domicile address may imply going to consulates/embassies in the scenario where the respective electronic authentication mechanisms are not configured in the entities responsible for this data processing.

In the case of Portugal, citizen needs to access the national portal3 and make the change request. Subsequently, the citizen will receive a letter at the new address to confirm the change of address associated with their Citizen Card on the portal4.

With the development of this use case, namely deregistration of the address, the citizen only needs to access the Portal of the Country of Destination, register the new address and request/approve its change in the Country of Origin. In this way, the Country of Destination will automatically send an address change request to the Country of Origin once the new address is available and verified, without the need for citizen intervention. As a final step in the process, and according to Portuguese procedural definition, the citizen will only have to confirm the change of address with the code received at the new address in the Country of Destination on the portal[5].

The only requirement for the citizens in Portugal to do this process when moving to a different country, is to have the Digital Mobile Key (eg. CMD) active or the PIN codes of their Citizen's Card. If the citizen wants to cancel a request for change of address that has been submitted, they will need to call the registration helpdesk or go to an IRN-servicedesk. It is also possible, if citizens prefer, to confirm the change of address at a Citizen Spot or at a desk of the IRN.

Advantages for the citizen:

▶ Simpler: a single change of address on the Country Portal where the citizen is and/or will reside, through authentication via the eIDAS node.
▶ More secure: Includes two security mechanisms - a password and a temporary code generated by the authentication.gov app (higher security level).
▶ More convenient: avoids going to face-to-face services and waiting times.

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[3] https://eportugal.gov.pt/en-GB/servicos/alterar-a-morada-do-cartao-de-cidadao
[4] https://eportugal.gov.pt/en-GB/servicos/confirmar-a-alteracao-de-morada-do-cartao-de-cidadao
[5] https://eportugal.gov.pt/en-GB/servicos/confirmar-a-alteracao-de-morada-do-cartao-de-cidadao

In the context of the SDG/OOTS, the presented use case can be useful to leverage the legal changes to allow an easy cross-border address change, being recognized by both the Origin Country and the Destination Country.

The technological components developed within the scope of this use case can be reused in the context of the SDG, at least on the Portuguese side, considering that the Portuguese ePortals will not have changes/adaptations for the SDG. Luxembourg also confirmed the intention to re-use as far as possible in the context of SDGR DE4A's automated back office deregistration procedure in order to implement a fully online and non-discriminatory cross-border change of address procedure, without asking the cross-border user to deregister via a separate, additional procedure.

2.1.2   Pilot environments (Data Evaluators and Data Owners)

MA partners have together prepared several data services (DO) and eProcedure portals (DE) for piloting. The possibilities in each country to set up environments vary, mainly due to national legal constraints. Not all partners / Member States were allowed to pilot using real procedures using SDGR-oriented solutions prior to the SDGR coming into effect. The table below displays the situation per partner.

Table 2: Type of environments involved in the pilot

MS / Use Case Environment Details	DO Data Source	DE eProcedure portal. Environment used	Portal type and evidence used
Spain	SGAD UC#1/UC#2	SGAD UC#1/UC#2	Simulated in pre-production environment, test evidence (Domicile, Birth, Marriage)
Portugal	AMA UC#1	N/A	Test evidences (Domicile, Birth and Marriage evidence)
Slovenia	MPA UC#2	N/A	Test evidence (Birth, Marriage)
Luxembourg	CTIE UC#1	CTIE UC1 (Deregistration domicile evidence)	CTIE Myguichet test portal (pre-production), test evidence (Domicile)

2.2   Suggestions to mitigate infrastructure delays

Evaluating the pilot, the following suggestions are shared to prevent delays when implementing the eIDAS and OOP Technical System infrastructure in the context of the SDGR:

▶ The general advice is to apply a pragmatic and agile approach, and not stop when an issue arises and wait for the ideal solution/components to become available but allow the temporary use of less-than- ideal solutions/components as a step towards the final implementation.

▸ The infrastructure basically consists of two parts: the eIDAS related infrastructure and an OOP related infrastructure. The Data Consumer and Data Provider integrate to these infrastructures and establish cross-border connections to exchange information. The OOP TS infrastructure is related strongly to the SDG and is meant for exchanging citizen evidences (in the case of "Moving Abroad" for Life Event procedures), while the eIDAS infrastructure is a pre-requisite to work with DE/DO systems and the OOP TS. In cases where the eIDAS infrastructure has not been completed but the OOP TS infrastructure is ready, the possibility to simulate authentication and authorization could be temporarily implemented. By mimicking these processes and providing functionality to manually

enter a citizen eID, it becomes possible to experiment with the OOP TS infrastructure only, albeit in a simulated piloting environment. This approach allows for gaining knowledge of and experience working with the OOP TS, towards final implementation.

▶ Wherever possible and beneficial, already available infrastructure (components) could be reused. These components needed some adaptation to be fit for use, but it often saves time compared to developing a completely new component. For example: Luxembourg managed to use available test environments for MyGuichet to deploy the DE4A Connector and additional components (e.g. Preview) to interact with the pilot.

▶ In situations where certain components or services that are needed to test are not available, these could temporarily be circumvented to continue with testing and development in the playground. This was used via the playground for AMA to progress with the deregistration sub use case while Luxembourg worked on integrations locally.

▶ The use of a playground proved to be of major importance to secure progress. The DE4A Playground consists of DE4A Connectors, Data Owner mocks and Data Evaluator mocks, as well as other transaction monitoring tools. These can be used by Data Evaluators and Data Owners in Member States, for development and testing purposes. This way, it is assured that the integration to the DE4A Connector works before cross-border testing starts with real DE4A infrastructure. Also, it makes it possible for Data Evaluators and Data Owners to start development and integration, even before DE4A Connector components are available in their countries. They can use the playground components instead, while the national infrastructure is being developed. The playground needs to be extensively tested, demonstrated, and documented before Member States start using it for development and testing purposes.

▶ Establishment of an Minimum Viable Product definition turned out to be very important to create focus and manage expectations. By explicitly aiming for a minimum viable product, all partners are forced to focus on what the implementation is really about, but also on what is really feasible.

▶ In case major dependencies/interference of DE4A development to other projects and systems migrations at DEs and DOs exist, specific isolated 'project environments' were set-up and used for testing. This was especially visible in the Romanian case who had to several times rebuild their test environment as other services and projects took precedence over DE4A. They did test the MOR components but were never able to achieve more than limited connectivity, failing to fully integrate and configure the Connector.

▶ Having resources and good knowledge on national systems to be integrated is key for timely delivery.

2.3 Achieved interoperability status

At the time this report is written the situation is as follows regarding the following combinations that were finally tested and, in some cases, also piloted with external users. The connection between LU and PT will continue to be integrated and tested and is expected to be ready before the end of the project.

MS acting as DO							
		LU	ES		SI		PT
MS acting as DE	L U		UC1 (Registration)	UC2 (Single evidence)	UC1 (Registration)	UC2 (Single evidence)	UC1 (Registration + Deregistration)
	ES	UC1 (Registration)			UC2 (Multievidence)	UC1 (Registration)	UC1 (Registration)

	Launched		Working in Playground		Tested in Connectathons

Figure 3: Cross-border interoperability status in Use cases 1 and 2

2.3.1 Use cases 1 & 2 (Functional Scope)

In order to be able to implement the MA pilot process (per participant) and to carry out the tasks the pilot process has been designed and described in detail in earlier deliverables. In the final phase the pilots were able to pilot:

▶ User Supported Intermediation pattern
▶ Single Evidence Request
▶ Request multiple Evidences in the same procedure instance
▶ Explicit Request of Evidence in Procedure (single and multiple evidence)
▶ Preview Evidence in Data Service (single and multiple evidence)
▶ Use Evidence in Procedure
▶ Three evidence types: Domicile, Civil Status Certificate and Birth Certificate
▶ Dynamic Look-up of Evidence Type, Data Service, Authorized Authorities
▶ Improved fault tolerance and error handling in the OOP System, for example:
  - OOP System not available
  - Evidence not available
  - Data Service not available
  - Evidence Provider not available
  - Delayed response from Evidence Provider
  - Evidence not received
  - Incorrect Evidence received
▶ (Re-)Alignment with SDG
▶ Notification of deregistration conclusion of the process

Consideration of future scenarios allowing for the family contact person to retrieve evidences and submit eProcedure on behalf of all family members was not piloted due to missing functionality in national systems as well as legal complexity.

Further achievement in the final phase was to test the MOR component. Another unexpected achievement was the realisation of new partner combinations in a very quick way e.g. the Slovenian connection with Spain as well as the introduction of the multiple evidences. Also adding new combinations based on earlier experience was easier than expected.

2.4 Updates in Metrics

The pilot goals, success criteria and metrics were defined in the previous deliverable D4.10 Pilot Planning [2].

The metrics were complemented by interviews with end users to get more insights into their feedback in the questionnaires.

3 Pilot success criteria related to pilot dimensions

This section addresses the evaluation of the four MA pilot goals, success criteria and pilot dimensions, based on observations and feedback received from participating real Data Owners, real Data Evaluators and real citizens. The success criteria results are summarised in relation to the metrics, and for applicable metrics comparison is provided of pilot results with target values that were defined in D4.10 Pilot Planning [2].

3.1   Goals and pilot success criteria

The MA-pilot evaluates several goals from a citizen, Data Owner and Data Evaluator perspective. In the previous project deliverables these goals were linked to success criteria, for which metrics were defined.

Table 3: Moving Abroad Pilot Goals

Actor	ID	Goal
Public authorities	A	Improve the quality of Moving evidence data within the service fulfilment process by re-using data from authentic sources, thereby reducing manual work and lowering processing costs.
Citizens	B	Simplified procedures and reduced manual work, lower transaction costs and improving enrolment speed for the moving citizen(s)
Project	C	Evaluate the OOP-components supporting the cross-border information flow: ▸ Assess technical impact on national services already in place ▸ Evaluate connections of national systems to the OOP TS
	D	- Evaluate whether the solutions designed to the MA specific challenges have proven adequate in piloting the MA eProcedures: ▸ Usability of harmonised Moving Abroad Evidence model ▸ Usability and security of Explicit Request and Preview ▸ Need for record matching on Natural Persons

Table 4: Success Criteria for Data Evaluators

ID	Criterion	Technical Common Criteria	Principles
	- Pilot goal A: Improve the quality of Moving evidence data within the service fulfilment process by re-using data from authentic sources, thereby reducing manual work and lowering processing costs - Pilot goal D: Evaluate whether the solutions designed to the MA specific challenges have proven adequate in piloting the MA eProcedures - Pilot goal C: Evaluate the OOP-components supporting the cross-border information flow: 　o Assess technical impact on national services already in place 　o Evaluate connections of national systems to the OOP TS		
A1	- The DE recognizes the moving data is of higher quality, more reliable and easier to process when using the OOP TS to retrieve moving data directly from the DO. (e.g. data	- Reusability, Transparency, Effectiveness & Efficiency,	- Use (U), Adoption (A), Learning

	is available in an electronic and structured format for easy processing in the systems of the DE, data requires less correcting, is up to date, reliable and leads to less exceptions when processing, moving data is more meaningful, has less inconsistencies and errors, is more complete).	Administrative Simplification	(L), Value (V)
D2	- Have the explicit request and preview requirements as specified in the SDGR proven suitable for the moving eProcedures	- Administrative Simplification, User Centricity, Inclusion and Accessibility	- U, L
C2	- The DE believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.	- Openness, Technical Neutrality and Data Portability	- U, A, V

Table 5: Success Criteria for Data Owners

ID	Criterion	Technical Common Criteria	Principles
-	Pilot goal D: Evaluate whether the solutions designed to the MA specific challenges have proven adequate in piloting the MA eProcedures		
D1	- Has the Moving Evidence Model proven adequate for cross-border exchange of information on companies for the MA eProcedures?	- Openness, Neutrality and Data Portability, Reusability	- U, V, L
D2	- Have the explicit request and preview requirements as specified in the SDGR proven suitable for the moving eProcedures	- Administrative Simplification, User Centricity, Inclusion and Accessibility	- U, L
D3	- Have the mechanisms for record matching at the DP proven adequate for the MA eProcedures?	- Administrative Simplicity	- U, L
C1	- The DO believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.	- Openness, Technical Neutrality and Data Portability	- U, A, V

Table 6: Success Criteria for citizens applying for a service

ID	Criterion	Technical Common Criteria	Principles
-	Pilot goal B: Reduce manual work, lower transaction costs and improving enrolment speed for the move		
B1	- The user acknowledges the procedure for applying for a service to be effective and efficient (e.g. the procedure requires acceptable effort, the procedure is not complex, has no language barriers, no interruptions. The user spends little time to	- Reusability, Effectiveness & Efficiency, Administrative Simplification, Transparency	- U, A, L, V

	correct data and experiences no errors after finishing the enrolment process).		
B2	- The user acknowledges the method to proof their authorisation as effective and efficient (e.g. requires little effort, is established with simple and effective communication, is reliable).	- Reusability, Effectiveness & Efficiency, Transparency, Security and Privacy	- U, A, L, V

Table 7: Success Criteria for evaluation of common components

ID	Criterion	Technical Common Criteria	Principles
Pilot goal C: Evaluate the OOP-components supporting the cross-border information flow: ▶ Assess technical impact on national services already in place ▶ Evaluate connections of national systems to the OOP TS			
C3	- The participating Member States believe the cost and effort for setting up and deploying the DE4A Connector in their national infrastructure will eventually be outweighed by the benefits.	- Openness, Technical Neutrality and Data Portability	- U, L, V

Based on the data, metrics and success criteria, the assessment of the goals is summarized in the table below. In the next section 3.2, the results are addressed in more detail.

Table 8: Summary of pilot goal evaluation

Goal	A	B	C	D
Number of success criteria	1	2	3	3
Number of metrics	3	2	6	3
Number of scale-type metrics with targets	3	2	3	0
Percentage of scale-type metrics below target	0%	0%	0%	0%
Percentage of scale-type metrics fully on/over target	100%	100%	100%	100%

Looking at the success criteria from this quantitative perspective, the results of the pilot must be interpreted as a success: all the metrics were fully over the target.

It must be considered that the number of involved participants is limited. This was recognized during piloting and led to a change in the evaluation approach to a more qualitative oriented approach (based on interviews). A study of the qualitative input that was conducted provided more lessons learnt, which are provided in the next sections.

3.2   Pilot dimensions

The foundation for this section can be found in the questionnaires that the participants filled in, and the interviews that were conducted. In total, interviews in online meetings were conducted with

▶   28 Citizens
▶   2 Data Evaluators

▶   4 Data Owners

The majority of metrics are on or above target. In the next section, the results of collected (quantitative and qualitative) information through questionnaires, observations and interviews have been processed into conclusions on both use cases. The figure below displays the distribution of responses per qualitative success criterion. The following distribution of citizenship was verified among piloting end-users:
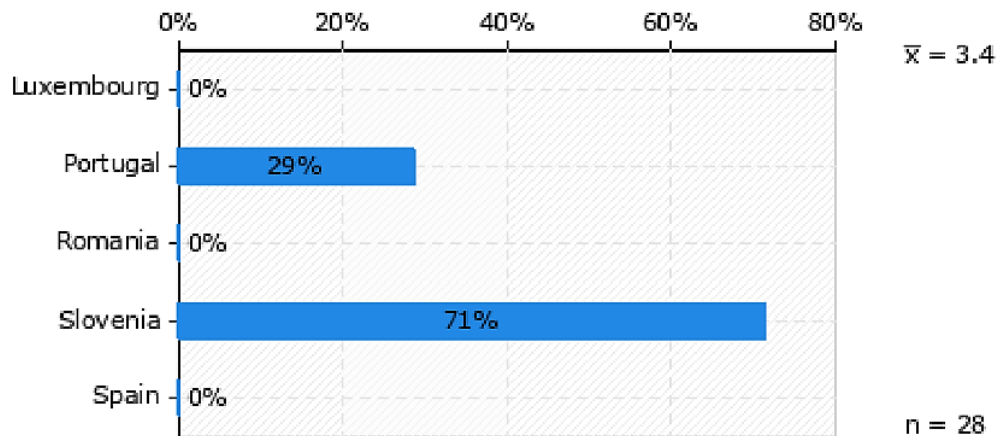
Figure 4: Distribution of Citizenship

3.2.1   Citizen Perspective

In total, a number of 28 citizens were involved in piloting from the two DO countries, answering online questionnaires and 5 interviews were carried out.
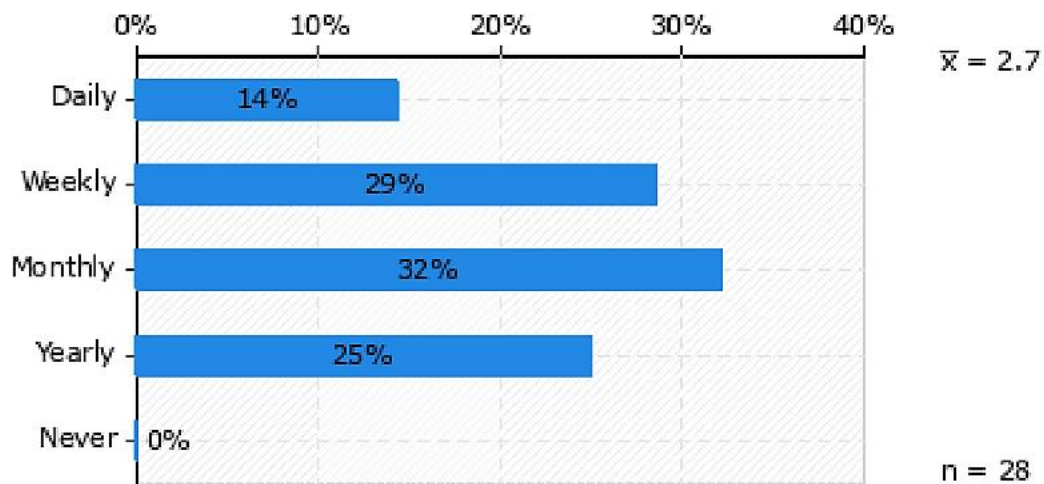
Figure 5: Familiarity with Online Public Services Usage

Most can be said to be regular users of online Public Services. There were quite a large (from 2 minutes to 5-12 minutes) variations in duration to use the service based on which country you came from, the longer values were all from Slovenia. This is not considered linked to the above data on familiarity with online public services, but rather to other technical issues.

3.2.1.1   Use

Citizens that participated in the pilot are in general very positive about the ease of use, immediate results and the fact that they don't have to collect and upload documented proof. The extent to which they can judge the usability, depends on the portal(s) they have piloted in. Citizens that piloted in simulated portals sometimes had a reduced set of functionalities available compared to those that piloted in a pre-production portal. Also, for part of the procedure steps (like authentication involving eIDAS screens), software of third parties had to be used and this is beyond the influence of the DE4A programme.
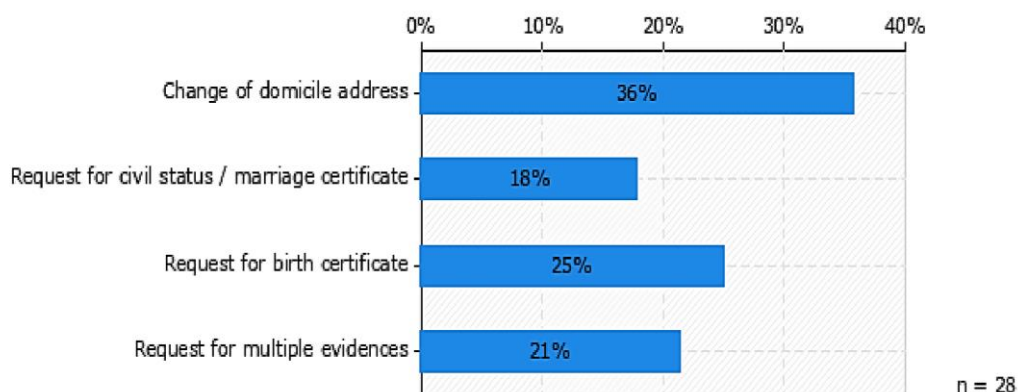
Figure 6: Which Service was used

Few conclusions can be drawn based on this as the services were based on approached but real (first-time) test users.

Based on average durations reported below in the technical logs section 3.2.1.2, it can be seen that the Multiple evidence takes longer to complete both based on technical as well as end user aspects due to increased complexity. One way to see it could be that that services probably should not be made too complex (e.g. too many evidences in one procedure) but, while this is true, citizens will still save time thanks to multi-evidence support (compared to using multiple separate procedures with single evidences each).
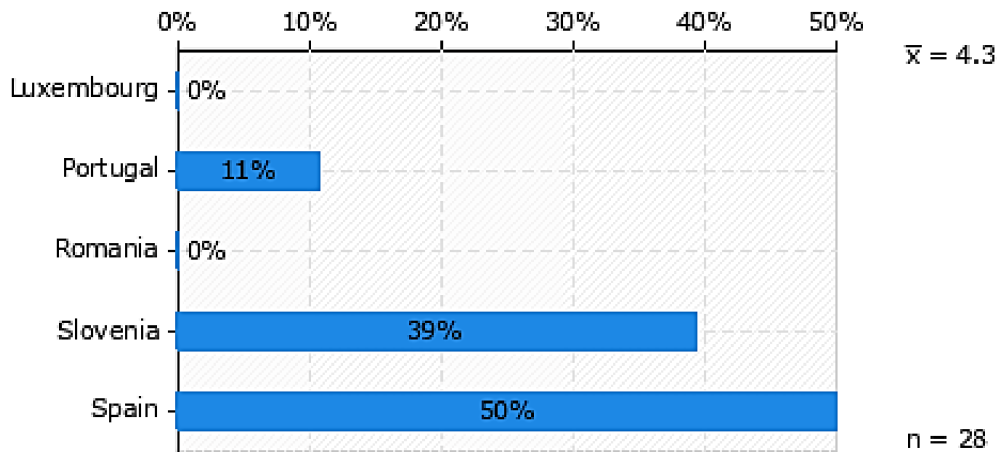
Figure 7: In which Country is the service located

Further it can be deduced that it is not clear to the end users where the service is executed. Rather it might be a matter of interpretation of the word "service" as Spain and Luxembourg were providing portals with electronic procedures as services but Portugal and Slovenia were providing data (evidence) services. Users may also think that because they are sitting in a country the service used is also executed from there based on which ICT-network they are using.

3.2.1.2   Value

Citizens appreciate the short duration of the entire online eProcedure. The piloted eProcedure has been completed within 2-3 minutes in many cases while, according to Data Evaluators, the current procedures could take days or weeks to complete without DE4A OOTS.
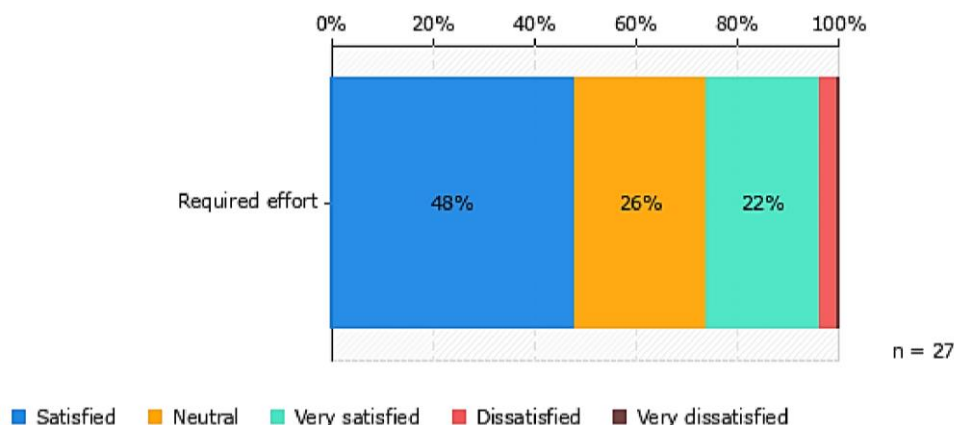
Figure 8: Required Effort

Table 9: Criterion B1

Criterion B1	The user acknowledges the procedure for applying for a service to be effective and efficient
Metric B1.1	The appreciation the user expresses on the effort to effectively complete all elements of the enrolment procedure (e.g. collecting moving information, language barriers, communication, problem solving, required effort, simplicity, number of errors and interruptions).
Target	More than 50% of respondents appreciates the effort (average of all perspectives) to complete the enrolment/registration procedure as reasonable (or less) effort.
Results	As shown in Figure 8 above, 70% of the citizens were satisfied or very satisfied with the required effort and overall experience Figure 9 below) of the completed procedures in the two use cases.
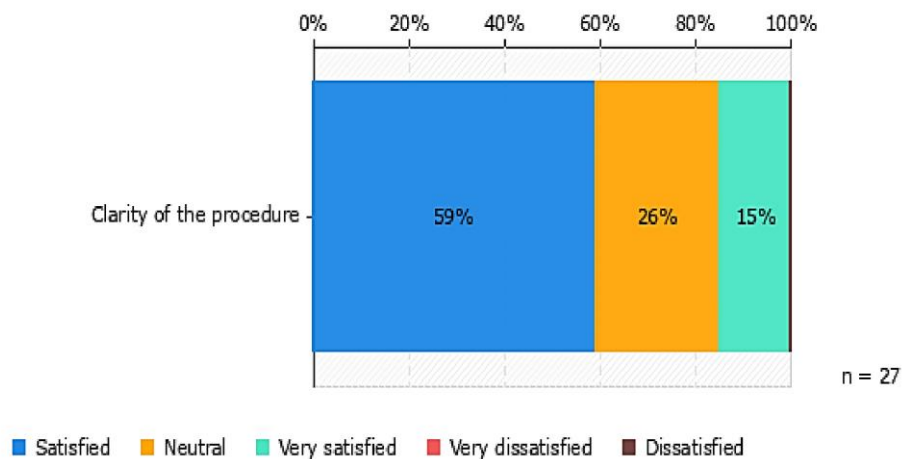
Figure 9: Clarity of Procedure

Citizens appreciate the clarity of the procedure (74% satisfied or very satisfied) while there are improvements that can be made based on feedback in comments and other interviews. This is covered further below.
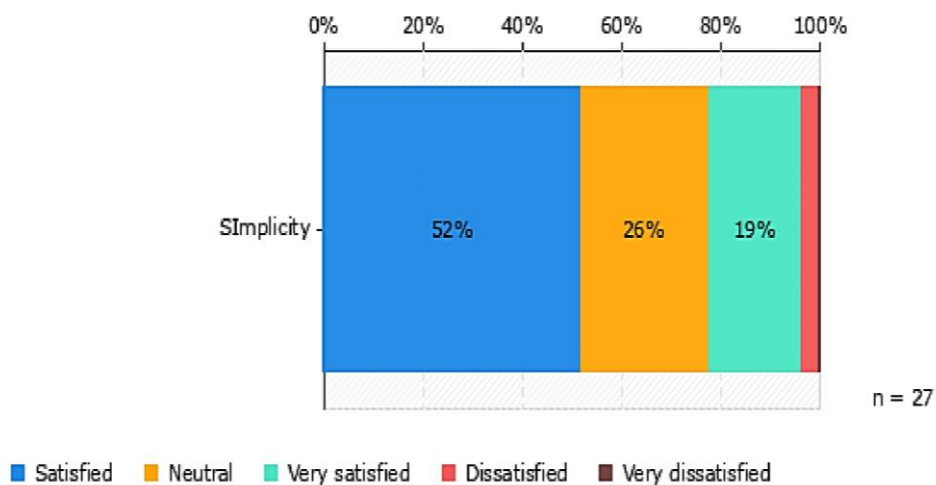
Figure 10: Simplicity of Procedure

Citizens appreciate the simplicity of the procedure (71% satisfied or very satisfied) compared to paper or email procedures, while there are improvements that can be made based on feedback in comments and other questions. This is covered further below.

Figure 11: Number of errors and interruptions

Due to the nature of the pilot having some shortcuts (e.g. test eID) and bugs found and often fixed, the comments showed to be very useful as feedback mechanism for example:

"after selecting type of certificate, button continue to data owner did not work on Friday 17.2; today on 20.2 the whole procedure went well. "

"it worked on the 4th try. "

" if you chose, that you would like to request marriage and birth certificate, you can only preview 1 at the end, and you are redirected to webpage where you can only see info about 1 of the 2 certificates you requested at the same time. things can 't be done "batch", even though the procedure looks like that is allowed through the service "
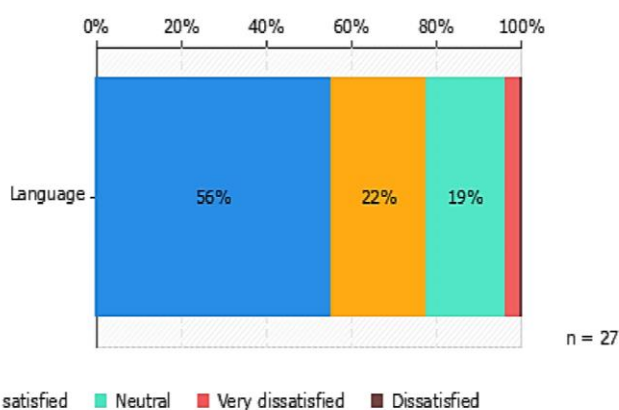
Figure 12: Language

During the pilot there were issues with the configuration of language. Depending on the Browser settings of the end users or the provided services leaving some comments like: "not in Slovenian, a mixture of English and Spanish."

Overall, the feedback is highly appreciative of the flexibility of language choice (78% are satisfied or very satisfied).
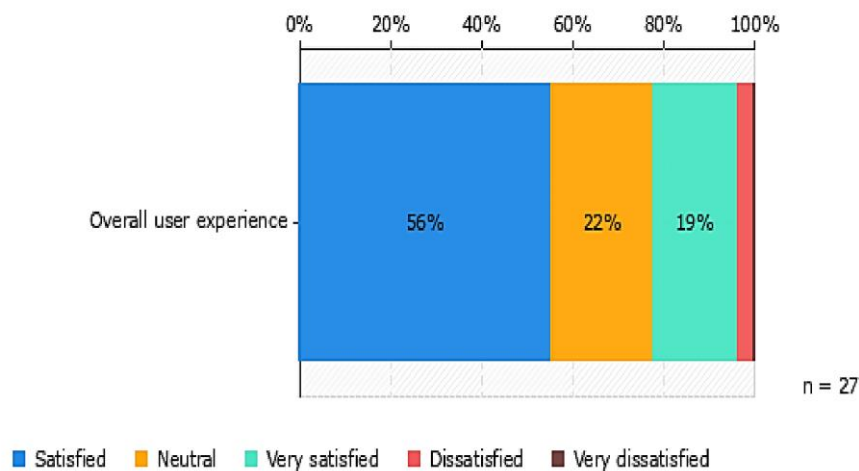
Figure 13: Overall user experience

It looks like there was only one person that is critical of the services in most questions and comments; apart from that, the results seem to be highly successful.

Be aware that the scale of the following figure and table are different (1-5 appreciation scale, seconds for average and median durations).
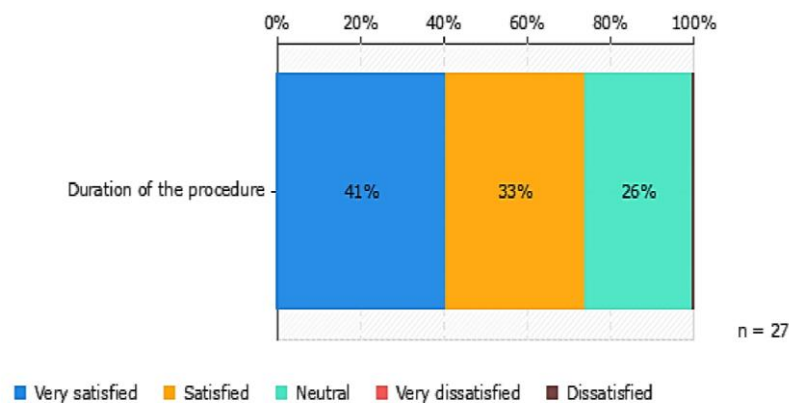
Figure 14: Overall Duration of Procedure

No one is dissatisfied with the duration spent on the service most even highly appreciate the speed.

Table 10: Duration of procedure

Use case	Service	DO	Average (sec)	Median (sec)
UC#1	ESES DE - PT DO (Domicile Registration) (n=8)	PT	121	101

UC#2	ESES DE - SI DO (Multi-evidence) (n=20)	SI	116	136

Times include eIDAS authentication but in the case of Slovenian testers, there was an outlier value of 13 minutes that has been discarded and, for 7 of them, average duration was around 5 minutes (287 seconds of average and a median of 222 seconds). It can be concluded that it is possible that Slovenian users comparably took longer for UC#2 than PT users for UC#1 due to national differences e.g. when authenticating to different DOs and in particular because multi-evidence exchange is more complex.

Table 11: Criterion B2

Criterion B2	The user acknowledges the duration of completing the online eProcedure activities to apply for a service as acceptable.
Metric B2.1	The satisfaction the user expresses on several aspects the duration of the process to apply for a service or registration (e.g. moving data collection, authentication data, eProcedure activities).
Target	More than 50% of respondents appreciates the duration (average of all aspects) to apply for a service or registration procedure as reasonable (or less) effort.
Results	As shown below, 74% of the citizens were satisfied or very satisfied with the duration of the procedures.
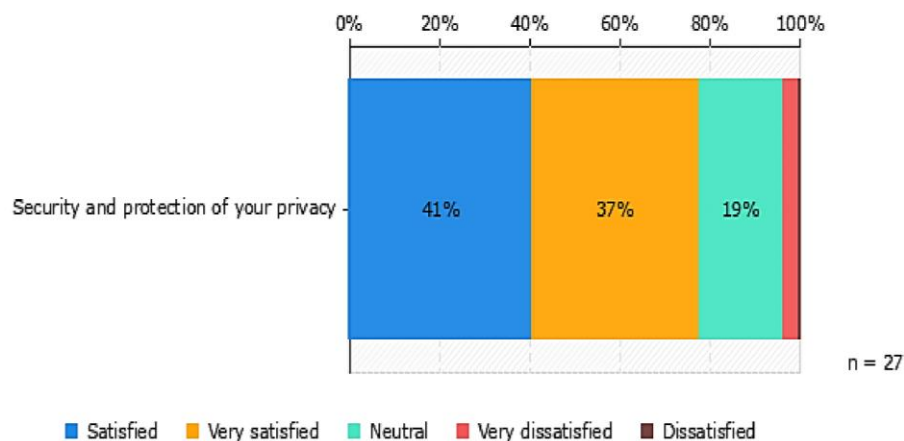
Figure 15: Perceived Security and protection of privacy
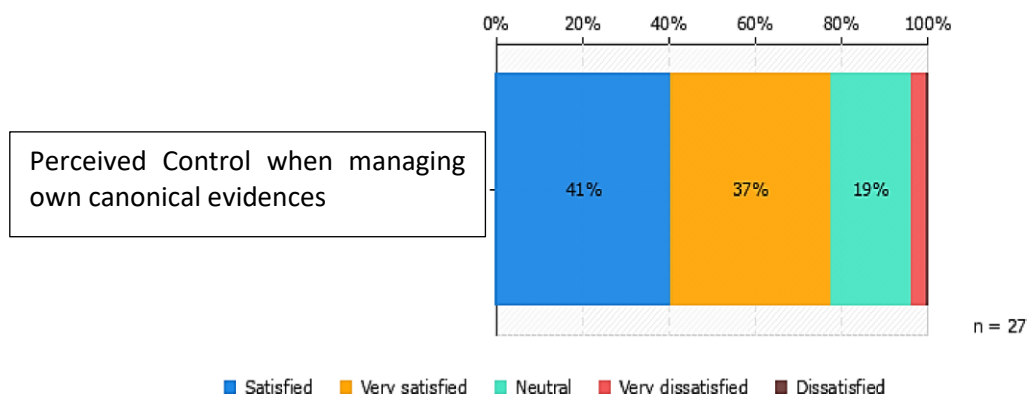
Figure 16: Perceived control when moving own citizen data

Looking at the two questions at the same time there are those that feel helpless using several services that push them around to retrieve and redistribute their personal data e.g.:

"The only good thing is that these services are transparent and not hidden (it is good that services are not seamlessly built into other services)."

"It is completely unclear where the data is, who can see it and how many it technicians and service providers have a possibility to steal my data (pdfs). there should be an option and a possibility to demand encryption of pdfs on the provider side. "

Such users would seem to prefer to collect the evidences (documents) locally (in Slovenia) and then upload them to the service requesting them. But most find the information is minimalistic due to the testing procedure and believe that the real procedure will be written in a more user-friendly version.

One user commented: "It is completely unclear where the data is, who can see it and how many technicians and service providers have a possibility to steal my data (PDFs). There should be an option and a possibility to demand encryption of PDFs on the provider side. " This is not a general comment but does point in the direction of what happens when there is not trust in a government or their agencies.

Most, however, do understand at the procedure start that it is a pilot, and that the information may be retrieved from another MS and find that Explicit Request was clearly stated, and even very straightforward.

Others did not read that text and think that few will, due to too much text: "Further if there is no real free choice (sic) but to use paper there is not much point in reading warnings and small print."

There is at least partial understanding under which conditions the service is provided and how and from where the evidence will be retrieved. At least some understood that the evidence was first visualised and previewed to them based on the source, before being transported to the end destination.

One end user stated that there was not enough transparency and that they therefore would not use the services sending signed PDFs around actors that are hard to get transparency with. "There is no control when an unencrypted PDF or whatever data is sent around. How can I know what is being transferred and to whom and over what providers?" This may lead to understand that such users prefer a DLT solution or at least full transparency and provenance on the data. However, two stated : "I felt informed of which data I authorized to be transferred and I did, indeed, feel in control of the evidence transfer."

UX-comments below on Clarity and understanding lead to at least some need for improved UI, but also show more users comfortable with transparency about which data is to be transferred and perception of security and control:

"For the real procedure I could expect clearer information on re-directions in general, for the whole procedures. The process really contains a lot of different points/portals. Otherwise, Preview was OK and clear."

"Mainly yes. Although the presentation of data could be implemented better. "

"I was fully informed what data will be transferred across border and I did feel in control of the evidence."

"Yes, data was fully presented. I felt moderately in control of the evidence transfer."

"I felt in control and secure, even though I do not know what exactly is happening in the back-end of the application. "

"Yes. I felt comfortable with the Preview space and in control of what information was transferred. "

3.2.2   Administrative users and Member State perspective

In total 2 Data Evaluators (ES, LU) and 4 Data Owners (ES, LU, PT, SI), spread over 4 member States were involved in the pilot and gave their input on the services during the pilot.

3.2.2.1   Data Evaluator Use

Overall, the Data Evaluators are positive about the perceived benefits when integrating to the OOP TS and eIDAS. Integrating (pre-)production systems was obviously more challenging than working with simulated environments. This has occasionally led to the decision to work in isolated environments, in order to reduce (or prevent) interaction with (and dependency of) other systems and projects, especially if systems make use of common local components.

Use Case 1 was piloted using simulated eProcedures (also Use Case 2) due to the nature of working with automatic deregistration and internal conditionings. Two member states tested Deregistration, Luxembourg and Portugal, which aim to use the results of piloting for future developments in their Data Evaluators to automatically improve data quality and to support other MS legal requirements.

Things worth mentioning are:

▶ Integrating the Explicit Request and Preview based on a generic design caused no problems. The functionality is very limited, simple and low-cost to implement.
▶ Logging was kept very basic and close to the existing logging mechanisms in the DE systems. To implement a global logging-system seems to be useful for error-tracking but introduces more challenges on security (as more connections to the outer world need to be established) and seemed not be cost-effective for a pilot.
▶ Some Data Evaluators, although seeing the advantages, also think that the integration with the OOP TS increases technical complexity (of the total solution to support the user-processes). In case of failing components, it is harder to solve these or provide work-arounds. Also organising good maintenance and support on the OOP TS is crucial.
▶ The MA solution seems to be an enabler for certain process-steps with some of the Data Evaluators, likely leading to redesign (improvement) of certain DE-procedures. For example, certain approaches like Deregistration are not really performed or followed up on in the current (conventional) processes but will be when using the OOP TS and eIDAS.
▶ Having too many small Building Block / Services teams causes organisational delays. It is important to have most, or all Team members present in the pilot-team.

Overall, the DEs have seen great improvements in process streamlining, compared to their current procedures.

3.2.2.2   Data Evaluator Value

Data Evaluators look forward to the benefits of having validated data available in a harmonized, structured and easy to process format. It saves time and produces fewer errors when processing in other existing systems. This benefit is expected to lead up to thousands of hours saved per year on processing and correcting, assuming that the solution is used for all DE processes using evidences not just the process that was piloted. On several occasions the implementation led to immediate process improvements on the DE-side, or to food for thought on process improvements. This is also the downside: if implemented for just one procedure, the solution would probably not be cost-effective. Also, some Data Evaluators expect the majority of benefits to become present after a learning curve that has already started with the DEs while piloting.

Data Evaluators consider both the eIDAS and the OOP TS solution to be reliable and fast. Both miss the functionality of Delegation Validation for example, procedures where all family members must approve the moving of a child to a new Member State. Even more difficult is the move when parents are divorced and maybe remarried. These types of procedures were in the end out of scope for the pilot mainly due to legal hindrance/complexity.

The Evidence Types that were piloted, fit the direct needs of the Data Evaluators for the piloted procedures. This means that mandatory attributes in the DE-systems were covered, while more work needs to be done to cover the non-mandatory data. For some of the DE's the evidence contains more attributes than strictly needed. While for others, there was a wish for more optional information. The models used for piloting, that were already designed considering work done for Multilingual Forms from EC regulation 2016/1191 and SDG Semantic Working Group models, turned out to be a good middle-way for the piloted procedures. So, it is to be expected that DEs will re-evaluate which attributes they really need for their eProcedure and (many) more evidence-types will come into existence once the SDG will be implemented for all SDG procedures for these basic but core evidences.

Table 12: Quality of Certificate/ Base Registry data

Aspect	USI (n=2)
Availability in electronic format	5.00
Availability in structured format	5.00
Completeness of available data	4.00
Correctness of available data	5.00
Reliability of available data	5.00
Meaningfulness of available data	4.00

Numerical values in table above were assigned to the appreciation rates as follows: very low (1), low (2), neutral (3), high (4), and very high (5).

Respondents have also rated the effort required for processing citizens' data when using the DE4A USI-pattern and solutions compared to the traditional situation (1 = considerably more effort, 5 = considerably less effort):

Table 13: Processing of Citizen data

Aspect	USI (n=2)
Amount of work	5.00
Interpretation of data	5.00
Solving transcription and translation errors, missing data and exceptions	5.00

(1 = considerably more effort, 5 = considerably less effort)

MA Pilot Data Evaluators also estimated the benefits of the integrated procedure compared to the costs and effort of customizing eProcedure portals and integrating them with the DE4A Connector.

Table 14: Estimated benefits to DE

Aspect	USI (n=2)
Lower manual effort of processing	5.00
Lower communication costs	4.00
Lower risk of errors	5.00
Shorter duration of application processing	4.00
More complete, valuable, consistent and correct data	4.00
Trustworthiness of the data	5.00

(1 = benefits are considerably less than cost and effort, 5 = benefits considerably exceed cost and effort).

Table 15: Criterion A1

Criterion A1	The DE recognizes the moving data is of higher quality, more reliable and easier to process when using the OOP TS to retrieve moving data directly from the DO.
Metric A1.1	The appreciation the DE expresses on the moving data being (considerably) more reliable, equally reliable or (considerably) less reliable than before. (e.g. being available in an electronic and more structured format, being more complete, correct and meaningful).
Target	More than 50% of respondents appreciates the reliability (average of all perspectives) of moving data as (considerably) more reliable than in the baseline.
Result	Both DEs confirmed high/very high satisfaction for all mentioned aspects in Table 12.
Metric A1.2	The appreciation the DE expresses on processing of the moving data requires (considerably) more, equally or (considerably) less effort than before (e.g. amount of work for interpreting and judging, solving exceptions).
Target	More than 50% of respondents appreciates the effort (average of all perspectives) of processing moving data as (considerably) less than in the baseline.
Result	Both DEs confirmed benefits considerably exceed cost and effort for all mentioned aspects in Table 14(1 = considerably more effort, 5 = considerably less effort) MA Pilot Data Evaluators also estimated the benefits of the integrated procedure compared to the costs and effort of customizing eProcedure portals and integrating them with the DE4A Connector. Table 14.
Metric A1.3	The estimated benefit the DE gets from moving data that is always up to date, with effort to resolve exception, manually changing data, interpret data, etc. being (considerably) much to (considerably) less.
Target	More than 50% of respondents estimates the benefits (average of all perspectives) of always having up-to-date moving data as Medium or (considerably) high benefit.
Result	Both DEs confirmed benefits from moving data that is always up to date with less / considerably less effort to interpret data, solve transcription and translation errors, missing data and exceptions and overall amount of work (Table 13).

Table 16: Research question D2

Research question D2	Have the explicit request and preview requirements as specified in the SDGR proven suitable for the moving eProcedures?
Metric D2.1	The appreciation on implementing Explicit Request in various procedures
Target	None (research topic)
Result	Integrating the Explicit Request based on a generic design caused no problems. The functionality is very limited, simple and low-cost to implement.

Table 17: Research question D3

Research question D3	Have the mechanisms for record matching at the DC an DP proven adequate and effective for the MA eProcedures ?
Metric D3.1	The appreciation of the DE on the need to do record matching on Natural Persons on their part.
Target	None (research topic)
Result	Each DE has specific requirements for registration of users and authentication of recurrent users. For foreign users, reliance on eIDAS personal identity attributes in (notified) eIDs is certainly helpful for DEs as this information is formally attested by EU MS authorities although locally other identifiers will normally be generated and used for people moving into another MS.

Table 18: Criterion C2

Criterion C2	The DE believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.
Metric C2.1	The estimate of the DE on the added value of the OOP TS usage (considerably) exceeding, being on par or being (considerably) less than the cost and effort spent to integrate the OOP TS.
Target	More than 50% of respondents estimate the benefits to (vastly) exceed the cost and effort.
Result	Both DEs confirmed benefits considerably exceed cost and effort for all mentioned aspects in Table 12 with an average value of 4.5.

3.2.3 Data Owner Perspective

3.2.3.1 Data Owner Use

Four Member States were able to get the Data Owner role ready with two of them used for combinations piloted with real users and these plus other two in DE4A Playground, all contributing to Data Owner Use and Value. The Data Owners, usually already provide standard data services, they did not notice much of the benefits but also no negative effects so still overall positive results.

3.2.3.2 Data Owner Value

MA Pilot Data Owners also estimated the benefits of the integrated procedure compared to the costs and effort of customizing eProcedure portals and integrating them with the DE4A Connector.

Table 19: Estimated benefits to DO

Aspect	USI (n=4)
Lower manual effort of processing	5.00
Lower communication costs	4.00
Lower risk of errors	5.00
Shorter duration of the request processing	5.00

The MS find that the services lower the manual efforts considerably. The communication cost are likely to improve slightly. The risk of errors is greatly reduced as is the duration of processing.

Table 20: Criterion C1

Criterion C1	The DO believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.
Metric C1.1	The estimate of the DO on the benefits of the OOP TS usage (considerably) exceeding, being on par or being (considerably) less than the cost and effort spent to integrate the OOP TS.
Target	More than 50% of respondents estimates the benefits (average of all perspectives) to (considerably) exceed the cost and effort.
Result	All 4 DOs confirmed benefits of OOP TS usage to considerably exceed the effort and cost with an average of 4.75 in Table 19.

Table 21: Research question D2

Research question D2	Have the explicit request and preview requirements as specified in the SDGR proven suitable for the moving eProcedures?
Metric D2.1	The appreciation on implementing Preview in various procedures
Target	None (research topic)
Result	Integrating the Preview based on a generic design caused no problems. The functionality is very limited, simple and low-cost to implement.

Table 22: Research question D2

Research question D3	Have the mechanisms for record matching at the DC an DP proven adequate and effective for the MA eProcedures ?
Metric D3.1	The appreciation of the DO on the need to do record matching on Natural Persons on their part.
Target	None (research topic)
Result	MA pilot DO stakeholders appreciate positively record matching at Evidence Provider side enabled by USI pattern. No specific issues were highlighted with record matching by DEs and eIDAS authentication process seems to have worked well in general (less than 20% of users were dissatisfied due to errors in general while piloting).

3.2.4   Success stories

Some examples of success stories related to the Moving Abroad pilot are the folling:

Integration of multilingual functionality in preview of evidences

The MOR solution; offers a complete set of resources for understanding canonical evidence types and for providing a dialogue with users for the explicit request and preview of evidences. A light multilingual ontology repository has been created with the terms of the Domicile Registration canonical evidence type, the terms used but this evidence type from common vocabularies, and the terms used by the user dialogue interfaces. Labels and descriptions of each term were defined in English, automatically translated into Romanian, Spanish, French and Portuguese, and then revised by domain experts speaking these languages.

In the Use Case "Request Address Change" of the second iteration of the project, the MOR client-side component for the explicit request dialogue has been used by Romania and the MOR web semantic functionality has been used by the Spanish preview page. The implementation of the explicit request functionality in the Romanian eProcedure portal required only the adaptation of the CSS classes of the MOR client-side component to the graphical style of the portal and the implementation of Javascript variables as interfaces with the MOR component, thus simplifying and accelerating the implementation of the explicit request functionality, including its dialogues with users and with the central components of the system.

The integration of the multilingual functionality in the Spanish preview page required only the inclusion of the MOR language selector and the corresponding Javascript module, as well as the use of the MOR custom attribute in HTML elements that contains labels to be provided in different languages, making it easy to incorporate the multilingual functionality into an existing page.

DE4A: a key step for a successful implementation of SDGR;

For Luxembourg, DE4A is mainly a true success story because it was and is an essential preparation and pilot implementation of many core elements and solutions that must be put in place anyway until December 2023 for the SDG OOTS defined in Article 14 of the SDGR.

DE4A made it possible to have a better and deep understanding of the requirements and the technical options also needed in the context of the SDG OOTS. The piloting and the many discussions and preparatory work done in this context allowed us and the other participants to gain hugely in maturity and in understanding of the issues involved.

This allowed Luxembourg and other MSs participating in DE4A to provide essential and valuable input also in the context of the SDG OOTS discussions and meetings that took place at EU Level: SDG coordination group, SDG Committee and dozens and dozens more technical and specialised meetings.

The main input of DE4A to the SDG OOTS is probably in this context that SDG OOTS finally also uses, after many and sometimes controversial discussions on the topic, essentially the USI pattern, the most appropriate pattern in our opinion to fit the requirements and needs defined in Article 14 of the SDGR. It is the most appropriate because it allows, to the highest extent, for the reuse as is of the national solutions used for authentication (e.g. eIDAS nodes) and the other national solutions (e.g. preview space), achieving hence the highest level of interoperability and efficiency and makes identity matching as easy as possible.

DE4A also made it possible, on a more national level, to put in place many national solutions and building blocks that can be reuses in the context of SDG OOTS: e.g. the connection between the MyGuichet platform and the eDelivery connector/access point. More specifically, the Moving Abroad pilot provides a strong basis for what has to be done in SDG anyway and made it possible to design an optimal online procedure for cross-border change of main residence, achieving a maximum level of user-centricity by including the deregistration of the user in the country he leaves directly in the registration process in the new country and making it hence unnecessary for the user to start a second,

specific online procedure just to deregister. This is true Once Only implemented in the best interest of the user.

3.2.5   Member States Perspective

The participating Member States were asked to estimate the benefits compared to the costs, effort, and time required to setting up and deploying the AS4 gateway, the SMP, and the DE4A Connector focusing on implementation, maintenance, training, and the duration of application processing (1 = benefits are considerably less than cost, effort and time, …, 5 = benefits considerably exceed cost, effort, and time). As only two MSs provided their answers, particular national issues (e.g. extensive security testing in Portugal) influenced the final results.

Table 23: Estimated benefits to MS

Aspect	Score (n=4)
Effort and cost of implementation	4.00
Effort and cost of maintenance	4.00
Effort and cost of training	4.00
Shorter duration of application processing	5.00

Table 24: Criterion C3

Criterion C3	The participating Member States believe the cost and effort for setting up and deploying the AS4 gateway, the SMP and the DE4A Connector in their national infrastructure will eventually be outweighed by the benefits.
Metric C3.1	The estimation the Member State expresses on the effort, cost and time involved in setting up a node and deploying a DE4A Connector being (considerably) more, on par or (considerably) less than expected.
Target	More than 50% of respondents estimate the benefits to (vastly) exceed the cost and effort will eventually be outweighed by the benefits.
Results	All piloting MS provided this data with values indicating benefits exceed/considerably exceed costs, average of 4.25.

3.2.6   Overall lessons learnt and Pilot Adoption Considerations

Pilot partners have also estimated the required effort for various steps, such as integrating the DE4A Connector or implementing the Preview functionality. Effort for USI pattern is summarized in the following tables based on answers from Luxembourg, Portugal, Slovenia and Spain providing at the end overall effort for integrating as well the DE and DO endpoints (including integration with eIDAS, Connector, SMP, UI internationalization and respectively Explicit Request or Preview and transformation from or to canonical evidence).

Table 25: Estimation of effort for the USI-pattern approach

Phase	Mean planned effort (in person days)	Spain	Portugal	Slovenia	Luxembourg

Setting up and deployment of DE4A Connector	4-5 days	5,5	20	25	12
Setting up and deployment of SMP	5-7 days	5,5	10	15	2
Integration of the portal with an eIDAS node	5-7 days	9	10	5	3
Integration with DE4A Connector	4-5 days	10,5	13	10	15
Implementation of explicit request	2-3 days	4	2	0/	4
Implementation of preview DE & DO	2-3 days	7,5+10,5	15	30	3
Transformation to canonical format and provision of the requested evidence	3-4 days	4,5	4	5	4
Transformation from canonical format and use of the received evidence	3-4 days	4,5	5	N/A/	N/A
UI internationalization	2-3 days	4	3	3	4
Overall effort for DE	11-15 days	31,5	N/A	/	40
Overall effort for DO	11-15 days	34,5	45	93	43

The mean planned efforts are described based on the implementation in two DO and one DE based on different levels of integration and were rough estimations when D4.11 [6] was released. The underestimation is often related to organisational issues (too many teams), also due to some underestimation of actual needed changes to existing systems. Now the values are better consolidated from two DEs and four DOs.

SGAD's (Spain's) effort generally matches with the original estimation. Note that SGAD is finally involved in more combinations than planned in both UC#1 and UC#2 with DE and DO implementations. SGAD also took advantage of acquired knowledge from the Studying Abroad pilot. In the case of DE4A Connector integration, it exceeded estimation because of issues encountered while configuring the components. SGAD opted to split the implementation of Preview because the information shown was slightly different in the Data Owner, including the Domestic evidence along with the Canonical evidence and the PDF evidence. In that case SGAD think the effort was a bit underestimated. The overall effort for DE and DO also includes the configuration once real testing was performed and final adjustments needed to be implemented.

Table 26: Criterion C2

Criterion C2	The DE believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.

Metric C2.2	The cost (manhours) involved to integrate the eProcedure portal to the DE4A Connector.
Target	none
Results	Efforts vary between 31.5 and 40 person-days, which is longer than expected initially due to different technical/organisational challenges that had to be addressed for real deployment integration and testing.

Table 27: Criterion C1

Criterion C1	The DO believes the cost and effort for integrating to the DE4A Connector will eventually be outweighed by the benefits.
Metric C1.2	The cost (manhours) involved to integrate the data service to the DE4A Connector. To be provided only if costs are not confidential.
Target	none
Results	Efforts vary between 34.5 and 93 person-days, which is longer than expected initially due to different technical/organisational challenges that had to be addressed for real deployment integration and testing. Especially 93 days in Slovenia stands out with most of the variation seen for cost of implementing Preview functionality.

Table 28: Criterion C3

Criterion C3	The participating Member States believe the cost and effort for setting up and deploying the DE4A Connector in their national infrastructure will eventually be outweighed by the benefits.
Metric C3.2	The cost (person days) involved to set up and deploy the DE4A Connector.
Target	None, compares to planned efforts
Results	It took longer than expected to set up an SMP and to deploy a DE4A connector with an integrated phase4 AS4 gateway.

3.2.6.1 Lessons learnt from analysing and designing national integration of cross-border OOP

Pilot partners analysing and designing their solutions learnt various lessons that are gathered in this section. For each lesson learnt, a suggestion for adoption is presented.

Table 29: Lessons learnt from analysis and design

ID	Topic	Suggestions for adoption	Lessons learnt
1	Design process	MA advises Member States to invest time to bring together the eIDAS and OOTS knowledge. This requires organising and prioritising as this knowledge is scarce.	Designing national integration required in-depth knowledge of both eIDAS and OOTS. This knowledge (specifically the combination of both) is not broadly available in Member States. Knowledge of both domains should be brought together to prevent designs based on false assumptions of the other domain. The entire infrastructure teams need to participate.

ID	Topic	Suggestions for adoption	Lessons learnt
2	Scoping	MA advises the European Commission and Member States not to solve all user scenario's at once, but to focus on the most frequently used ones. They should first focus on core functionality only. And at the same time organise follow-ups on improvements and additions to address later on.	The project encountered many complex issues and topics that needed to be solved in the pilot design phase. The pilot lead has organised a series of meetings to address these topics bringing together interdisciplinary expertise. To keep focus on the core research questions and to limit resources needed, the pilot partner agreed to simplify whenever adequate, e.g. focussing at the most important evidence type, with the least risk (eg. avoiding death certificates) instead of all possible types (means of living that is highly complex). The pilot secured slow but steady progress by ensuring all was heard (eg. full and multiple security reviews as well as organisational stakeholder management) and scoping strictly on implementation as close to real services as possible.
3	Explicit request	MA advises data evaluators to integrate (1) request to consent and (2) explicit request into one joint question to the user to prevent adding to the confusion - of course in case both are applicable at the same time.	In some cases, users need to express consent for the retrieval of attributes (GDPR). In almost all cases when using the OOTS, the user needs to express explicit request (SDGR). Although legally sound, in practise the difference between both is difficult to understand for data evaluators. DEs furthermore expect that users will ignore such requests and just click "ok".
4	Multiple-MS scenario's	MA advises Member States to make an early start with the analysis of the SDG-implementation where data exchange involves more than 2 Member States.	The pilot involved combinations of 2 Member States in the exchange of evidences about citizens. The level of complexity for analysis increases vastly with each additional Member state that is involved in the exchange of information. An example of a 4 MS-scenario could be a father from MS A, Mother from MS B and Child MS C (adopted) and Legal Guardian from MS D. Such an analysis introduces a level of complexity that exceeded the constraints of the pilot.
5	eIDAS non-notified eID	MA advises The European Commission and the Member States without notified eIDs to agree on a temporary solution for using non-notified eIDs in SDG-procedures.	Some of the participating Member States do not operate a notified eID (SI, RO). On a bilateral basis non-notified eIDs will be accepted for piloting purposes, although pilot partners expressed their doubts regarding the acceptance of non-notified eIDs for large scale SDG. Notification of eIDs is a strong prerequisite for implementing SDG. Mandatory eID-notification as expected under the new eIDAS regulation (eIDAS revision) will not be available in time for SDG-implementation.
6	Sector specific systems	Integration of the OOTS with sectoral systems (EESSI in this pilot) has proven to be not as straight forward as many	For the MA pilot alignment to - or integration with - EESSI has been an important topic from the start of the project. The solutions have been developed for different purposes and hence are not easily aligned.

ID	Topic	Suggestions for adoption	Lessons learnt
		expected at the start of the project.	Also ESSPASS should be considered when deciding on how to move forward. Involving all needed agencies.
7	User interaction design	MA advises the European Commission to provide wireframes to have generic steps (like Explicit Request and Preview) implemented in a similar way by all MS.	Several data evaluators needed to implement the same logic in their specific systems, including user interaction (general explanation, Explicit Request, Preview). The user interaction design across participating Member States turned out to show some differences in informative texts, detail of explanation, use of buttons, etc. This may lead to confusion for the user that deals with multiple data evaluators as well as a slow learning curve. MA decided to provide a pilot-wide reference in the form of wireframes to allow for more uniformity across the pilot.
8	USI pattern	MA advises to consider the use of the USI pattern in the context of evidence exchange for online procedures and data services holding citizens data	MA Pilot chose to pilot the USI pattern considering a number of important MS requirements and guarantees that would be satisfied thanks to user interactions at the DP side including reduced errors in record matching, increased user control and transparency of the process having Preview at DP side. Given the fact that USI pattern also reuses, as far as possible, the same specifications and standards as the intermediation pattern, it would allow, beyond this fact, to reuse more of the building blocks that are already available on national level (e.g. Preview implemented in many data service portals) and lead to less complexity by avoiding the duplication, only for cross-border needs, of such solutions. Now this advice is de facto taken up as the evidence exchange pattern in OOTS Implementing Regulation can be considered to be almost equivalent to DE4A's USI pattern.
9	USI pattern	MA advises to build on existing sectoral Regulations such as Public Documents Regulation in order to leverage existing solutions that are beneficial in cross-border contexts	DE4A Information Exchange Model has been particularly useful for this pilot as it allows to exchange structured evidence (canonical) but also original evidence and multilingual forms that are compliant with the Public Documents Regulation (EU) 2016/1191 and which were considered together with ISA2 models for the pilots' canonical evidences.

3.2.6.2 Lessons learnt from implementing and testing the DE4A OOP TS

Table 30: Lessons learnt from implementation and test

ID	Topic	Suggestions for adoption	Lessons learnt
1	Planning and	MA advises to allocate a multi-month phase for establishing alignment, priorities, financial	The components to be used (in the pilot) were distributed over several authorities in a Member State, requiring the commitment from all

ID	Topic	Suggestions for adoption	Lessons learnt
	organising tasks	means etc. for all organizations involved. Furthermore, it is necessary to have a coordinating team (equipped with sufficient knowledge about the solution) in each Member State to make sure that legal, semantic, technical and managerial issues are being resolved in a timely manner.	authorities. This commitment is not obvious and must be secured beforehand. Also, as the systems are distributed, the teams working on the systems are distributed as well. Collaboration took more time and, in each team, keeping DE4A with high priority became challenging. LU finally managed to bring in most of the needed experts while RO didn't manage to achieve systems integration though they had good technical experts but maybe too few individuals.
2	Handing over	MA advises the European Commission to put additional efforts into explaining the workings of the SDG OOTS components to public authorities involved. The better the solution is understood by all, the smoother the SDG implementation will be. The national complexity that the SDG imposes on Member States (e.g. record matching) is easily underestimated.	Design documents and specification have sometimes been interpreted by different pilot partners in different ways. The preparation of the pilot or during interoperability testing such differences surfaced. It would be better to have a detailed common understanding of all the design details prior to the testing phase. Take the time for handing over Solution Architecture and components to other work packages in the DE4A programme, and make sure that everything is understood.
3	Documenting	MA advises the European Commission to invest in proper and clear documentation for developers in Member States, so they can get the OOTS up and running with the least amount of effort. Documentation should not be too cryptic and short, but definitely must not be too extensive. Feedback on the documentation from first movers has proven to be very useful in the MA pilot. Additionally, installing a small central team to technical experts providing support technical experts in Member States, could be considered.	For developers of the common components, there's a lot of logic behind its internal routines, structure, configuration, etc. Deploying these components by the Member States in the MA pilot raised several questions regarding the use of Docker images, configuration items that needed to be set correctly, required firewall and DNS settings, etc. Using Wiki and GitHub worked very well to facilitate internal communication and to make results externally available..
4	Configuring	MA advises Member States to prepare for the steps to be taken to request the certificates needed to operate the OOTS. MA advises the European Commission to investigate	The components needed for SDG rely heavily on use and exchange of certificates for server authentication, signing, etc. The process of acquiring the certificates turned out to be time-consuming and error-prone (all details must be in place when requesting the certificates).

ID	Topic	Suggestions for adoption	Lessons learnt
		whether the process for acquiring the OOTS certificates can be simplified. MA advises the European Commission to design a procedure for communication between Member States in case of change of certificates and to provide for certificate-rollover to guarantee OOTS-connectivity.	Furthermore, the procedure of requesting certificates is regulated in a way it requires signatures of responsible people within the requesting institution that do not on a daily basis work with - and understand the use of - certificates. Or people that are not available immediately (organisation executives, infrastructure and network experts).
5	Integrating DE and DO	MA advises Member States to take the impact on existing systems into account. Including existing items on backlogs that might need to be resolved before being able to connect to the OOTS.	When integrating to the DT/DR, expect to run into existing problems in the DO/DE systems that need resolving as well. This will involve extra work, although the work is not directly being created due to integration with the DT/DR. The problems in the DE/DO systems were existing already, but were not causing real issues until then (problems were accepted) but might need to be resolved in order to achieve good integration to the DT/DR.
6	Interoperability testing	Wider OOTS implementation requires more inter-Member State coordination regarding the exchange of connectivity details, configuration and cross-border interoperability testing. Planning of these activities requires much attention and flexibility from the Member States. MA advises to take this into account when connecting the decentralised SDG OOTS components. eIDAS lessons learnt with regards to the exchange of certificates for example, are also relevant.	The speed of development varies per Member State. Therefore, readiness for cross-border testing (and piloting, for that matter) is also distributed in time. Member State A can have their DE ready months before Member State B has (due to several national impediments). Testing on fixed moments in time for all DEs and all DOs has proven not realistic so going for a phased pilot launch has been proven as the right approach. It is conceivable to start also immediately (within 6-12 months) with basic testing (eIDAS, connectivity) and other easily available technical resources. Applying Agile to projects of the size and complexity of DE4A is often a challenge.
7	Interoperability testing	Establish clear readiness criteria for the DE/DO and the DE4A Connector before starting Connectathons.	The MA pilot has proven that a lot of settings need to be configured correctly to allow successful cross-border evidence exchange. During interoperability and integration testing (Connectathons) Member States sometimes had different views on what components or parameters had to be set in order to start testing. As a result, not in all cases the complete flow could be tested at once. This was improved in the final piloting phase with Getting started guides in the Wiki.

ID	Topic	Suggestions for adoption	Lessons learnt
8	Interoperability testing	MA advises the European Commission to coordinate the exchange of test credentials between Member States. Many-to-many "requesting and sending of eID's on a bilateral basis" should be prevented.	Proper interoperability testing is only possible with the required test eID means. These national eID means have not always been easily available (depending on the MS-specific situation – dependencies on IdP's may exist). This hindered cross-border interoperability testing at some occasions. The effect of lacking test credentials will be much greater in case of large scale implementing the SDGR.
9	Reliance on eIDAS	MA advises the Member States to setup and test national eIDAS deployment prior to implementing the SDGR in order to prevent delays.	MA piloting – just as SDG implementation – relies on the use of eIDAS. Unfortunately, eIDAS is not fully up and running in all Member States. In interoperability testing, several eIDAS related setup or instability issues needed to be solved.
10	SDG implementing acts	MA advises the European Commission and Member States to be aware no such thing as 'a final version' exists in the area of inter-Member State information exchange. Moving forward step-by-step with versions currently available is crucial to progress. Note that continuous alignment with all European initiatives during single steps is not feasible and will delay each initiative started.	MA pilot implementation has experienced delays by numerous discussions (within Member States and between Member States) on alignment with the SDG OOTS that was being sketched at the same time. Although this approach had been deliberately chosen and agreed upon at the start of the MA project (to enable real piloting and provide input to SDG), in practise discussions were raised over and over again and caused prioritization challenges for the pilot activities of partners.
11	Coopera-tion	MA advises to facilitate technical experts of the Commission and the Member States to easily ask each other questions, respond, etc. using a tool for this purpose, e.g. Slack.	Slack, Wiki and Github seems to be a good means (better than mail) to have developers of different MS / WPs collaborate.

3.2.6.3 Technical, semantic, organizational, and legal knowledge shared with work packages

Table 31: Lessons learnt from semantic, technical and organizational/legal activities

ID	Topic	Suggestions for adoption	Lessons learnt
1	Communi-cation	Use visual tools to show the benefits of OOP to users, e.g. presentations and videos. Prepare the creation of an animation by setting up a good storyline and slides that illustrate the flow of the animation.	Implementation of the Once-Only Principle might be interpreted as abstract by users / companies that might benefit from it. From a user perspective, there's not too much to see in the OOP-process. OOP might be interpreted as 'not a big deal' by the user. Large parts of the solution are "complexity under the hood". Hence, additional efforts are needed to explain

ID	Topic	Suggestions for adoption	Lessons learnt
			in an understandable way the huge difference that OOP makes.
2	Legal	Start early with legal Mockups	Discuss in detail the meeting of different regulations and languages to get a good understanding of the cross-border implications of legal basis and complete purposes. Document the legal status before going live.
3	Legal	Simplify national side administration	Cumbersome and difficult bureaucracy to satisfy some legal requirements, such as the physical signing of the Delegation of Power data/document/certificate/VC.
4	Semantics	"Deregistration" still needs to be understood better after final phase but may be interesting also for other services.	What may seem like a simple step to complete a procedure may in reality turn out to be quite complex depending on cultural and regulatory implications in 2 or more countries. Also the availability of a non mandatory attribute was added.
5	Organisational	Ensure project participants are also those that will finally audit the infrastructure/service before go-live.	Anticipate for the need of formal required national security auditing processes that need to go through all solution components.
6	Technical	Expect different domain identifiers to have to interact in one Service.	An identified future need relates to the implementation of advanced identity linking mechanisms, that will work around the lack of persistence of some eIDAS eIDs, across Member States or even across portals in the same Member State. That workaround would allow for the Previewer and Authorization portal to correctly identify the same citizen that previously was only registered in a Data Owner portal.

3.2.6.4 Pilot learning for sustainable impact and new governance models

Table 32: Lessons learnt on new government models

ID	Topic	Suggestions for adoption	Lessons learnt
1	Stabilization	Some MS have added further reaching security requirements than expected from the start. This should be harmonized and adopted by all.	There needs to be a minimum level of common agreed security measures for all to build trust, especially over time.
2	Organisational	Early and detailed planning and sharing of plans to avoid making the same mistakes.	Adjustments are required to cope with different levels of progress in the partner's developments/ deployments. Including networkport opening.

ID	Topic	Suggestions for adoption	Lessons learnt
3	Organisational	Simplification and harmonization of deployment procedures.	Deployment delays due to the complexity of the internal IT department structure. Also IT-team work overload played a role.
4	Policy	Quicker Member state decisions and re-decisions.	Different sustainability goals across partners with a consensus emerging to either deploy or keep pilot services in production or use DE4A infrastructure to keep exchanging messages until the SDGR OOTS is in production. There seem to be a need of quicker and clearer cost/effort estimates. A suggestion is to agree on one domain (Digital Government Transformation) model not only for the SDGR services but also all services reusing the canonical evidences.

3.3   Technical common criteria

From a technical perspective, the services piloted in DE4A must adhere to several common criteria. The following table describes how each of the DE4A technical common criteria was met by the pilot in the final iteration.

Table 33: Reflection per Technical Common Criteria

ID	Topic	
1	Openness	The entire DE4A common component documentation is publicly available on the DE4A wiki and GitHub. eIDAS documentation is also publicly available. Documentation on DE/DO systems is however not publicly available, which is in line with other documentation of DEs and DOs.
2	Transpa-rency	Procedures and results of the pilot, as well as the actual status of connections and readiness have been (and still are) publicly available on the DE4A wiki, and on the DE4A.EU website. Using these sources, interested parties can follow along and study the details of the pilot. End-users were informed on the piloting conditions and what it meant to participate in the pilot by their pilot session supervisors, through the microsite, and on the procedure portals. Internally, an MoU also provides for MS authorities transparent information on requirements, assurances, and limitations in relation to piloting.
3	Reusability	The MA pilot used existing data sources at the side of the DO, and building blocks like eIDAS, SMPs and DE4A building blocks. The types of evidence exchanged during the pilot concerned data that is already available in civil registers. As another aspect of reusability, users from Member States that have a notified eID, appreciate the usability of this familiar eID instead of having to obtain a specific account to use in the eProcedure across borders.
4	Technologi-cal neutrality and data portability	The MA partners used software provided by the technical work package in the DE4A project. This concerns for example the connector and the SMP. Member States were free to choose an AS/4 gateway. Data Evaluators and Data Owners chose their own standards and software and developed an integration to the

ID	Topic	
		DE4A common components using the proposed APIs to the Connector and other common components.
5	User-centricity, inclusion and access-ibility	In MA, this aspect is applicable for the DE eProcedure Portal, DO data services and eIDAS. The usability of each portal depends on the standards applied by the DE/DO. Each portal has its own design-language and standards. For eIDAS, standard user-interfaces were used, as supplied by various suppliers (which were out of scope for the pilot). On the user centricity aspect, not too much can be said without touching the constraints that exist from DE/DO-portals and other standards. What was observed however, was that users generally don't like to read the entire texts on the screen. Offering all texts in the mother-tongue of the users improves accessibility.
6	Security and privacy	On several occasions achieving publicly available portals, or just establishing connections between DE4A Connectors, turned out to be difficult and very time-consuming. Many issues were encountered in opening up firewalls and obtaining certificates. To secure safety, organisations have many policies and administrative procedures in place which, however very useful and necessary, are a major cause for delays.
For privacy-protection, a MoU and DPO were installed before and during the project. No incidents occurred during pilot runs.
Users would appreciate an increased insight and control of the (DO) data source (i.e. know exactly what data and what source is used) and – usage (by the DE. i.e. which data, for which procedures exactly and for how long). This can partly be explained by a design-choice and delimitation of the pilot scope and MOR component is designed to help with this demand.
7	Administra-tive simplifica-tion	As stated in previous sections, both the DE and citizens recognize the simplicity of the procedure. It is faster, safer, more secure and with less activities than the traditional procedures. Also, processing the data is easier because of higher data quality, resulting in less errors that need to be resolved. In some cases, introduction of working with the OOP TS also initiates process improvement within DE processes.
8	Effective-ness and efficiency	Data Evaluators and Citizens recognize the fact that less manual work is involved in the piloted procedure and that the duration of the procedure is massively reduced. The average duration of the Portuguese tests UC1 procedure is 121 seconds. The median is 101 seconds. The average duration of UC2 with multiple evidences was 116 seconds and the median was 135 seconds. For part of the Slovenian UC2 tests (7 testers) the average was 287 and a median of 222 and one outlier of 13 minutes was discarded.

4 Pilot Procedures

4.1 Cross border testing approach

4.1.1 General approach

To establish and confirm the cross-border connection between Data Owners and Data Evaluators, tracks with milestones for the following topics were established:

- ▶ OOP TS UC1 (USI)
- ▶ OOP TS UC1.5 (Deregistration Extension based on Lookup response)
- ▶ OOP TS UC2 (USI)

These tracks were initially meant for all Member States to use synchronously. This however, turned out to be unrealistic because all Member States turned out to have their own challenges, leading to different speeds of development. Sometimes, the availability of resources and priority conflicts with local projects result in frequently changing timelines. These changes also impact timelines of other Member States that are being interacted with.

The general approach where tracks and milestones were defined remained useful, however for each combination of Data Owner and Data Evaluator a separate timeline turned out to be necessary. For piloting several use cases using each specific (version of) component in the infrastructure, close monitoring and flexibility in planning was required to prevent conflicts in compatibility. The complexity in planning is expected to be present (and perhaps even stronger) when implementing the OOP TS on a European scale.

4.1.2 Connectathons

Member states performed unit -tests themselves before attempting cross-border testing. Specific meetings, named Connectathons, were held to test and confirm connection (at Milestone-level) between all Data Owners, Data Transferrers, Data Requestors and Data Evaluators. In these meetings, structured testing based on testcases from D4.10 [2] was applied to confirm connections for both the eIDAS track and the OOP TS track, making sure that cross-border communication and error handling work as expected. In case of errors and issues, the technical experts attending the meeting used the time available to investigate and solve issues like configuration -errors and back-end integrations. In case experts could not solve the issue right away, they defined actions to perform between two Connectathons, e.g. configuration of firewalls and local DNS -components. For issue-solving, experts shared screens and collectively studied log-files in the involved Member States.

Knowledge developed in the earlier Connectathons was shared with other MA partners and DE4A pilots, in order to smoothen future Connectathons and establish remaining connections sooner. Also, test cases and presentations to structure these Connectathons were re-used for future meetings, securing a constant quality of the established connection between components. During preparation for piloting the use cases, 42 connectathons for eIDAS and the OOP TS were performed all connectathons where. 42 Connectathons were recorded to be able to go back and analyse/check technical logs etc.

4.2 End users' engagement progress and dissemination / impact activities

4.2.1 End user involvement

The pilot planning D4.10 [2] defined the user involvement activities, including interviews. To summarize, the following user groups were targeted for participation in and evaluation of the pilot for Use Case 1:

- ‣ employees not involved in the pilot of the data evaluator in all MA Member States
- ‣ employees, not involved in the pilot of the data owner in all pilot Member States
- ‣ Citizens in all MA Pilot Member States

Involvement of people from outside of the pilot turned out to be difficult, as Citizens do not have their eIDs and are not often in need of the services piloted but the 28 end users that did use were happy to get to try them out in a pilot setting. User involvement was typically initiated 2 weeks in advance of the planned start of each pilot combination. In the end AHA was not approached since the community ceased to exist. The sharing in LinkedIn was done at the very end of writing this report, so questionnaires possibly filled out until the review will not be part of this deliverable. So mainly friendly users from the agencies involved in the pilot were testing (SI-MPA, AMA), but none of them had been part of the development of the services. Plans to recruit 50 users in the were mainly missed due to the very late availability of some DEs (or unavailability in the case of Romania).

4.3   Pilot governance and internal progress report

In advance of every new DE/DO combination data on the privacy measures as defined in the MoU were checked and executed, and the Data Protection Officer was informed. Before piloting, a press -release was made available on the DE4A website.

Pilot Runs were organized by the MS as this is best made on a local basis. Pilot running sessions were organized via online meetings. Several sessions were recorded (to collect evidence) and recordings were saved on a secure location (with limited access) as well as published on the website after anonymization or just using test users.

No issues existed during the pilot runs, that required any intervention from the DPO after the definition of the deregistration process.

The Executive Board was informed on every meeting about the progress of the pilot runs.

4.4   Knowledge exchange among pilot partners

MA pilot partners met on a weekly basis to discuss progress, planning and issues. Notes were collected, issues/lessons learnt were shared in Slack and when needed maintained at the DE4A Wiki (which was also used for further developing this report). On several occasions, additional meetings were organized in order to discuss certain topics in more detail such as the Deregistration.

Connectathons were used to confirm connectivity and pilot-readiness, while developers used Slack to collaborate online, in order to resolve issues and prepare Connectathons.

The MA pilot set up and maintained a wiki (https://wiki.de4a.eu/index.php/Moving_Abroad_Pilot), providing information on the status and progress, but also on solution architectures for pilot. The wiki was also used to collaborate on the production of official pilot deliverables. On the wiki, general descriptions of the pilot, use cases, status and solution architectures for the pilot have been documented.

4.5   Stabilisation of pilot experience and user support

The MA results will be combined with the results of the other DE4A pilots, to produce a more general perspective on piloting the SDG.

Reflecting on the pilot procedure, the citizens receive documentation first via the DE4A web and then execute the pilot eProcedure on their own, followed by completing a questionnaire and afterwards the MA-pilot participants would interview some of the testers. The non-supervised mode worked and there were reports of ended sessions due to unavailability of supporting services like eIDAS.

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4.6   Suggestions for extended functions post-pilot

Feedback from people involved (interviewees and beneficiaries) in the pilot points towards several possible improvements that could be taken into account for the implementation of the SDG OOTS.

4.6.1   Functional and technical improvement

Looking at the observations and interviews, it becomes clear that the citizen and civil servants want to spend as little time as possible to complete an eProcedure. Previous sections already pointed out that the Explicit Request and Preview functionality, legally sound and meant for 'users being in control' do not necessarily actually contribute to that direction for many people. Further developments in the short term include a need for widely spread use of citizen digital identity that works crossborder and digital services (public and private). The MS agencies need better back-office and integrated systems.

MS need to define and implement more mandatory (and agree on also optional) attributes and connected Services catalogues. MS need to define and implement common infrastructure components (eIDAS, eIDs, Preview space, wallet, OOTS) more widely. New Evidence Types and services need to be agreed and made available, this maybe being services like finding Day-care for your kids, taxation and exercising voting rights. More "digitally born" or digital by default documents and services are sought after.

MS need to define their "backbone" and core digital components, be it infrastructure, defined data and models. MS and EC need to make decisions on Distributed Ledger technologies, MS also need to define and publish APIs and/or Verifiable credentials and continue to invest in their own skills as well as to support External Developer Networks. More national services are expected to reuse the fundamental MA canonical evidences in OOP TS and other MS services. MS need to publish towards a decentralized but federated EU catalogue as a source of evidence type per Member State. Eventually mid-term catering for Only-digital access should be aimed for a basic catalogue of transactions, with Only-digital access also for an advanced catalogue of transactions in the longer term.

4.6.2   Suggestions for pilot procedures improvement

Activities and effort spent on recruiting users to become involved in the pilot have produced learning that these activities are very timing-sensitive. On the one hand, it seems hard to involve users and therefore, all effort should start long before the actual start of running a pilot. On the other hand, pilots may or almost certainly will experience delays. The procedures for recruiting users therefore need to become a continuous process, to offer as many citizens as possible the opportunity to participate. This is one of the reasons why LU and PT have chosen to continue the services beyond the project.

A more complete and more coherent accountability framework is needed at a MS level so that MS can provide high availability of services. MS also need to agree on and implement metrics on actual usage and re-usage as well as to agree on allowed monetization models (fee for service from different actors, etc.). This needs to take into consideration the different exchange patterns used as well as reports on number of subscriptions (per MS/DE), report on number of notifications per MS/DE. Number of registrations per MS/DE meaning actual usage of the OOP TS need to be monitored. Detailed Cost-benefit analysis on MS and EU level based on an agreed model is needed. Functionality should be offered like a privacy Dashboard/Overview on who uses and reuses citizen evidence and on what legal basis, when did it happen and how long is the data valid for, in short data provenance for simpler reuse in a human-centric way.

MS want to define and implement auditing and verification ethics and legal accountability / liability across projects and different regulations based on interdisciplinary working groups. The laws and regulations on "Mandates & Powers" (Rights & Responsibilities) managed in real time need to be

understood in each Member State and also negotiated and technically implemented crossborder in the medium term.

MS want to define and implement global cross-network interoperability protocols as well as common security measures and robust and resilient infrastructure this includes record matching being solved in real time as well as broader and frequent use (e.g. weekly) of European Union Digital Identifiers (EUDI) and allowing also a European eID. This calls for a clear and concise governance model for all real services not just MA procedures or eIDAS but SDGR and other European Commission-driven 50 services. A vision mentioned by some partners is a "Europe's IT Office for Maintenance and support (of OOP TS)". This calls for a roadmaps' alignment of OOP TS and eIDAS.

5 Conclusions and major achievements

The MA pilot has come to an end, but the services live on for some time and lessons learnt are of high value for OOP and SDGR communities. The technical testing leading to real users piloting ran into some difficulties both in timing and experience as well as availability of resources with the right skills and permissions. But the same technical teams were able to pull together at the end, and due to reuse of components and improved knowledge, more combinations which could be added with extreme speed towards the end.

In the end also the MA pilot has completed successfully and yielded valuable insights. Pilot partners managed to analyse the most important challenges for the implementation of the SDGR e.g. deregistration and the use of multiple evidences. The MS developed an international infrastructure for the cross-border exchange of fundamental civil registries evidences by deploying and integrating DE4A common components to citizen registers and service providers. This infrastructure was designed, implemented, extensively tested and improved during Connectathons and used for piloting with several citizens new to the services, mainly in a piloting environment but based on the "real-pre-production portals" of the MS.

Based on the executed eProcedures, interviews with parties involved and their common comments, the final SDGR services will deliver simpler eProcedures with shorter duration and often what is perceived as immediate real time results. The quality of evidences and the minimized effort for processing seem the most important benefits that were observed.

The piloted eProcedures have shown simplicity and speed, as well as lower cost (in time spent) for both Public agencies and citizens. The higher data quality results in less processing-errors for the Data Evaluator compared to the current way of executing procedures. A broad implementation comprising several procedures is required to maximize real usage.

The need for receiving notifications (deregistration) about changes in citizen register entries was validated during analysis and design, regarding both changes in domicile data and life events like e.g. getting divorced or change of name for other reasons.

Citizens seem to focus on completing the online procedure as fast as possible and pay little attention to texts about, for example how the Deregistration process works, that can consequently be missed. Further work needs to be done to design a common look and feel for "pop-ups" to discern between when a citizen makes an active important choice and when they are just being informed.

The used local/MS infrastructure determines the required effort for DE and DO integration to a medium extent. Member States therefore establish their own maximum speed for implementing the necessary infrastructural, legal and procedural changes. Priorities and therefore timing differ between Member States because each Member State has a different starting point and therefore faces different challenges. Applying a general step-by-step strategy for implementing the SDG infrastructure, gradually increasing complexity, has proven to help with the focus and management of the implementation, but the timing and availability of expert resources in peripheral processes has been more important.

The availability of an EU-wide operational eIDAS network and notified eIDs are prerequisites for implementing the SDG and should be in place as a prerequisite for EU funding in any future projects.

Mandates validation is lacking and this needs to be part of the solutions for moving families (own children, your own and possibly from new partners) and for the elderly e.g. children supporting their parents in the difficult transaction of buying a new house abroad (a transaction often involving administration at all NUTS levels).

Establishing a harmonized dataset that embodies the evidence to be exchanged cross-border turns out to be time-consuming. Having the evidence match the needs of Data Evaluators and making sure that

this can be provided by Data Owners requires much analysis but is key in making the cross-border exchange of information valuable and durable. Focusing on a first limited, yet still valuable, set of data increases feasibility and secures progress. However, MA Pilot made a good starting point thanks to data models defined for multilingual forms in the Public Documents Regulation EU) 2016/1191.

References

[1] Deliverable D4.9 – Use Case Definition, 22-02-2022, can be consulted via https://www.de4a.eu/_files/ugd/2844e6_a07e5bbeac0f404999beb323c82b1416.pdf (Accessed: 25/04/2023).

[2] Deliverable D4.10 – Pilot Planning, 22-02-2022, can be consulted via https://www.de4a.eu/_files/ugd/f739c2_594de9341c1d415682b7db53ec3872f5.pdf (Accessed: 25/04/2023).

[3] Deliverable D4.11 – Initial Running Phase, can be consulted via https://www.de4a.eu/_files/ugd/2844e6_cd8abc5ce50048fa8fc32bb283775bc9.pdf (Accessed: 25/04/2023).

[4] Deliverable D4.13 Pilot Evaluation, 30-10-2022, can be consulted via https://www.de4a.eu/_files/ugd/2844e6_8566a8b2d4b7424c91f96bee48d6132e.pdf (Accessed: 25/04/2023).

[5] Single Digital Gateway Regulation, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.295.01.0001.01.ENG&toc=OJ:L:2018:295:TOC, 22-02-2022

[6] Deliverable D4.11 Moving Abroad Initial Running Phase, can be consulted via https://www.de4a.eu/_files/ugd/2844e6_5fe07e7808684e3a8c5870926427668e.pdf (Accessed: 25/04/2023).