

Impact Assessment of Disruptive Technologies on Electronic Identities (eID) for the Improvement of Digital Public Services for Citizens

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1 ABSTRACT

Public services are increasingly being transformed into smart public services, also known as digital public services or eGovernment. In several cases, access to specific services is personal and non-transferable, thus requiring secure and trustful identification as well as management of the so called “digital identities”. In this context, it is obvious that citizens and public services in particular would benefit greatly from digital identity management technology, as new and emerging technologies have strong potential to empower existing eID systems. Yet, while opportunities enabled by these technologies are undeniable, challenges also exist, including technological and social implications, as well as barriers, risks and limitations. In addition, the establishment of standards for these ecosystems and compliance with framework conditions, including national and European regulations are essential points that must be considered. Based on these observations, the IMPULSE (Identity Management in PUBLIC SERVICES) project, funded under the Horizon 2020 programme, was launched in early 2020. IMPULSE aims to perform a multidisciplinary evaluation of the disruptive transformation of electronic identity (eID) management in public services enabled by Distributed Ledger Technology (DLT) and Artificial Intelligence (AI). Overall, this paper will present the research pathway set up to answer the question of how a single adaptive eID solution can be useful to the whole city ecosystem, from the micro-citizen level to the macro-governmental perspective, by focusing on the main achievements of the IMPULSE project so far.

Keywords: digital innovation hub, public services, disruptive technologies, electronic identities, smart city

2 INTRODUCTION

IMPULSE aims to develop a method for evaluating eID management, more specifically the identification of individuals when accessing online public services, using distributed ledger technology (blockchain) and artificial intelligence. This evaluation covers not only the benefits, but also the risks to be considered, the costs to be borne and the limitations that this new eID solution may have. In addition, the potential socio-economic, legal, ethical and operational impacts will also be considered, while taking into account the current framework conditions, at European or national level (e.g. GDPR, existing national e-identity systems and standards, etc.). In order to achieve this, it combines the bottom-up approach of co-creation with the need for a universal vision of digital identity ethics by drawing up a user-centric multi-stage method. To this end, IMPULSE brings together a range of experienced partners, including six case studies in public administrations in five different countries, as well as other key players, in line with its ambition to conduct its research in an open form. Ultimately, the research will result in specific and actionable outcomes. The first one is a framework for a holistic integration of AI and blockchain technology to support secure and privacy-preserving eID management by public services, having been deployed and assessed in different countries to complement existing EU identity schemes. The second is the drafting and dissemination of actionable roadmaps for the adoption, escalation and sustainability of advanced eID technology by public services in the European ecosystem, in different countries and at different levels (local, regional, national, and cross-border) and supported by Digital Innovation Hubs (DIHs) all around Europe.

3 SELECTED TECHNOLOGIES

IMPULSE intends to be a novel eID system to be integrated into online public services as a new and alternative eID option. Unlike other centralized eID systems like the ones based on user/password or federated identities (i.e., Facebook, Google, LinkedIn...), IMPULSE proposes a secure and privacy preserving alternative for existing eID management systems, the self-sovereign identity (SSI) concept (Mühle et al., 2018) being at the core of the user-centric IMPULSE eID approach.

3.1 Artificial Intelligence and Blockchain in the SSI context

IMPULSE combines disruptive technologies such as Artificial Intelligence and Blockchain with the goal of transforming the two critical processes of the whole eID system, which are needed to get a secure and privacy preserving access to online public services: the enrolment and authentication processes.

Enrolment is the process of registering a user in the system. In IMPULSE, this process is conducted by following an AI-based digital onboarding process. To verify citizens' identities, IMPULSE runs a combination of AI algorithms – based on deep Convolutional Neural Networks (CNNs) – which involves both the validation of the identification documents and the facial recognition of the citizens. Additionally, security measures are duly applied to avoid both presentation attack and document tempering attempts. If the onboarding results in success, a verifiable identity credential (ID-VC) is issued by the Public Administration to the citizens. Such a credential can be used for authentication purposes in online public services.

Unlike centralised identity systems, in IMPULSE the citizens' credentials are verified in a blockchain network, in particular in the European Blockchain Service Infrastructure (EBSI) (EC, 2018) and following the self-sovereign identity model defined on the European Self-Sovereign Identity Framework (ESSIF).

3.2 Concrete implementation – building blocks

The building blocks of the solution can be grouped into three domains depending on the location and the controller of each one: the user domain handled through an Android device, the Public Administration (PA) domain located in the public administration's backend, and the blockchain infrastructure domain which corresponds to the EBSI network.

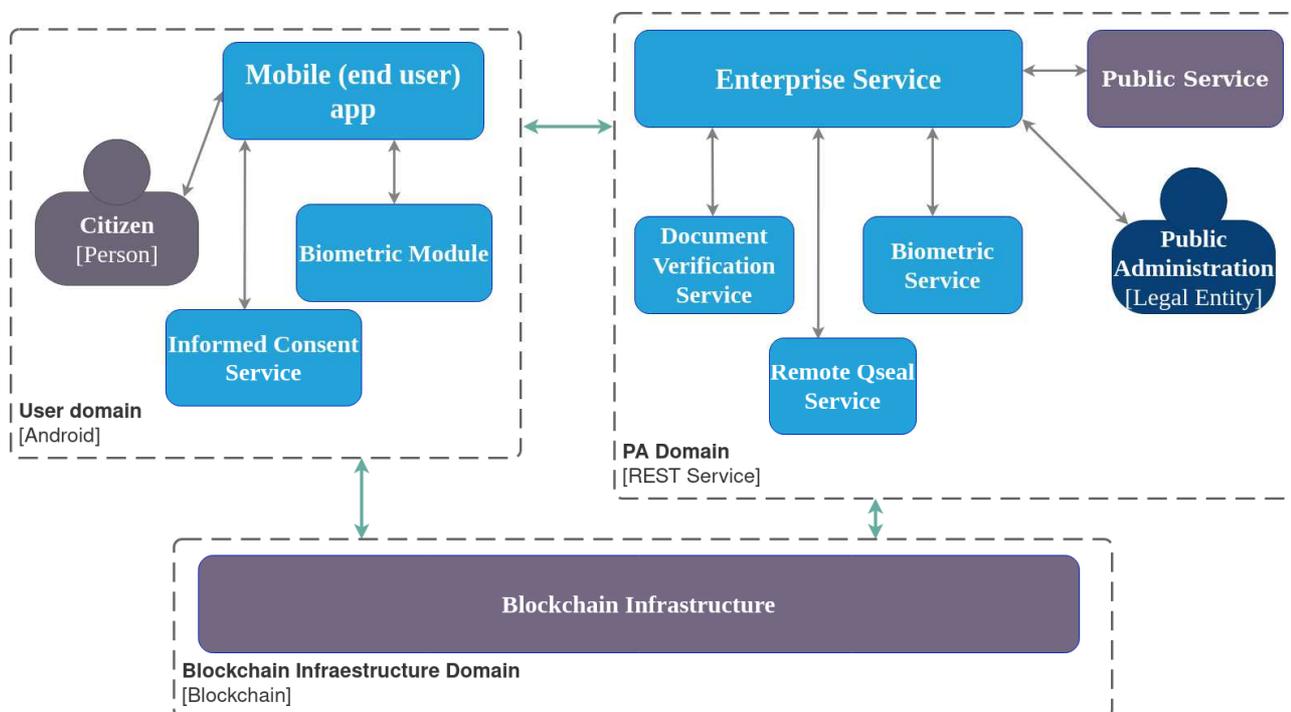


Fig. 1: IMPULSE solution building blocks

Regarding the user domain, the functional blocks are the following:

- Mobile app: the IMPULSE application that holds the digital wallet and interacts with the user, the modules inside the same domain and with other domains.

- **Biometric module:** a facial recognition module with the capability to create a local biometric profile of the user, using a selfie. This biometric profile is used to protect the access to the credentials.
- **Informed Consent Service:** A service that can register informed consent in a public blockchain using Smart Contracts.

Regarding the PA domain, the functional blocks are:

- **Enterprise Service:** the deployable core component of the solution that interacts with all the modules within the public administration domain and with other domains. This element is integrated with the PA service enabling IMPULSE for the public administration.
- **Document Verification Service:** a service that can validate the authenticity of an ID document submitted by the user.
- **Remote Qualified Seal (Qseal) Service:** a service that can sign the credentials with a qualified signature.
- **Biometric Service:** a service that can match the faces of a selfie and the ID document of a user.
- **Public Service:** the online public administration service that is integrated with the IMPULSE solution.

Regarding the blockchain infrastructure domain, there is one functional block: the European Blockchain Services Infrastructure (EBSI) which is a blockchain network oriented towards the creation of cross-border services for citizens of public administrations within the European Union (EU).

3.3 Opportunities and challenges

There are several opportunities and challenges that emerged during the implementation of the IMPULSE project. Among them, the following stand out:

- Simplifying the integration and instantiation processes of the solution by public administrations.
- Complying with current European legislation, such as eIDAS 1, eIDAS 2 and GDPR.
- Standardizing Self-Sovereign Identities for both natural and legal persons.
- Designing the solution with careful consideration for inclusion and accessibility.

4 OPEN COMMUNITY OF STAKEHOLDERS

The integration and engagement of stakeholders, whether internal or external are crucial points for a project to be successful. Internal stakeholders are those who are directly and actively involved in the project, while external stakeholders are individuals or groups outside the project, who can influence it or be influenced by it.

4.1 Internal actors

Internal actors are mainly understood to be the members of the project consortium. They reflect the multidimensional approach set up for the project and thus enable a holistic view which enriches the project efforts, quality and outcomes. The gathering of diverse and interdisciplinary expertise and experience is an obvious strength of the consortium which has been built to provide a balanced participation of interested parties, covering all the roles needed to develop the eID solution. In order to help fostering knowledge transfer and the exploitation of IMPULSE, a strong public-private partnership has been established between 16 partners from 9 EU countries including: 6 public administrations acting as local testbeds; 1 Digital Innovation Hub managing the stakeholder community and ensuring the transferability of the project; 2 Research and Technology Organisations (RTOs), one of which is focusing on the evolution of existing blockchain-based identity management solutions for integration into the public sector, while the other is analysing the socio-political and socio-economic effects and implications of the solution; 1 university working on co-creative design and piloting of the IMPULSE solution together with end-users, approaching the project from the “public service demands” side; 4 SMEs respectively leading the analysis and verification of the digitised documents provided by the citizens during the registration process, as well as experimenting with and transferring the practical use of the eID management approach to public service providers and providing ethical and legal assessment that will lead to recommendations for decision makers on privacy,

ethical and legal issues in the eID field, 1 large company overseeing the innovation and exploitation management, dissemination and communication, and 1 standardisation body working on the initiation of standardisation activities, for the development of new standards.

4.2 External actors

To achieve meaningful impacts, gain acceptance and promote the adoption of disruptive eID concepts in public services, collaboration with external stakeholders is considered at the core of IMPULSE. As part of the project activities, a stakeholders community has been set up. It is understood as the gathering of actors around a common interest: to jointly explore the notion of eID management for public services. This community is also thought as being open. The opportunity is given to each of its participants to contribute to help determine the direction and outcomes of the project. Each stakeholder brings its own expertise, opinions, needs, expectations and concerns, allowing a global view of the context in which the project was undertaken. For IMPULSE, the considered stakeholders and their specificities are: any additional public administration providing an even broader and richer perspective of the EU's public context; end-users (general public) perfecting the solution by sharing their views on which solution would best meet their needs; innovative SMEs, entrepreneurs, GovTech providing perspectives on public-private partnership as well as their view for the market introduction of the solution; policy makers having the actual capacity and means to influence the transformation of public services; other established networks taking on the role of IMPULSE advertisers to reach even more stakeholders; and finally Digital Innovation Hubs (DIHs) as well as European Digital Innovation Hubs (EDIHs). A strong emphasis was placed on the latter. What has been highlighted, when defining the partnership with DIHs, was their capacity to act as enablers and facilitators. They can reach and connect different actors in the innovation ecosystem by playing a brokering role not only at local but also at European level. Therefore, they can act as a bridge between the project and various ecosystems allowing for fruitful exchanges of knowledge and good practice. Moreover, they have the necessary infrastructure to provide testing grounds for the solution expansion. In a nutshell, the significant assets of DIHs made their involvement in the IMPULSE project more than relevant, especially in ensuring the transferability of the project effectively for the benefit of all.

4.3 Opportunities and challenges

Bringing these two types of stakeholders together creates both opportunities and challenges to be considered. In terms of opportunity, it is the possibility to define the framework as well as identifying and understanding the needs as comprehensively as possible, coupled with the ability to improve the solution through co-creation, leading more confidently to a solution implementation with a higher reliability and takeover rate. However, different stakeholders are often heterogeneous in their logics, values, goals, capacities and power, as well as their fields of activity, experiences and interests. This is a key point to take into account when setting up an open collaborative approach, in particular when it comes to getting similar types of actors to work not only together, but also with those from other fields of work to create new synergies.

5 METHODOLOGY

At its core, the project is based on a demand-driven co-creative research process in which public administrations carry out pilot experiments with the system-agnostic IMPULSE solution. Through two piloting phases, the objective will be to assess what this eID solution brings out in terms of benefits, but also risks and limitations, taking into account possible socio-economic, ethical and operational impacts, as well as alignments between European and national framework conditions.

To achieve the co-creation and evaluation of the IMPULSE solution, the project employs the action design research (ADR) method. The ADR method features an iterative design process of building, intervention and evaluation (BIE-cycle) that is helpful for solving open-ended research problems in information systems. The ADR method supports collaboration between the researchers, developers and end-users, which is vital for a co-creation process (Sein et al., 2011).

BIE-cycles allow a continuous improvement of the IMPULSE solution during pilot experiments as both piloting phases will go through one cycle. By using an iterative improvement process, the end-users will be more involved in the co-creation of the solution and their opinions are better considered in the development process.

5.1 Pilot experiments

Pilot experiments are used in IMPULSE at the core of the research, throughout the project lifetime. On this basis, different areas were chosen as exemplifying applications of the use of selected disruptive technologies to be piloted in public services. Thus, a set of six case studies in five different countries has been set up:

- City of Aarhus (Denmark): provide vulnerable citizens with secure storage for identity documents to ensure equal access to digital services for all citizens.
- Police Department of Ertzaintza (Spain): make the issuing of complaints fully digital to increase police efficiency and citizen safety.
- Gijón City Council (Spain): demonstrate the advantages of new identification systems for the Gijón Citizen Card, dedicated to municipal services for citizens.
- Municipality of Peshtera (Bulgaria): provide a more secure and GDPR-compliant digital system for civil registration & certification to citizens.
- Union Camere & Info Camere (Italy): design and implement the necessary infrastructure to provide an enterprise digital drawer for business leaders to access public/private services online.
- City of Reykjavik (Iceland): test of an eID solution that will enable citizens with physical impairments to authenticate on Reykjavik’s participatory democracy platform “Better Reykjavik”.

The piloting process of the project is divided into four phases consisting of the pre-piloting phase, the first piloting phase, iteration and the second piloting phase. During the pre-piloting phase, software requirements, needs and concerns are collected from the literature as well as from stakeholders through surveys, workshops and interviews. The collected set of functional and non-functional requirements are evaluated by the researchers and developers to create the initial prototype of IMPULSE.

During the first piloting round, the IMPULSE prototype is tested by end-users and the existing requirements are modified based on feedback received. Afterwards, the prototype is improved to implement the new requirements and the second version of IMPULSE is tested during the second round of pilots. After the pilots are over, IMPULSE is finalized within the scope of the project.

5.2 Impact assessments

5.2.1 Standardization

In terms of standards implications, there is a gap in transferring successfully research results into practice, as most dissemination and exploitation activities only lead to the development of publication or patents (Blessing and Seering, 2016). Standardization is one answer to tackle this challenge. The European Commission is therefore fostering the integration of standardization in their Framework Programme projects in the last years (EC, 2018). IMPULSE is one of these projects that integrates standardization throughout the whole project duration. As a first step, the project has intensively assessed the relevant standardization landscape. The top 10 standards have their origin in Germany, Spain, as well as at European and international level. Especially the Spanish standard UNE 71307-1 “Digital Enabling Technologies. Part 1: Reference Framework” has high relation to the project activities. Therefore, IMPULSE has already established a partnership with the standardization committee. Further so-called liaisons are planned to interact with the relevant standardization committees at European and international level. Within these committees, a variety of organisations are involved which supports the outreach of the project results to external stakeholders to enhance, validate and promote them. Thus, the impact that the standardization activities have on the IMPULSE solution can be rated as very high. There is on the one hand interest in the standardization world to get the results of IMPULSE, and on the other hand the standardization tool provides an appropriate way to actively disseminate and exploit the project solutions into practice via standardization.

5.2.2 Socio-economic, socio-political impact analysis and ethical implications

Further questions increasingly arise in IMPULSE, related to the socio-economic and socio-political contexts: first, what end-users want, expect, and need when it comes to new self-sovereign identity schemes, innovative eID solution and the online identity, and second, what are the impacts of novel ID systems for public services. To this end, IMPULSE aims to assess the social acceptability of its solution, discover which

public services would derive significant societal benefits from the use of eID technology and determine the specific economic benefits for public systems with eID technologies in selected contexts. Some of the drivers for adoption and acceptance that our social science anchored analysis (literature review, qualitative interviews with pilot experiments owners, stakeholder survey) has highlighted so far refer to the quality and size of accessible services in a broader eGovernment ecosystem (Aztori, 2015; EC 2020b), usability and security issues related to the used technology (Doerk, 2020; Ehrlich et al. 2021; Pöhn et al., 2021), personal and demographic characteristics of the user (Feher, 2019; EC 2020a), as well as the economic rationality of the novel eID solution (van Dijck, 2020) and contextual legal-organizational environment of the public institutions in question (Doerk et al. 2020). Larger societal, economic and political benefits from the use of eID technology mainly focus on efficiency and convenience gains (EC 2020b), time savings for both final and end-users of the eID solutions and public administrations (WBG 2018a, 2018b; Nortal, 2020), potential reduction of fraud, interoperable activity resulting from potential wallet features (Addo & Senyo, 2021) and new business models. Envisioning the socio-economic and political analysis, IMPULSE will promote in its final stage the adoption of eID technologies in public services considering relevant stakeholder groups and potentially divergent perspectives as well as specify case-related business models for the IMPULSE solution.

This raises the question of the IMPULSE solution ethical implications. Arguably, the most important benefit it promises is facilitating access and therefore hopefully increasing the uptake of digital services, especially for less privileged parts of the population. It does this by substituting biometric recognition to the standard current authentication technologies (username/passwords, PINs, etc.), rendering the registration process faster and less complicated. Surveys indicate that a substantial number of people find it difficult to use multiple digital identities and authentication means in parallel and that the less advantaged and educated are most suffering from this (Initiative D21, 2019). For similar reasons, digital processes for service access can be more inclusive their offline counterparts (less travel/waiting time, fewer papers to keep track of, etc.). Nevertheless, like all technologies, the IMPULSE solution comes with potential risks, the two most important ones being facilitating surveillance and increasing the digital divide. Although it is designed to increase users' control over their data by requiring their active consent to make said data available to third parties, the very presence of this data can entice service providers to require an excessive amount of it in return for access to their service.

6 CONCLUSION

IMPULSE is an ambitious project inscribing itself within the logic of the smart and sustainable city. Indeed, it uses disruptive technologies to create a solution aiming at making the access to digital public services easier, but also more secure and respectful of citizens' private data. In order to achieve that, the project partners are creating a community including all stakeholders that can be involved in the implementation of such a solution with a double objective: feeding the IMPULSE project with their needs and perspectives, but also fostering other innovative initiatives that could complement IMPULSE's work (actionable roadmaps based on the experience of the 6 pilot experiments will be developed to help support such initiatives).

Although some risks have been identified, these are less a question of the solution itself, but more of its governance and in particular the presence or absence of institutional safeguards. This is why IMPULSE partners also intend to produce guidelines and recommendations involving input from relevant policy makers.

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