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Technical and Nontechnical Measures for Inclusive Online Public Services. Implications for an Inclusive EU Digital Policy

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Abstract

Developing and deploying inclusive digital public services is one of the EU's key digital targets. Digital Inclusion in the context of public services implies that all people moving and living within Europe, irrespective of their economic, social and cultural capital, can benefit from the use of digital public services. Indeed, inclusive digital public services can also be a lever for social inclusion, if digital services are delivered with a high quality, as highlighted in the research literature. This article therefore analyses, on the basis of a pan-European survey, how the design and delivery of public services could be made more inclusive. In particular, it assesses how vulnerable groups behave in relation to digital public services and what technical and non-technical measures could contribute to digital inclusion. Using the example of an eID management solution that was developed as part of an Horizon 2020 research project, the authors critically discuss the extent to which an SSI-based eID solution can make digital public services more inclusive.

Keywords: digital inclusion, identity management, eGovernment, digital public services, attitudes, self-sovereign identities (SSI), European Union.

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1 Introduction

One of the EU's key digital targets (EP, 2022, Article 4, (4)) and a key principle of eGovernment in Europe (EU eGovernment Action Plan 2016) is the deployment of inclusive digital public services. For public services, digital inclusion means that all people moving and living in the EU, regardless of their economic, social and cultural capital, have equal opportunities and appropriate skills to securely access such services and derive value from this for their daily lives (Bourdieu, 2015; Pawluczuk, 2020; UN, 2024). Public services strive to generate public value for all citizens and the success of eGovernment policies can be measured by how well its innovations help to generate this value (Misuraca & Viscusi, 2015). The value created relates to the individual's capacity to translate online access to public services into the enjoyment of welfare, social rights, job opportunities or participation in society in the offline world (Addo & Senyo, 2021; Van Deursen & Helsper, 2015).

The EU's digital targets coincide with the growing ambition of EU member states to digitize public services, which has been encouraged by the COVID-19 pandemic (Heponiemi et al., 2023).

Innovation in the public sector, such as digitizing services, offers governments new opportunities to improve the effectiveness of their policies and to engage closer with all groups in society, including those who have been less involved in public services and are less 'visible' to the state such as homeless people or refugees (Alexopoulou 2020; Botrić & Botrić, 2021; Hartley et al., 2022). Some authors argue that public services, if provided of high quality, have the potential to increase trust in government and strengthen our democracies (Wihlborg et al., 2021).

On the other hand, digitizing public services can increase the risk of digital exclusion, if social groups are unable to access public services, find them difficult to use, or suffer from undesirable outcomes or consequences (Shakina, Parshakov, & Alsufiev, 2021). For this reason, the authors of this article argue that the deployment of digital public services will require both technical and non-technical measures to facilitate the adoption of such services by all social groups (Addo & Senyo, 2021; Lythreatis, Singh & El-Kassar, 2022; De Marco et al., 2023). In fact, in some European countries such as Finland, digital public services are already part of the welfare state and access to libraries and e-books is offered for free (Tomczyk et al., 2019).

However, the risk of digital public services becoming exclusionary is increased if they require a digital identity (Allmann& Radu, 2021). A digital identity is composed of a set of claims made by one digital subject about another digital subject regarding an intended purpose, in our case the use of a digital public service (Toth & Anderson-Priddy, 2019). Digital identities can provide new opportunities. For example, people who are otherwise unknown or 'invisible' to the state can be provided with a proofed digital identity. This allows them to access public services online more effectively, even if they have lost their identity documents in the offline world. However, digital identities raise new concerns about unbeneficial consequences for their holders, such as unauthorized access to sensitive information (identity theft), unlawful tracking of individuals (surveillance), or fraudulent transactions in the name of the identity holder. These concerns and perceived risks can then lead to digital exclusion, particularly for vulnerable groups, which are already disadvantaged in terms of access and skills (Addo & Senyo, 2021; Alexopoulou, 2020; Botrić & Botrić, 2021). Recently, new Self-Sovereign Identity (SSI) solutions have promised to reduce these risks by providing individuals control over how their identity information is used and shared (Mahula et al., 2021).

In this article, the authors provide empirical evidence on how to make digital public services more inclusive. Therefore, we first identify those social groups in Europe that are most at risk of digital exclusion. In a second step, *we ask how digital public services can be made more inclusive through both technical and non-technical measures*. For this end, we assess the attitudes of these groups in the face of new digital identity solutions and digital public services. We thus critically discuss the inclusiveness of SSI-based solutions.

The article is structured as follows. First, based on a literature review, we identify those social groups that are most at risk of being digitally excluded (*Section 2*). We then present a conceptual framework for the analysis of how such vulnerable groups actually behave when faced with digital public services (*Chapter 3*). *Section 4* explains how we have used this framework for the operationalization of our empirical analysis, while *Section 5* summarizes our findings. Here, we also discuss how general concepts of innovation adoption might help us to better understand our findings. In *Section 6* we draw preliminary conclusions for how to make digital public services more inclusive.

2 Target groups for inclusive public services

On the basis of a literature review, this chapter identifies those social groups which are most at risk of digital exclusion. We do this because, from our point of view, it is these groups that would be the most important target groups for inclusive digital public services. *Public services* encompass all services which are provided by public sector organizations such as municipalities, cities, childcare and training facilities, hospitals, higher education institutions or authorities. *Vulnerable groups* are defined of being composed of individuals, which, due to their demographic background (e.g., age, gender, residence, ethnicity), socio-economic position (e.g., income, education, labour market position) as well as digital skills and negative attitudes are disadvantaged in terms of access and usage of online public services (Heponiemi et al., 2020; Robles et al., 2021).

According to the literature, some variables could be universal to identify vulnerable groups. For example, *people living in rural areas* might belong to this group, as they often live under conditions of less developed infrastructure and training opportunities compared to people living in urban areas (Kerras et al. 2022; Tomczyk et al., 2019). Similarly, *handicapped people* who do not have equal access to computers and the Internet due to personal disabilities, but also those who do not have the means to formally prove their legal identity, are most at risk of digital exclusion public services are digitized. For Europe, this could be *refugees* or *homeless people* (Addo & Senyo, 2021; Heponiemi et al., 2023; Tomczyk et al., 2019). Also people with a foreign ethnographic background (*migrants*) might compose vulnerable groups because they are less likely to use public services that are available online, even if they have good internet access and skilled users of social media (Wihlborg et al., 2021).

At the same time, it is clear from the literature that a single variable is often not sufficient to identify vulnerable groups. Within one group, there may be interactions with other variables. Old age, for example, does not necessarily explain digital exclusion. In some European countries such as Slovakia, Slovenia, Estonia or Poland, young people adopt obtain information from government websites more quickly, due to the digitization of their lives in terms of education, communication, peer relationships and access to information (Botrić& Botrić, 2021; Tomczyk et al., 2019). In other countries, such as Ireland, Luxembourg and Portugal, older adults are the driving force behind the adoption of digital public services (Botrić& Botrić, 2021). Other studies suggest that seniors can compensate their lack of access or digital skills. Alexopoulou 2020, for example, concludes that in Greece, people over the age of 65 are still able to adopt new digital services by 'borrowing' access from close family members. Apparently, seniors use social networks and family support more effectively than younger citizens (cf. Heponiemi et al., 2020).

Such variations across within one variable such as age, education or income could be partially explained by intermediary factors such as poor online access or digital skills, lack of trust in the Internet or negative attitudes towards technologies (Robles et al., 2021). Research has found that privileged individuals, defined as those with more socio-economic resources, better access to the Internet and more digital skills, can still be digitally excluded relative to those who are frequent users of digital services. This is also true vice versa, the unprivileged can be digitally included (Anrijs et al., 2023; Heponiemi et al., 2023). This means, in order to identify vulnerable social groups more accurately, interactions between variables should be taken into account. For example, seniors belong to a vulnerable group, if their income and education is low, they have little computer experience and weaker social networks (Niehaves & Plattfaut, 2014; Olsson & Viscovi, 2023).

In this paper we agree with Heponiemi et al., 2023, that social factors are crucial to better understand how inclusive digital public services really are. Those factors might then refer to

access, but more importantly to *digital skills and attitudes* (Heponiemi et al., 2020; Tomczyk et al., 2019). Digital skills are considered independent of formal education and refer to the ability to use digital services correctly and which are often built up outside formal education programs (Botrić& Botrić, 2021; Pawluczuk, 2020). Some studies, for example, point to gender differences and find that men tend to be more digitally skilled than women. Other studies have found that young people can be at risk of digital exclusion due to a lack of digital skills, such as in terms of privacy or safe online communication (Pawluczuk, 2020).

Table 1. Target groups of inclusive digital public services

Vulnerable social groups	References
Seniors in rural areas	Botrić & Botrić, 2021
Women living in rural areas	Kerras et al. 2022
Female senior citizens	Botrić & Botrić, 2021
Handicapped people	Tomczyk et al., 2019
Anyone with low digital skills for services	Wihlborg et al., 2021
Anyone with poor access and digital skills as well as negative attitudes towards digital services	Heponiemi et al., 2023
Anyone who cannot formally prove their identity	Addo & Senyo, 2021

Taken together, the literature suggests that vulnerable groups can be identified based on variables covering (1) socio-demographic background, (2) socio-economic position and (3) social factors such as digital skills and attitudes. In our study, we use such variables to identify vulnerable groups, which, from our perspective, are the main target group for inclusive public services. Based on the literature review, we have identified seven target groups, as shown in Table 1.

In a second step, we look at those groups' attitudes. The literature review has revealed that there is a lack of empirical data on how such target groups actually behave in the face of digital public services and SSI-based eID solutions. In fact, there are several studies pointing out that understanding the users' attitudes is crucial for deploying inclusive public services (e.g., Heponiemi et al., 2020, Heponiemi et al., 2023).

Therefore, the strength of our article is the assessment of *how vulnerable groups actually behave in the face of digital public services, and what technical and non-technical factors can contribute to their digital inclusion*. From an innovation management perspective, the objective is to identify the technical and non-technical factors that can facilitate the adoption of innovative digital public services among vulnerable groups at an accelerated rate. The next chapter explains how we have operationalized this research question for an empirical analysis of survey data.

3 Conceptual framework

Consistent with the literature, the authors of this study understand digital public services as a lever for social inclusion of vulnerable groups, if they are deployed in an inclusive way (Heponiemi et al., 2023; Lythreatis, Singh & El-Kassar, 2022; De Marco et al., 2023; Ragnedda, Ruiu & Addeo., 2022; Ragnedda & Kreitem, 2018; Tomczyk et al., 2019). In this chapter, we present our framework that we have used to operationalize attitudes of vulnerable groups.

As Fig. 1 stresses, *social inclusion* is the main policy objective of digital public services. By definition, social inclusion is achieved when social groups benefit from public services in terms of

better health, better social care, better employment opportunities, greater participation in public life or a higher quality of life as a result of access to public services (e.g., Anrijs et al., 2023; Heponiemi et al., 2023; Lythreatis, Singh & El-Kassar, 2022; Van Deursen & Helsper, 2015).

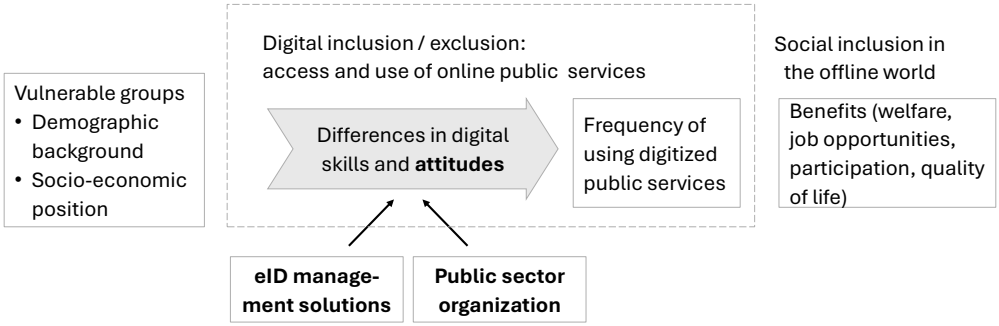

Figure 1. Inclusiveness of digitized public services

Our measure of *digital inclusion / exclusion* is the frequency with which people use online public services. Our main target groups, *vulnerable groups*, are defined as being composed of individuals who are disadvantaged in accessing and using digitized public services due to their demographic background, socio-economic position, digital skills and attitudes. In our models, we have introduced a number of *independent variables* in order to identify vulnerable groups (see section 4).

In order to assess what technical and non-technical measures could make digital public services more inclusive, we also introduced intermediary variables such as *digital skills* as well as a number of variables measuring the *attitudes* towards eID solutions and digital public services (Robles et al., 2021; see sec. 4). These intermediary variables are not only a measure of an individual's risk of digital exclusion but also their likelihood of adopting innovations. Individuals, who are motivated to adopt an innovation by showing positive attitudes towards eID solutions and are capable to do so by showing a sufficient level of digital skills are more likely to adopt eID innovations (Greenhalg et al., 2004 p. 599; Rogers, p. 261). This combination of risk factors for digital exclusion and hesitance to adopt innovation is particularly relevant for our research case which is digital innovation of public services.

At the core of our contribution is a critical discussion of the technical and non-technical measures to make public services inclusive. For this reason, we have included *eID management solutions* and *public sector organizations* as additional factors into our conceptual framework. In particular, we analyze the impact of SSI-based eID solutions on the inclusiveness of digital public services. SSI-based solutions promise that a digital identity can be used, proven and verified across multiple locations, independent of centralized authorities, unlike other eID solutions that store identity data in centralized or federated repositories (Toth & Anderson-Priddy, 2019). This promise, if realized, could give users more control over their identity information and reduce the perceived risks of identity data being stored, shared and used by third parties, which could increase trust in digital services (Giannopoulou & Wang, 2021).

Furthermore, *public sector organizations* could be another factor in making digital services inclusive, as they are responsible for deploying digital public services according to regulations like

GDPR or eIDAS, and for providing user groups with support that could make access and use of public services easier (Mahula et al., 2021).[1]

Based on this framework, we use our data to provide evidence on how vulnerable groups actually behave in the face of digital public services. The next chapter shortly introduces our methods and data.

4 Methods and data

We have used primary data from a web survey in order to answer our research question.

4.1 Pan-European web survey

A pan-European survey is our data source, which we have conducted in eight EU countries (Bulgaria, Denmark, Germany, Spain, Finland, Iceland, Italy). The survey was developed in the context of the EU Horizon 2020 research project IMPULSE (Identity Management in PUbLic SErvices), which has developed and piloted a decentralised SSI solution for digital public services. Besides sociodemographic questions, the survey covers the respondents' attitudes towards data protection, digital identities and online public service as well as their assessment of the IMPULSE solution.

The questionnaire was developed and distributed as a web survey from May 2022 to June 2023. It achieved 740 valid responses. However, there are some limitations, which will be mentioned briefly. In particular, the country distribution is uneven. Germany is the country with the most respondents (203), followed by Spain with 192. The countries with the lowest representation are Bulgaria with 41 and France with only 24. In addition, since the majority of respondents were either graduates or students at the time of the survey, the higher educated may be over-represented. Connected to that, we also see an over representation of wealthy people in the sample.

4.2 Variables

For the identification of vulnerable groups, we have used the reported number of online public services used per year as the *dependent variable*. The overall mean is 4.8 digital public services per year, but the results vary from country to country. Bulgaria has the lowest mean of 3.3 and France the highest with 7.7. A logarithmic transformation was used in the following analysis as the data were not normally distributed.

The *independent variables* are made up of demographic and socio-economic variables. These include age, gender, education and income, place of residence (rural or urban), ethnicity, citizenship status and country of residence.

Beyond this, there are several variables, which should have a *mediating* effect. One of these variables is digital skills. These were measured using the Digital Literacy Index, which was developed based on the Digital Literacy Framework for Citizens and consists of seven different items. We used three items to identify the digitally low skilled (see section 5).

To characterise the behaviour of vulnerable groups, we have used additional variables. These include *attitudes* towards new technologies, data security and handling of identity data, use of eID solutions such as IMPULSE, self-management of eIDs and suggestions for improving digital services. Out of this range of variables, we have chosen to include the following variables in our

1. At the same time, public sector organizations can use SSI-based eID solutions to provide their services more efficiently. For example, by cutting out intermediaries and paper-based verifications and allowing users to interact directly and verify their identity digitally. This level of processes and strategies within service providers is not part of this study.

models.[2]

- *Openness* for IMPULSE, which measures whether respondents prefer IMPULSE or other eID solutions on a likert scale, from 1 'certainly not' to 5 'certainly yes'
- *Digital IDs*: Digital identities, which measures how the respondents think of using multiple identities, such as 'using multiple digital identities is a hassle, but sensible' or 'I would prefer to have a single digital ID for all online services and accounts'
- *Log-ins*: Preferred options for online services, computers or smartphones, e.g., user name & password, SmartCard + PIN-Number, face recognition
- *Why not?* Reasons for not using Digital Public Services (DPS), measured by phrases why the user would do so, for example "I would be worried to make a mistake if I use eGovernment"
- *Improve:* Suggested improvements, which measures respondents' suggestions for improving digitized public services, e.g. 'make it easier and quicker to sign up for eGovernment' or 'make more public services available online'

4.3 The IMPULSE solution

As part of the survey, respondents were asked about their perceptions of IMPULSE, an SSI-based digital identity management solution. To this end, a short video explaining IMPULSE was included as part of the survey. As we are critically discussing SSI-based eID solutions as a lever for digital inclusion, here is a brief description of the IMPULSE solution

IMPULSE is a smartphone application. It can be used to create a digital identity with which the user can register and authenticate herself to digital services. To do this, the user goes to the website of the service provider and indicates that she would like to register with IMPULSE. The app is opened and the user takes a photo of her ID card and makes a selfie. Both of these are then uploaded to the IMPULSE server. AI then verifies that the images match the real ID and user. In addition, the necessary information - such as name, date of birth, etc. - is automatically extracted from the ID card or entered by the user. Based on this information, the IMPULSE creates a digital identity for the relevant digital services, which is stored securely on the smartphone. This identity includes a 'biometric profile' so users can authenticate via facial recognition. The images are then deleted from the system. In order to log in to the service, the user goes to the website of the service and selects 'Log in with IMPULSE' (or similar). The IMPULSE app will open and the user will select the digital identity for the service and then take a new selfie. If the selfie matches the stored biometric profile, the user is authenticated and logged in to the Service. The image will then be deleted.

5 Findings

First, we have identified vulnerable groups based on different variables (cf. sec. 4.2). In terms of demographic and socio-economic factors, in our regression models only *age* and *education* emerged as significant for digital inclusion / exclusion. In our sample, *seniors* over 65 years of age were more *frequent users* of digital public services than younger users. This is consistent with other research showing that seniors can also be early adopters of such services (see sec. 2).

2. We also included security concerns in our models, e.g. in relation to privacy, individual control over personal data. The literature suggests that such variables could be measures of trust (Robles et al., 2021). Unfortunately, these were not significant.

While the effects of education are not as clear as for the other variables, we can still see that people with lower secondary education use less digital public services than those with higher education. In our models, *income* did not appear to be a significant determinant of the use of digital public services. This is surprising given the research literature. However, it may be due to a bias in our data towards wealthier people (see sec. 4.1).

More importantly than demographic or socioeconomic variables, and consistent with research literature, digital skills and attitudes towards new technologies emerged as key drivers of digital inclusion / exclusion. People with *low digital skills* and those who are *not comfortable with new technologies* report significantly lower use of digital public services than the general population.

Unfortunately, we were not able to further specify vulnerable groups by considering different variables and interactions, as we had intended to do (see sec. 2). In fact, with the exception of the interaction between *age and digital skills*, our regression models showed no other significant interaction effects. Here we can see: The older a person gets, the more important it is to have digital skills in order to prevent digital exclusion. However, the size of the effect is rather small.

The lack of other interaction effects may also be partly explained by the limitations of the survey sample, which had few cases with low household income or education (see sec. 4.2). Overall, as shown in Table 2, we have identified three vulnerable groups.

- The *less digitally skilled*, defined as people who do not have advanced computer skills, which means they are not able to use cloud applications such as Google Drive, to understand simple computer code, or to update or reinstall computer programs.
- The *lower educated people* are defined here as those who have not completed a secondary education, neither vocational training nor university education.
- People with *poor attitudes* towards new technologies defined as those who disagreed with the statement: "I like to try new technologies".

To better understand how to make digital public services more inclusive for these groups, we assessed their attitudes. We started by analysing how they perceive eID solutions and digital public services. Table 2 summarizes our findings. It shows how these groups (1) deal with multiple eIDs; (2) prefer to log in to digital services; (3) prefer an SSI solution over other eID solutions and (4) have suggestions for improving digital public services.

Table 2. Handling of eIDs and digital public services

Groups	Multiple eIDs	Preferred log-in	SSI or other?	Improvements
Less digitally skilled	Forget PW, discouraged by complicated sign up, hard to manage multiple eIDs	Strong preference for name & PW, second preference for fingerprint	55% SSI (majority prefers SSI)	More need for assistance, less interest in more digital services
Lower educated	More likely to use more digital services, if they needed only one ID	Same as less digital skills	72% SSI (strong majority for SSI)	More DPS and ensure that they are fully online

Groups	Multiple eIDs	Preferred log-in	SSI or other?	Improvements
Negative attitudes	Sometimes forget PW and get discouraged by complicated sign up	Preference for name & PW, less for fingerprint and face recognition	52% SSI (majority SSI)	Higher need for more / easier infor-mation

For the *'less digitally skilled'*, it is clear that dealing with multiple eIDs seems too much of a challenge. They show a strong preference for the traditional login with a user name and a password, even though they are also more likely to forget their password. This group is often put off by complicated login processes, therefore easier identification, for example through fingerprint recognition (47%) or face recognition (41%), or better user support could be a way forward for inclusion. However, making more public services available online may have little impact on digital inclusion.

For the *'less educated'*, IMPULSE would be the most likely choice over any other eID solution. Here, reducing technical complexity in the sense described for the less digitally skilled, i.e. by reducing the number of eIDs to manage, by using name and password, fingerprint (58%) or face recognition (40%) as login, could contribute to the digital inclusion of this group. Here, making more public services available online could be a lever for digital inclusion.

Unsurprisingly, the *'negative attitudes'* group prefers well-known ways of signing up, which is to say name/password. Face recognition, which is used by IMPULSE is only a preferred log in option by 27% of the group compared to 46% of the rest of the respondents. Consequently, digital inclusion could be promoted here rather through non-technical measures, such as more and easier to find information about digital services.

In a next step, we investigated how an SSI solution like the IMPULSE app could make public services more inclusive. To do this, we assessed: (1) the groups' openness to an SSI solution; (2) their reasons for not using it; (3) how they perceived such a solution; and (4) for which services such a solution might be useful.

Table 3. Attitudes towards SSI solution

Groups	Openness for SSI	Reasons against	Perception of it	For which services
Less digitally skilled	41% open	Don't want to de-pend on smart-phone, are afraid of loosing it	Less perceived as privacy friendly, safe and conve-nient, more as complicated	Most online ban-king then eHealth
Lower educated	Majority open (above average)	Worried about facial recognition	Safe, interesting, makes signing up easier	More email, other-wise like above

Groups	Openness for SSI	Reasons against	Perception of it	For which services
Negative attitudes	Less open, only 33%	Most worried to lose smartphone, dependence on smartphone	Fewer say easy to use, but most say convenient, saves time, privacy friendly	Less online banking and tax returns, most say eHealth

Although over 40% of the *less digitally skilled* are open to IMPULSE, this solution does not appear to significantly promote digital inclusion. This group, whose digital inclusion is apparently more likely to be strengthened by a reduction in technical complexity, seems to find the solution very complicated, not very simple and rather discouraging. They do, however, welcome having more privacy protected.

People with a *lower level of education* are apparently the most open to an SSI solution such as IMPULSE, because it appears as safe and interesting solution, which makes signing-up easier. However, this group would use it for emails, so overall its contribution to digital inclusion might remain weak.

Again, it is not surprising that those with a *negative attitude* to new technology are the least open to an SSI solution such as IMPULSE. This group, which is more interested in having more support, finds the solution rather complicated and the reliance on smartphones problematic. However, a strong argument in favor of the solution could be the protection of personal data, which is particularly important for eHealth.

We now discuss our findings in terms of the attributes that help or hinder the adoption of innovations, which are well established in the literature on innovation management (Rogers, 2003). An evaluation of the IMPULSE solution shows that more than 45% of all respondents do not see any relative advantage of IMPULSE. It seems that they do not believe that it can help to save time or make the registration process easier. The second criterion is the compatibility of the innovation with values, previously introduced ideas and user needs. Around 40% of all respondents describe IMPULSE as being privacy friendly or helping them to gain control over their data. This indicates compatibility with the value of data protection and privacy. Third is complexity, with around 35% of all respondents describing IMPULSE as easy to use and only 11% describing it as complicated, indicating a medium level of complexity. Fourthly, trialability, as IMPULSE is designed as a mobile application that can be downloaded from an Appstore, potential users have an easy way to test the application. Finally, observability is high because the benefits of using IMPULSE can be easily communicated to the population through advertising.

Overall, drawing on the literature on innovation adoption, the IMPULSE design provides only moderate support for its uptake. While compatibility with privacy values and complexity are at medium levels, the perceived relative advantage is low, making rapid adoption unlikely.

6 Preliminary conclusions

On the basis of our findings, this section draws preliminary conclusions on how to make digital public services more inclusive. This will be further elaborated in another version of this paper, based on more empirical data. For now, our conclusion is that an SSI solution such as IMPULSE is unlikely to have a widespread impact on digital inclusion.

Since the groups with low digital skills and low educational level report that they would use more digital public services, if signing up for them would be easier, digital identity services like

IMPULSE could promote digital inclusion. However, this solution seems particularly *beneficial for lower educated* people of which 51% report struggling with having multiple identities. For the other groups IMPULSE might still appear as too complicated. In addition, IMPULSE uses face recognition for authentication which is only the third favourite log-in method for people with low digital skills and education (behind name and password as well as fingerprint) and particularly unpopular among people with negative attitudes towards new technologies.

In fact, the promise of SSI solutions for greater convenience does not fully match the perceptions of our groups of IMPULSE. In particular, the less digitally skilled and those with negative attitudes perceive the use of IMPULSE for login as less convenient. For this group, the solution seems to require new technical knowledge and they are afraid to use it incorrectly. In addition, the perceived risk of dependence on smartphones could make its use more exclusionary, especially for those with negative attitudes. Most importantly non-technical factors like being afraid of making mistakes and wishing for more assistance are more common among our groups and provide a barrier to them use online public services.

A further argument in favour of such a solution, which emerged across all groups, is that it could increase trust in digital public services due to the apparently limited disclosure of identity data to the service provider. However, this does not seem to be specific to the IMPULSE and could also be achieved by means of regulation. Other technical or non-technical measures could also cover more assistance, better user support and easy and quick registration. Therefore, a later version of this paper will discuss the capabilities of public sector opportunities to make digital services more inclusive.

Our research suggests that the inclusiveness of public sector organisations could be enhanced by further research into the organisational and institutional factors that either facilitate or inhibit ICT-enabled government innovation in the public sector.

Further research could also investigate the overlap between the digital divide and the diffusion of innovation and its implications for inclusivity of innovation in the public sector.

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