Introduction

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Abstract This chapter introduces some technological and policy developments that are at the heart of the mGov4EU project. In the mGov4EU project, various pilots implement and validate enhanced infrastructure services for electronic voting, smart mobility and mobile signing, using mobile devices most of us nowadays naturally expect as a default way of accessing services. The pilots aimed to demonstrate the feasibility of providing cross-border information to enhance cross-border mobility and cross-border collaboration in the European Union. The pilots also demonstrated how enhanced electronic identities and trust services (eIDAS) and Single Digital Gateway Regulation (SDGR) layers can accommodate once-only, digital-by-default and mobile-first principles.

For this to result in user-centric, user-friendly mobile public services, stakeholders' roles (including but not limited to end users' experiences and requirements) have to be identified, architecture core building blocks have to be assembled, implementations have to align with EU eIDAS and SDG regulations and, with the eSignature interoperability system and the Digital Wallet System, ethics, security and privacy requirements have to be taken into account and evaluated. The long-term viability has to be ensured. This first chapter briefly introduces all these relevant angles and describes how the various chapters will focus on how specific challenges were tackled and what lessons learnt could be drawn.

Keywords Mobile government · Pilots · eIDAS · SDG · Once-only

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1 Mobile Cross-border Government Services for Europe

It is almost a bit of a cliché to note that governments around the world provide public services more frequently through electronic means. The phenomenon of electronic public service delivery has existed for decades. The topic has brought academics from various fields together to form a mature academic discipline that studies the development, use and impacts of electronic public services at local and national levels of government. Political and technological trends have converged for a couple of years, resulting in new research puzzles, engineering challenges and questions for policymakers.

The first trend is mobile and wireless communication technologies within government administrations. The use of mobile technologies in public service delivery can be seen as either an extension or a subset of electronic public service delivery [1, 2], and it has inspired experts and academics to coin the term mobile government (or m-government). Reviews of literature on mobile government [1, 3] have traced the origins of mobile government to the beginning of the millennium, with mobile government being defined as a strategy and its implementation involving the use of mobile and wireless technologies for the delivery of public services to citizens, business and all government units [1, 2, 4, 5], including but not limited to location-based services [6]. For about two decades, a stream of academic publications has focused mainly on explaining mobile government use intentions and behaviours [1]. Gaps in the literature include a lack of attention to the impact of user-friendliness on the adoption of mobile government, negligence of service providers' technological conditions and capabilities and questions regarding how mobile government initiatives align (or fail to do so) with existing administrative procedures and public policies, for instance, about security requirements, privacy concerns and information ethics [1, 3].

A second trend in developing e-government in Europe is that more and more, electronic public services are open to more than just local [7, 8] or national [9] contexts. For countries in the European Union, the emergence of the European Single Market and Digital Single Market has underlined the importance of digital public services that are provided across national borders or require information exchange across national jurisdictions [10–12]. These services are commonly referred to as cross-border digital public services. An example of a cross-border digital public service is an electronic prescription, a service that, during the COVID crisis, proved to be of vital importance for medication-dependent citizens who contracted COVID and had to self-isolate while in transit. Developing and implementing cross-border services requires levels of legal, organisational, semantic and technical interoperability that are hard to realise in the real world. It has been observed that the academic literature underreports the challenges of developing services in a cross-border context [10, 11, 13].

A third trend is related to developing policy initiatives in the European Union. One relevant initiative in this context is the Single Digital Gateway Regulation. To further develop the European Union's Digital Single Market, the Single Digital

Gateway Regulation (SDGR) was adopted in 2018 by the European Parliament. The regulation allows for developing a network of national portals in EU member states and the four European Free Trade Association countries (Iceland, Norway, Switzerland and Liechtenstein), with the Once Only Technical System (OOTS) being the underlying platform. A driving idea behind this policy initiative is that OOTS will become a trusted tool and a pillar of the Digital Single Market, allowing European citizens and businesses to provide their data only once while carrying out administrative procedures across the EU and the EFTA countries. Another relevant policy initiative is regulating electronic identities and trust services (eIDAS). eIDAS regulation marks an important milestone toward electronic identification and e-transactions across EU borders by enabling e-signatures across European Union authorities and companies that provide public services. eIDAS is, therefore, considered a foundation for securing cross-border transactions in Europe. eIDAS has been updated and is still part of an ongoing revision initiated by the European Commission. Part of the revisions is mandating the implementation of a European Union Digital Identity Wallet (EUDI Wallet or EUDIW) to member states. EUDI Wallets complement physical ID documents such as identity cards, driving licenses, passports, payment cards, transport cards and travel passes. They are meant to facilitate online identity verification.

The abovementioned trends may be seen as converging into a new electronic public service delivery form in a European Digital Single Market. This new image emphasises user-centric, user-friendly mobile public services that are efficient in their use by citizens, governments and businesses, allow for inclusivity and non-discrimination and boost security and privacy protection levels. With the Single Digital Gateway Regulation in place, electronic identities and trust services and digital wallets being developed, European flagship policy initiatives are well underway, and the prospects of realising visions of seamless, 24/7, location-independent public services are thought-provoking. At the same time, it must be observed that there are many uncertainties and challenges to overcome at the time of writing. Currently, various member states in the European Union are providing public services accessible using smartphones. However, a fair assessment also is that mobile government is still in its infancy. This is the point of departure of the Horizon 2020 project mGov4EU. This multidisciplinary project was funded by the European Commission and brought together ten partners from five countries to develop an open ecosystem for providing secure mobile cross-border electronic government services using the eIDAS and SDGR foundations. This book presents the main findings, outcomes, lessons learned and policy recommendations developed during the project.

2 The mGov4EU Project

The mGov4EU project took place between January 2021 and December 2023 and had at its core the ambition to unlock the full potential of mobile cross-border services, the Single Digital Gateway and updated eIDAS regulations. The project's final results were presented during an international symposium held on the 4th of December 2023, at the Permanent Representation of Estonia to the European Union in Brussels.

In the mGov4EU project, it is acknowledged that digital transformation and the challenges of providing seamless, user-centric, secure and privacy-preserving public services require practice and academia. Within each of those realms, various disciplines work hand in hand. It is not uncommon to claim that understanding digital public service delivery (either or not using mobile technologies) requires bringing together insights from disciplines ranging from computer science to law, political science, public administration and organisation studies. However sympathetic this may sound, it must not be underestimated that important epistemological differences exist between social sciences and engineering disciplines and practice and academia. Traditionally, social science has committed itself to answering 'questions and striving for theories of high generality, where the epistemology of the engineering discipline (including but not limited to computer science), the practical question "what works" drives much of the research' [14]. Experiences in the mGov4EU project showed that.

To bridge the gap between epistemological differences and make sure to lift mobile cross-border public services to new levels, mGov4EU has committed itself to implement and validate three pilots:

- An internet voting pilot with which an identification mechanism and SDG layer are integrated into a remote online voting system. This solution was implemented and tested during University Council elections at the University of Tartu in Estonia.
- A mobile signing pilot with which electronic signatures were implemented and validated in the mGov4EU workflows and business processes, which requires cross-border information exchange because signatories use electronic ID means from various European Member States.
- A smart mobility pilot with which an eIDAS authentication backend, an eIDAS node, an SDG backend and a reconfigured Passenger App were used to allow German and Austrian test users to use their national test eIDs for using the state-subsidised FiftyFifty taxi service that operates in German rural areas.

The abovementioned pilots served not only as testbeds for realising technological solutions but also as providers of valuable data with which users' responses could be theorised and improved understanding of development activities and users' evaluation could be realised.

3 Outline of the Book

Insights from pilots are documented in various chapters, which are the core of this book. The contents of various chapters are summarised below.

In the chapter 'User Journey, User Experience', Rachelle Selling and Thomas J. Lampoltshammer discuss user experience design literature and explain how various pilots' user experience was considered to develop mobile electronic public services so that users of mobile government experience better public services. The chapter provides the reader with good practices for appropriately designing mobile government services and lessons learned throughout from these various pilots.

In the chapter titled 'Stakeholders', Rachelle Sellung and Thomas Lampoltshammer provide an overview of the mobile government ecosystem and discuss roles performed by various stakeholders that populate the ecosystem, using qualitative studies that were conducted with mobile government stakeholders in Estonia and Austria.

The chapter 'Design and Architecture of Mobile Cross-Border Services Building Blocks', authored by Blaž Podgorelec, Thomas Zefferer and Andreea Corici, discusses the eID interoperability system, the SDG interoperability system, the eSignature interoperability system and the Digital Wallet system as core building blocks of a technical architecture that serves as the foundation for mobile government applications. The assemblage of these building blocks makes it possible to design secure ways for citizens to identify themselves electronically, develop cross-border solutions that make efficient use of user-authorization access points, allow for trust to emerge among users by the generation of electronic signatures and provide a user-friendly platform (a wallet) that allows citizens to manage credentials and evidence of transactions. The chapter provides technical details of each component and discusses current and future applications of the architecture in European mobile government initiatives.

In 'Implementation and Systems Integration', Bernd Prünster, Andreea Corici, Roland Czerny, Tobias Wich and Thomas Zefferer discuss how more or less traditional focus on uses of Web browsers on desktop computers needs to be reconsidered when services are delivered through smartphones, as the latter have different characteristics, capabilities and also other limitations. The chapter provides specific solutions to technical mobile government challenges.

Jordi Cucurull, Polina Toropova and Andreea Corici describe the Internet voting pilot in their chapter, 'An i-Voting Pilot in the eIDAS and SDG Context'. The authors describe transitioning a laboratory proof of concept to a real-world application and discuss voters' experiences.

The chapter 'Ethics and Privacy' provides Hans Graux's elaboration of the relevance of the General Data Protection Regulation (GDPR), the Single Digital Gateway Regulation (SDGR) and ongoing revisions of the eIDAS Regulation for mobile government applications. Hans Graux also reflects on how regulations interact, what ethics principles underlie these regulations, how legal rules impact mGov4EU and how mGov4EU addresses known legal and ethics issues.

Lucy Temple and Gregor Eibl focus on transdisciplinary research at the heart of the MGov4EU project. In 'Evaluation and Transdisciplinarity', the authors reflect on the needs, promises and challenges of truly transdisciplinary research and develop and apply an evaluation framework with which the relevance of digital government projects—including mobile government initiatives—can be assessed.

An important issue with mobile government is security, which is the topic of Thomas Zefferer's chapter titled 'Security'. Mobile devices introduce new security challenges, like their vulnerability to theft and loss, while their 'always on'-characteristic paves the way for new attack vectors. Thomas Zefferer describes a security-evaluation model that helps ensure mobile government solutions' security during design and implementation. The feasibility of the model describes the results of its application to software components and applications developed in the mGov4EU project.

Sustainability is a core area of attention of the mGov4EU project, and Carsten Schmidt, Stefan Dedović, Bogdan Romanov and Thomas J. Lampoltshammer reflect on MGov4EU's lasting impact in their chapter, 'Sustainability'. The authors discuss the project's outcomes and deliverables and critically examine whether and, if so, how, the involvement of stakeholders and focus on take-up, flexibility and interoperable solutions and continuity have contributed to results that are likely to extend beyond MGov4EU's life span.

The chapter titled 'Relevant Business Models and Patterns' discusses the results of an expert analysis of business model patterns for the eID interoperability system, the eSignature interoperability system, the SDG interoperability system and the Digital Wallet. In this chapter, authors Thomas J. Lampoltshammer and Rachelle Sellung also reflect on the sustainability of these mGov4EU components beyond the project's end date.

In 'Future Outlook, Research Ideas', Herbert Leithold, Carsten Schmidt, Thomas Zefferer and Thomas J. Lampoltshammer synthesise main results and findings discussed in the abovementioned chapters into a road map of research that is needed to reap the benefits of eIDAS, SDG, the Once-Only Technical System and the European Digital Identity Wallet. The authors provide a governance outlook, a privacy and data protection outlook, an electronic services outlook and a mobile technologies outlook.

In this book's final chapter, 'Summary', Carsten Schmidt, Thomas Lampoltshammer and Vincent Homburg look over all the contributions and lessons learnt and try to regain a bigger picture of the European mobile government's past, present and future.

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