EXECUTIVE SUMMARY OF THE THESIS

Interoperability: the precondition for proactive public service provision

TESI MAGISTRALE IN MANAGEMENT ENGINEERING – INGEGNERIA GESTIONALE

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ACADEMIC YEAR: 2021-2022

1. Introduction

Nowadays, e-government is well established and widespread among public organizations, as many governments are increasingly focusing on developing e-government initiatives (Erlenheim et al., 2020). Indeed, an increasing number of services are provided online and progressively more information is available through different databases (Erlenheim et al., 2020). The role of the state is constantly changing, and the government has more functions to accomplish as increasingly more services are expected to be delivered in a more efficient manner to citizens (Sirendi, Taveter, 2016).

2. Literature review

2.1. Proactive services

The relationship between citizens and PA, during the pandemic, has changed. Citizens have started to expect from the PA services digitally, as private company have done from several years. ICT and digital technologies can help actuate a paradigm shift in the public service provision: allowing the PA to provide proactive services to the citizens, meaning pushing the service provision rather than waiting for the citizens to request a certain service.

Making a public service proactive is a complicated process that needs a strong e-government infrastructure in order to be completed. A technological integrated and interoperable infrastructure is at the base to reach a proactive service provision (Sirendi et al., 2018).

Additionally, it is fundamental to build and design the service around the citizen and their needs. This is the starting point of the process; hence it is then necessary to take in consideration the needs of the entire stakeholder audience. Therefore, a multi stakeholder approach needs to be taken when designing. Sirendi and Taveter (2016) claim that better and more efficient services can be designed by efficiently modelling stakeholders' roles, goals, interactions, interests, and knowledge through the Agent-Oriented Modelling (AOM) methodology.

The aforementioned design principles are at the base of a proactive service provision approach. The realization of the latter can be facilitated by the

concept of moments of life, which can be further divided in "human" life events and business events (Kõrge et al., 2019). The PA that is able to connect the service provision to the citizens' moments of life is more user oriented and able to actuate a proactive service provision.

Erlenheim et al. (2020) suggests ten design principles necessary to ensure proactivity in service delivery: Wholesomeness, Once-Only Principle, Digital-by-Default Principle, Possibility to Opt-out, Personalized and role and situation-centered, Intuitivity and Simplicity, Transparency, Recent and timely information, Reliability and security and Multilingual access. Then also implementation strategies are suggested by the literature, Kuhn et al. (2021) proposes three different strategies that can be followed to reach a proactive service provision: internalized user activities, where the providing entity takes over all the citizen's activities; leverage other parties, where a third party, different from the providing agency, takes over the different activities; and enable the user to automate, where the service provider offers the user the possibility to outsource the activities, making the user the one that triggers the shift.

The increase of facilitation in public services usage can be achieved through the creation of a one-stop shop, which is defined by Wimmer (2002) as "A single point of access to electronic services and information offered by different public authorities". This creates an integrated front office from the citizens' point of view, bringing together and delivering the citizens the information they need through a personalized interface. The one-stop shop is just considered the starting point for proactive service provision, whose further development results in the no-stop shop (Scholta, Lindgren, 2019). The no-stop shop is government service delivery that has an integrated back end and is proactive or predictive (Scholta et al., 2019). It is important noticing that not every government has to go through the one-stop shop in order to achieve the no-stop shop and that not every service can be made fully proactive due to its intrinsic characteristics.

Oude Luttighuis et al. (2021) argues that an inverse relationship between the level of proactivity and the amount of interaction effort that a citizen has to perform exists and Erlenheim et al. (2020) claims that proactivity can be defined as a spectrum. In their papers the authors propose two different frameworks: Erlenheim et al. (2020) suggests the reactivity proactivity spectrum in which he defines different proactivity stages and Luttighuis et al. (2021) presents a framework in which the level of proactivity is determined based on the eligibility process and the delivery process. Concluding not every service can be made fully proactive, thus proactivity has to be considered as a characteristic that has different levels and that can be incorporated with a certain degree.

2.2. Interoperability

The delivery of digital and proactive services requires collaboration and seamless exchange of data between government agencies (Kubicek, 2008) and the lack of these interconnections could prevent the provision of the service (Lampathaki et al., 2010). For these reasons, the concept of interoperability, which is the ability to exchange data and to share information and knowledge by using common standards (Er Riyanto et al., 2018), is introduced as a fundamental precondition for e-government and proactive service delivery, as already anticipated by the analysis of the proactive service literature.

Interoperability has a multifaceted nature, meaning that, when dealing with interoperability, governments have to go beyond the technical dimension and covering also the formal and social one (Backhouse, Halperin, 2009). The broad meaning of interoperability reflects on the definitions that the authors gave to the concept. Initially, interoperability was conceived only for the field of information technology and systems engineering services therefore the definitions had purely a technical perspective. Later, the concept was presented with a much broader and high-level view which considers, along with technical aspects, cultural, social, political and organizational factors crucial for ensuring interoperability. The complexity of the concept contributes also to the diffusion of many frameworks describing interoperability as a structured concept composed of different layers (Ordiyasa et al., 2016), each representing a perspective or area where it is necessary to intervene to guarantee interoperability. The frameworks describe many perspectives (layers) of interoperability underlining again its multifaceted nature. Some examples of interoperability layer

are: technical, formal, informal, syntactical, semantic or organizational. The evolution overtime of the frameworks reflects the evolution path followed by the definitions: the older models were centered on the technical layer, while the more recent models gave the same relevance to all perspectives.

APIs are useful tools employed to introduce and enhance interoperability between different systems and players (Vaccari et al., 2021; Puspitasari et al., 2021), in particular the technical aspect (layer) of interoperability, that deals with the design of the technical infrastructure and make possible the actual data exchange between systems. An API is a software intermediary that, serving as an interface, allows two applications or systems to interact and facilitates smooth flow of data (Williams, 2018; Stani et al., 2020). Applied to the public sector APIs can be used by a PA to transfer information of a citizen to another PA, thereby preventing the need to register the same data twice (Once Only Principle) (Stani et al., 2020) and facilitating accessibility and re-usability of information (Vaccari et al., 2021). Therefore, APIs can create ecosystems by establishing interrelationships between various groups of stakeholders. Adoption of APIs in government needs to take into account many aspects: first, the role played by the PA in the API Journey (provider, consumer or publisher) and the data quality matter (Stani et al., 2020); second, general enablers, drivers, barriers and risks, and challenges need to be taken into account in implementing APIs (Vaccari et al. 2021); third, all the challenges related to sensitive data and privacy (security, regulation and specifications or standards) (Williams, 2018). Despite the benefits APIs give, a common view, regarding who should define APIs, how they should be defined and whether to standardize their creation, is still lacking (Borgogno, Colangelo, 2019). For this reason, the EU institutions encourage to use open, standardized and well-documented API more broadly. The European Commission started also advocating the adoption of standardized and common data formats and common protocols, in order to facilitate data gathering and processing, in an interoperable manner, from different sources. This would enable the usage of a single type of API to gather and process data across organizations. With this respect, the Single Digital Gateway project would be benefited. Joint Research Center Study on API

presents a number of APIs use cases demonstrating the major benefits that APIs can bring in terms of interoperability.

2.3. Research questions

The literature addresses in a comprehensive manner the most efficient frameworks that a country that wants to increase its public sector interoperability has to implement. On the contrary the literature does not specify how to actually introduce the framework in an already existing digital society to reach the objective of building a functioning e-government able to provide to the citizens also proactive services. In our thesis, in order to fill this gap, we will answer the following research questions:

- *RQ1: What are the interventions undertaken by virtuous countries to increase the e-Governance quality?*

- *RQ2: Which are the steps to follow to provide and/or increase interoperability in the public sector?*

- *RQ3: How can the Italian PA provide a higher e-Government service quality to the citizens?*

  - *RQ3.1: Which is the current level of digitalization and interoperability of the local PA in Italy?*

  - *RQ3.2: Which are the interventions that Italy can implement?*

3. Interoperability in the Italian public sector

The analysis of the results of the questionnaire, focused on digitalization developed by the Digital Agenda Observatory and submitted to the municipalities, has been fundamental in order to define the actual Italian public sector interoperability situation.

The Italian e-government is defined by the eGovernment Benchmark 2022 as "non-consolidated", meaning that interventions to increase interoperability and digitalize public serviced are required. Concerning the overall results about internal and external interoperability Italy places itself in a good starting situation since 82% of the respondents have integrated their internal databases and 50% of the municipalities have integrated their databases with external

entities' ones. Particularly on the one hand the internal database integration is widely diffused in smaller municipalities while, on the other hand integration with external organization is not very spread and much more implemented by big municipalities. In regard to the criticalities municipalities run into, while performing integration projects, it emerges that the municipalities, regardless of their size, do not recognize only the technical aspect of interoperability, but also issues related to organizational, semantic and legal interoperability emerged, highlighting the need to intervene in all the different interoperability aspects to achieve the best solution possible, as the literature and the EIF emphasized.

4. E-government and interoperability: case studies from EU countries

The answers to our research questions were found in the analysis of four cases studies about EU countries that present a developed e-government structure and that throughout the past years have performed successful interoperability interventions. The four case studies are about: Denmark, Estonia, the Netherlands and Sweden. For each country we have developed an in-depth analysis about their digitalization journey, their specific interventions and the results that they were able to obtain. On the whole we have been able to gather all the common characteristics observed and cluster them, in order to provide guidance to increase interoperability and e-government quality.

4.1. Digitalization approach

The establishment of an interoperable public digital infrastructure cannot be built overnight, for example Estonia took 30 years to develop it and achieve the goal of providing proactive services. E-government experts suggest starting with the services that would most benefit citizens and businesses, working on interoperability between the entities that participate to their provision, in order to digitalize those. This approach will facilitate the citizens' usage of the service and its spreading in the society. Furthermore, a reasoning about the structure of the country service provision, needs to be made. As for countries that

provide the majority of services through federal public authorities creating interoperability is easier due to the larger size and smaller number of entities. While for countries where local governments have more power and provide a great number of services, creating interoperability is harder and more efforts in facilitating collaboration between different entities are required.

4.2. Collaboration

Collaboration, between the different public agencies is at the base of a fluent data and information exchange. The experts interviewed have repeatedly highlighted this fact, stressing the necessity to engage all levels of the public administration since the project definition phase, in order to improve the projects' outcomes and create a community. The first step is making the different administrations understand that sharing their data and information is beneficial also for them. Especially in the case of a PA management decentralization, the increase of collaboration is crucial and useful to solve matters of organizational interoperability, such as the alignment of business purposes and processes.

4.3. Technical interventions

Even though technical interventions are not the only aspect that countries willing to develop their e-government have to undergo, they are fundamentals. Each country at the beginning of their process has created a consistent digital infrastructure through the development of cross sectoral digital interventions. The most successful example, in this regard, is the Estonian X-Road which is an advanced data exchange layer that connects all information systems and all public organizations in Estonia, enabling secure data exchange and service provision. Additionally, the experts from the different countries suggested some key interventions that countries interested in developing their interoperability have to work on:

- The development of a single digital identification that can be used to access any type of governmental portal and service.

- The availability, for every governmental agency, of basic data.

- The harmonization and standardization of data formats through a common information model.

- The creation of a single point of contact with the citizen, a one-stop shop, where all the services that the PA provides are available and accessible by the citizen.

4.4. Legal interventions

Legal efforts need to go hand in hand with the technical and infrastructural development, in order to achieve successful results. For instance, Estonia in 2001 enacted the Public Information Act that contains all the legal basis of their e-government structure. Legal interventions like the aforementioned one are essential, since define what the PAs can and cannot do, and facilitate, or even force, the implementation of interoperability interventions. One of the most discussed legal issues is data ownership, in the most advanced digital societies the PA does not own citizens' data, on the contrary the citizen is the only holder of their information and can allow a public entity to use their personal data for the service fruition. Moreover, one other issue one related to data duplication, as long as the different agencies will save every data they need in their own databases, interoperability will be hindered. With the introduction of a low prohibiting data duplication the interoperability implementation would be facilitated.

4.5. Incentives

All the interviewed experts stressed the importance of practically implementing and spreading interoperability. The deployment of the interoperability interventions across all the public sector levels is facilitated by a coherent regulatory setting, since laws can be binding and can oblige public entities to implement interventions. Many countries adopt a cooperative approach, involving all the interested since the first phases of the decision-making process. This approach incentives the respect of centrally given guidelines due to the fact that they are developed jointly, and every agency believes in them. Another approach widely diffused is binding new funds to the implementation of a part of the interoperability project. This approach is used by Sweden that developed ENA, the Swedish digital architecture, in a modular way and that manages the architecture implementation checking the realization of specific building block and unlocking new funds after their completion.

4.6. Financing structure

The entirety of the country analyzed uses both EU and budget funds, since the grants that the EU provides to member countries are not enough to develop a functioning architecture. Estonia for example uses the EU funds for long term development and budget fund for the system every day running costs. Sweden, for specific projects complements the financing with money coming from the private sector. In regard to project financing every country uses its own method, Denmark for example uses a co-financing allocating 40% to the central government, 20% to the region and 40% to the municipality, in this way the responsibility is shared.

5.   Methodology

Our master thesis has been structured in a literature review focused on the topics of proactive services and interoperability and in an empirical analysis on the best practices in the field of interoperability.

5.1. Literature review

The literature review is made of two chapters: the first one on proactive services and the second one interoperability. In relation to proactive services, we have analyzed 25 papers and selected 9. The topics and the respective number of papers related are listed below:

Topic	Number
Proactive services	6
Service design for proactivity	4
Moments of life	3
One-stop shop and no-stop shop	2
Reactivity proactivity spectrum	3

Regarding interoperability we have executed two queries and selected 19 papers. The topics and the respective number of papers related are listed below:

Topic	Number
Interoperability definition	11
Interoperability frameworks	4
APIs	5

5.2. Empirical analysis

The empirical part of our thesis is composed of two sections: the analysis of the Italian public sector interoperability state and four case studies about four countries with a developed and well-functioning e-government.

The Italian analysis has been based on a questionnaire developed by the Digital Agenda Observatory of Politecnico di Milano and submitted to all Italian municipalities between August and October 2022. The questionnaire has been submitted to all the Italian municipalities and 952 of them answered. We analyzed the questions focused on interoperability, both between organizational units of the same agency and between different agencies, and on e-government interventions aiming at reducing citizens' fulfillments.

Concerning the case studies' analysis, we have interviewed 11 experts from four different EU countries: Denmark, Estonia, the Netherlands and Sweden. We conducted semi structured interviews asking questions related to the level of interoperability in their country, the path followed to reach the actual situation and the main steps they went through, their financing choices and the interventions in regard to organizational issues.

Through the answers received and the information present in institutional website we managed to build four case studies, one per country, and to identify the common characteristics, clustering them and define a guide to increase interoperability and e-government quality.

6. Conclusions

Through the evidence from our empirical analysis, we managed to develop six areas of interventions that supports governments and public administrations in introducing interoperability in the national public sectors. The cluster are digitalization approach, collaboration, technical interventions, legal interventions, incentives and financing structure.

Our research is affected by limitations which generate the possibility for future developments. Extending the study to not EU counties, focusing future research to some specific layers of interoperability and looking at the private sector experiences are some possible hints for future

development aiming at extending the knowledge on interoperability provided by this study.

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