JeDEM 17 (2): 1-30, 2025
ISSN 2075-9517
http://www.jedem.org
Date of submission: 24.09.2024
Date of acceptance: 16.04.2025
Article DOI: 10.29379/jedem.v17i2.961

Development of a parsimonious evaluation model to support one-stop shop implementation

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Abstract: One-stop shop (OSS) is an integrated hub offering information and public services at one point of access. The streamlined service delivery makes OSS a preferred concept for governments undergoing modernisation efforts. However, similar to other electronic government initiatives, OSS success is contingent upon user acceptance. While previous research primarily focuses on operational aspects, examining user attitudes toward using OSS remains underexplored. Therefore, we propose a user-centred OSS parsimonious evaluation model (OSSPEM) that could help service providers evaluate OSS success and monitor user feedback throughout the OSS lifecycle. The OSSPEM integrates socio-demographic factors, constructs from both the original and extended Unified Model of Electronic Government Adoption, and the OECD Best Practice Principles for Regulatory Policy. The model comprises a conceptual and measurement framework tested in the context of North Macedonia, involving a study population of 200 respondents. The collected data were analysed using binary logistic regression. The findings expose the validity of the employed constructs in the endeavour to identify drivers of OSS utilisation.

Keywords: E-government evaluation, E-government adoption, Intention to use, One-stop shop, User-centred

Acknowledgements: The authors extend their gratitude to all participants who took part in the research and contributed to a better understanding of user needs in public electronic service delivery. We also sincerely thank the reviewers and editors for their insightful comments and suggestions, which have greatly enhanced the quality of this work.

1. Introduction

Interaction between citizens and government today requires efficient, user-centred, timely, and convenient service delivery. As technology has become a resource for participation, the one-stop shop (OSS) concept has become a widely used tool for providing public services that meet citizens' needs, and promises to improve accessibility to services, while reducing costs and delays in service delivery (Scholta et al., 2019; Howard, 2017; Gouscos et al., 2007; Kubicek & Hagen, 2000). Administrative modernisation strategies favour the OSS concept, which is often promoted as a "win-win solution that provides seamless services at a lower cost" (Howard, 2017). In line with the good governance principles, the OSS approach is seen as a strong incentive for public administration reforms aimed at creating an optimal environment for electronic service (hereinafter e-service) delivery.

The OSS is a physical place or a virtual service point where users can obtain various public services and service-related information at a single point of access (Kubicek & Hagen, 2000; Reid & Wettenhall, 2015; Howard, 2017). In the physical sense, OSS is a facility where multiple public services are provided in a single building, in a modern physical environment, rather than in different government facilities (Janenova & Kim, 2016). In the online sense, OSS is a centralised platform for the provision of electronic government (hereinafter e-government) services to citizens, a single point of access to electronic services and information offered by different public institutions (Scholta et al., 2019; Wimmer, 2002). This centralised online solution is expected to surpass the fragmentation caused by multiple portals of public institutions and streamline access to public services (Wimmer, 2002). As for the technical features, OSS relies on integration and interoperability. Integration involves centralising information and public services at a single point of access, interconnecting institutions within a one-stop system, and integrating data and resources used by different institutions (Kubicek & Hagen, 2000; Costopoulou & Tambouris, 2004); while interoperability enables seamless data exchange and data use across different government systems (Zeng, 2019).

The provision of services through integrated and interoperable systems enables the seamless data exchange between institutions and facilitates a single point of access for users to obtain services and information (Wimmer, 2002). This technological milestone represents the transition from traditional to electronic services provision, with OSS being one of the prominent forms of public e-services delivery. Therefore, the development and evaluation of OSS are strongly embedded in the broader e-government initiatives and rely on the same theoretical basis for evaluation. In this context, similar to e-government initiatives, the success of OSS is evaluated based on user acceptance. The active participation of users confirms the effectiveness of such initiatives and legitimises and justifies their implementation.

Technology acceptance models have long sought to uncover the drivers of e-government acceptance and use. However, as conventional constructs from prior models did not suffice to explain the intricacies of e-government acceptance, Dwivedi et al. (2017) proposed and validated the Unified Model of Electronic Government Adoption (UMEGA). The UMEGA builds on the empirical comparison of previously validated models, while incorporating e-government-specific constructs (Dwivedi et al., 2017). The model explores the relation between user attitudes and the behavioural intention to use. Over time, the UMEGA has been extended with constructs that reflect

the evolving pace of e-government acceptance (Mensah et al., 2020; Verkijika & De Wet, 2018). The extensive application and validation of the UMEGA in an e-government setting (Zahid et al., 2022; Altin & Yilmaz, 2022; Garcia-Rio et al., 2023; Kirat Rai et al., 2020) provides a solid conceptual ground that can be further adapted in the context of OSS assessment and evaluation.

In terms of broader impact, the Organisation for Economic Co-operation and Development (OECD) has recognised OSS as an essential component of broader regulatory reform efforts. To promote the development of OSS, the OECD (2020) provides a framework of best practice principles based on the experiences of countries with the most developed OSS. The OECD (2020) framework provides comprehensive guidance at a general level. However, current academic research calls for OSS-tailored design based on the specific needs and circumstances in a particular community. This tailored approach optimises the practical functioning of OSS and reduces communication barriers between governments and citizens (Khrais et al., 2019; Sigwejo & Pather, 2016). Relying on both the UMEGA and OECD principles framework in our research design consolidates the approaches of academia and practitioners in the endeavour to suggest optimal solutions for encouraging the acceptance and use of newly introduced public service delivery initiatives.

Previous research has shown that operationalising OSS faces hurdles due to the lack of a holistic framework that supports the integrated modelling of electronic public services and synchronisation with technological developments (Wimmer & Tambouris, 2002). Another pressing issue is that public sector reforms are often introduced through a top-down approach rather than being a result of user-driven innovation (Sørensen & Torfing, 2011). While research to date is primarily concerned with technological challenges (Tambouris, 2008; Otjacques et al., 2007), organisational aspects, technical performance, drivers, and adaptation of OSS (Askim et al., 2011; Howard, 2017; Scholta et al., 2019), there is a gap in developing a context-specific evaluation model that explains the role of user attitudes and socio-demographic factors in OSS acceptance and utilisation levels.

Despite the promised results, the OSS often faces practical challenges in implementation. Practical issues include failing to live up to citizens' expectations, insufficient human and technical resources in public institutions, and emerging dilemmas related to administrative specialisation (Howard, 2017). Another important aspect is that OSS initiatives should be continuously monitored and evaluated to ensure that the efforts and technologies are benefiting the end users (Gouscos, 2007). Without an adequate assessment and evaluation framework, there is a risk of inefficient resource allocation, where the capacity of service providers is utilised, while citizens in the role of end users remain dissatisfied with the service delivery.

1.1. Research aim and hypotheses

Acknowledging the need to focus on users and their specific needs, this paper suggests a parsimonious evaluation model to help service providers identify opportunities for improvement in the early stages of OSS implementation and monitor user feedback throughout the OSS lifecycle. The model is conceptually based on the UMEGA (Dwivedi et al., 2017), including constructs of the extended UMEGA (Mensah et al., 2020) and aligned with the OECD (2020) Best Practice Principles for Regulatory Policy: One-Stop Shops for Citizens and Business. The proposed solution model includes a conceptual model, a framework for the evaluation of OSS, and a questionnaire.

For our research, we take the case of North Macedonia as a country that has recently introduced single service points as physical premises and the National e-Services Portal, as part of the government's efforts to create a favourable environment for the provision of public e-services. Earlier studies in North Macedonia analyse the financial impact of the introduction of OSS, and provide information on interoperability processes regarding the transition from traditional to electronic service delivery (Todevski et al., 2013). However, little is known about user attitudes and socio-demographic influences on the acceptance of services offered via OSS. Furthermore, there is a lack of evaluation and assessment tools that can be used to monitor the performance of OSS throughout their lifecycle. To fill the gap, this paper tests the developed OSS parsimonious evaluation model with a study population of 200 respondents living in North Macedonia. Although the model was built as a case study, it can be further customised according to context-specific characteristics and applied in similar environments at the early stages of OSS implementation. The hypotheses addressed to the whole population in the given research context are:

H1: Demographic characteristics influence the decision to use public e-services.

H2: The use of commercial e-services influences the decision to use public e-services.

In addition, the model includes hypotheses about the group of non-users and users:

H3: The determinants of behavioural intention influence the intention to use public e-services.

H4: The determinants of behavioural intention influence the intention to continue using public e-services.

Under public e-services, we refer to the delivery of government information and services through the internet (Dwivedi et al., 2017) or through channels that utilise interoperable systems in government service delivery. Under commercial e-services, we refer to services offered through the internet by private or commercial entities to facilitate transactions, provide entertainment, or enable social networking. Referring to commercial e-services, in this paper, we include e-banking, online shopping, e-sports, e-books, and social media.

The paper is organised as follows: the next section gives the conceptual framework for OSS evaluation modelling, and describes the theoretical underpinnings, the purpose of evaluation, and the evaluation models on which our approach is based. Then, a brief overview of the research context is presented, covering the specific developments in public e-services delivery. In the methodology section, we present the development of the measurement model, the data collection, and the hypothesis testing method. The results section presents the findings from the questionnaire. The discussion section frames the results in the findings of previous research and presents implications for theory and practice. Finally, the conclusion provides additional guidance based on aspects of the evaluation model, developed and aimed at improving recently implemented OSS initiatives.

2. Conceptual framework for OSS evaluation modelling

The practical need to eliminate lengthy and burdensome bureaucratic procedures led public administrations to focus on citizen-centred, cost-effective, and high-quality delivery of public services. This ambition went beyond the New Public Management (NPM) client-centred approach to the network-oriented New Public Governance (NPG), which further encourages service effectiveness and collaboration (Bouckaert, 2023; Osborne, 2006). The Neo-Weberian State (NWS) paradigm goes a step further, and in line with good governance principles, promises the functions of inclusive and equitable service delivery, resilient crisis management, and effective innovation for state and society (Pollitt & Bouckaert, 2017; Bouckaert, 2023). These developments undoubtedly redefined the position of citizens from simple service recipients to having a participatory role in service delivery.

To achieve these goals while meeting the diverse needs of users, governments faced the need to utilise information and communication technology (ICT) as one of the core elements for future interaction between government and citizens. In this respect, the introduction of e-services and the development of e-government reflect the ultimate visions for the modernisation and restructuring of public administration and governments (Wimmer & Krenner, 2001; Margetts, 2008; Pedersen, 2018). E-government is a "strategic tool that promotes the maximum involvement of citizens in the political and social development of a country through effective participation, consultation, and empowerment" (Mensah et al., 2021). These developments enabled government-citizen interaction through multiple channels, both physical and digital. As government services need to be accessible to all citizens, those able to use digital access channels and those needing additional support, government services should be offered through multiple channels, including traditional means as face-to-face, phone or mail and electronic channels as the web, e-mail or other digital means (Dias & Rafael, 2007; Rey-Moreno & Medina-Molina, 2016).

The approach to tailoring evaluation solutions requires a conceptual delineation of the terms associated with OSS. To this end, we conducted a keyword search in the Digital Government Reference Library, using "one-stop shop", "one-stop government", and "integrated service", to identify notable works in the field. While e-government is a broader concept encompassing the application of ICT in government operations to foster citizen-centred service provision (Mensah et al., 2020), one-stop government refers to the integration of services at a single point of access, either physical or virtual (Tambouris & Wimmer,2008; Kohlborn et al., 2015). In this context, OSS serves as the operationalisation tool for timely, convenient, and efficient service delivery, supporting the broader goals of e-government. Furthermore, OSS is considered the final stage in the e-government stage models preceded by publication of information, communication with citizens, and offering electronic service transactions, while paving the way for citizens' participation in decision making (Chasin & Scholta, 2015; Linders et al., 2018; Scholta et al., 2019). The capacity of OSS to operate efficiently is primarily attributed to integration and its ability to make several services accessible at a single point. However, citizens' expectations and preferences go beyond integration, as they require service delivery with minimum effort on their side (Kubicek & Hagen, 2000). More recent developments describe the transition from OSS to no-stop shop, a shift from reactive to proactive and formless service delivery where no action is required from citizens, but institutions initiate

procedures automatically (Scholta et al., 2019). This line of research, while not directly related to the focus of this paper, is valuable for further investigation of optimised service delivery.

The terms “single window", “integrated services”, and “OSS" are often used interchangeably, although they have nuanced meanings (Costopoulou & Tambouris, 2004). Literature distinguishes three levels of integrated service provision: first stop or information centres, convenience stores or single windows, and a true OSS (Kubicek & Hagen, 2000; Contiades, 2007). What all three levels have in common is the centralisation of information and services at a single point. However, at information centres, there is no service delivery, only information provision (Contiades, 2007). In the case of convenience stores or single windows, there is an integrated front end, a single counter or a virtual point of access, while institutions in the background may remain fragmented (Scholta et al., 2019). However, for citizens, this option is convenient, as they interact with a single point of contact at the front end to process their request (Contiades, 2007). Finally, the ideal level, the true OSS, enables a full service transaction based on a specific life event (e.g., change in employment status, change in family status, starting a business, buying property, etc.) at a single point of contact, even when the set of public services spans multiple jurisdictions (Alqahtani et al., 2014; Contiades, 2007; Kubicek & Hagen, 2000; Costopoulou & Tambouris, 2004). Similarly, practice distinguishes two basic OSS models in the physical sense: individual services, meaning each institution has its separate counter at the OSS, and integrated services, based on life events, meaning a single official can complete all of the service-related matters, from service request to service provision (OECD, 2020). In the virtual sense, OSS can represent an informational website, providing information on service-related matters, a transactional website, enabling completion of service procedures online, or a combination of both (OECD, 2020). Considering the different OSS levels is vital, as they set the standard of what citizens can expect when they enter the physical or virtual OSS.

2.1. OSSPEM development

Theories and models of technology acceptance form the basis for comprehensive approaches to the evaluation of e-government service delivery. Some of these theories and models include the Diffusion of Innovation Theory (DOI) (Rogers, 1962, 2003); the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975); the Technology Acceptance Model (TAM) (Davis, 1989); the Theory of Planned Behavior (TPB) (Ajzen, 1991); the Decomposed Theory of Planned Behaviour (DTPB) (Taylor & Todd, 1995); the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003); and the Information Systems (IS) Success Model (DeLone & McLean, 2003), among others. However, the conventional constructs and approaches of these theories and models were not able to fully reflect e-government complexities in the search to explain and predict user behaviour or the intention to use (Mensah et al., 2020). In response to the need to build a model to better understand e-government adoption, Dwivedi et al. (2017) proposed and validated the Unified Model of Electronic Government Adoption (UMEGA). The UMEGA builds on the basic concepts of technology acceptance theories and the basic principle of the UTAUT of Venkatesh et al. (2003). The UMEGA (Dwivedi et al., 2017) includes four antecedents of the users' attitude, performance expectancy, effort expectancy, social influence, and perceived risk, and facilitating conditions impacting the behavioural intention. In line with field developments, the UMEGA has been further extended by Verkijika & De Wet (2018) by including self-efficacy, trust

in the internet, and trust in government; and by Mensah et al., (2020) by including perceived service quality, trust in government, and intention to recommend the adoption of e-government services. In our research design, we include the constructs from the original UMEGA (Dwivedi et al., 2017), along with trust in government and perceived service quality, as proposed by Mensah et al. (2020). The construct of social influence from the original UMEGA has not been incorporated in our study, as we considered social influence to be embedded into awareness and level of information, thus maintaining the parsimony of the model. The extension and validation of the UMEGA confirm the need to adapt pioneer models to context-specific realities, while being grounded in sound previous research. The adaptation of constructs based on practical circumstances further contributes to gaining a closer insight into user attitudes and behaviour towards the use of public e-services.

Focusing on the specific challenges of OSS, we can consider a general framework of OSS principles guided by the OECD (2020) Best Practice Principles for Regulatory Policy: One-Stop Shops for Citizens and Business. The framework consists of eleven groups of principles: overarching principles, political commitment, leadership, legal framework, collaboration and coordination, role clarity, governance, public consultation, communication and technological considerations, human capital, and monitoring and evaluation. Most of these principles relate to governance, management, organisation, and technical features of the system. We particularly focus on the second overarching principle, "OSS should be user-centred and based on life events, and the principle of monitoring and evaluation" (OECD, 2020), which provides a solid foundation for the development of evaluation and assessment tools. Implementing the principles, governments need to fully understand the needs of users in order to incorporate them in the user-centred design of services (Sirendi & Taveter, 2016). Accordingly, OSS should be designed to be citizen-centred by structuring services around life events, offering citizens assistance with online forms, either in person or through virtual support, and by providing follow-up assistance (Wimmer, 2002). This requires special attention to OSS design and its effective implementation aimed at reaching the goal of improving the quality of services for users.

Menezes et al. (2022) contribute a systematic review of public service evaluation from users' perspectives. They report four leading approaches to public service evaluation: quality of service, user satisfaction, user experience, success and acceptance of information systems, and three evaluation dimensions: satisfaction, service quality, and information quality (Menezes et al., 2022). As an essential opportunity for improvement, they present the lack of clear guidelines for evaluation models to be applied in different contexts. In searching for suitable tools for assessing OSS in less developed environments, we agree with Menezes et al. (2022) on the need for specific evaluation tools for specific contexts. In this regard, we add to this endeavour by proposing a concrete operational solution.

Table 1: OSSPEM determinants

One-Stop Shop Parsimonious Evaluation Model OSSPEM (Authors)	**UMEGA (Dwivedi et al., 2017); Extension of the UMEGA (Mensah et al., 2020)**	**Best Practice Principles for Regulatory Policy: One-Stop Shops for Citizens and Business (OECD, 2020)**
Trust in the goodwill of the government	Perceived risk	Broader strategies
	Trust in government	
Awareness of OSS services	Facilitating conditions	Communication considerations
Prerequisites		
Accessibility and support	Effort expectancy	
Efficiency		User-centred
Quality, reliability, and time saving	Service Quality	Effectiveness
Value	Performance expectancy	
Citizen's socio-demographics	X	X
Use of commercial e-services		
Intention to use	Intention to use	

Source: Authors, incorporating model constructs from Dwivedi et al. (2017), Mensah et al. (2020), and the OECD (2020) Best Practice Principles for Regulatory Policy: One-Stop Shops for Citizens and Business

Table 1 presents the proposed concept of the solution, the OSSPEM, including the links to the models and frameworks considered in defining OSSPEM. Since OSSPEM intends to support real-life decision-making, we define slightly more specific determinants (first column) than the original ones (second column) based on the determinants of intention to use the UMEGA (Dwivedi et al., 2017; Mensah et al., 2020). To give decision-makers insight into the groups of citizens with different characteristics that moderate intention to use OSS, we cover economic status and ICT skills with citizens' socio-demographics, prerequisites, and use of commercial e-services. In this way, we have aligned our model with one of the overarching best practice principles in the development of OSS for citizens, defined as "OSS should be user-centred and based on life events" (OECD, 2020).

As our objective is to devise an assessment tool for a specific purpose in a specific context, we define the research challenge as follows: developing a user-centred evaluation model that helps service providers evaluate the success of one-stop shop service points and monitor user feedback throughout the OSS lifecycle.

3. Research context

In this paper, we test and validate the developed model through the case of North Macedonia. North Macedonia is a landlocked country in the Western Balkans with a population of about 1.8 million (State Statistical Office, 2022). In line with the efforts to integrate into the European Union (EU), the country has put efficient and user-centred service delivery at the top of the public administration reform agenda. To achieve this goal, a number of policy and legal instruments have been adopted over the past decade to support the transition from traditional to e-services delivery.[1][2] The extensive policy and legal framework exists along with the National Interoperability Platform.[3] The current Public Administration Reform (PAR) Strategy 2023-2030 of the Ministry of Information Society and Administration (MISA) expresses a commitment to enable an optimal digital environment supported by intensive digitalisation aligned with the EU Digital Agenda (MISA, 2023).

One of the initial steps in bringing public services closer to citizens was to establish service points known as "Single Point for Services" (ETU). The project was intended to provide information about and access to services from several institutions at one physical point. Between 2019 and 2021, five service points were established in different cities across the country: the capital city of Skopje, Tetovo, Kumanovo, Bitola, and Ohrid. When first opened, the service points offered about 40 public services from 10 institutions. Over time, as per the information available on the official ETU website, the number of services increased as the service points became intermediaries for applications for available public e-services.

Alongside this initiative, the National e-Services Portal (hereinafter the Portal) was launched in 2019. As described on its official website, the Portal is an electronic platform where citizens can obtain information and access e-services from competent institutions and other entities. The Portal offers a detailed description of all available services and life events categorisation. At the time of preparing this article, there are 116,037 registered users, which accounts for about 8% of the population over 18 years old. Out of 246 available services, 107 are directly accessible on the Portal, while for the others, users are redirected to the portals of the respective institutions.

However, both initiatives struggled with implementation challenges. Although intended to follow OSS principles, the physical single service points (ETU) were perceived as simple extensions of counters from different institutions located in a single office, resulting in queues and thus hindering efficient service delivery (Belcheva-Ristovska & Bojadzievska, 2021). The State Audit Office (SAO, 2023, 2024) also noted that the physical single service points and the Portal are underutilised, identifying insufficient promotion as one of the potential reasons. The process of accessing e-services is not fully centralised, as some services are offered outside of the Portal, causing fragmen-

[1] A list of strategic documents available on the official website of the Ministry of Information Society and Administration: https://www.mioa.gov.mk/documents-strategies432.nspx

[2] A list of legislative framework available on the official website of the Ministry of Information Society and Administration: https://www.mioa.gov.mk/documents-legislation0.nspx

[3] Macedonian National Interoperability Platform: https://www.mioa.gov.mk/6742432.nspx

tation in access and delivering services at higher costs (SAO, 2024). The current number of connected institutions to the National Interoperability Platform is 53 out of 1288, representing 4% of total institutions, which remains one of the key technical challenges for OSS service delivery.

The overall score in the eGovernment Benchmark Report of the European Commission (2023), which monitors digitalisation of public services based on data analysis from 2021 and 2022, places the country in the last position among European countries. While digitalisation is an ongoing process, and lessons can be learnt from the implementation challenges of the single service points (ETU) and the Portal, a thorough analysis exploring the reasons behind these issues is yet to be conducted. Hence, the parsimony of the user-centred OSS evaluation model, a product of this paper, may provide practical guidelines for policymakers in exploring drivers of OSS acceptance and utilisation from the users' perspective.

4. Methodology

In this chapter, we first elaborate on the development of the measurement model, along with the statements included in the questionnaire. Secondly, we explain the process of data collection and present the method used for hypothesis testing.

4.1. Development of measurement model

The empirical part of the evaluation framework consists of a measurement model operationalised through a questionnaire. In order to develop practical suggestions for developing the measurement model, we distinguish between users and non-users by measuring experiences with public e-services and expectations of public e-services. Accordingly, the measurement comprises a questionnaire that includes a general part for both groups, and a customised part for users and non-users, with two different sets of variables for accessibility, quality, and efficiency in the measurement model (Table 2).

Table 2: Measurement model of determinants of behavioural intention

	Determi-nants	**Measurement variables/questions**	
Users	Perceived accessibility	I find it simple and easy to access e-government portals. The Single Points for Services are easily accessible. Service providers provide technical and administrative support.	Behavioural intention
	Perceived quality	The requested e-service was delivered promptly and with no data errors.	
	Perceived efficiency	I have fully accessed the public e-service in one contact with the public institution. I believe public e-services save time and resources.	
Nonusers	Expected accessibility	I expect it is simple and easy to access public e-services. I think the Single Points for Services are easily accessible to the citizens.	
	Expected quality	I believe using public e-services makes mistakes in documents more likely to appear.	
	Expected efficiency	Using public e-services would help me complete requests more quickly and efficiently. I believe public e-services save resources.	
Both	Awareness	I am informed about the existence of e-government portals. I am informed about the services offered through the e-government portals. I am informed about the existence of the Single Points for Services. I am informed about the services offered through the Single Points for Services.	
	Trust	I believe the government introduces public e-services in the interests of the citizens.	
	Value	I believe the public e-services fulfil my needs and requests.	

Both	Prerequisites	I believe I have the basic conditions and resources to use public e-services. I believe I have the skills and knowledge needed to access public e-services.	
	Citizen's socio-demographics	Region, Age, Gender, Education	
	Use of commercial e-services	e-banking, online sales, social media, e-books, e-sport	

Source: Authors

To provide the decision makers with an insight into the reasons guiding citizens' behaviour against public e-services provided through OSS, we devised four hypotheses checking the influence of the determinants on the use and intention to use public e-services. Two hypotheses test the factors of the decision to use or not to use public e-services:

H1: Demographic characteristics influence the decision to use public e-services.
H2: The use of commercial e-services influences the decision to use public e-services.

The first hypothesis expresses the expectation that socio-demographic characteristics make a difference in citizens' attitudes towards public e-services. Several authors report the influence of socio-demographic characteristics such as gender, age, income, education, ethnicity, and geographical differences (Nam, 2014; Venkatesh et al., 2013; Goldfinch et al., 2009; Sharma, 2015) on the intention to use public e-services. Furthermore, the theory of diffusion of innovations (DOI) indicates that early adopters of technological innovations share common characteristics – they are young, well-educated, and have a higher income (Rogers, 1962, 2003).

The second hypothesis tests the expectation that the use of commercial e-services increases the probability of using public e-services. The variables testing the use of commercial e-services could be considered as proxies for digital skills and attitudes towards digital technology. Previous research provides evidence for the links between e-commerce and the use of e-government services (Stahl, 2005; Metaxiotis & Psarras, 2004; Scholl et al., 2009), as well as the rising role of social media in using e-government (Dwivedi et al., 2017; Tursunbayeva et al., 2017). Researchers have also investigated whether the tools and techniques that have contributed to the success of commercial e-services can be applied to the tasks of e-government (Stahl, 2005; Metaxiotis & Psarras, 2004). Among other functional characteristics, the private sector has been praised for its greater agility, greater resourcefulness, less burdensome bureaucracy, and greater motivation for proactive innovation compared to public sector organisations (Barzilai-Nahon & Scholl, 2007).

H3: The determinants of behavioural intention influence the intention to use public e-services.

The third hypothesis addresses the intrinsic factors and perceptions related to the use of public e-services. As found in previous literature based on technology acceptance models such as the TAM, UMEGA, and UTAUT, users' perceptions influence behavioural intention, which in turn influences system usage (Hooda et al., 2022; Nikou & Economides, 2017).

H4: Determinants of behavioural intention influence the continued use of public e-services.

The fourth hypothesis examines behavioural intentions concerning experiences that may determine attitudes towards the continued use of public e-services. Researchers have referred to perceived ease of use, perceived usefulness, social influence, facilitating conditions, satisfaction, trust, perceived risk and past use (Chao, 2019; Suki et al., 2012; Jackson et al., 2007; Luarn&Hui-Lin, 2005) to examine the behavioural intention for acceptance and continued use of public e-services.

The concepts of the hypotheses are measured with the questionnaire based on the measurement model (Table 2), which includes three determinants (accessibility, quality and efficiency) on the prediction side, which are defined slightly differently for users and non-users, and four determinants (familiarity, trust, value and prerequisites), as well as socio-demographic variables, for the total population. The response variable measures citizens' behavioural intentions using a question with a five-point rating scale.

4.2. Method and data collection

The method of hypothesis testing is logistic regression. As the first two hypotheses comprise a binary response variable (the use of public e-services), they are tested using binary logistic regression. Predictive variables in the remaining two hypotheses are latent variables calculated by exploratory factor analysis. The response variable in both hypotheses is ordinal, and consequently, they are tested using ordinal logistic regression. The statistical analysis was conducted using Jamovi, a freely available statistical software. The questionnaire was available in online format and distributed to respondents via e-mail. Our goal was to reach at least 200 participants to ensure reliable findings, given the number of variables included in the exploratory factor analysis and the binary logistic regression. The respondents were identified using the non-probabilistic purposive and snowballing sampling techniques. The reason for the purposive sampling is to cover diverse socio-demographic profiles of both users and non-users of public e-services, thus matching the sample better to the aims and objectives of the research, while keeping the rigour of the study (Campbell et al., 2020; Vehovar et al., 2016). The first group of respondents was identified by using a set of e-mail contacts known to the author as a starting point to enable further reliable distribution of the survey. The snowball sampling helped to distribute the questionnaire within the communities of interest of the study (Hossan et al., 2023). To mitigate potential bias and maintain the thoroughness of the survey sampling approach, the respondent pool was diversified by reaching out to contacts across various regions and socio-demographic backgrounds. Additionally, we made targeted follow-up efforts to include underrepresented groups needed for the study. While the approach from the beginning may indicate a group of similar socio-demographic backgrounds, the additional approach of a targeted sampling strategy was to ensure inclusion of as many diverse population groups as needed for the study.

5. Results

A total of 200 participants living in North Macedonia participated in the e-mail survey on public e-services delivered through the physical single points for services or the National e-Services Portal. The representativeness at the municipal level is 32.1%, 26 out of 80 geographically dispersed municipalities and the City of Skopje as a separate administrative unit, located in the 8 statistical regions of North Macedonia. The population sample covered respondents aged 18-63, with more than 50% of respondents younger than 35 and 10.5% of respondents older than 55. There were 56.5% female and 43.5% male respondents, with the following structure of highest education level completed: 21.0% secondary school degree; 59.0% BA degree; 17% MA degree, and 3% of respondents with a Ph.D. degree. To check the coverage of regions, we have introduced three regions: Eastern, Central (Skopje), and Western. The sample is nearly uniformly distributed with slightly higher numbers for the Skopje region.

The survey was initially structured with a question on general access to available e-formats, e.g., e-books, social media, e-banking, public e-services, or e-sports. 88% of respondents stated that they use social media, 80% use e-banking, and 56% have accessed public e-services offered by physical OSS points or via the National e-services Portal. Only 3.5% of respondents have not accessed any of the services listed, while almost two-thirds of respondents have used four or more services. In general, the use of public e-services lags behind the use of commercial e-services.

5.1. Hypothesis testing

The rest of the report is divided into two sections. The first section deals with the first two hypotheses, which concern the entire population. The second section, on the other hand, provides evidence for groups of users and non-users defined in the third and fourth hypotheses. The two hypotheses over the whole population are:

H1: Demographic characteristics influence the decision to use public e-services.
H2: Use of commercial e-services influences the decision to use public e-services.

The dummy indicator for the use of public e-services plays the role of the response variable in both hypotheses. The null hypothesis is rejected if at least one predictor variable makes a statistically significant difference in the prediction that a citizen is a user. The predictor variables for the first hypothesis are the four socio-demographic variables mentioned at the beginning of the section. Table 3 shows that the estimates are statistically significant for the age category 'up to 24' compared to '35 - 45' ($p = 0.018$) and for all education categories compared to secondary school or less. Accordingly, H1 could be accepted. The probability of a public e-service user being randomly selected is almost three and a half times lower for the youngest group of citizens (OR = 0.288). The lower odds also apply when comparing the other three age groups with the “35-45” age group, albeit with non-significant estimates. The age group “35–45” is the most active in using public e-services. The odds of selecting a user in the groups with higher education compared to secondary education increase from 3.333 for a first-level university degree to 15.683 for a doctoral degree. A public e-services user is almost twice as likely to be a male citizen as a female citizen. This result is

only statistically significant for α = 0.1 (p = 0.055, OR = 1.899), but it offers some insights into the socio-dynamics of the environment under study.

Table 3: Socio-demographic influence on the use of public e-services

Predictor	Estimate	SE	Z	p	Odds ratio
Intercept	-2.334	0.621	-3.760	< .001	0.097
Regions_merged:					
Eastern – Skopje	-0.083	0.384	-0.216	0.829	0.920
Western – Skopje	-0.143	0.393	-0.363	0.717	0.867
Age_categories:					
to 24 – 35 - 44	-1.244	0.524	-2.375	0.018	0.288
25 - 34 – 35 - 44	-0.528	0.431	-1.226	0.220	0.590
45 - 54 – 35 - 44	-0.456	0.518	-0.880	0.379	0.634
55 and over – 35 - 44	-1.069	0.651	-1.642	0.101	0.343
Sex:					
Male – Female	0.641	0.334	1.920	0.055	1.899
Education:					
University degree, first-degree undergraduate – Secondary school	1.204	0.500	2.406	0.016	3.333
University degree, second-degree master studies – Secondary school	1.441	0.622	2.315	0.021	4.224
University degree, third-degree doctoral studies – Secondary school	2.753	1.235	2.229	0.026	15.683

Note. Estimates represent the log odds of "User = Yes" vs. "User = No"

The predictors of the second hypothesis are dummy variables indicating the use of specific commercial e-services. The response variable is the same as in the first hypothesis. Of the five e-services included in the questionnaire (e-banking, online sales, social media, e-books, e-sport), only e-banking stands out, as the probability that a user of a public e-service is selected from the population of e-banking users is almost six times higher than that of a non-user (p < 0.001, OR = 5.700).

Accordingly, we could accept the second hypothesis that the use of commercial e-services influences the decision to use public e-services. According to the result of the hypothesis test, we can relativise our assertion: the use of e-banking influences the decision to use public electronic services.

To prepare the data for the H3 and H4 tests, we conducted an exploratory factor analysis to define a model of determinants adapted to the empirical data. We calculated two-factor models for users and non-users. Both models had similar characteristics, with an acceptable result of Bartlett's sphericity ($p < 0.001$ for both models) and the Kaiser-Meyer-Olkin test (MSAusers = 0.820 and MSAnonusers = 0.785). We ran both factor models with maximum likelihood extraction and varimax rotation, which resulted in uncorrelated factors. The factor structures consisted of one strong factor composed of four manifest variables (6 - accessibility) and four less strong factors composed of two or three variables. The models explained more than 70% of the total variance.

Table 4: Foreseen and extracted determinants

		Users	**Non-users**
	Foreseen	Extracted	Extracted
1	Awareness	Awareness of OSS physical points	Awareness of OSS physical points
		Awareness of e-government portals	Awareness of e-government portals
2	Prerequisites	5 - Efficiency	6 – Accessibility
3	Trust	6 - Accessibility	4 - Value
4	Value	7 - Quality	Value and Trust
5	Efficiency	Perceived efficiency and prerequisites	Expected efficiency
6	Accessibility	Perceived accessibility and trust	Expected accessibility and prerequisites
7	Quality	Perceived quality and value	

Source: Authors

Table 4 shows the relationship between the predicted structure of the concepts and the structure extracted by the factor analysis for users and non-users. Although the awareness for both groups is divided into two concepts - awareness of OSS physical points and awareness of e-government portals - the extracted structures include fewer determinants than predicted. The results show that users and non-users align the prerequisites, trust, and value with the perceived or expected characteristics of OSS.

For users, prerequisites contribute to perceived efficiency, trust is linked to accessibility, and value is integrated into the dimension of perceived quality. Prerequisites enable more efficient use of public e-services and are therefore associated with efficiency. Value is the outcome that an e-service delivers and is therefore linked to quality. The logical link between trust and perceived accessibility is less obvious and requires further investigation.

Non-users combine value and trust, which illustrates their attitude towards e-services and the government in general. They see prerequisites as a dimension of expected accessibility, while expected quality fell out of the model. The latter could be a consequence of non-users not having a clear idea of the quality of public e-services.

The two remaining hypotheses deal with the antecedents for the intention to start and continue the use of public e-services for non-users and users, respectively:

H3: The determinants of behavioural intention influence the intention to use public e-services.
H4: The determinants of behavioural intention influence the intention to continue using public e-services.

The hypotheses analyse the influence of the determinants on the behavioural intentions of users or non-users. The response variables are ordinal variables, which force the use of ordinal logistic regression. The predictor variables are factors obtained by factor analysis (Table 4). The null hypothesis is rejected if at least one of the predictor variables is statistically significant.

Table 5: Ordinal logistic regression model of determinants of Intention to start using public e-services

Model coefficients - Intention to use

Predictor	Estimate	SE	Z	p	Odds ratio	Mean value
Value and Trust	0.877	0.258	3.400	< .001	2.40	3.82
Awareness of e-government portals	0.640	0.242	2.640	0.008	1.90	3.01
Expected efficiency	1.248	0.263	4.740	< .001	3.48	4.36
Expected accessibility and prerequisites	0.499	0.214	2.330	0.020	1.65	3.78
Awareness of OSS physical points	0.426	0.211	2.020	0.043	1.53	2.28

Source: Authors

Table 5 shows the estimation table of the ordinal logistic regression model for the determinants of the intention to use public e-services. As can be seen from the table, we can reject the null hypothesis for all five estimates ($p <= 0.043$ for all estimates) and confirm H3 that the determinants of behavioural intention influence the intention to use public e-services. Expected efficiency has the greatest influence ($p < 0.001$; OR = 3.48), with a one-unit increase in value leading to a three-

and-a-half times higher probability of higher intention to use. Similarly, citizens who rate the value and trust of one unit higher are 2.40 times more likely to have a higher intention to use. Citizens' motivation to use public e-services is based on expected efficiency, value, and trust in government. In addition, the mean comparison shows the lowest scores for awareness, with a quite low score for awareness of OSS. The result indicates a deficit in informing citizens about new ways to access public services.

Table 6: Ordinal logistic regression model of determinants of Intention to continue using public e-services

Model coefficients - Intention to continue using

Predictor	Estimate	SE	Z	p	Odds ratio	Mean value
Perceived accessibility and trust	0.251	0.276	0.910	0.363	1.29	3.61
Awareness of OSS physical points	0.252	0.259	0.975	0.330	1.29	3.46
Perceived quality and value	0.991	0.306	3.239	0.001	2.69	3.67
Awareness of e-government portals	1.414	0.374	3.782	< .001	4.11	4.09
Perceived efficiency and prerequisites	0.502	0.272	1.847	0.065	1.65	4.35

Source: Authors

Table 6 shows the estimation table of the ordinal logistic regression model for the determinants of the intention to continue using public e-services. As can be seen from the table, we were able to reject the null hypothesis for two (perceived quality and value and awareness of e-government portals) ($p <= 0.001$) out of five estimates. Accordingly, we confirm hypothesis H4 that the determinants of behavioural intention influence the intention to use public e-services. Awareness of e-government portals has the greatest influence ($p < 0.001$; OR = 4.11), with a one-unit increase in the value leading to more than four times the likelihood of a higher intention to continue using e-services. Similarly, citizens who rate the perceived quality and value of a unit higher are more than two and a half times more likely to continue using it. Citizens' motivation to continue using public e-services is based on awareness of e-government portals and perceived quality and value. Furthermore, the mean comparison shows the lowest values for perceived quality and perceived value and a fairly low value for awareness of OSS.

6. Discussion

The first hypothesis refers to the demographic characteristics that influence the decision to use public e-services. Our results show that we can describe a user of public e-services as a male between 35 and 44 years old with a university degree. These results are consistent with the findings of Venkatesh et al. (2012) and Venkatesh & Morris (2000), who found that men are more likely to use e-services than women. Furthermore, Sharma (2015) and Taipale (2013) found that public e-services usage is well predicted by various demographic characteristics and personality variables such as age, gender, geographical location, and education level. In this context, our results call for action to inform and activate citizens with lower levels of education and to promote equal use of public e-services by men and women. On the other hand, the results are not entirely consistent with the findings of Yang (2017), who discusses the diminishing influence of traditional demographic variables such as age, gender, education, and income on the account of cognitive factors such as trust and motivation.

The second hypothesis pointed out the relationship between the use of public e-services and the use of commercial e-services. The findings show that the use of commercial e-services, particularly e-banking, positively influences the decision to use public e-services. This finding is in line with Kitsing's (2011), showing that the emergence of internet banking has directly favoured the provision of e-government services in Estonia. Other scholars have noted that using the e-commerce paradigm as a proxy for the continued success of e-government is an ambivalent endeavour with its strengths and shortcomings (see more in Stahl, 2007; Scholl et al., 2009; Barzilai-Nahon & Scholl, 2007). Accordingly, measures to encourage more citizens to use public e-services could be linked to the development and ease of use of e-banking systems.

In the third hypothesis, we examined the effects of the determinants of behavioural intention on the intention to use public e-services. Our results confirmed the positive effect for all five estimates: value and trust, awareness of e-government portals, expected efficiency, expected accessibility, and prerequisites and awareness of OSS physical points, with expected efficiency having the largest effect. The results also showed significant scores for value and trust in terms of motivation to use, and the lowest mean scores for awareness or lack of information for citizens about existing public e-services. To improve awareness, studies point to the need to promote the adoption of public e-services through targeted marketing and collaboration with communities (Zubir & Latip, 2023). Governments can facilitate promotion through both traditional and modern media in accordance to citizens' preferences. Some ideas include sharing best practices, organising forums in the communities, distributing posters and pamphlets, and encouraging the exchange of experiences among community members (Dwivedi et al., 2017).

The fourth hypothesis established the relationship between the determinants of behavioural intention and their influence on the intention to continue using public e-services. Our results confirmed that perceived quality and perceived value, as well as awareness of e-government portals, influence the intention to continue using public e-services. These findings follow the pattern of previous studies showing that familiarity, along with service quality, are significant variables that influence citizens' intention to continue using e-government services (Al-Jaghoub et al., 2010; Hidayat-ur-Rehman et al., 2023). On the other hand, other studies find that other determinants of

behavioural intention are also relevant, such as habit, hedonic motivation, and facilitating conditions (Zhou et al., 2022); satisfaction, trust, performance expectancy, and effort expectancy (Chao, 2019). The latter suggests that the identification of relevant variables may be context-dependent, so the research design should follow the practical circumstances in the case study of interest.

6.1 Implications for practice

With the developed OSSPEM model, we introduce conceptual and measurement frameworks that are tailored to the specific circumstances of OSS implementation in less developed public administration systems. The specific case under study describes the underutilisation of services available through newly introduced e-government initiatives, as in the example of OSS. However, the identified reasons behind this incident could be a relevant starting point in tailoring widely applicable strategies that enhance service acceptance and use. In this vein, based on our findings, the call for raising public awareness, enhanced promotion, and familiarising the public with the benefits of OSS, we recommend the following as relevant points in policymaking:

- Communicate clearly to citizens what the OSS represents by describing the type of information and services it offers
- Gather user feedback throughout the OSS lifecycle to match OSS performance with user expectations
- Include both users and non-users in strategy design to encourage wider acceptance and use of OSS
- Enhance the technical infrastructure that supports integrated and interoperable data exchange between institutions to optimise OSS functioning
- Provide an open space for citizen participation in service design and overall OSS functioning
- Identify the best means of communication, traditional or modern media, to facilitate the promotion of OSS within different socio-economic contexts
- Motivate sharing best practices within communities to encourage wider use of OSS

Our model shows that considering both users and non-users of public e-services is instrumental in inclusive policymaking. User input is beneficial to optimise the experience, and non-user insights contribute to tailoring strategies that would enable them to accept and start using the public e-services. Since the findings confirm the relationship between perceived quality, perceived value, and awareness as drivers of the intention to use, policy efforts should be directed to promoting best practices, actively informing citizens, and ensuring the standard of quality service delivery.

6.2 Implications for theory

The OSSPEM was developed on the basis of the UMEGA (Dwivedi et al., 2017), the extended UMEGA (Mensah et al., 2020), and the OECD Best Practice Principles for Regulatory Policy (2020). By building on the UMEGA and OECD principles framework, OSSPEM consolidates the approaches of academia and practitioners in the endeavour to offer a potential solution to understanding the drivers of acceptance of recently introduced e-government initiatives.

With OSSPEM, we consider citizens as non-users and users of OSS physical points and e-government portals. Hence, we developed two slightly different models derived from the results of the exploratory factor analysis. Both models, shown in Table 4, include the assessment of awareness of OSS physical points and e-government portals, and comprise three dimensions for non-users and users, respectively. For non-users, these are value and trust, and two expectations of e-public services, expected efficiency and expected accessibility; for users, these are efficiency, accessibility, and quality. Both models show some differences in the experience of users and the expectations of non-users, as demonstrated in previous research (Susanto & Goodwin, 2013; Seo & Bernsen, 2018).

The model for non-users includes three dimensions of expectations of public e-services, including the combined dimensions of value and trust, expected accessibility, and prerequisites (Teo et al., 2008; Van de Walle et al., 2018). As non-users express their expectations, they base their assessment of value on trust. Similarly, expectations of accessibility are linked to the assessment of their prerequisites for using public e-services.

The user model includes three dimensions of experience with public e-services: perceived efficiency and prerequisites, perceived accessibility and trust, and perceived quality and value (Sang et al., 2009; Venkatesh et al., 2012; Li et al., 2020). Users understand the efficiency of public e-services subjectively in relation to the prerequisites they possess. For the same reason, they do not distinguish between the quality and value of public e-services. The combination of accessibility and trust is less obvious, but in the digital environment, trust is strongly associated with security (Bélanger & Carter, 2008; Seo & Bernsen, 2018), and this could be one of the reasons.

OSSPEM represents a two-fold model, considering citizens as non-users and users of public e-services. This approach could be instrumental in examining the nuanced perspectives toward OSS utilisation through the lenses of user experiences and non-user expectations. The employed constructs, conceptually based on previously validated models (Dwivedi et al., 2017; Mensah et al., 2020) and guided by OECD principles, were defined to reflect context-specific variables, as there is no one-size-fits-all solution in identifying drivers of acceptance and use of OSS initiatives. However, the potential shortcomings of a single model may not fully unveil the intricacies of these processes. Therefore, complementing constructs by studying both inhibitors and drivers in a dual model could provide comprehensive insights into the factors that influence the acceptance of recent public e-services delivery and similar initiatives (Rey-Moreno et al., 2018).

7. Conclusion

The concept of OSS has been long studied in the context of its technical and organisational aspects (Askim et al., 2011; Howard, 2017; Scholta et al., 2019). The practical opportunity to integrate and offer multiple services at one point made OSS the preferred channel of public e-services delivery in the broader context of e-government reforms. However, effective OSS implementation needs to consider user attitudes and drivers behind the intention to use and continue using OSS-provided services. Developing a tool that continuously monitors OSS deliverables by employing user-centred variables focused on accessibility, quality, and efficiency could help to minimise failure rates of e-government projects (Hooda et al., 2022).

In this regard, we propose the OSS parsimonious evaluation model (OSSPEM), based on the UMEGA and OECD Best Practice Principles for Regulatory Policy. Our solution includes a conceptual model, a framework for the evaluation of OSS, and a questionnaire. The OSSPEM is a monitoring tool that explores the effects of socio-demographic factors and accessibility, quality, and efficiency determinants of citizens' intention to use and intention to continue using OSS-provided public e-services. The model introduces quantitative indicators and evaluation methods to examine the success and quality of the service offered to users, and to support the implementation of a continuous improvement process. The model is intended to be used regularly as a monitoring tool to support the implementation of OSS. Accordingly, parsimony and efficiency are considered in the definition of the tool.

The model was tested in a practical environment using the case of North Macedonia, and confirmed the developed hypotheses. The findings called for activating and informing citizens with lower levels of education, stressed the need for widespread promotion of new, alternative methods of public services delivery, and reaffirmed the connection between the determinants of the behavioural intention to use with the actual use and intention to use of e-government service provision outlets.

In line with the OECD (2020) recommendations, our developed model suggests that OSS design should be user-centred, based on a conducted needs assessment to identify specific users' needs or requests. In the same context, testing services before they go live (OECD, 2020) could ensure meeting citizens' expectations related to accessibility, quality, and efficiency to further encourage the intention to use. Monitoring OSS throughout its lifecycle supports the well-informed approach to user-responsive OSS design. Based on theory and empirical testing, the practical application of the developed parsimonious evaluation model could demonstrate its usefulness for practitioners in monitoring and improving the implementation of OSS.

7.1. Limitations and further research

The paper takes into consideration a single case study to test the developed evaluation model, OSSPEM. Taking into consideration that OSS effective implementation is context-dependent, other specific research settings may require additional relevant variables to determine and explore user behaviour. While the survey sample of 200 respondents, reached via e-mail, provides valuable insights, it may not fully capture OSS acceptance and utilisation levels among citizens who do not

use e-mail. Therefore, further research could benefit from expanding the survey sample in size and including diverse socio-economic profiles by employing in-person or telephone surveys. This approach would enhance the generalisability of the findings and ensure a broader representation of the population. Furthermore, longitudinal studies following the development of OSS once the evaluation model is applied could show if monitoring and assessment tools indeed contribute to the optimisation of OSS performance. Including the side of service providers in research could also provide valuable insights into understanding the full picture of achieving an effective OSS implementation.

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