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Exploring the impact of external rewards on e-government services adoption: empirical evidence from Jordan

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ABSTRACT

This research investigates how external rewards influence citizens' adoption of e-government services in Jordan, using data from the 2021 Technology and Internet Survey. Extending the UTAUT model, it incorporates external rewards as an extrinsic motivator. Findings show rewards significantly impact adoption, varying by location, age, income, education, and digital skills. It contributes to understanding e-government demand and offers policymakers strategies to increase adoption rates, fostering a more inclusive digital ecosystem.

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KEYWORDS E-government; e-services; digital services; adoption; public sector; government; UTAUT; digital transformation; digitalization; extrinsic motivation; external rewards; digital divide; digital inequality; digital skills

Introduction

Information technologies have become integral to public sector operations, transforming the way governments deliver services and engage with citizens (Furr, Ozcan, and Eisenhardt 2022; Gil-Garcia, Dawes, and Pardo 2018). Around the world, governments are increasingly utilizing digital platforms to streamline public engagement and service provision (Jiang, Meng, and Zhang 2019). Governments are moving towards digitalized services to gain the benefits associated with information technology, such as efficiency and cost savings (S. Kim, Andersen, and Lee 2021; Osman et al. 2019; Ramirez-Madrid et al. 2022; Ruijer et al. 2022), higher productivity (Goh and Arenas 2020; Maclean and Titah 2021), increased competitiveness (Castelnovo and Sorrentino 2018; Dunleavy et al. 2006; Giest and Klievink 2022), echoing the private sector technological advancements (Schiff, Schiff, and Pierson 2021).

Despite the potential benefits, widespread adoption of e-government services remains a challenge (Ma and Zheng 2018; Piehler, Wirtz, and Daiser 2016), particularly in developing countries (Ramirez-Madrid et al. 2022). According to the United

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Nations, in 2019, only 47 per cent of individuals in developing countries were online, compared to 87 per cent in developed countries (ITU 2019). Compared to developed economies, the digital divide in developing countries is more pronounced due to infrastructure limitations, with unreliable access to high-speed internet, electricity, and digital devices, especially in rural areas. Socio-economic disparities and higher poverty levels further restrict access to digital technologies, while limited financial and administrative resources hinder the implementation of large-scale digital initiatives. Additionally, economic instability and regional conflicts strain resources, making it harder for citizens, particularly those relying on government aid, to access services through digital platforms. This disparity highlights the pressing need to better understand the barriers to e-government adoption in developing economies.

From the perspective of the demand side, low e-government adoption rates could be attributed to the digital divide (Abu-Shanab and Khasawneh 2014; Botrić and Božić 2021). The term digital divide indicates that disadvantaged groups of the population are denied access to technology (Robinson, DiMaggio, and Hargittai 2003). Different types of inequalities can cause digital divides such as life chances, economic and social conditions, skills, and capabilities (J. A. Van Dijk 2006). Notably, the digital divide is more evident in the developing countries due to lack of human and technical infrastructure, low acceptance rates of technology, and inadequate institutional cooperation and information sharing mechanisms (B. Kim and Park 2018). Disadvantaged groups can suffer in different ways from the technology exclusion including hindering their ability to acquire knowledge, access educational materials, develop essential skills, participate in the digital economy, connect with society, access online exclusive benefits, civic engagement and political participation (Charles et al. 2024), leaving a significant gap between these groups and those who are more privileged. Bridging this divide is crucial for promoting digital inclusion and ensuring that the benefits of e-government services are accessible to all citizens, particularly those from disadvantaged backgrounds.

Given these challenges, this study explores the role of extrinsic motivation as a strategy to incentivize e-government adoption among disadvantaged groups. Extrinsic motivation refers to the performance of a certain activity to obtain an external reward (Deci 1972), which serves as a positive reinforcer for a desired behaviour (Bénabou and Tirole 2003). External rewards refer to incentives that can make people wealthier and materially successful if they meet the criteria for receiving the reward (Kasser and Ryan 1996). External rewards are significantly associated with people's behaviours and the choices they make, external rewards tend to have high outcomes since money is tangible, further, the reward type whether financial, recognition or social can have different impacts on behaviours depending on the timing of reward, conditions of uncertainty and relationship with intrinsic motivation (Malek, Sarin, and Haon 2020).

In developing countries like Jordan, where digital literacy and access to technology are limited, external rewards can serve as critical drivers to encourage citizens to engage with digital platforms. These rewards help bridge the motivational gap for individuals who may not perceive immediate benefits from adopting e-government services, thus playing a vital role in increasing adoption rates. For disadvantaged populations, offering tangible rewards – such as monetary incentives – may encourage the use of digital government services, helping to reduce inequalities in access (Voigt 2017). In the context of information systems, extrinsic motivators like performance

expectancy have been shown to significantly influence technology adoption (Malhotra, Galletta, and Kirsch 2008; Petter, DeLone, and McLean 2013). However, the role of external rewards – particularly monetary incentives – in driving e-government adoption in developing countries remains underexplored (AlHadid et al. 2022; Rabaa'i 2017).

To address this gap, this paper investigates the impact of extrinsic motivation, specifically monetary rewards, on e-government adoption in Jordan, a developing country characterized by significant socio-economic disparities. Specifically, we seek to answer the following research questions:

(1) What role does extrinsic motivation, specifically monetary rewards, play in driving the adoption of e-government services in Jordan?
(2) How can external rewards help disadvantaged groups overcome barriers to adopting e-government technologies?

This paper is framed within the unified theory of acceptance and use of technology (UTAUT) model, a widely used framework in technology adoption. While previous research has focused primarily on performance expectancy, effort expectancy, and social influence as drivers of e-government adoption, we extend the model by incorporating external rewards – an underexplored construct in this context. Unlike performance expectancy, external rewards provide tangible incentives, such as monetary benefits, that go beyond expected service quality. Prior studies have shown that monetary incentives can significantly increase user engagement with digital platforms in other domains (Camera, Casari, and Bortolotti 2016; T. Sun et al. 2019).

We employ data from Jordan's 2021 Technology and Internet Survey, which comprises 10,703 individuals. Jordan presents a unique context for this study: while urban centres in the country enjoy modern infrastructure and a growing middle class, rural areas face significant challenges, including limited access to education, healthcare, and employment opportunities (World Bank 2023). Additionally, the influx of refugees from neighbouring conflict zones has further strained resources and exacerbated socio-economic disparities. These factors contribute to a pronounced digital divide, making Jordan an ideal case for studying the impact of external rewards on e-government adoption.

Our findings show that external rewards significantly increase the likelihood of e-government adoption, particularly among disadvantaged groups, such as rural residents, low-income individuals, and the elderly. We also find that factors such as geographic location, income, and digital skills moderate the relationship between external rewards and e-government adoption.

This paper contributes to the literature in several ways. First, it adds to the demand-side in e-government research by examining how extrinsic motivators, specifically monetary rewards, influence citizen adoption. Second, it extends the UTAUT model by incorporating external rewards as a unique construct, offering new insights into how disadvantaged groups in developing countries can be incentivized to adopt e-services. Third, while much of the existing research focuses on developed economies, our study provides context-specific evidence from Jordan, a developing country, contributing to a more nuanced understanding of e-government challenges in similar regions. Finally, this study provides large-scale empirical evidence using data directly collected by the government, answering calls for more quantitative research in the field

of digital transformation (Addo 2021; Giest and Klievink 2022; Goh and Arenas 2020; Larsson and Skjølsvik 2021; Lekkas and Souitaris 2022; Schiff, Schiff, and Pierson 2021).

Literature review

Technology has been an essential element in shaping changes in public management for several decades (Dunleavy et al. 2006; Maclean and Titah 2021). Governments all around the world are under constant pressure to make improvements in their internal processes and public services (Dickinson and Yates 2021), as the rise of data-driven systems suggests a new public service delivery regime (Giest and Klievink 2022) and digital reforms and modernization projects have become a priority on the political agenda of governments (Barbosa, Pozzebon, and Diniz 2013). The importance of e-government is recognized worldwide; the UN placed it at the centre of its 17 Sustainable Development Goals for 2030 (United Nations 2018).[1]

In the past two decades, digital transformation in governments took various forms, starting from developing websites to help citizens access government services (Larsson and Skjølsvik 2021; Ngwenyama, Henriksen, and Hardt 2021), government open data available freely to the public (e.g. climate data, energy data, and transportation data) (Mu and Wang 2020; Ruijer et al. 2022) and to design mobile applications to improve public services (Gil-Garcia, Dawes, and Pardo 2018; Lekkas and Souitaris 2022). More recently, advances have included applying artificial intelligence to chatbots to engage with citizens (Dickinson and Yates 2021; Larsson and Skjølsvik 2021; Maragno et al. 2022), and routine assessments for public claims (Gaozhao, Wright, and Gainey 2023; Giest and Klievink 2022). Additionally, governments are applying Internet of Things techniques in smart cities (S. Kim, Andersen, and Lee 2021; Kraus et al. 2022; Lekkas and Souitaris 2022).

In this context, the concept of e-government includes providing services by a government to citizens through information technology and mainly via the Internet (Maclean and Titah 2021). Governments are keen to use e-government services for various reasons including the transformation of the future of the delivery of public services (Barbosa, Pozzebon, and Diniz 2013; Gupta, Dasgupta, and Gupta 2008), simplifying work arrangements and reducing the need for manual labour work (Addo 2021; Dickinson and Yates 2021; Goh and Arenas 2020; S. Kim, Andersen, and Lee 2021), efficiency and cost savings (S. Kim, Andersen, and Lee 2021; Osman et al. 2019; Ramirez-Madrid et al. 2022; Ruijer et al. 2022), productivity (Goh and Arenas 2020; Maclean and Titah 2021), improved interaction with business and industry (Gupta, Dasgupta, and Gupta 2008), employee and citizen empowerment (Gupta, Dasgupta, and Gupta 2008; Larsson and Skjølsvik 2021; Lember, Brandsen, and Tõnurist 2019), offering new means for the governments to produce value for citizens (Larsson and Skjølsvik 2021), changed decision-making process (Giest and Klievink 2022; S. Kim, Andersen, and Lee 2021; Lember, Brandsen, and Tõnurist 2019), removal of bureaucrats personal bias in dealing with citizens (Gaozhao, Wright, and Gainey 2023; Miller and Keiser 2021), and improvements in the citizen – government relationship by increasing the citizen's trustworthiness of government (Maclean and Titah 2021).

Previous literature has explored different aspects of e-government both on the supply and demand side. On the supply side, scholars explored the barriers to digital

transformation, such as bureaucracy (Addo 2021; Goh and Arenas 2020), public servants' resistance, and fear of job loss (Addo 2021; Dickinson and Yates 2021; Noesgaard et al. 2023), weak commitment to organizational change (Addo 2021), weak competencies and technical skills (Q. Hu 2018; Mu and Wang 2020), inflexible standard operating procedures, limited government capabilities to sustain innovation over time (Mu and Wang 2020), and lack of legal and regulatory frameworks (Furr, Ozcan, and Eisenhardt 2022).

On the demand side, previous literature analysed citizen's adoption from different aspects such as trust (F. K. Chan et al. 2010; Janssen et al. 2018; Porumbescu 2016; Ramirez-Madrid et al. 2022; Venkatesh et al. 2016). e-participation (Jiang, Meng, and Zhang 2019; Lee and Kim 2018; Van den Berg et al. 2020), co-production and co-creation (Larsson and Skjølsvik 2021; Lember, Brandsen, and Tõnurist 2019; Xu and Tang 2020), citizens' privacy concerns (Willems et al. 2022), and the impact of system quality characteristics on citizens' perceptions (F. K. Chan et al. 2021; Piehler, Wirtz, and Daiser 2016; Scott, DeLone, and Golden 2016).

Both the supply and demand side in the developing economies experience challenges due to the digital divide, as these countries are under pressure to move towards e-government and adopt the Western context of IT development as part of their development and modernization projects (Addo 2021). The digital divide separates nations and individuals, therefore, recognizing this divide is key to empowering citizens' participation and technology adoption (Okunola, Rowley, and Johnson 2017). The digital divide refers to the difference in the adoption and use of digital technologies according to demographic characteristics, such as age, gender, race, income level, and location (Charness and Boot 2022). The existence of the divide can limit the success of e-government programs (Asgarkhani 2005). Developed nations such as West Europe and the US remain at the top of the digital development index while developing countries including Jordan struggling at the bottom (UN 2022), the technology infrastructure index in the developing countries is 44 per cent compared to 84 per cent in the developed countries (UN 2022). The digital divide in developing regions resulted from the high cost of building and maintaining the technology infrastructure, the monopoly of telecommunication providers and the cultural norm where citizens prefer in-person interactions (Zhao et al. 2018).

In light of the above, the gap remains in the demand side of e-government (Lee and Kim 2018; Ma and Zheng 2018), especially in the developing countries struggling to bridge the digital divide (Addo 2021; Avgerou and Bonina 2020; Kraus et al. 2022), and the factors driving e-services adoption (Lee and Kim 2018; Van den Berg et al. 2020).

Theoretical framework and hypotheses

Theoretical framework: UTAUT

The UTAUT is one of the most widely used frameworks in technology adoption research, it was introduced by Venkatesh et al. (2003) and it combines eight technology acceptance models and frameworks: Theory of Reasoned Action, Technology Acceptance Model (TAM), Motivational Model, Theory of Planned Behavior (TPB), Combined TAM and TPB, Model of Personal Computer utilization, Innovation Diffusion Theory and Social Cognitive Theory (Venkatesh et al. 2003). The model includes four main factors: performance expectancy, effort expectancy, social

influence, and facilitating conditions, and four moderators (age, gender, experience, and voluntariness) related to identifying the behavioural intention for technology use and adoption. Performance expectancy is the benefits expected by the users when performing a certain activity using technology, effort expectancy is the ease of use associated with the technology, social influence is the extent to which the user feels that it's important that others believe he or she should use the technology and facilitating conditions includes the organizational and technical infrastructures supporting the use of technology (Venkatesh et al. 2003).

While UTAUT provided valuable insights into users' technology acceptance by focusing on the main constructs such as performance expectancy, effort expectancy, social influence, and facilitating conditions, the previous research conceptualized the extrinsic motivation in the performance expectancy, effort expectancy and social influence constructs (see Figure 1).

Previous literature has noted that this model may not provide a comprehensive understanding of the impact of user motivation on information system adoption (Malhotra, Galletta, and Kirsch 2008; Petter, DeLone, and McLean 2013) and has called for the addition of further elements into the model (Blut et al. 2021). While performance expectancy, effort expectancy, and social influence are established extrinsic motivators in the UTAUT framework, our research extends this model by focusing on external rewards as a distinct form of extrinsic motivation. External rewards refer to tangible incentives, such as monetary benefits, which are not inherently tied to the perceived performance of the e-government service but rather provide direct and immediate benefits for using the system. This is distinct from performance expectancy, which emphasizes improvements in service quality or user outcomes. For example, an external reward in the context of e-government services might include financial incentives like tax credits or waived fees, which provide a direct, tangible benefit upon usage of the service. This differentiation is particularly important in the context of developing countries, where socio-

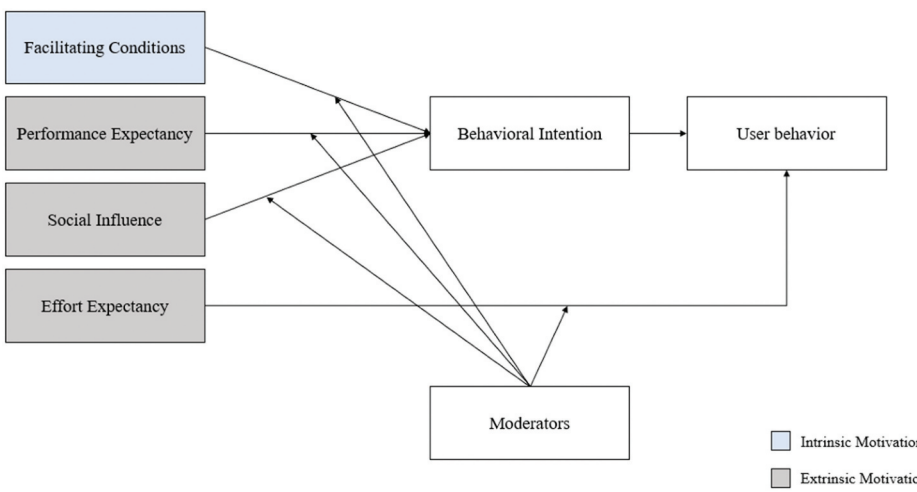

Figure 1. Original UTAUT model adopted from Venkatesh et al. (2003).

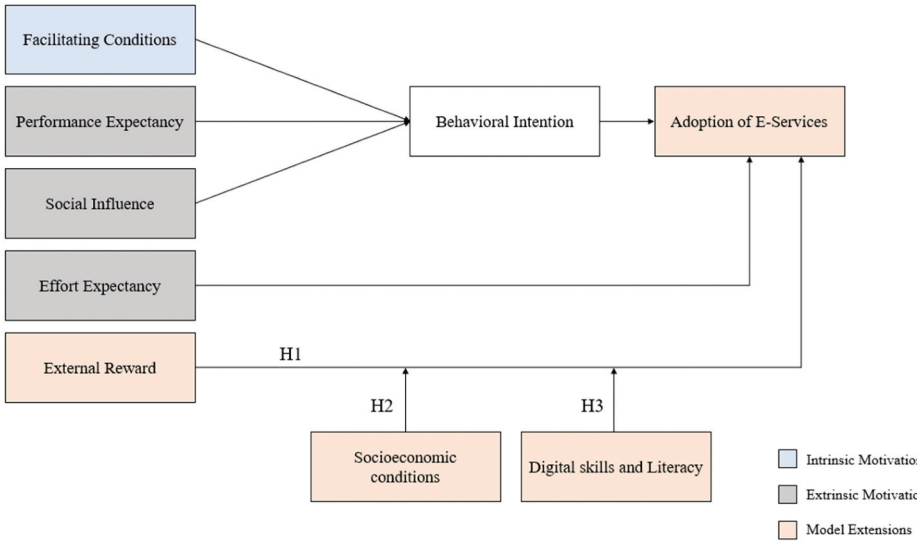

Figure 2. Extended UTAUT model.

economic disparities may mean that financial incentives have a greater influence on adoption than perceived service quality alone. In the next section, we discuss the addition of external reward as an additional construct to the UTAUT model (see Figure 2). The impact of extrinsic motivation is grounded in other contexts (Camera, Casari, and Bortolotti 2016; T. Sun et al. 2019).

Extrinsic motivation and external rewards

Extrinsic motivation refers to the performance of a certain activity because it will lead to an external reward (Deci 1972). Extrinsically motivated behaviours refer to activities that are unlikely to be performed unless there is an extrinsic reason to do so such as monetary rewards or financial incentives (Gillespie, Noble, and Lam 2016). Extrinsic motivation is proven to be an important predictor in employment, productivity and performance (Becker et al. 2018; Kreps 1997; Wright 2007).

External rewards serve as positive reinforcers for a desired behaviour (Bénabou and Tirole 2003). Rewards as a motivational factor have been widely studied in the organizational behaviour literature, mainly with reference to the Self-Determination Theory (Deci and Ryan 1985). External rewards are tangible benefits associated with an action (Birk, Mandryk, and Atkins 2016; Roumani, Nwankpa, and Roumani 2015), which is considered a powerful type of extrinsic motivation due to its immediate benefit (Akinwumi, Muturi, and Ngumi 2016; Shi et al. 2022). External rewards can provide the necessary motivation for individuals to adopt new tools and systems, specifically when intrinsic motivations are not sufficient (Budu et al. 2019), further, the adoption of technologies is often contingent upon perceived benefits associated, which can be enhanced through effective reward systems (Holl, Pardo, and Rama 2013).

Hypotheses: extrinsic motivation and e-government services adoption

In the domains of the information system, there is also a key influence of extrinsic motivational factors on ICT-based knowledge-sharing in the workplace (Kankanhalli, Tan, and Wei 2005; Papadopoulos, Stamati, and Nopparuch 2013; Rode 2016), additionally, extrinsic motivators are important drivers of using information systems (Malhotra, Galletta, and Kirsch 2008; Wu and Lu 2013), and strongly associated with the overall information system success (Petter, DeLone, and McLean 2013). Petter, DeLone, and McLean (2013) identified extrinsic motivation as a strong determinant of system usage, defining it as incentives – such as financial rewards, recognition, or reputation – that are distinct from performance-related benefits. This distinction is crucial in contexts like e-government, where the use of digital services may not directly improve individual performance but instead focuses on user engagement, making external rewards a key independent motivator.

In e-government systems, the goal is to encourage users to engage with digital services, rather than improve personal performance outcomes. External rewards, such as monetary incentives, play a significant role in increasing engagement by providing tangible benefits that encourage users to adopt e-services (Eisingerich et al. 2019; Harwood and Garry 2015; Högberg et al. 2019). Studies by Cappa et al. (2018) and others have shown that both intrinsic and extrinsic motivations are essential in driving participation in virtual communities, where external rewards can be particularly effective in increasing user engagement (Boudreau and Lakhani 2015; Bullinger et al. 2010; Franzoni and Sauermann 2014).

A key distinction must be made between performance expectancy and external rewards. Performance expectancy refers to the belief that using a system will result in gains in efficiency or job performance (Venkatesh et al. 2003). In contrast, external rewards are tangible benefits tied specifically to the action of using the system, independent of any performance improvements (Birk, Mandryk, and Atkins 2016; Roumani, Nwankpa, and Roumani 2015). For instance, G. Hu et al. (2019) included both concepts in their research model, showing that performance expectancy reflected job performance improvements, while external rewards acted as direct incentives for system use. Similarly, Adenuga, Iahad, and Miskon (2017) conceptualized external rewards as a reinforcement factor distinct from performance expectancy, highlighting how users expect to be rewarded for using the system independently of any efficiency gains.

In the context of e-government, the rewards users receive from engaging with digital services, such as financial incentives or exclusive access, are not tied to improving individual performance but rather serve as extrinsic motivators aimed at driving adoption. These rewards are offered specifically to encourage the use of digital channels and effectively motivate behaviours that may not occur otherwise, especially among users who are less concerned with service efficiency.

Providing monetary incentives or waving fees leads to a significant increase in mobile application adoption (Camera, Casari, and Bortolotti 2016; T. Sun et al. 2019). This distinction is especially relevant in the e-government context, where external rewards are offered not to enhance service performance but to incentivize digital engagement. Such rewards motivate behaviours that would otherwise be less likely to occur, thereby promoting the adoption of e-government services among users who may not be driven solely by improvements in service efficiency

or performance outcomes (Krishnamurthy, Ou, and Tripathi 2014). Unlike performance expectancy, which motivates users based on expected gains in efficiency or service quality, external rewards provide direct, tangible benefits for adopting e-government services. These rewards are independent of service outcomes and are particularly effective in incentivizing disadvantaged groups, such as low-income individuals, who may not be motivated by the perceived efficiency of the service alone. The existence of such rewards may encourage citizens to adopt e-government services, therefore our first hypothesis is:

H1: External rewards positively influence the adoption of e-government services.

Additionally, extrinsic motivation can have differential effects across different demographic groups (Malhotra, Galletta, and Kirsch 2008). The citizens' demographic characteristics can provide valuable insights into adoption rates, socioeconomic factors such as age, gender, employment, income, and geographic location affect the extent of the digital divide (Okunola, Rowley, and Johnson 2017). Moreover, these socio-demographic factors may alter how external rewards influence technology adoption, as the needs and incentives of different groups vary. E-government performance and adoption behaviours may differ significantly across social groups based on these factors, particularly age, geographic location, and income (Ma and Zheng 2018; Van den Berg et al. 2020).

The rapid diffusion of digital technologies has produced an age-related digital divide in the adoption of technology, where older age groups are lagging the younger (Charness and Boot 2022; Lam and Lee 2006; Lei, Yu, and Zhou 2023). Citizens of different age groups display different preferences, abilities, and demands for technologies (Crespo Cuaresma and Lutz 2021), younger citizens are more likely to use e-government services (Ma and Zheng 2018), while elderly citizens are less likely to use digital technologies (Xu and Tang 2020). In particular, older citizens may be more motivated by external rewards, such as financial incentives, due to their fixed income or retirement status (D. Y. L. Chan, Lee, and Teh 2023; Peek et al. 2014). The combination of economic constraints and the perceived value of financial incentives could make external rewards more attractive to this group. Therefore, age seniority could have a major impact on the relationship between external rewards and e-government services adoption.

The geographical location is also a major determinant of e-government services adoption. Rural populations face unique challenges compared to their urban counterparts, including limited infrastructure and access to reliable internet (DeStefano, Kneller, and Timmis 2023; Schleife, 2010). In developing countries like Jordan, the socio-economic divide is further amplified between urban areas with modern infrastructure and rural areas struggling with access to basic services. Rural populations, who may experience greater economic challenges, are likely to respond more positively to external rewards due to the tangible and immediate benefits these incentives offer (Akinwumi, Muturi, and Ngumi 2016; Shi et al. 2022). Therefore, the rural location could have a significant impact on the relationship between external rewards and e-government services adoption, as these incentives could offset some of the barriers to digital adoption in underserved areas.

Finally, household income is a significant determinant of e-government service use (Sipior, Ward, and Connolly 2011). Moreover, Jordan is classified as a low-middle-

income country with 14 per cent of the population living below the national poverty line (World Bank 2021), which indicates that the income levels are below the worldwide average; therefore, low-income households could be more motivated to adopt e-government services if the adoption is associated with a tangible external reward to relieve their financial distress.

In summary, external rewards serve as a key motivator across multiple socioeconomically disadvantaged groups, though the effect of these rewards may vary based on specific demographic factors. For elderly individuals, the reward addresses economic limitations tied to fixed incomes. For rural populations, external rewards help offset geographic and infrastructure barriers. For low-income citizens, the financial benefit serves as a direct incentive to engage with e-government services. Thus, we propose the following hypotheses related to the moderation effect of specific socioeconomic variables:

H2a: The positive effect of external rewards on the adoption of e-government services is stronger for individuals in older age groups.

H2b: The positive effect of external rewards on the adoption of e-government services is stronger for individuals in rural locations.

H2c: The positive effect of external rewards on the adoption of e-government services is stronger for low-income individuals.

Having the required digital skill to access e-government services is an important issue, as citizens may not be able to use the e-services due to lack of knowledge. The adoption of digital technologies is conditional on tech-related skills and access, and higher educated citizens tend to adopt technology faster (Crespo Cuaresma and Lutz 2021). E-government platforms can exclude citizens who lack digital experience (Larsson and Skjølsvik 2021), and digital technologies require new skills and diminish the need for the skills previously acquired (Firk et al. 2021; Lember, Brandsen, and Tõnurist 2019). For those without IT proficiency, digital technologies may appear intimidating, and the promise of rewards acts as a motivating factor to overcome perceived challenges. External incentives become instrumental in addressing the learning curve associated with acquiring IT skills, offering immediate benefits that make the adoption process more attractive (Venkatesh et al. 2003). These rewards serve as catalysts for overcoming resistance to change, fostering digital inclusivity by making e-government services accessible to individuals with diverse skill sets (Beer and Nohria 2000; Omazić, Vlahov, and Klindžić 2011; Warschauer 2004).

Higher-educated citizens are more likely to use e-government services (Liang et al. 2021), and education is a significant determinant of e-government service use (Sipior, Ward, and Connolly 2011). Additionally, education is important to the use of computer equipment (J. Van Dijk 1999; J. Van Dijk and Hacker 2003). Moreover, E-government adoption is adversely affected by the digital divide since the adoption of e-government requires education and training to develop the required computer knowledge and skills (Zhao et al. 2018), additionally, citizens who engage with the e-government tend to be higher income and higher educational groups (Thomas and Streib 2003).

Despite the fact that the adoption of modern technology has grown rapidly in developing countries, a challenge remains in the digital skills imbalance and the poor education outcomes, many individuals and households in disadvantaged communities have low education levels and trapped in low-paid work with little or no access to social protection (Kaplinsky and Kraemer-Mbula 2022), disadvantaged groups may require financial assistance to afford the digital skills and education, consequently, the existence of external rewards could encourage those groups to adopt e-government services. Therefore, we hypothesize the following:

H3a: The positive effect of external rewards on the adoption of e-government services is stronger for individuals with lower educational levels.

H3b: The positive effect of external rewards on the adoption of e-government services is stronger for individuals with no digital skills.

Methodology

Context: digital transformation in the government of Jordan

Jordan is a lower-middle-income country in West Asia with a population of around 10 million people. Most of the population lives in the capital, Amman, and the country faces a significant socio-economic divide (World Bank 2023). While the nation has made progress in modernization and economic diversification, disparities persist. The influx of refugees from neighbouring conflict zones has further strained resources and deepened the socio-economic imbalance (World Bank 2023).

Jordan's context differs significantly from developed economies due to its unique combination of infrastructure limitations, socio-economic disparities, and regional instability. Unlike developed nations, where internet access, reliable electricity, and digital literacy are widespread, Jordan faces major gaps in digital infrastructure, particularly in rural areas. As a lower-middle-income country, these challenges are worsened by the fact that many – especially in low-income and rural areas – lack access to digital devices and the skills needed to use e-government services. Moreover, the government's resources are strained by ongoing economic challenges and the influx of refugees, further complicating efforts to implement and maintain large-scale digital initiatives. These factors, combined with the socio-economic divide, make Jordan's path to digital transformation fundamentally different from more developed countries, where resources and infrastructure are more stable and accessible.

The digital transformation in the public sector in Jordan is led by the Ministry of Digital Economy and Entrepreneurship (MODEE). The country's Digital Transformation Strategy was launched in 2020 in line with Jordan Vision 2025. The strategy outlines the changes and strategic requirements to improve the delivery of public services, enhance the efficiency of government performance, meet the needs of beneficiaries, and enhance e-participation levels, improve the quality of life more effectively, sustainably, and reliably, and achieve well-being.

The improvement of e-government services by the Jordanian government involved providing six different access methods to e-services which are: (1) government entity websites, where the citizen can register through creating a user name and password

then use the electronic services through the website, (2) government entities mobile application where there are 40 government entities have its own mobile applications, and citizens' or corporations can access and request services, (3) e-government website, which serves as a web-based gateway for the services, (4) e-government mobile application (Sanad), (5) electronic booths, available inside government agencies and other post offices to get the services electronically instead waiting in the que to get the service in person, and (6) knowledge stations which are computer labs that allow citizens to use the computers to access the e-government services and online learning, mainly in the rural areas far from the government agencies offices.

Data

To test our hypotheses, we used data from Jordan's Technology and Internet Survey for the year 2021. The dataset includes responses to a questionnaire prepared by the Ministry of Digital Economy and Entrepreneurship in Jordan (see Appendix 1 in the supplementary material).[2] The purpose of the survey was to identify the spread of technology and the Internet across Jordan, in addition to the use of technology to access e-government services through different means such as websites, mobile applications, electronic booths, and knowledge stations. The data was collected in the fourth quarter of 2021 by a team of researchers from the Ministry and the Jordanian Department of Statistics. The data collection team included field officers, researchers, supervisors, and data quality auditors.[3] The researchers visited the households and collected the data directly from everyone in the household. The dataset included 10,703 individuals over 16 years of age.

Measures

We measure our dependent variable e-government service adoption with a binary variable. The variable reflects whether the citizen used any of the six methods available to access e-government services: (1) government entity websites, (2) government entities mobile applications, (3) e-government website, (4) e-government mobile application (Sanad), (5) electronic booths, and (6) knowledge stations. The variable is equal to one if the individual used any of the e-government and zero otherwise.

To investigate the impact of extrinsic motivation on e-government service adoption, we operationalized the independent variable external reward as a binary construct within our analysis. This variable is coded as 1 for citizens who are eligible to receive various forms of government aid and assistance. These include benefits such as lower fares on airline tickets, access to health insurance, customs exemptions, waiver of work permit fees, as well as support for training, education, and employment.

We further explore the impact of socioeconomic variables and digital skills on e-government services adoption and how these variables moderate the effect of external reward on the adoption. To capture the full complexity of these relationships, we included both linear and quadratic terms for key demographic variables such as age, income, and education in our regression models. This approach allows us to capture diminishing or increasing returns, providing a more nuanced understanding of the moderating effects of these variables. Prior studies have also demonstrated the importance of modelling non-linear effects to better assess the role of demographic

characteristics in technology acceptance (Morris and Venkatesh 2000; H. Sun and Zhang 2006).

The first group, the socio-economic conditions, includes age, low income, and rural location. The age variable is continuous, the sample age ranges between 16 and 97, and we also used the quadratic term of the age to explore non-linearities. We generated a binary variable to indicate whether the citizen lives within a low-income family which is lowest 14 per cent of the income distribution (World Bank 2021), finally, we used a binary variable for the location to indicate whether the individual is located in a rural area. The second group of variables includes the digital skills and literacy: lack of IT skills and number of years in education. We created a binary variable to indicate whether an individual lacks the digital skills required for using e-services, particularly in relation to e-payments and e-commerce. This variable is coded as 1 for individuals who do not engage in online activities such as e-commerce, e-banking, mobile wallets, or other internet payment methods (e.g. Google Pay and PayPal). Additionally, we used the number of years in education to identify the education level of the citizen, the years of education of less than 13 years indicate that the citizen has only attended primary and high school education and equal or greater than 13 indicates that the student attended higher education in terms of bachelor, master's, or PhD degrees. We also used the quadratic term of education for non-linearities. A full description of the relevant variables is included in Table 1.

Model

Due to the binary nature of our dependent variable, e-government services adoption, we employ logit regressions. We present different specifications. The first specification (Column 1 in Table 1) includes the variables of control, namely, the socio-economic conditions (age, low income, and rural location) and the digital skills and literacy (Lack IT Skills and Education Years). Column 2 builds on specification one and includes our main independent variable of interest, external reward (Hypotheses 1). Columns 3 to 7 include the interaction terms of external reward with the different socioeconomic and digital skills. Column 3 shows the interaction of external reward, age, and age squared (Hypotheses 2a), column 4 shows the interaction of external reward and rural location (Hypotheses 2b), column 5 shows the interaction of external reward and low income (Hypotheses 2c), column 6 shows the interaction of external reward, education, and education squared (Hypotheses 3a), and column 7 show the interaction of external reward and lack of IT skills (Hypotheses 3b).

Results

Descriptive statistics

The results were analysed using Stata 18. Table 2 presents descriptive statistics for the variables included in the analysis. The mean, standard deviation, minimum, and maximum values. The sample age ranged between 16 and 97, and the average age was 39 years, 39 per cent of the sample live in rural areas, the years in education ranged from 0 to 23 years, with an average of 9 years. The low-income households accounted for 14 per cent of the sample, and 16 per cent of the sample are eligible for external reward. Moreover, 54 per cent of the respondents adopted the e-government services

Table 1. Variables description.

Variable Name	Description	Type	Possible Values	Basis of Calculation
Adoption	E-Government services adoption regardless of the method of accessing the services	Binary variable	Yes, No	Respondents answer to any of the questions related to the adoption of e-government channels.
Entity App	Accessing e-government services through the governmental organization mobile application	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through the government entity mobile application.
Entity Website	Accessing e-government services through the governmental organization website	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through the government organization website.
Sanad App	Accessing e-government services through the e-government mobile application 'Sanad'	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through Sanad Application
E-Government Website	Accessing e-government services through the e-government website	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through the the e-government website
Electronic Booths	Accessing e-government services through the government-provided electronic booths	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through the electronic booths.
Knowledge Stations	Accessing e-government services through the government-provided Knowledge Stations	Binary variable	Yes, No	Respondents answer to the question related to the use of e-government services through the Knowledge Stations.
Number of adoption methods	The total number of e-government services access methods adopted by an individual	Count variable	0,1,2,3,4,5,6	The number of (Yes) responses related to the adoption of services through the six e-government channels.
Age	Individual age	Continuous Variable	Values range between 16 and 97	Directly from the survey responses.
Rural	It indicates whether the individual lives in rural area	Binary	Yes, No	Calculated by grouping the governorates to urban/rural
Education Years	The number of years of education an individual obtained in school and higher education	Continuous	Values range between 0 and 23	Calculated by identifying the years in education for each education level starting from school till postgraduate degree
External Reward	Whether an individual receive aid from government for being eligible for pension or has a disability	Binary	Yes, No	Calculated by identifying whether the individual is eligible for aid

(*Continued*)

Table 1. (Continued).

Variable Name	Description	Type	Possible Values	Basis of Calculation
Lack IT Skills	Whether the individual does not have the skills to use the e-payments and e-commerce	Binary	Yes, No	Calculated by identifying the participants who used the internet for the e-commerce or e-payments; including e-banking, mobile wallets, or other internet payment methods
Low income	Households with income within the lowest 14% of the income distribution	Binary	Yes, No	Calculated by identifying if the household income is in the lowest 14%
Gender	Male/Female	Binary	Yes, No	Directly from the survey
Personal Computer	Whether the individual has a personal computer	Binary	Yes, No	Calculated from the respondents' answers to the question related to the type of computing equipment used.
Laptop	Whether the individual has a laptop	Binary	Yes, No	Calculated from the respondents' answers to the question related to the type of computing equipment used.
Tablet	Whether the individual has a tablet	Binary	Yes, No	Calculated from the respondents' answers to the question related to the type of computing equipment used.
Smartphone	Whether the individual has a smartphone	Binary	Yes, No	Calculated from the respondents answer related to not using the computer due to having a smartphone.

Table 2. Descriptive statistics.

Variable	Mean	SD	p25	p75	Min	Max
Age	39.048	17.231	24	51	16	97
Age^2	1821.646	1553.509	576	2601	256	9409
Gender	0.497	0.500	0	1	0	1
Rural	0.390	0.488	0	1	0	1
Education Years	9.805	4.611	8	12	0	23
Education $Years^2$	117.389	83.796	64	144	0	529
Low Income	0.140	0.347	0	0	0	1
External Reward	0.159	0.366	0	0	0	1
Lack IT Skills	0.977	0.149	1	1	0	1
Entity Website	0.213	0.409	0	0	0	1
Entity App	0.138	0.345	0	0	0	1
E-government Website	0.170	0.376	0	0	0	1
Sanad App	0.409	0.492	0	1	0	1
Electronic Booths	0.008	0.089	0	0	0	1
Knowledge Stations	0.009	0.093	0	0	0	1
Adoption	0.539	0.499	0	1	0	1
Number of Adoption Methods	0.946	1.337	0	1	0	6
Gender	0.497	0.500	0	1	0	1
PC	0.102	0.303	0	0	0	1
laptop	0.129	0.335	0	0	0	1
tablet	0.013	0.112	0	0	0	1
smartphone	0.240	0.427	0	0	0	1

using different methods; 41 per cent used the Sanad mobile application, 21 per cent used the government entity website, 17 per cent used the e-government website, 14 per cent used the government entity application, and less than 1 per cent used the electronic booths and knowledge stations. Additionally, in terms of technology equipment, the smartphone is the most popular with 24 per cent of respondents using it, followed by the laptop with 12 per cent of the respondents, then personal computers with 10 per cent of the respondents.

Regression results

Table 3 shows the logit regression results. The first model indicates the impact of the control variables on the dependent variable. The age had a positive and significant impact on adoption $\beta = 0.037$ ($p < 0.01$) and the quadratic term of age had a negative and significant impact on adoption $\beta = -0.001$ ($p < 0.05$) (with a turning point of 106 years), indicating a positive but decreasing impact of age on adoption of e-government. The education years had a negative and significant impact on adoption $\beta = -0.276$ ($p < 0.01$) and the quadratic term of age had a positive and significant impact on adoption $\beta = 0.016$ ($p < 0.01$), which indicates that the likelihood of adoption decrease till it reaches a turning point of 8 years of education then it will increase, only 20 per cent of the sample are on the left side of the curve and the remaining 80 per cent on the positive increasing side. The rural location had a negative and significant impact on the adoption $\beta = -0.341$ ($p < 0.01$), the lack of IT skills had a negative and significant impact on the adoption $\beta = -0.926$ ($p < 0.01$), the low income did not have a significant impact. Among the technology equipment, both the personal computer and laptop had a significant and positive impact $\beta = 0.483$ ($p < 0.01$) and $\beta = 0.734$ ($p < 0.01$), respectively, and the smartphone had a negative and significant impact $\beta = -0.488$ ($p < 0.01$) and the tablet did not have a significant impact.

The second model shows the impact of the explanatory variable the external rewards on e-government service adoption, the relationship is both significant and positive $\beta = 0.438$ ($p < 0.01$), which supports hypothesis 1. The marginal effect suggests that the likelihood of e-government services adoption increases by 0.109 for the external reward, which corresponds to a 20 per cent increase in the sample mean.[4]

Models 3 to 7 explore the moderating impact of the socio-economic conditions and digital skills. In column 3, the analysis revealed a significant negative interaction between the age and external rewards $\beta = -0.203$ ($p < 0.01$) and significant positive interaction between the quadratic term of age and external rewards $\beta = 0.002$ ($p < 0.01$). Figure 1 in the supplementary material shows the curvilinear relationship between the impact of the interaction of age and external rewards on e-government services adoption. Figure 1 shows that the effect of external reward is particularly notable from 60 years of age, supporting hypothesis 1a. In column 4, the interaction between the rural location and external rewards is significant, and positive $\beta = 0.643$ ($p < 0.01$), which supports hypothesis 2b. Figure 2 in the supplementary material shows that external rewards are particularly relevant in the context of rural areas, where there is a significant difference in the probability of adoption between those receiving the external reward and those who do not.

In column 5, the interaction between the low-income and external rewards is significant and positive $\beta = 0.856$ ($p < 0.01$), which supports hypothesis 2c. Figure 3

Table 3. Logit regression – Adoption.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Age	0.037***	0.051***	0.132***	0.049***	0.048***	0.063***	0.051***
	(0.006)	(0.007)	(0.012)	(0.007)	(0.007)	(0.007)	(0.007)
Age^2	−0.001**	−0.000***	−0.002***	−0.000***	−0.000***	−0.001***	−0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Gender	−0.713***	−0.707***	−0.696***	−0.704***	−0.702***	−0.739***	−0.706***
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)
Education Years	−0.276***	−0.268***	−0.246***	−0.262***	−0.264***	−0.185***	−0.267***
	(0.017)	(0.018)	(0.018)	(0.018)	(0.018)	(0.020)	(0.018)
Education $Years^2$	0.016***	0.016***	0.015***	0.016***	0.016***	0.013***	0.016***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rural	−0.341***	−0.340***	−0.345***	−0.420***	−0.342***	−0.363***	−0.340***
	(0.044)	(0.044)	(0.044)	(0.047)	(0.044)	(0.044)	(0.044)
Lack IT Skills	−0.926***	−0.917***	−0.911***	−0.912***	−0.917***	−0.932***	−1.023***
	(0.197)	(0.197)	(0.196)	(0.196)	(0.196)	(0.195)	(0.210)
Low Income	−0.031	−0.031	−0.002	−0.033	−0.136**	−0.009	−0.031
	(0.061)	(0.061)	(0.061)	(0.061)	(0.067)	(0.062)	(0.061)
Personal Computer	0.483***	0.496***	0.568***	0.488***	0.490***	0.473***	0.496***
	(0.075)	(0.075)	(0.076)	(0.075)	(0.075)	(0.075)	(0.075)
Laptop	0.734***	0.743***	0.803***	0.738***	0.732***	0.725***	0.742***
	(0.075)	(0.075)	(0.076)	(0.075)	(0.075)	(0.074)	(0.075)
Tablet	0.045	0.037	0.039	0.039	0.028	0.043	0.036
	(0.203)	(0.204)	(0.210)	(0.204)	(0.204)	(0.203)	(0.204)
Smartphone	−0.488***	−0.481***	−0.471***	−0.481***	−0.485***	−0.476***	−0.480***
	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)	(0.053)
External Reward		0.438***	4.570***	0.214*	0.301***	1.622***	−0.622
		(0.102)	(0.787)	(0.110)	(0.106)	(0.186)	(0.546)
External Reward#Age			−0.203***				
			(0.029)				
External Reward#Age^2			0.002***				
			(0.000)				
External Reward#Rural				0.643***			
				(0.131)			
External Reward#Low Income					0.856***		
					(0.198)		
External Reward#Education Years						−0.201***	
						(0.043)	
External Reward#Education $Years^2$						0.005*	
						(0.003)	
External Reward#Lack IT Skills							1.075**
							(0.546)
_cons	1.211***	0.961***	−0.391	0.980***	1.002***	0.293	1.055***
	(0.249)	(0.254)	(0.305)	(0.254)	(0.254)	(0.268)	(0.265)
N	10703	10703	10703	10703	10703	10703	10703
Log likelihood	−6568.549	−6559.121	−6519.679	−6547.045	−6548.942	−6509.091	−6557.614
Pseudo R-sq.	0.111	0.112	0.117	0.114	0.113	0.119	0.112

Standard errors in parentheses.
*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

in the supplementary material shows external rewards are particularly relevant for low-income households, where there is a significant difference in the probability of adoption depending on receiving the external reward. Column 5 revealed a significant negative interaction between education and external rewards $\beta = -.201$ ($p < 0.01$) and a significant positive interaction between the quadratic term of education and external rewards $\beta = 0.005$ ($p < 0.1$). Figure 4 in the supplementary material shows the impact of

the interaction of education and external rewards on e-government services adoption. The impact of external rewards is significant for those groups with lower levels of education, supporting hypothesis 3a. Finally, in column 6, the lack of IT skills had a positive and significant interaction with the external reward $\beta = 1.075$ ($p < 0.05$), which support hypothesis 3b. Figure 5 in the supplementary material shows that external rewards are particularly relevant in the absence of digital skills. Robustness check and further results are included in the supplementary material.

Discussion

The findings of this study highlight the critical role that extrinsic motivation plays in shaping the landscape of e-government adoption. Our results, which support hypothesis 1, confirm that external rewards significantly and positively influence citizens' likelihood of embracing e-government services. This aligns with established theories in organizational behaviour, particularly in the realm of Self-Determination Theory, where external incentives serve as potent drivers for desired behaviours (Bénabou and Tirole 2003). The implications of this result extend beyond the immediate context of e-government adoption, echoing the broader literature on technology acceptance. Kankanhalli, Tan, and Wei (2005), Papadopoulos, Stamati, and Nopparuch (2013), and Rode (2016) have all emphasized the pivotal role of extrinsic motivational factors in fostering ICT-based knowledge-sharing and overall information system success. For instance, our results support previous works that identified the role extrinsic motivation plays in the success of information system adoption (Kankanhalli, Tan, and Wei 2005; Malhotra, Galletta, and Kirsch 2008; Papadopoulos, Stamati, and Nopparuch 2013; Rode 2016; Wu and Lu 2013) and mobile applications adoption (Camera, Casari, and Bortolotti 2016; T. Sun et al. 2019). This work also validates the impact of socio-economic conditions such as age, low income, and rural location on e-government service adoption.

Our results support previous literature on age-related digital divides by showing that different age groups exhibit distinct preferences, abilities, and demands for technologies (Crespo Cuaresma and Lutz 2021). Our results support previous studies highlighting the impact of age on technology adoption and use (Charness and Boot 2022; Lam and Lee 2006; Lei, Yu, and Zhou 2023). Our results also reveal that younger citizens, when receiving external rewards, exhibited a lower likelihood of embracing e-government services. However, this trend reverses as citizens approach the age of 43, at which point the likelihood of adoption begins to increase, supporting hypothesis 2a. This could be attributed to the fact that by this age most of the citizens would have completed 20 years of work and are subject to voluntary retirement and receiving a pension.

Furthermore, the urban-rural divide emerges as a crucial factor influencing e-government adoption in the presence of external rewards. Our results found that citizens in rural areas may exhibit a positive response to external rewards in the context of e-government adoption, supporting our hypothesis 2b. This can be explained by economic conditions of rural areas, where citizens often face lower average incomes and limited employment opportunities, making external rewards, such as financial incentives, particularly appealing and effective motivators (Addo 2021). Limited access to resources, including educational opportunities and technological infrastructure, further enhances the significance of external rewards, acting as catalysts to overcome

barriers associated with resource constraints (Sipior, Ward, and Connolly 2011). In addressing digital inclusivity challenges, where rural populations may have lower levels of digital literacy, external rewards provide additional incentives for individuals to embrace technology use (Crespo Cuaresma and Lutz 2021).

Moreover, the interaction between external rewards and low-income unveils a significant positive relationship, supporting hypothesis 2c and indicating that citizens within economically disadvantaged groups are more likely to adopt e-government services when motivated by external rewards. This finding aligns with existing literature emphasizing the household's significant role in determining e-government service use (Sipior, Ward, and Connolly 2011). In a country like Jordan, where income levels are below the global average, the economic benefits associated with external rewards can be particularly compelling.

We also find a positive effect of external rewards on the adoption of e-government services would be stronger for individuals with lower educational levels, supporting hypothesis 3a. The empirical results reveal that the moderation impact of education is indeed significant. Citizens with lower educational levels exhibit a stronger positive response to external rewards, suggesting that educational disparities play a crucial role in shaping the dynamics of e-government adoption.

Our analysis also revealed a significant moderation effect of digital skills on the relationship between external rewards and e-government adoption, supporting hypothesis 3b. Citizens lacking digital skills demonstrate a heightened positive response to external rewards, indicating that the presence of rewards acts as a crucial motivational factor for overcoming the perceived challenges associated with digital technologies. This finding aligns with the broader literature on digital inclusion, where external incentives are recognized as catalysts for overcoming resistance to change and fostering inclusivity (Beer and Nohria 2000; Omazić, Vlahov, and Klindžić 2011; Warschauer 2004).

Conclusion

This paper provided empirical evidence on the impact of external rewards on e-government service adoption in Jordan, employing a large-scale dataset from Jordan's 2021 Technology and Internet Survey, extending the original UTAUT model to include external rewards as an extrinsic motivator, the research deepens our understanding of how such incentives can drive adoption. The data were analysed using logit regression, and the analysis validated the impact of the external reward on e-government service adoption moderated by socio-economic conditions, digital skills, and literacy. In particular, our study sheds light on how disadvantaged groups such as senior citizens, citizens living in rural areas, and those who are categorized as low-income households tend to adapt e-government services if the service was associated with an external reward.

This research makes several significant theoretical contributions to the literature on e-government services adoption. First, the research addresses the context of a developing country facing unique socio-economic challenges and addresses the unfortunate side of the divide, where the majority of literature addressed the e-government adoption in the Western context, this research helps in addressing this imbalance and provides more insights of the developing countries digital transformation challenges and possible solutions to bridge the digital divide, adding to the e-government

literature in developing countries (Addo 2021; Ramirez-Madrid et al. 2022). By examining how external rewards can drive digital engagement, particularly among disadvantaged groups, the study highlights strategies that could help bridge the digital divide in developing economies. Second, it addressed the demand side of e-government by focusing on the factors driving citizens' adoption of e-government services, since the supply of e-government services will not contribute to the digital transformation goals without adequate adoption by citizens, understanding what drives and sustains adoption, which also adds to the literature that addressed different aspects of the demand side such as trust (F. K. Chan et al. 2010; Porumbescu 2016) and privacy concerns (Willems et al. 2022). Third, the research extended the UTAUT model to include external rewards as an extrinsic motivation factor. While previous research has largely focused on performance expectancy and social influence as drivers of technology adoption, external rewards introduce a new dimension of motivation by providing direct and tangible incentives for using e-government services. These findings are particularly relevant in the context of developing countries, where financial incentives may have a greater impact on adoption decisions than perceived efficiency or social influence. This is a novel contribution that builds on calls to expand the UTAUT model by including new predictors (Blut et al. 2021). Finally, it contributes to the e-government literature with large-scale empirical evidence, testing the cause-and-effect relationship between variables providing more generalizable results about the population and answering the calls for more quantitative research on digital transformation.

Our paper provides several lessons for policymakers, particularly in developing economies, looking to increase the level of adoption of the e-government services. Though the government of Jordan has progressed in its digital transformation, a challenge remains in the low adoption rates. Our research has highlighted critical factors that play important roles in shaping the citizens' adoption of e-government services, particularly the role of external rewards in motivation adoption among disadvantaged populations. Based on our findings, we propose a set of policy implications to promote digital inclusion and enhance e-government adoption among citizens. First, the government should leverage external rewards to encourage citizens to adopt e-government services. These rewards can act as motivators, encouraging citizens – especially those from disadvantaged backgrounds – to engage with e-government services. However, it is important to note that while social programmes themselves are not designed to drive e-government adoption, when offered through digital channels, they provide a tangible incentive for citizens to transition to e-government services. Second, establish a mechanism for technology grants or subsidies for low-income households to enable them to acquire essential equipment, such as computers, laptops, and smartphones, which can reduce economic barriers and facilitate broader access. Third, establish digital inclusion curricula and implement comprehensive digital literacy and upskilling training programmes, targeting disadvantaged communities in specific areas. Finally, governments shall focus their efforts on mobile-centric applications, which in turn can help governments achieve their cost-efficiency and resource optimization goals. By implementing those policies, governments can take a step towards fostering digital inclusion and ensuring that e-government services are accessible to different segments of society.

While this research provides valuable insights into the relationships between external rewards and e-government services adoption in Jordan, several

limitations require consideration. First, the cross-sectional nature of this research limits analysing the changes in responses or behaviours over time. A longitudinal approach may offer a deeper understanding of how these variables evolve over time, allowing for the identification of trends and changes. Second, while the analysis demonstrated that external rewards significantly impact the number of access methods adopted, it did not directly control the frequency of service use, as this information is not available in the survey. This presents a limitation in disentangling whether citizens engage more with e-government services primarily due to external rewards or out of necessity (e.g. needing to access government aid). Third, the scope of extrinsic motivation in this study was limited to external economic rewards, such as monetary incentives, and did not explore other forms of rewards, such as non-economic incentives (e.g. awards, points, or recognition). Future studies could examine a broader range of extrinsic motivators to see how different incentives influence e-government adoption. Fourth, future research could split the sample based on specific social programmes (e.g. elderly pensions and disability benefits) to analyse how different types of government aid might affect e-government adoption differently. Fifth, the geographical scope of the research is focused on Jordan, a country with specific socio-economic challenges and may not be generalizable for countries with different socio-economic profiles. Comparative studies across diverse contexts could provide insights into how socio-economic conditions influence the effectiveness of external rewards in different regions. Finally, future research could use primary data to have more detailed data directly from the citizens.

Notes

1. The Sustainable Development Goals (SDGs), were announced by the United Nations in 2015 as a universal call to action to make the world a better place by ending poverty, protecting the planet, and ensuring that all people enjoy peace and prosperity by 2030. Jordan scored 69 out of 100 in the UN sustainable development goals report, and none of the SDGs were achieved in Jordan; despite the country had fair progress, acceleration is needed (United Nations 2023).
2. Details about the sampling process and data collection can be found on the Jordanian government's official website: https://www.modee.gov.jo.
3. Citizens were obliged to answer all the survey questions.
4. The marginal effect of 0.109 for external rewards was calculated using a post-estimation margins command after conducting a logit regression. This value represents the change in the probability of adopting e-government services when a citizen qualifies for external rewards, while holding other variables at their means. The 20 per cent increase was derived by dividing the marginal effect (0.109) by the sample mean of e-government adoption (0.539, as shown in Table 2). This indicates that qualifying for external rewards increases the likelihood of adoption by approximately 20 per cent relative to the overall adoption rate of 53.9 per cent in the sample.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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