

E-government, digitalization, and environmental sustainability. A theoretical overview, focused on the Romanian national profile

~ Ph. D. Student **Andreea Pernici** (The Bucharest University of Economic Studies, Bucharest, Romania) ORCID: <https://orcid.org/0009-0008-0754-7849>

E-mail: perniciandreea17@stud.ase.ro

~ Ph. D. Professor **Stelian Stancu** (The Bucharest University of Economic Studies, Bucharest, Romania; Centre for Industrial and Services Economics, Romanian Academy, Bucharest, Romania) ORCID: <https://orcid.org/0000-0002-4727-993X>

E-mail: stelian_stancu@yahoo.com

~ Ph. D. Student **Monica-Ioana Vulpe** (The Bucharest University of Economic Studies, Bucharest, Romania) ORCID: <https://orcid.org/0000-0001-5190-194X>

E-mail: ioanarenard@gmail.com

~ Ph. D. Candidate **Florin Răducu** (The Bucharest University of Economic Studies, Bucharest, Romania)

E-mail: florin.raducu@csie.ase.ro

Abstract: *In the last 30 years, the internet revolution has seized all areas of life, being undoubtedly one of the most important innovations of the century. At the same time, digitalization and e-government slowly followed the lead, significantly impacting the way citizens, businesses, and public administrations interact. However, now that all agents have integrated the new technologies into the socio-economic structures, the mere study of the two concepts individually will not be enough, considering the complexity of the current times and the challenges of the future. Therefore, the current paper aims to introduce a new element in the picture, namely environmental sustainability, as the practice meant to limit global warming and ensure healthy conditions of life. In this sense, we will start to illustrate the theoretical relationship between e-government, digitalization, and sustainability, with a focus on describing the Romanian administrative reality. Consequently, the subject will be split into two sections, first by looking at the related literature for*

an explorative approach, and then proceeding to examine the national case study. In the second part, we will start by defining Romania's e-government status quo, in comparison to the other EU member states, while also showcasing what has been done and what is pending in the next years. Lastly, we will explore some sustainability implications visible at a national level, introducing new digitalization vectors such as NGOs. Having in mind the approach presented, the subject at hand can be considered relevant for the current public agenda, while the methodology employed will help fill in the gap in terms of e-government and sustainability connections, especially in correlation with Romania's reality.

Keywords: e-government, digitalization, environmental sustainability, Romania, literature review

JEL: Q56, O38, D73

1. Introduction

In the last 30 years, entire flows and processes have undergone fundamental changes as a result of the Internet emergence. Starting from the industrial sector, going into private life, and then to the political-administrative systems, technology has altered the way we construct any socio-economic structure. Therefore, although it might not be the first effect that comes to mind in terms of the innovations brought by the internet phenomena, e-government will be a revolution on its own, aiming to replace, or at least improve the conventional bureaucracy systems. Thus, the goal of e-government, under the umbrella of digitalization, will be to provide citizens with higher-quality public services that can facilitate communication and improve the overall level of interaction with different audiences. More than that, considering the recent focus put on environmental protection and sustainability, e-government is gaining a new valence, since it has the potential to become a building block in the new sustainable, inclusive, and circular economy.

Therefore, the current paper aims to connect the concepts of e-government, digitalization, and environmental sustainability and analyze them in the broad context of the 4th industrial revolution. In terms of methodology, the first section of the study will showcase a summary of theoretical approaches and insights found in the related literature, with a focus on e-government. Secondly, we will construct a Romanian e-government profile, starting with a short historical overview and then proceeding with the illustration of the current solutions implemented. To complete the status quo, we will then present the future or work-in-progress solutions in terms of digitalization, while also showcasing the importance of NGOs in the broad Romanian context. As a last step, we will explore some examples where the three concepts could be found together, drawing an initial picture in terms of their synergy and aggregated potential.

At the same time, it's important to make one last methodological mention. Throughout the exploration of the related research, we have observed a prevalence of defining sustainability as part of the development axis, frequently linked with the Sustainable Development Goals designed by the United Nations. However, in this paper, our objective will be to highlight the environmental direction of sustainability, in this way, focusing our attention on the ecological and natural impact. We consider this to be a valuable contribution to the general field, as well as a point of differentiation.

2. Literature review

As seen more and more recently, international cooperation institutions have started to understand the importance of linking digitalization, e-government, and environmental sustainability, designing strategies in an aggregated manner, and enhancing each other's potential. In this regard, perhaps the most important example will be the newest growth model elaborated by the European Union in 2022, namely Towards a green, digital, and resilient economy (European Commission, 2022). This model proposes a transition to a more sustainable, digitalized, and shock-resilient system, that aims to decarbonize the economy, reduce greenhouse gas emissions, increase the use of renewable energy, and ultimately reach the greenhouse emissions neutral goal by 2050.

However, in terms of digitalization, there will be multiple action plans designed to strategically tackle the future directions. One of the most important will be The Digital Europe Programme (European Commission, 2021a), an agenda designed to sustain projects in five crucial areas: supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring the use of digital technologies across the economy and society. As mentioned also in the official presentation, the action plan is meant to support the twin EU objectives of both a green transition and digital transformation, illustrating the high correlation between the two. Another important European strategy will be The 2030 Digital Compass: the European Way for a Digital Decade (European Commission, 2021b), which will describe the four main vectors of a digital EU: a digitally literate population and highly skilled digital professionals, a sustainable, secure and efficient digital infrastructure, the digital transformation of businesses, and the digitization of public services. In correlation with the sustainability agenda, the action plan will emphasize the importance of building digitalization solutions that have a smaller environmental footprint, are energy efficient, and use resources productively.

Thus, it is getting more and more clear that the way forward is to design a framework in which digitalization, e-government, and green technologies are complementary. However, it's important to highlight that there will be no clear lines between the three concepts, either from a theoretical or practical perspective, so to assess their relationship we will first look at the main e-government effects and then extrapolate some important sustainability implications, in a broader context. Moreover, we will split these effects into two categories: macroeconomic and social.

2.1. Macroeconomic e-government impact

In terms of the first category, we can start with Fritz Machlup, one of the first theorists to identify the economic effects of the information society, with broad applicability to e-government. According to him, information and communication technologies will involve the transfer of funds and money resources, ensuring constant financial and monetary flows (Machlup, 1983). From this perspective, the most impactful effect brought by technology will be absorbed by the tax systems since one of the first goals and functionalities presented by e-government will be tax collection growth. The principle behind this is simple: by having a complementary method of payment that is less costly in terms of time, citizens will have an extra incentive to pay their tax

obligations, thus increasing revenues to the state budget. This can lead to multiple sustainability implications, mostly under the umbrella of reallocation of tax revenue to projects that can build a greener infrastructure, promote better education in the direction of sustainability, implement better waste management systems, or integrate green taxation schemes that can create and model new consumer behaviors.

Another macroeconomic impact of e-government solutions will be the reduction of costs and the correlated savings and budget revenues. A significant part of this reduction will be generated by lowering the administrative procedures costs and building economies of scale. This will be possible by first, replacing the traditional bureaucratic services that consumed substantial resources, and then by lowering maintenance costs and removing low-productivity links. At the same time, as demonstrated also by (Castro & Lopes, 2022), e-government will stimulate sustainable development, evaluated through the adjusting net savings.

Further on, cost reduction will be equivalent to providing better control of government expenditure through the implementation of integrated financial management systems (Bhatnagar, 2003). Highly correlated, several sustainability advantages can be extrapolated, such as reduced paper use, improved data management systems, or the potential to build energy-effective institutions and procure sustainable electronic services and solutions. To confirm that, (Lee, 2017) has elaborated an extensive literature review on the relationship between e-government and environmental sustainability, summarizing the same macroeconomic effects. Finally, e-governance systems can prove beneficial in the mitigation and management of disaster risks, with a clear cost-reduction perspective being valid (UN News, 2008).

Lastly, since we are discussing macroeconomic effects, it's important to also highlight the impact of e-government on the private sector. Therefore, through building a hardware and software national infrastructure, the motivation to invest in a business environment that is supported by a high degree of digitalization is rising considerably. Thus, private companies will be incentivized to build new headquarters and increase the flow of money in the national economy. Consequently, much like a domino effect, the connection between sustainability and digitalization will be the most evident. Several sustainability advantages can be emphasized, starting from the high innovation platforms that the private sector develops and the shared interest in allocating and using resources more efficiently. Moreover, the investments that are allocated by businesses in the green or circular industries can prove to be decisive in the overall transition to a new growth model, so the priority of the national administration should be to facilitate as much as it can the state-company interactions.

2.2. Social e-government impact

Going forward into another category, namely the social effects, an important aspect that e-government yields is the decision-making and public agenda designing. Digitalization can enhance both, offering increased transparency, interoperability, and the prevention of abuse or corruption. In this sense, there will be many instruments, as well as best practices that can be used, starting from the online public consultations, open data portals, and the adjacent visualization

tools, the public institutions' websites, or the digital feedback mechanisms. Finally, by building a more digital public landscape, sustainable policies, regulations, and practices can be proposed, voted on, or implemented, thus helping the transition towards the new green economy model.

Remaining in the societal effects category, as with any other technology and innovation, the labor market is bound to be impacted. Regarding digitalization, the consequences could be perceived as both positive and negative, since there will be new skills that need to be developed, as well as acknowledge the endangerment of some job descriptions. However, the role of the state in this discussion will be crucial since the entire paradigm can be switched to people's advantage if implemented properly. For example, through building e-government solutions, the changes in the skills required for data processing will not only energize the workforce but also integrate new jobs in the administrative apparatus, forced to keep up with the private sector environment. Therefore, the occupational reorientation will either keep constant or increase the number of white-collar workers, while also reaching the goal of bureaucratization minimization (Machlup, 1983).

In terms of how the re-education process will impact the sustainability agenda, it's important to mention that the new proposed economic framework has as a priority to ensure inclusivity and stimulate the job creation, with green energy being a main pillar for that goal. However, this remains to be seen, and the future of work, especially in the administrative sector and the interaction with citizens, could be threatened by the technologies designed to automate manual processes (Arntz, Gregory & Zierahn, 2019). Hence, it will be crucial to prepare and integrate professionals with high digital skills, since they will be more eager to adapt to new job opportunities, overlooking the risks of transition from their current positions or responsibilities.

Lastly, to sum up the aspects previously described, in Table 1 we have designed a schema that starts from the advantages of digitalization and then extrapolates some environmental sustainability implications.

Table 1. Digitalization (e-government) advantages and the sustainability implications

CATEGORY	ADVANTAGES	SUSTAINABILITY IMPLICATION
MACRO-ECONOMIC EFFECTS	Increased tax collection	Tax revenues can be used to finance sustainable projects and solutions around green energy and the adjacent sectors.
	Stimulation of the private sector and the flow of investments	Private companies can significantly enhance sustainability by driving innovation, designing business models based on resource optimization and efficiency, adapting, and promoting circular economy practices, and investing in renewable and green energy industries.
	Cost efficiency, budget and energy savings, and resource optimization	E-government can help improve bureaucracy, with immediate effects: reducing paper use, improving data management, and building a long-standing low-maintenance cost infrastructure.
SOCIAL EFFECTS	Job creation and skills development	Prepare new generations of professionals, with high digital skills that can easily adapt to the new green and sustainable areas of work.
	Improved decision-making and public agenda designing	Promote, vote, and implement sustainability policies, regulations, and practices in a more fast, easy-to-follow way.

Source: Authors' own research

We can see that through the aspects previously described, we have focused more on the opportunities created by digitalization and e-government in the fight against climate change and the ambitious goals set up in terms of pollution and gas emissions. However, it's important to note that there will be some negative implications that digitalization undoubtedly brings to the table, in a reverse relationship. The most evident will be the environmental cost of building a complex infrastructure since it will employ high levels of energy consumption and electronic device waste. Therefore, as emphasized multiple times by the European Commission, in the transition to the new growth model, it will be crucial to design regulatory measures to reduce the environmental footprint of data centers and communication networks, while also reducing the amount of ICT products disposed.

3. Romanian e-government profile

3.1. Status quo and historical overview

Going now to the second part of our paper, as a starting point in this discussion, it's useful to define Romania's status quo, especially compared to other European Union states. One method of evaluation can be represented by the European Digital Economy and Society Index, an instrument used to track the performance of the EU's digital competitiveness. Therefore, in the last report, namely (DESI, 2022), Romania was ranked last in terms of digital transformation, not

converging with the rest of the EU member states. The report will explain that although Romania managed to attract significant investments in the last years, mainly through the high-speed and capacity server network (connectivity direction), it is still lagging in terms of human capital, digital public services (e-government), and overall integration of digital technologies.

Thus, the slow digital transition can present a domino effect, impacting the progress toward a sustainable and modern economy. However, there will be some good signs that Romania can accelerate the transition, since in 2022, for the DESI sub-indicator named ICT for environmental sustainability the registered value was 68%, two points over the average European level – 66% (DESI, 2022). This indicator is designed to measure the share of enterprises that are having medium or high-intensity green actions through ICT, and the good results registered at a national level demonstrate that Romania's private sector is interested in this new socio-economic framework. At the same time, the performance confirms one important theoretical link between sustainability and digitalization, namely the bidirectional stimulation of the private sector.

Going forward in the construction of the national profile, although Romania's progress remains modest in comparison to the other European Union member states, several e-government systems have been developed and pushed forward by the authorities, gaining more popularity as we speak. To understand the evolution of those, we will quickly look through a historical overview. Therefore, the first relevant legislation applied to the information society was adopted in 2001, namely, the 544/2001 Law on free access to information of public interest. At that moment, the legislation was describing for the first time the electronic transmission of information.

In practical terms, however, one of the first national implementations was happening in 2003, when the National Electronic System (SEN) was set up as part of the anti-corruption package to ensure the transparency and good functioning of public responsibilities. Currently, it will be synonymous with e-guvernare.ro portal and will provide access for citizens, companies, and government agencies to the main points of contact in terms of digital administrative services and procedures. At the same time, e-guvernare.ro will be Romania's node in the Single Digital Gateway (European Commission, 2018), the interactive network of the European Union designed to offer easy access to information, procedures, and assistance in issues management. The system is under the responsibility of the Romanian Digital Authority (ADR), an institution created in 2020, with the broad objective of turning digitalization into reality, as part of the current Research, Innovation and Digitization Ministry. Therefore, in terms of its goals and instruments, ADR is implementing new e-government solutions that aim to enhance the national administration through concepts such as interoperability, electronic identity, and governmental cloud.

Since the 2000's many e-government solutions have been developed, implemented, and connected, all of them being easily accessible through the e-guvernare.ro or ADR (adr.gov.ro) website. For example, we can mention the launch of the e-Licitatie system in 2004, operational since 2006, now called the Electronic Public Procurement System (SEAP). The solution was designed to improve the transparency and control of public procurement, becoming now a best-practice case, internationally recognized. In terms of some other solutions, we can name aici.gov.ro, an intermediary portal for the registration of documents addressed to public institutions that do not have their platform, the national catalog of public services, or the Single Electronic Point of Contact.

Therefore, to sum up and build the entire picture, in Table 2 we have illustrated the most important e-government and digitalization systems, which are currently active, along with some statistics in terms of use and operation in December 2023.

Table 2. Main e-government services in Romania, December 2023

E-GOVERNMENT SOLUTION	OBJECTIVES	STATISTICS
E-GOVERNMENT PORTAL (NATIONAL ELECTRONIC SYSTEM) https://e-guvernare.ro/	The official portal for e-government services, designed for citizens, businesses, and government agencies. Connects Romanian administration to the European network Single Digital Gateway (SDG).	8.363 institutions
VIRTUAL PAYMENT WINDOW https://www.ghiseul.ro/ghiseul/public/	Online card payment of taxes and fees to the public institutions enrolled.	1.897.265 users
ELECTRONIC PUBLIC PROCUREMENT SYSTEM (SEAP) https://www.e-licitatie.ro/pub	Electronic procurement of goods and services necessary for public authorities.	231.898 SEAP entites
TRANSPORT LICENCES PORTAL (SIAE) https://www.autorizatiiauto.ro/Portal	Electronic allocation of international road authorizations and national routes in the transport programs.	1.802.168 licenses
SINGLE ELECTRONIC CONTACT POINT https://edirect.e-guvernare.ro/	Connecting central and local government and other competent authorities to obtain the necessary authorizations for service activities.	5.817 procedures
AICI.GOV.RO https://www.aici.gov.ro/home	An intermediary platform for registering documents addressed to public institutions that do not have their online registration system.	608.907 Users
ROeID https://roeid.ro/	ROeID is Romania's Single Sign On (SSO) solution, through which citizens will be able to use a single username and password for all state IT platforms.	

Source: Authors' own research

3.2. Current and future projects

Regarding the future, there are several projects that Romania is working on to improve the e-government level. These projects aim to provide more efficient data management, to stimulate the private sector and the citizen's public activity, while also connecting the national system to the European Union network. At the same time, in Romania's Recovery and Resilience Plan (RRP, 2021), one of the main national objectives is to address digital shortcomings, with a significant 1.82 million euros being allocated for this goal. As stated in the agenda, the digital transformation of the public sector, cybersecurity, and connectivity, are only some of the aspects that will be in focus in the next five to ten years.

As a result, in Table 3 we can see the work-in-progress e-government solutions, which are currently being implemented by the ADR and other administrative institutions. We have categorized them into three classes: financial, social, and strategic. Some important processes regarding life events will be improved, such as adoption, disability, and several health systems. At the same time, in 2024, multiple financial solutions will be implemented, that aim to improve the interaction with the private sector. Examples in this category are the long-awaited e-invoice system or the e-VAT. Lastly, a couple of strategic solutions will be implemented soon, with a connectivity objective.

Table 3. Main e-government services to be implemented in Romania

AREA	E-GOVERNMENT SOLUTION	OBJECTIVES
FINANCIAL	INFORMATION SYSTEMS OF NATIONAL STRATEGIC INTEREST (SIISN)	<ul style="list-style-type: none"> • National e-Invoice system for electronic invoicing • National RO e-Transport system for monitoring road transport of goods with high fiscal risk. • National RO e-Seal system for electronic sealing of goods. • e-SAF-T system for the standard fiscal control file. • National RO e-Cash register system for the national register of electronic fiscal cash registers. • National e-VAT Information System RO for pre-filling information on taxable operations in VAT statements.
SOCIAL	NATIONAL INFORMATION ADOPTION SYSTEM (ANPDCA)	Implementation of an adoption portal designed to integrate the necessary administrative processes, such as the electronic child file, the post-adoption monitoring, and the interoperability of all institutions involved.
	NATIONAL MANAGEMENT SYSTEM FOR DISABILITY (ANPPDP)	Develop and implement a centralized national platform for collecting, storing, and distributing information on people with disabilities (adults and children) to central and local public authorities, individual beneficiaries, and institutional partners.
	NATIONAL HEALTH INFORMATICS SYSTEM (REGINTERMED)	Implementation of health registers and their interconnection with other e-health IT platforms. Progressive updating of information according to health information needs - diagnosis, treatment, evolution, and decision-making in emergencies.
	THE INFORMATION SYSTEM FOR CLINICAL RECORD OF INTENSIVE THERAPY SECTIONS (SIEC – ATI)	The implementation of a modern IT system for monitoring, documentation, and exchange of medical data related to anesthesia and intensive care activities (ATI), which will function as a decision support system in a central unit of the Ministry of Health.
STRATEGIC	INTEGRATED SYSTEM FOR A PERFORMANT INFORMATION SOCIETY (SIMSIP)	Increase the administrative capacity of ADR to support institutional reforms through the implementation of a unified quality, and performance management system.
	TECHNOLOGICAL INTEROPERABILITY SYSTEM WITH EU MEMBER STATES (SITUE)	The construction of the eIDAS node for Romania will interconnect it with the eIDAS nodes of the other Member States and the identity and electronic services providers in Romania.

Source: Authors' own research

3.3. Sustainability implications

Finally, we have seen how the e-government and digitalization profile of Romania is developing at an accelerated pace, in this process generating positive and negative sustainability effects. Although we couldn't find any available numbers regarding a quantitative sustainable impact, we will identify several projects or areas in which e-government, digitalization, and sustainability work together. For example, the integration of smart cities and urban mobility (Mihaila, 2018), intelligent agriculture, and waste management enhancements are some ongoing solutions that are currently carried out all over Romania. Another is presented by the transport system, with 864 million euros being allocated in the next years for railway digitalization and the development of sustainable road infrastructure (DESI, 2022).

At the same time, we need to mention that Romania has ambitious targets in terms of energy reconfiguration, stimulated by the potential it has when it comes to wind, solar, or hydroelectric energy projects. In this sense, a brand-new initiative was presented at the end of December 2023, by the Oil and Gas Employers' Federation in partnership with the Employers' Association of Women Entrepreneurs. The project entitled #ITforENERGY aims to improve the level of digital skills of 320 employees who carry out their main activity in less developed regions, mainly in the energy and environmental management sectors, to adapt their activity to the dynamics of the economic sectors. We can therefore see how another theoretical insight was confirmed, namely the strong correlation between sustainability, the private sector, and the digital skills of the future.

However, besides the national administration and the business sector, it's important to mention that Romania's civil society has also become more and more active in the implementation of digitalization and sustainability objectives. Consequently, we have multiple non-governmental organizations which are developing solutions to improve interactions between citizens, while also promoting projects in the energy and environmental protection field. From this list, we could name Greenpeace Romania, Green Revolution, TechSoup Romania, or Tech Lounge. However, in terms of the synergy between the three concepts, there is an NGO that can be considered representative: Code for Romania, an independent, non-partisan, and non-political organization. The main vision behind all the digital solutions proposed by the NGO will be based on 5 highways: education, care, health, participation, and environment for Romania. Thus, in the last category, we can pinpoint several solutions (and objectives) that have a clear sustainable effect: healthy and protected forests, pollution measurement, recycling and waste management, friendly cities, or natural disaster and earthquake prevention. All of these are work-in-progress, designed and implemented by volunteers who believe in the potential to redesign a more sustainable community, through digitalization.

Therefore, regardless of the main agent of change, the public, private, or civil sector, digitalization, and e-government can help build technologies that are cheaper in the long run, more efficient, and personalized to the national profile. As mentioned in the Digital Reset Report (D4S, 2022), a clear vision for digital technologies is indispensable to addressing social and environmental challenges successfully. This can be done by having agile governance institutions, in which the social-economic goals are redesigned to integrate positive sufficiency, circularity, and sustainability effects.

4. Conclusions

As seen throughout the literature review section, one of the crucial elements that will minimize vulnerabilities and accelerate progress will be prioritizing e-government and digitalization as a sustainable development pillar. Following the European Union strategies, the redesign of the economic framework needs to rely on the green energy transition and the inclusive modernization of government interactions. Therefore, the concepts proposed undoubtedly show a high correlation, both from a theoretical and practical perspective, since they have the potential to stimulate the private sector, reconfigure the skills of the future, enhance tax collection, and reduce

administrative costs. Thus, the focus should be put on the medium and long-term gains, since on the immediate horizon, the investments necessary to achieve the reconstruction could have a high impact on the general rentability.

Moreover, regarding Romania's digital profile, the first steps in this direction have already been made, with several solutions being implemented by both the national administration and the civil society. At the same time, what was lacking in the last decade, namely the full-prioritization of e-government and digitalization has now been tackled and pushed forward by the pandemic context, with multiple solutions being expected in the next couple of years.

Having all these in mind, we consider that the case study put forward represents a good starting point in understanding where Romania is heading in this domain, especially in correlation with the European Union's actions. The synchronization pace will also be crucial since it will make the difference between the states that are highly adaptive and have understood the new, modern paradigm, and the ones that are still struggling to make the transition. What is certain is the fact that the ability to build complex, feasible, and sustainable systems will be the way forward in achieving socio-economic development, while also minimizing the multiple health and climate risks that humanity is facing.

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