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Development of digitization services in the context of the COVID-19 pandemic a solution for Smart City. Case study: Romania

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Abstract. *The COVID-19 pandemic has led to the globalization of services worldwide, due to restrictions that have been imposed for a certain period. In this context, the digitization of services, both in rural and urban areas, contributes to the development of Smart City and its integration into communities. Romania is a country that does not have digitized services, which are under development, but the COVID-19 pandemic has created a forced "opportunity" to accelerate this process. Also, the areas that had digitization projects, being integrated in Smart City projects, were advantaged during the period of restrictions during the state of emergency in 2020 or the state of alert from 2020 to 2022. The digitization of services depends on several factors such as infrastructure and internet connectivity. At European level it is the DESI index (index of the digital economy and society) which highlights digital competitiveness in the Member States of the European Union, the main areas of analysis being human capital, broadband connectivity, integration of digital technologies by businesses and digital public services. This study will focus on the development of digital public services between 2020 and 2021 and will see if they have been affected by the coronavirus pandemic. The indicators analyzed will be "people who use the Internet to interact with public authorities", "level of Internet access of households", "households with broadband access". The paper will highlight the state of digitalization of public services in Romania and how these services are ranked in the European context.*

Keywords: connectivity, Digital Economy and Society Index (DESI), services, Smart City, Romania

Introduction

Digitization has the role of stimulating innovation, promoting the efficiency of services and improving them. Digital technologies are an important tool to help countries cope with and recover from the COVID-19 pandemic, which has disrupted global economies and societies[1]. Through a digitalization process integrated in a society, in addition to streamlining services, jobs are also

[1] https://www.oecd.org/g20/topics/digitalisation-and-innovation/.

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created. Digitization is perceived as a phenomenon, in the field of service marketing it is often conceived as being particularly important for the development of collaboration structures between business actors (Li, Merenda and Venkatachalam, 2009; Makkonen & Vuori, 2014). It is perceived as relatively new, but research has long emphasized its importance in studies on the need to use information technology (e.g., the Internet and other technology-based information systems) to improve the business environment (Ekman, Erixon, & Thilenius, 2014; Makkonen & Vuori, 2014; Ryssel, Ritter and Gemünden, 2004; Stump & Sriram, 1997).

At European level, it is a digital agenda, which aims to use and integrate information technology into the work of society. It was set up as a result of the Lisbon Strategy and is for 10 years. It was the digital agenda for Europe 2010-2020, and now it is the digital agenda 2020-2030. a fair, open and secure digital environment: ensuring better access for consumers and businesses to digital goods and services across Europe, creating the right conditions for the development of digital networks and services, and maximizing the growth potential of the digital economy. With regard to the second period for the digital agenda, in 2020, a five-year strategy has been set, "Shaping Europe's digital future", with three main objectives: technology for citizens, a fair and competitive economy and a sustainable society. open, democratic and sustainable. Also, in 2021, the strategy was completed with concrete aspects for the 10-year period and what needs to be achieved: the European model for the digital decade.[2]

It can be noticed that at European level a special importance is given to digitalization, for this reason it is important to observe how Romania is situated at the level of the member states of the European Union. The digitalisation of society is important in the context in which informatics and information technologies are constantly evolving. The European Union provides support for digitization to Member States through the Digital Europe for Digital Technology program, with a total planned budget of EUR 7.5 billion for the period 2021-2027, which will provide strategic funding to support projects in five areas. In addition, there are funds provided by Horizon Europe, the European Interconnection Mechanism for Digital Infrastructure, the Recovery and Resilience Mechanism and the Structural Funds Mechanism. Also, in the context of the economic recovery from the COVID-19 pandemic, EU Member States must allocate at least 20% of their recovery funds to projects that digitize economies and societies, which stimulated digitization (Ratcliff, Martinello, Ciucci, Sofsky, Kaiser 2022).

The European Digital Agenda focuses on e-government, e-commerce, e-business, e-health and online security (Avram, 2020). The stage of digitalization of public services in Romania is influenced by the access to European non-reimbursable funds, but also by the connectivity in the country, both in urban and rural areas.

Digitization has advantages in transforming societies by giving citizens the opportunity to be efficient in interacting with public, economic, health, etc. services. The coronavirus pandemic offered the opportunity to accelerate the digitalization process in societies, being also the case of Romania. An ecosystem of interdependent digital technologies supports digital transformation, its constant evolution continues to drive economic and societal change.

This digital technology ecosystem is based on and produces large amounts of data, which have become an important source of economic and social value. Globally, it is the OECD Going Digital project, which aims to help policy makers better understand digital transformation and develop appropriate policies to help shape a positive digital future. The digital transformation and the effects of digital technologies on economies and societies are shaping a positive digital future.

[2] https://www.europarl.europa.eu/ftu/pdf/ro/FTU_2.4.3.pdf.

Important areas for digitization are the labor market, trade, finance, taxation, consumer policy, SMEs, agriculture, health, public governance, competition, the environment.[3]

In 2020, the "Authority for the digitization of Romania" was established in order to digitize the Romanian society. This institution has the role of encouraging and supporting public institutions and the private sector to provide fast services through digitalisation. Digitization means fast, efficient and secure services. Digital transformation can change the life of society and help citizens interact with the services they need.

Literature review

Conceptual clarification of the main concepts that are used in this study is the main stage. Thus, the main concept that is used is digitalization, which is defined by Scott Brennen and Daniel Kriess (2014) from an academic perspective as digital communication and the impact of digital media on contemporary social life. Digitization means integrating digital technologies into business and producing added value (Georgescu et al., 2021).

The Gartner Glossary and Pearce-Moses (2005) define digitization as the process of switching from analog to digital form, also known as digital activation. In other words, digitization takes an analog process and transforms it into a digital form without various changes in the nature of the process itself.[4]

Digitization refers to the transformation of interactions, communications into (more) digital data, which is often reduced to a combination of digital and physical, such as Omni channel customer service, integrated marketing or industrialization of production with a mix of autonomy, semi- autonomous and manual operations, electronic services, etc. (Mircica, 2020). Thus, there is often confusion between digitization and digitization, but they are interdependent. If digitization is the transformation of analog data into digital, digitization is the way administrations, the business environment, the healthcare environment work, using technology to use them.

Digitization has certain advantages, including the fact that digitized data, information can be represented universally, and data can be used and edited on digital devices without being degraded, at very high speeds and with negligible marginal costs (Avram, 2020). It should be noted that the process of digitization or processing of analog information is slow, and the digital transformation is one of the global trends leading to structural and organizational reforms in the public and private environment by adopting information and communication technology (ICT) solutions. to optimize operations and provide improved services to customers or citizens (Lappi et al., 2019).

Digitization improves access to resource information. The digitization process makes the invisible visible. Also, a large number of users can access the same document / service at the same time without hindrance. An important aspect is that it eliminates the problem of distance, because users do not have to travel to locations that have paper copies of materials (Khan, Khan, Aftab, 2015)

The digitization process may seem to be a recent phenomenon, due to the importance given to the existing financial support, but digitization has appeared with that of computers, since 1950, since then there has been a tendency to convert analog or physical documents into digital. For example, in 1956 IBM (International Business Machines) introduced into the business world magnetic disks and random access data with 305 RAMAC and 650 RAMAC (Random Access

[3] https://www.oecd.org/digital/going-digital-project/.

[4] https://www.gartner.com/en/information-technology/glossary/digitization.

Memory Accounting), first used in the United Airlines reservation system. In 1960 American Airlines launched the Saber Flight Reservation System, in 1968 libraries in the United States began using MARC (Machine Readable Cataloging) records, which referred to the transition of cataloging data for approximately 16,000 titles in bands. machine-readable magnetic cards for easier distribution account balances and withdraw various amounts without interacting with a human cashier (Batiz-Lazo, 2015). Thus, it can be seen that digitization began in the 50s and 50s, it developed and intensified as information technology developed and its benefits were understood.

The literature includes studies that highlight the importance of digitalization for the economy, the development of "Smart City", for the public sector or in the context of the COVID-19 pandemic. The transformation of today's economies has been achieved through the emergence of online markets and new business models, following the emergence and processing of databases in 1960, which led to the development of modern programming languages and algorithms; the advent of the computer for sale in the 1970s; the development of business software in the 1980s, the development of the Internet in the 1990s, the advent of mobile broadband technology in the 2000s; the launch of social networks between 2000 and 2010 and the development of the process of processing large databases in 2010 (Bughin et al., 2016; Avram, 2020). Information technology has contributed to the development of the economy and reconfigured some economic sectors due to the global appearance of the smartphone, artificial intelligence (AI) and distributed blockchain or ledger technology (DLT) (OECD, 2019).

The use of digital technology determines the level of digitalization, which in turn has a proven impact on reducing unemployment, improving the quality of life and growing citizens, access to public services (Khan, Khan, Aftab, 2015). The use of digital technologies is a means of stimulating economic activities. Developed economies have higher economic growth due to digitalization, such as growth and productivity, but with fewer jobs. The main reason for the different effects of digitization is the economic structures of developed and emerging economies‖ (El-Darwiche & Singh, 2013).

At the economic level, digitalization has a different influence due to economic progress (Khan, Khan, Aftab, 2015; El-Darwiche, Singh & Ganediwalla, 2012). For example, a report published by Booz & Company in 2015 highlighted that the impact of digitization on global economic progress can be achieved by using the digitization index, a measure of the country's digitization level.

The information technology used in the public domain allows the administration to operate more efficiently and to provide more citizen-oriented services. However, the increasing pace of technology evolution, budgetary constraints, coupled with the change in demographic structure generate new challenges that public authorities must find solutions to (Avram, 2020). The use of information and communication technology (ICT) and e-government strategies reaches various evolving levels (digital government), in which technologies and user preferences are integrated into production and service delivery and are part of broader public sector reforms (Ozols & Nielsen, 2018).

According to the literature, digitalization is an opportunity for development and is a necessity to reduce the effect of problems in areas such as health, education, social assistance. Through digitization, certain categories of vulnerable people may have access to services that would not have access for various reasons: distance, cost (Pedersen & Wilkinson, 2018).

The first part of the paper mentioned that digitization as a whole is particularly important in the European Union, with the digital agenda being created for a period of some 10 years and funding being allocated to Member States to support this. Digitization depends on digital

infrastructure, connectivity, but also on the development of digital hubs, located mainly in cities (at European level they are in: Amsterdam, Berlin, Dublin, London, Paris and Stockholm). At European level, due to the digital agenda and the use of information technology, cultural tourism has increased the economic value of specific activities by developing tourism applications that provide information about heritage sites and improve the visitor experience (Varbova & Zhechkov, 2018).

In addition to the extensive literature, which includes the conceptual clarification of terms, the history of the phenomenon of digitization, its intensification, highlighting the importance of digitization for the economic sector, in the European Union is the index of the digital economy and society (DESI). in terms of digital competitiveness in areas such as human capital, broadband connectivity, the integration of digital technologies by businesses and digital public services. The paper also referred to this index in terms of digitalization of public services in Romania and how they evolved during the pandemic.

Methodology

This section provides details on the data analysis and indicators used. The data used were centralized on the website eurostat.ec.europa.eu, in order to be able to make an integrated analysis in the European context of Romania's digitalization.

The data used in this study are:

- ✓ Broadband coverage (> 30 Mbps and> 100 Mbps)
- ✓ Fixed broadband coverage
- ✓ LTE coverage
- ✓ People who use the internet to interact with public authorities
- ✓ Use of the Internet by individuals
- ✓ People who use the internet to find information about goods and services
- ✓ Individuals who use the internet for internet banking
- ✓ People who use the internet to search for health information.

During the analysis, the data will be analyzed by reporting to the average of the Member States of the European Union in order to observe the state of connectivity, internet use or digitization in Romania. Information on the DESI indicator will also be analyzed in relation to the European average.

Results and discussions

During this stage, the previously mentioned data are analyzed, the stage of digitalization of public services in Romania in a pandemic context. The statistical data are analyzed for the period 2010-2021/2013-2020 in order to observe whether the pandemic period influenced the digitization in Romania. In 2020, the Agency for the Digitization of Romania was established, the National Agency for Fiscal Administration created the one-stop shop for virtual payments, the establishment of the virtual space, etc., the payment service for “ghișeul.ro” fees and taxes was optimized. The digitization of public services depends on several factors, including the economic one, to support the development of such services, then the connectivity of the population to the Internet, and this aspect is for the rural environment, especially.

At European level, studies are being carried out on broadband coverage in Europe and the progress of EU Member States in achieving the goals of the Digital Agenda for Europe is being monitored. Progress towards "universal broadband coverage with speeds of at least 30 Mbps by 2020" is being monitored and "50% of households should have broadband subscriptions of 100

Mbps or more by 2020". A global study by McKinsey also found that the COVID-19 pandemic accelerated digitalization by 7 years globally. It has stimulated resilience and innovation by supporting the digitization of government services.

The European Union is promoting digital transformation as a government priority for Member States, and investment needs to be made in this regard. [5]Romania ranks 27th out of 27 EU member states in the 2021 edition of the Digital Economy and Society Index (DESI). In terms of human capital, Romania ranks 26th, with below average scores on most indicators. Despite the fact that Romania has a large number of ICT graduates (4th place), the shortage of ICT specialists it limits the country's ability to innovate and reap the benefits of digital transformation. In terms of connectivity, progress continued in 2020 for fixed broadband coverage, the adoption of broadband services has progressed at a slower pace. However, Romania ranks 7th due to the high bandwidth absorption of at least 100 Mbps (52%).

Connectivity in Romania can be improved by focusing on raising digitalisation in rural areas, updating the broadband strategy and transposing the regulatory framework in line with EU law. Regarding the evolution of broadband coverage> 30 Mbps for Romania, in the period 2013 - 2020 it can be seen that it increased from 0.34 in 2013 to 0.86 in 2020, while broadband coverage > 100 Mbps had an evolution of 0.18 in 2013 to 0.82 in 2020. The concern for connectivity in Romania stems from the steady increase in broadband coverage.

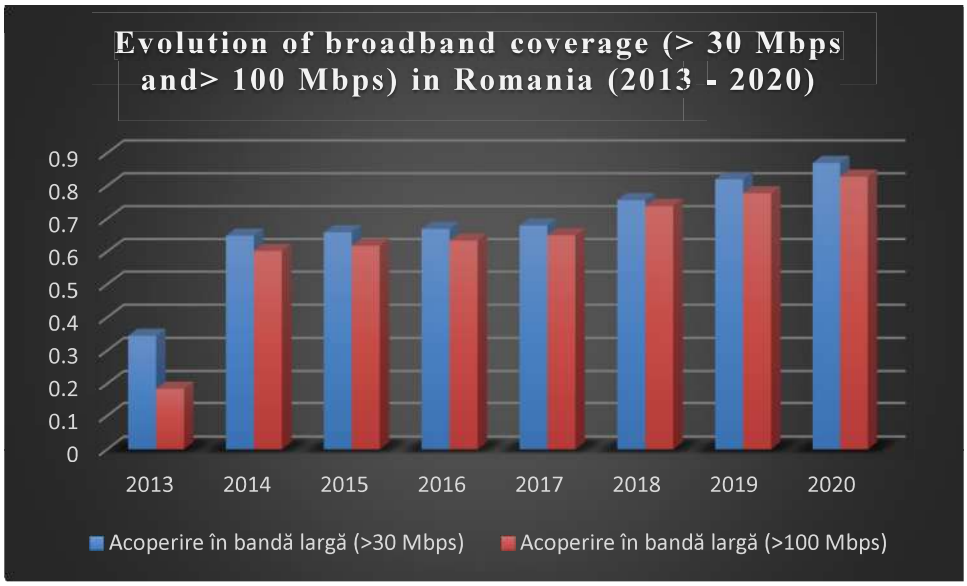


Figure 1. Evolution of broadband coverage (> 30 Mbps and> 100 Mbps) in Romania (2013-2020)

Source: https://ec.europa.eu/.

Also, the fixed broadband coverage in Romania in the period 2013 - 2020 shows a decrease between 2013, from 0.89, to 0.87 in 2019, following an increase in 2020 to 0.89.

[5] https://digital-strategy.ec.europa.eu/en/library/egovernment-benchmark-2021.

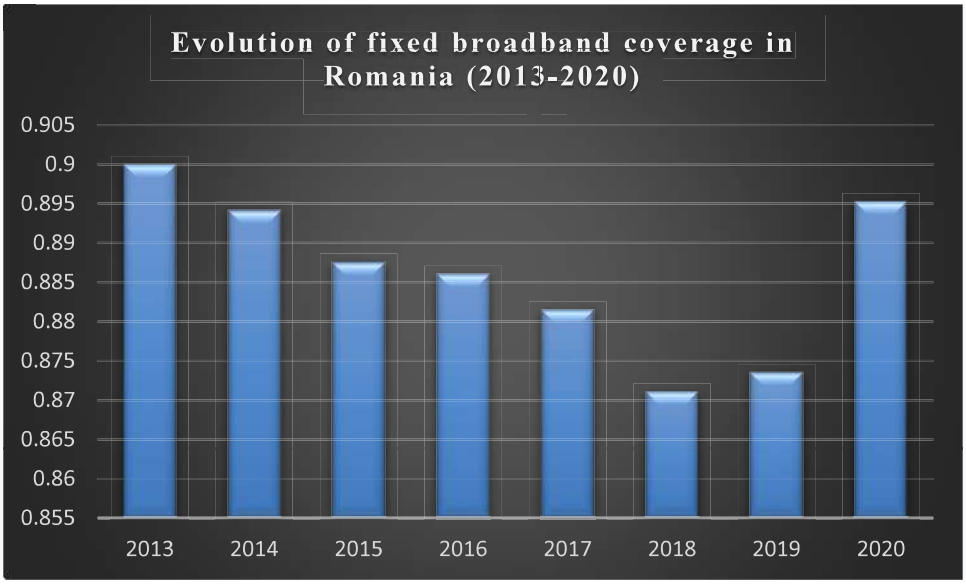


Figure 1. Evolution of fixed broadband coverage in Romania (2013-2020)

Source: https://ec.europa.eu/.

The Long Term Evolution (LTE) for Romania in the period 2013-2020 highlights the improvement of the technology used by phones. Thus, there is a concern for improving internet speeds for mobile telephony. In 2013 LTE was 0.25, while in 2020 it was 0.99. The speed of LTE use in Romania increased steadily during the indicated period.

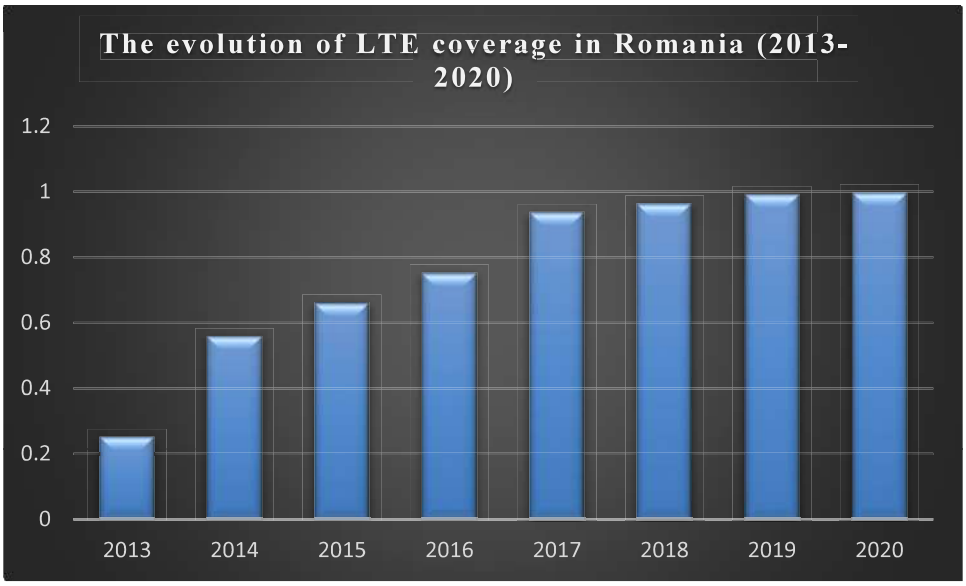


Figure 2. The evolution of LTE coverage in Romania (2013-2020)

Source: https://ec.europa.eu/.

In addition to the connectivity of people, an important aspect for the digitalization of the country is the use of the Internet by people, especially for public services. According to statistical data, in Romania's population in 2010 8% of the population used the Internet in interaction with public authorities, while in 2020 and 2021 it increased to 13% and 15%, respectively. The use of

the Internet by the population in interaction with public institutions may be the consequence of both a low connectivity of the population, but also the lack of digitalization of public institutions.

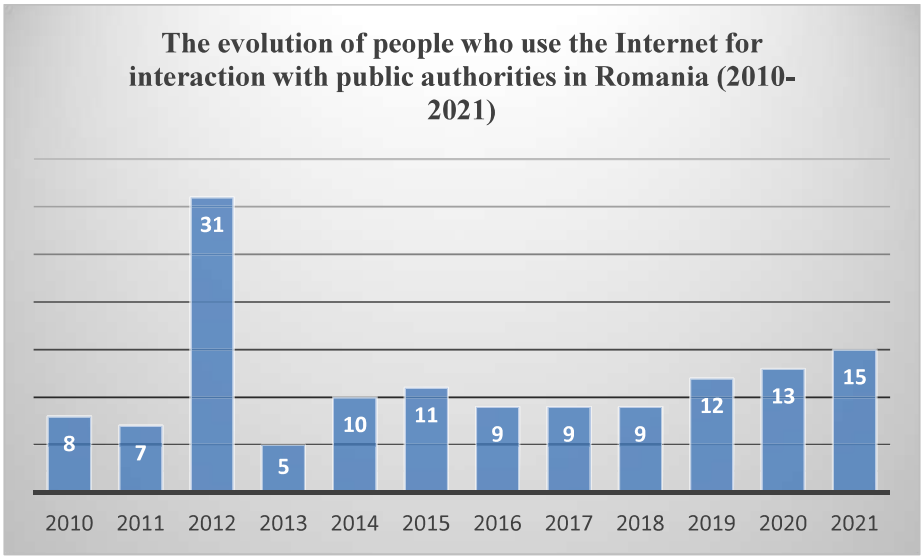


Figure 3. The evolution of people who use the Internet for interaction with public authorities in Romania (2010-2021) (2010-2021)

Source: https://ec.europa.eu/.

Analyzing the data for the use of the Internet by individuals in Romania, it is found that between 2010 and 2021 the percentage of the population increased from 36% to 84%, an increase of 6 percent between 2020 and 2021, which can be explained by the pandemic situation. Comparing the data for the use of the Internet by individuals and for the use of individuals in the interaction with the authorities, it can be seen that in Romania there is a problem in this regard. In a context where a high percentage of people use the internet, it indicates that there is internet connectivity, but it is a problem in the approach of digitization by public authorities.

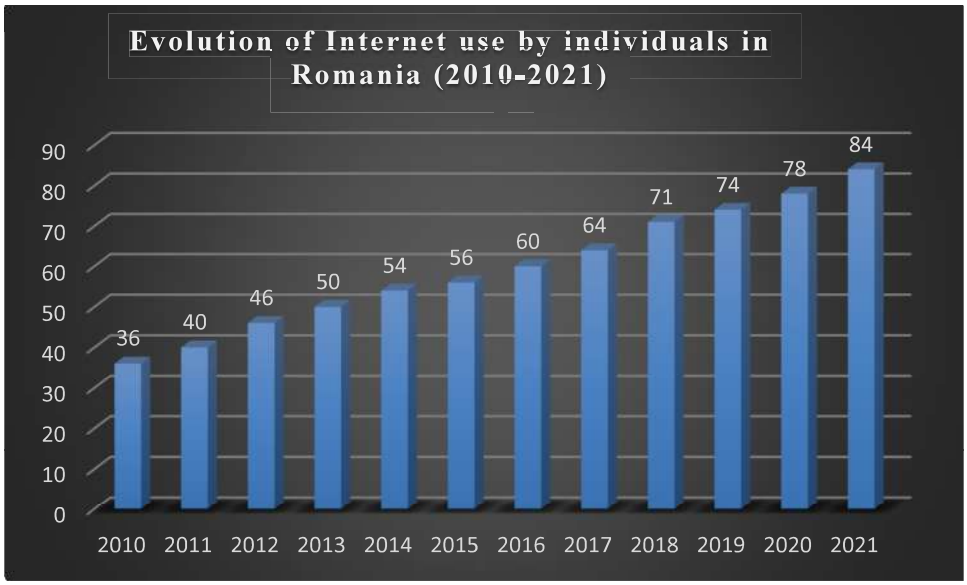


Figure 5. Evolution of Internet use by individuals in Romania (2010-2021)

Source: https://ec.europa.eu/.

The following graphs aim to highlight what individuals use the Internet for, analyzing data for identifying information for services and goods, using the Internet for banking or health services. Between 2010 and 2021, the percentage of people using the Internet for information on services and goods increased from 26% in 2010 to 44% in 2021 (46% in 2020).

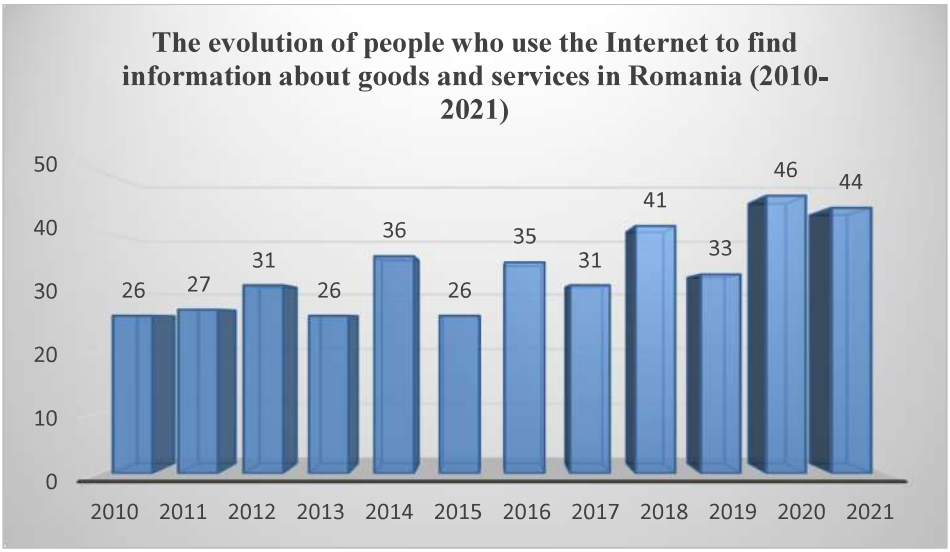


Figure 6. Evolution of Internet users to find information about goods and services in Romania (2010-2021)

Source: https://ec.europa.eu/.

The percentage of people who use the Internet for banking services has increased from 3% in 2010 to 15% in 2021. Between 2019 and 2020 it has increased from 8% to 12%, which indicates that banking institutions have digital banking services. which can benefit the population, if it so desires.

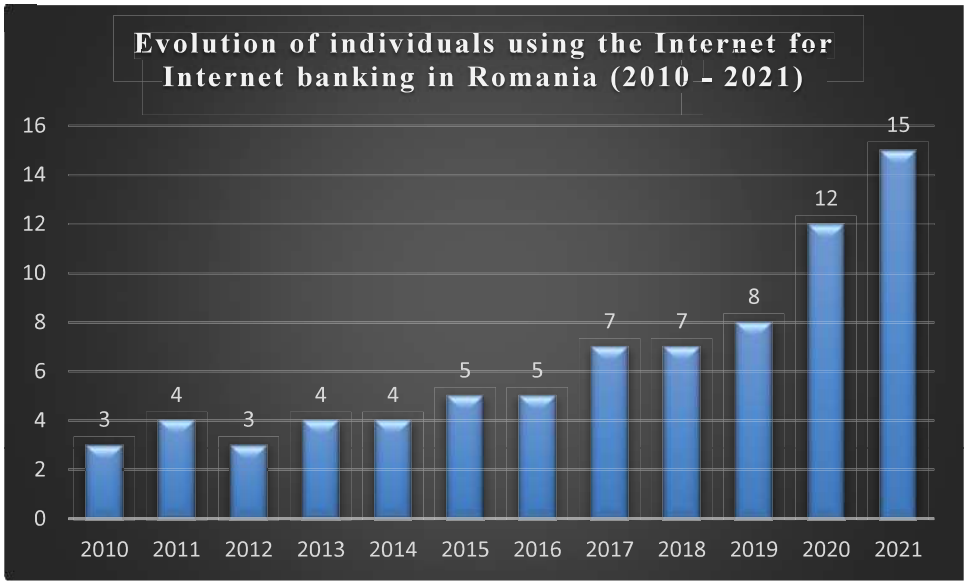


Figure 7. Evolution of individuals using the Internet for Internet banking in Romania (2010 - 2021)

Source: https://ec.europa.eu/.

Regarding the use of the Internet for health information, it can be seen that the percentage of the population increased from 11% in 2008 to 40% in 2021. Between 2019 and 2021, the percentage increase was 9 percent, from 31%. , which may be due to the COVID-19 pandemic.

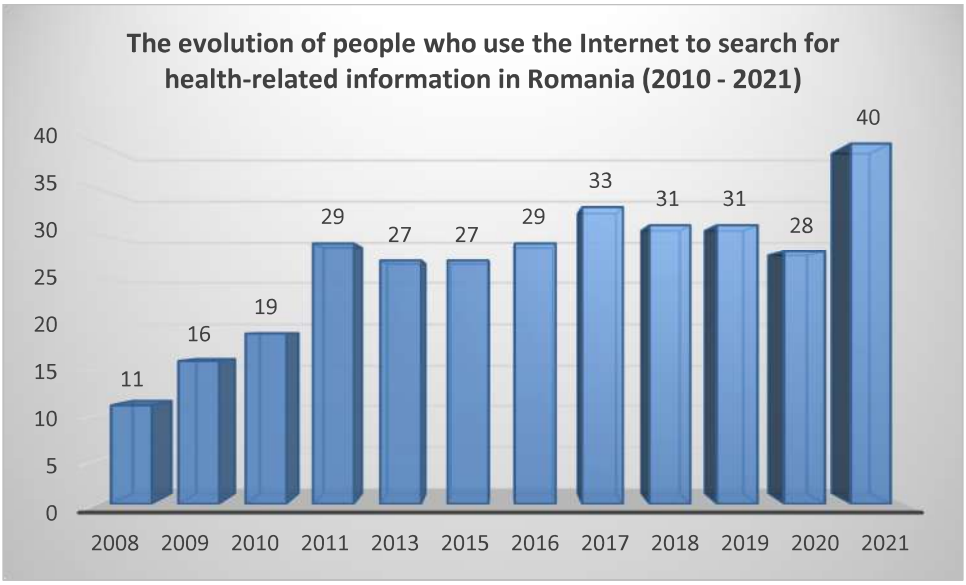


Figure 8. Evolution of Internet users to search for health information in Romania (2010 - 2021)
Source: https://ec.europa.eu/.

In the analysis of statistical data it can be seen that the population of Romania uses the Internet, there is connectivity, but there is a small percentage of people who use the Internet in interaction with public institutions. The DESI index, for digitization, is 40.1 in 2020, compared to the 71.4 average of the Member States of the European Union. In terms of digital skills, they have an index of 33.1 for Romania, compared to the EU average of 48.5, the absolute connectivity is 53.1 for Romania, while the EU average is 51.1. The private sector has a digitization of 23.8, and the EU has an average of 39.

The government's effectiveness on digitization has an index of 44.4 and an EU average of 71, while the maturity of open data has an index of 69.2 and an EU average of 78.1. At European level, eGovernment is being carried out, which compares how governments provide digital public services across Europe. The indicators used by eGovernment are grouped into 4 main top-level benchmarks: user centricity, which indicates the extent to which a service is provided online, mobile compatibility, and usability in terms of available online support and feedback mechanisms; transparency - indicates the extent to which governments are transparent about the delivery process, responsibilities and performance of public organizations, personal data processed in public services; cross-border mobility, indicates the extent to which users of public services in another European country can use online services and key factors, indicates the extent to which the technical and organizational preconditions for the provision of e-government services, such as e-identification and authentic sources, are established.

Romania ranks last for key indicators such as digital public services for citizens and businesses, e-government users and pre-completed forms. Through the National Investment and Economic Recovery Plan, launched by the Romanian Government in July 2020, with a budget allocation of 100 million euros from European funds, for the period 2021-2030, digital projects

will be supported, such as the creation of a interoperability, coupled with identification and connection to key data registers, use of electronic signatures in public administration, development of a single point of contact, introduction of electronic identity card, migration of public services to a government cloud, development of open data systems private sector to data assets held by general government, investments to increase the ability to manage cyber risks and to connect electronic tax cash registers. The pandemic has helped trigger the use of digital public services and accelerated the digital transformation through the use of information technology. Continuity in development and implementation of digitization measures would contribute to a stable increase in Romania's performance in all dimensions of DESI. [6]The modernization of the Romanian public administration must be done in order to provide digital public services that would improve the country's performance. Five of the seven digital policy areas aimed at facilitating resilience through measures in the Recovery and Resilience Plan: connectivity, human capital, e-government, digital public services and local digital ecosystems, business digitization.

Component 7 of the Recovery and Resilience Plan, "Digital Transformation", focuses on digitization. The digital amount allocated to this component is EUR 1,817 million and includes measures in several areas: digital public services, services, digital connectivity, cyber security and digital skills, human capital and the use of the internet. Thus, it can be seen that digitalization for public institutions is a priority for Romania. The lack of digitalization of public institutions may be due to several aspects such as cloud infrastructure, improving the interoperability of digital public services, the lack of IT specialists within institutions. The digitization of the Recovery and Resilience Plan will be carried out in several areas, in addition to public authorities or administration and in health, education, entrepreneurship. Also, in the European documents, annual reports found that the transport, road and rail, is not digitized, which would contribute to a sustainable transport.

At the Romanian level, the establishment of the Romanian Digitization Authority (ADR) is an important step that will help to digitize the country, especially the public administration. Thus, it has developed a Public Policy on e-Government, adopted in June 2021 and which aims to increase the number and quality of electronic services in Romania. According to studies or reports analyzing the state of digitalization in Romania, it is observed that public institutions need an increase in capacity to operate in an advanced digital environment and to provide mature electronic public services, and this aspect refers especially to a reform of digitization. The public sector needs to strengthen the general digital skills of public sector employees and to specialize ICT staff or recruit IT professionals in the public sector. This institution has created the framework for the adoption of innovative technologies in public administration for the period 2021-2027, the areas having included artificial intelligence, blockchain, open science cloud and high performance.

Through ADR in the period 2020 - 2021, the aim was to improve the National Electronic Online Payment System (ghiseul.ro), launch the implementation of the Centralized Digital Identification Software Platform (PSCID), implement the Public Policy on e-Government, an action plan for the next 10 years, establishing a program of efficient and sustainable measures for the digitization of public administration, making an inventory of existing digital public services provided by the central public administration.

Following the analysis of statistical data, information on the digitization of Romania in general and public services in particular, it was found that public institutions are not digitized, so that the non-use of the Internet by the population in interaction with the public service is due

[6] Digital Economy and Society Index (DESI) 2021 Romania.

exclusively to lack of digitization. The 2020 pandemic forced certain authorities to digitize their services or to implement existing platforms in this regard, such as the one for the payment of taxes and fees, ghiseul.ro. There is a difference in the digitization of the public sector in urban and rural areas. Thus, urban authorities (Cluj-Napoca, Iasi) have applied for various projects that contribute to the development of Smart City, and digitalization is an important component of it, which has led to support for the digitization of certain services. The digitalization of the Romanian public sector needs an integrated strategy, which should include both urban and rural areas, in order to be able to offer citizens modern, high-quality public services. In terms of connectivity, Romania is constantly evolving, and citizens' access to the Internet has a high coverage, but public services are not digitized, which highlights a problem of awareness of public authorities and reluctance to digital transformation and modernization.

Conclusion

Following the analysis, it was found that Romania does not have a digitized public sector, being at a low level. At European level, Romania ranks last in terms of digitization among its members, as all the indicators that make up the DESI index are well below the European average. Only 16% of Romanian online users use e-government services, compared to a European average of 64%. Regarding the indicator of pre-completed forms, Romania's score is 6, while the European average is 63. Regarding digital public services for citizens and businesses, respectively, Romania has a score of 44 and 49, while the European averages are 75 and 84 respectively.

The digitization of public services needs financial support, and through the Recovery and Resilience Plan projects will be supported to contribute to the digitization. At the central level, the Romanian Government established the Romanian Digitization Authority in 2020 to support the digitization of the administration. It has conducted an analysis of barriers to the digitization of the public and private sector in Romania and its report highlights several barriers: lack of an efficient and effective IT architecture, lack of information systems for central public institutions, low number of specialists in e-government and the absence of a coordinated and efficient legislative and procedural framework.

The use of the Internet by the population is at a high and increasing level in the last 10 years, but in terms of the use of the Internet for interaction with public services it is at a low level, with an increasing trend since 2020. Thus, the pandemic of 2020 forced the public authorities, the administration to develop digital services to support its activity and to be able to interact with citizens, such as the National Agency for Fiscal Administration, which developed the virtual space for individuals and legal entities. Awareness of the central authorities for the need to digitize the public administration is an important step, but its realization is a long process, which requires adequate infrastructure for digitization, ICT specialists, etc. There are premises for the digital transformation of the public service, and this aspect can be followed in the coming years, but what is obvious and can be seen refers to the fact that the COVID-19 pandemic contributed to this aspect.

The study can be continued by deepening the topic for urban and rural areas, on comparative case studies. It is also important to note whether the areas with digitization projects in Smart City's extensive development projects have managed to deliver digital public services and there is a clear difference at the national level. The certainty regarding the digitalization of the public sector in Romania is given by the fact that it is missing, that is why the citizens cannot use the internet for digital public services.

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