




Ready for the Digital Era? A Comparative Analysis of Hungary and Romania in the Field of Digital Policy

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DOI: <https://doi.org/10.24193/JSSP.2024.1.04>

Received: 05 March 2024

Received in revised form: 04 June 2024

Accepted for publication: 18 June 2024

Available online: 25 June 2024

Keywords: e-government, digital education, Romania, Hungary, public policy

ABSTRACT

The progress concerning the digital transformation of society is characterized by wide differences among different European countries, in terms of the intensity and timeline of the digital transformation. The extent of the digital transformation in Romania and Hungary is below the EU average and thus, both states need to intensify their endeavours. The present study analyses the e-government and digital education policies of the two countries, in terms of main goals, addressed challenges and predicted impacts of the digital transformation. Alongside the specific societal challenges and drawbacks, we found significant approach differences in elaborating public policies such as the coordinated and centralized approach in Hungary versus the fragmented and the more sector oriented Romanian approach. Among the similarities, we noted the optimistic view on digitalisation impacts in the analysed documents – while the benefits are widely presented, far less attention was given to the possible negative outcomes.

1. INTRODUCTION

In the last decades, digital technologies have been massively changing the global economy and the everyday life of most humans. The digital transformation was found to drive economic growth (Solomon and van Klyton, 2020; Bocean and Vărzaru, 2023), while digital technologies may support and accelerate the attempts to achieve the Sustainable Development Goals (UNDP, 2023a). However, digital transformation also poses challenges for governments, companies and citizens (Schwab, 2016). Besides, digital technologies are not risk-free, as they may negatively impact privacy, security, human rights (Royackers et

al., 2018; UNDP, 2023b) or increase social inequality (Heeks, 2022; Buchert et al., 2023).

Well aware of the prevalence of positive perceived impacts, the European Union (EU) announced the goal of a rapid and efficient digital transformation (European Commission, 2021a), by proposing ambitious targets for 2020-2030, a period that has been declared the “Digital Decade”: basic digital skills for at least 80% of the population, 100% online key-public services, increased connectivity (gigabit for everyone, 5G everywhere) and enhanced digital transformation of businesses etc. However, large differences can be noted among the EU countries in terms of digital transformation.

These differences are most accurately revealed by the Digital Economy and Society Index (DESI) indicators that have facilitated the assessment of the digital transformation of Member States and their ranking in accordance with their performance. DESI measures four main dimensions: human capital, connectivity, integration of digital technologies by businesses, and digital public services. According to its assessment of the EU members for 2022 (Fig. 1), Finland ranked first, with 69.6 points out of 100, followed by Denmark with 69.3 points. At the other end, the lower third of the ranking was mostly constituted by Eastern European countries including Hungary, with 43.76 points, and Romania, with 30.58 points. One can note the significant differences to the top-ranking countries and to the EU average (52.28 points), especially in the case of Romania, which ranked last in this hierarchy.

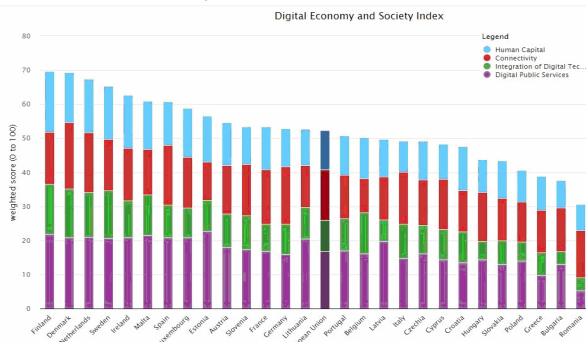


Fig. 1. Ranking of the EU Member States according to DESI 2022 (source: European Commission, 2022a).

Strategies aiming at the digital transformation were elaborated and initial steps were taken in the past decades, at the EU level. Starting with the e-commerce and copyright directives in early 2000s, the European Commission paid increasing attention to the impact of digital technologies on the European economy and society. Within the framework of the Digital Agenda for Europe 2010-2020 (European Commission, 2010) and the Digital Single Market strategy (European Commission, 2015), several advancements towards a unified European digital society were registered, such as the “Roam like at home” regulation, the GDPR Directive, regulations supporting cross-border portability of online content and reducing geo-blocking etc. Under the second Digital Agenda for Europe (2020-2030) (European Commission, 2020a), important advancements have been made by the adoption, in 2022, of the Digital Service Act (targeting online platforms and online intermediary services and aiming for safer and more transparent online environment) and the Digital Market Act (promoting competition in the digital economy and preventing the “gatekeepers” - large companies such as Microsoft, Meta, Google, Amazon etc., from misusing their dominant position).

Increasing pressure was felt by countries in the lower third of the digital development ranking to align

their policies and investments in order to accelerate their digital transformation. As a consequence, the digital divide among the European countries has narrowed over the past decade (Andrei et al., 2023), but further improvement is still needed.

In this context, several authors studied country-specific characteristics of the digital transformation: Moroz (2017) analysed the context and particularities of the process in Poland, Laitsou et al. (2020) focused on the challenges faced by Greece in this digital era, Bánhidi and Dobos (2021) on the situation of Russia compared to EU members, Nagy (2020) on the impact of digitalisation on public services, Esses and Szalmáné Csete (2022) on the digital dynamics of EU capitals etc. Besides, several comparative reports and studies offer wider perspectives that bring insights into specific challenges and possible best practices for digital transformation (e.g., Hofmann et al., 2020; Mărcuț, 2020; Andrei et al., 2023).

The COVID-19 pandemic was a turning point that implied immediate change and accelerated development on many levels. The corresponding measures (especially the lock-down) led to a large increase in the use of digital technologies, exposing both the benefits and the disadvantages of the digitalisation. Countries with lower digitalisation levels had to react and implement digital measures just as quickly as countries with developed infrastructures and advanced knowledge. Thus, a pronounced digital divide among countries, and within regions and groups of people was revealed in the context (OECD, 2020).

In terms of efficiency in adapting their digitalisation process to the challenges posed by the COVID-19 pandemic, Romania and Hungary were the two most inefficient countries among the EU27 countries, registering 61,03% efficiency, respectively, 65.01% (Georgescu et al., 2022). To put it into perspective, other nearby countries had much higher scores: Bulgaria scored 90.65%, Croatia 85%, the Czech Republic 83% etc. The authors link the low scores of Romania and Hungary to similar causes, lacking digital public services and the low level of digital skills of the population.

Switching to online education during the pandemic posed challenges to Romania, especially regarding the disadvantaged areas in terms of internet connection, devices, digital platforms, teachers’ skills in managing online classes etc. The state needed to make substantial investments in providing electronic devices with stable internet connection to schools throughout the country. In 2020, it spent more than 3 million EUR for such devices, yet, there were still many students unable to access online classes due to lack of devices or of internet access (e.g., Iași and Bacău counties each counted around 15,000 students without devices suitable for online learning) (Săgeată et al., 2023).

At the beginning of the pandemic, all schools in Hungary had access to internet for pedagogical

purposes (UIS data, 2022) while the digital skills of teachers (especially those under 40) were considered adequate (Kukucska, 2022). An online learning support system (Digital Collaboration Space/Digitális Kollaborációs Tér), in the early stages of developing (Csordás, 2018), was quickly made available. However, schools with a high share of disadvantaged children have often had problems with delivering the online education, leading to significant drop backs (Holb et al., 2022). 30-40% of children were impacted during this period while around half of the lessons in primary schools had not been delivered online, the students only receiving homework via email (Hermann and Molnár, 2022).

Online education seemed unmanageable, especially in Hungary's poorest regions, such as Cserehát, where most households do not have a computer or internet connection. Communication in these villages was done via mobile phone while paper-based education still remained, teaching material being sent by post (Cseke, 2020). In contrast to Romania, the Hungarian government only provided students with IT equipment starting from 2022, first addressing secondary technical students and then primary school classes.

Table 1. Selected DESI indicators for Hungary and Romania, 2022.

Indicators	EU	RO	HU
At least basic digital skills (% individuals)	54	28	49
Above basic digital skills (% individuals)	26	9	22
ICT specialists (% individuals in employment aged 15-74)	4.5	2.6	3.9
ICT graduates (% graduates)	3.9	6.7	3.1
Overall fixed broadband take-up (% households)	78	66	83
Mobile broadband take-up (% individuals)	87	82	84
SMEs with at least a basic level of digital intensity (% SMEs)	55	22	34
eGovernment users (% internet users)	65	17	81
Digital public services for citizens (score 0-100)	77	44	68
Digital public services for businesses (score 0-100)	84	42	76
Pre-filled forms (score 0-100)	68	19	60

(source: DESI 2022 Hungary and DESI 2022 Romania).

On this note, we regarded Romania and Hungary as interesting case-studies for a comparative analysis of their digital policies, even more so, since they both have a communist legacy and a similar level of economic development. Based on the ICT Development Index (IDI, 2023), the two countries score similarly (Hungary: 86.8; Romania: 87.0) while the

added value of the ICT sector within each country's economy is also steadily increasing.

Based on DESI indicators (Table 1), the absolute scores of the two countries suggest favourable values for several of them, such as the ones measuring connectivity - the only dimension in which both countries are close to the EU average. However, the deviation from the EU average in eGovernment and the digital intensity of the SMEs is very high. Moreover, Romania ranks last in the EU for three out of the four DESI dimensions: human capital, digital public services, and integration of digital technologies. Hungary ranks higher than Romania in this matter (places 23, 21 and 25) but still needs advancement in these domains. However, both countries have registered a generally ascending trend on the four DESI dimensions, in line with the EU, but while there still is progress, the significant gap between them and the EU average does not appear to narrow over time (see Fig. 1 in Supplementary material).

Detailed comparisons between the two countries regarding the digital transformation have been carried out by Nábrádi and Kovács (2020) on the sharing economy, Kovács et al. (2021) on the digitalisation of companies or Lipták et al. (2023) on teleworking. However, a comparison in terms of digital education or public services has not yet been published, a research gap that we are trying to address in the present paper.

2. METHODOLOGY

Our approach began with an inventory of policy and procedure documents (strategies, plans, programmes, laws) from Romania and Hungary aiming at the digital transformation in the four directions monitored by DESI (see Table 1 in Supplementary material). In order to identify relevant documents, we searched the websites of governmental agencies (e.g., the National Authority for Management and Regulation in Communications of Romania - ANCOM, the Authority for the Digitalisation of Romania - ADR, the Governmental Information Technology Development Agency - KIFÜ, National Media Infocommunications Authority, Digital Success Programme from Hungary) and read the DESI reports on Romania and Hungary for 2015-2023. We further focused on the more recent national sector strategies addressing digital education and digital public services. We analysed them according to the approach presented in Figure 2.

By using the questions listed in Figure 2, we were able to compare documents with different internal structure, content and area of interest. Alongside the overall high-level goals (expressing the vision on the digital transformation in a specific policy area), the questions address "self-perceived" national specificities regarding the domains of the strategies and the

conditions and outcomes of implementing the strategies. Highlighting society-wide factors (e.g., the level of the digital literacy, the trust in public administration) helps understand the general context of the analysed policy. The negative and positive outcomes refer to the estimated and foreseen impacts of the

policies' implementation. The findings of this research are based on the selected and analysed documents, which may represent a limitation of the study. Further information, data and recommendations might be included in other documents not yet publicly available or still under consultation.

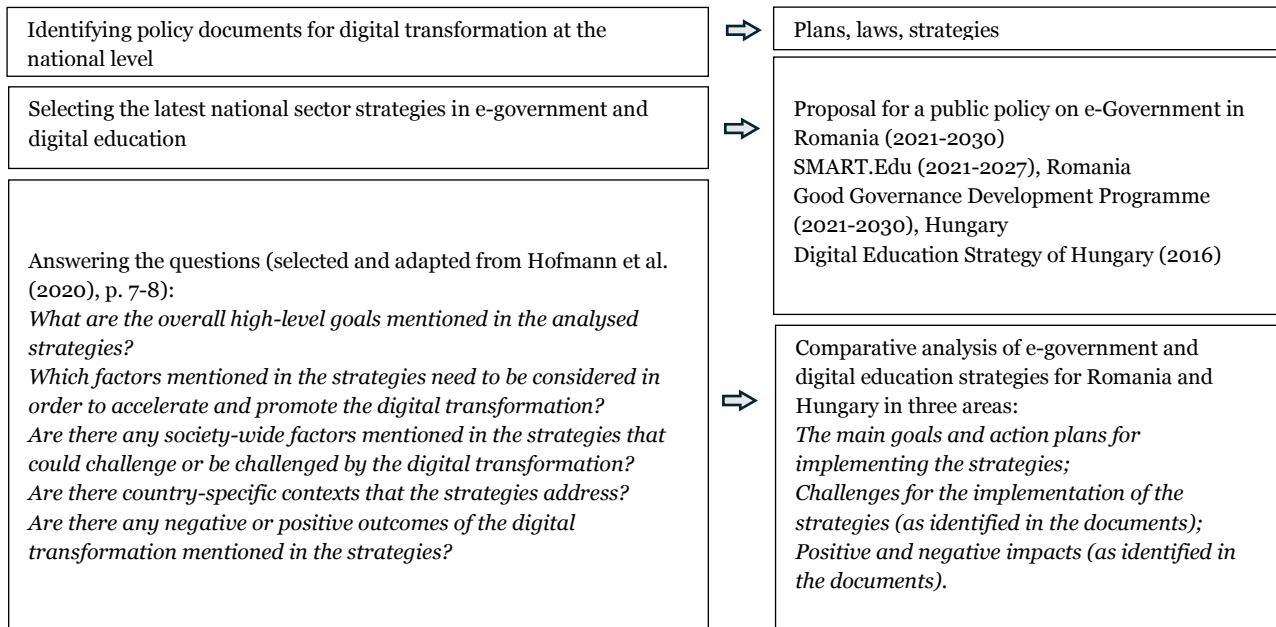


Fig. 2. Main steps of the research.

In addition, several EU reports on the Member States' progress towards the EU goals in e-government and digital education (the E-government Benchmark and the Education and Training Monitors/ETM) were also used in documenting the present study as they facilitated comparisons between the progress of the two countries. Several Eurobarometer Surveys were consulted in order to argue the awareness or perceived impact of the digital transformations: Special Eurobarometer 532, The Digital Decade (European Commission, 2023d); Special Eurobarometer 518, Digital Rights and Principles (European Commission, 2021b) and Special Eurobarometer 503, Attitudes towards the impact of digitalisation on daily lives, (European Commission, 2020b).

3. RESULTS AND DISCUSSION

The Hungarian Government adopted a first action plan on the digital transformation of the society in 2009, followed by a complete National Infocommunications Strategy, in 2014, setting out the objectives for 2014-2020. Since 2015, the public policy on digital transformation took place under the Digital Success Programmes (2015, 2017, 2019) that have been addressing the whole Hungarian digital ecosystem, aiming at making every citizen and business in the country a winner in digitalisation. Consequently, several strategies, action-plans and targeted measures (Digital Education Strategy – that we will detail later, in

comparison to the Romanian programmes, Click Grandma, E-Point countrywide, Digital Skills in Higher Education etc.) were launched, shaping the ongoing improvement in the usage rate of digital services (Cseh, 2020). The National Digital Strategy 2021-2030 (issued in 2019), sums up the main goals and initiatives for digital transformation up to 2030, including the latest strategy on e-government (also described in correspondence to the Romanian strategy in this paper).

The Romanian Government issued a first law targeting the development of the broadband in 2009, followed by a plan for the NextGeneration Network in 2015 (Supplementary material, Table 1). Alongside, the National Strategy Digital Agenda for Romania 2020 (Romanian Government, 2015), issued the same year, was transposing the EU policy (Digital Agenda for Europe 2020) into the national context. The goals related to the digital transformation of the society by 2030, in accordance with the European Digital Decade are introduced in several documents, addressing several domains: the digital economy (a Strategy for Small and Medium-size Enterprises), digital education (SMART.Edu, included in the comparative discussion later) or framework technical aspects (the governmental cloud, Strategic framework for using AI in public administration etc.).

The first integrated national policy for digitalisation and digital transformation in Romania, Digital Agenda for Romania 2020 (Romanian

Government, 2015), addressed four main domains – I) e-government, interoperability, cyber-security, cloud computing, open data, big data, social media; II) ICT in education, health, culture and e-inclusion; III) e-commerce, research and development, innovation in ICT; IV) broadband and digital services infrastructures. Still, the DESI 2020 report on Romania (DESI 2020 Romania) notes that the rate of accomplishment of these objectives is unknown. It is also unclear if there is any evaluation plan for the implementation of the strategy or any report on its progress (SMART.Edu). Several issues were also listed in a report on the challenges in the e-government domain (ADR, 2021): lacking IT architecture and general management of the public digital services, lacking IT infrastructure needed for functional services, lacking e-government experts and human resources in the IT departments of public institutions, lack of a unified legal and procedural framework for e-government.

There is a time gap in transposing the European digital policies in national documents between the two countries. In terms of e-government and digital education, Hungary issued a first Public Administration Development Programme in 2011 (Hungarian Ministry of Public Administration and Justice, 2021), much earlier than the inclusion of measures addressing e-government in the Digital Agenda for Romania 2020 (2015) and the specific strategy elaborated in 2021. On the other hand, measures targeting the digitalisation of the education systems were listed in both the Digital Agenda for Romania 2020 and the first Hungarian Digital Success Programme, issued in 2015 (Hungarian Government, 2015), while a strategy for digital education was issued in 2016 in Hungary (Hungarian Government, 2016), and 2021 in Romania.

In terms of the approach of policy making, the process was highly centralized in Hungary, where the Digital Welfare organisation (Digitális Jólét Nonprofit Kft.) had been in charge of elaborating a large share of the documents related to the digital transformation of the society (between 2015 and 2023), being followed by the Government Information Technology Development Agency (since May 2023). On the one hand, this could have had positive outcomes, by providing a high level of integration of all documents and thus, bringing clarity - as Bánhidi et al. (2020) noted, the DESI dimensions are closely related and can be effectively developed through a coherent and coordinated strategy. On the other hand, this integrative approach may have been more susceptible to rigidity due to the lack of alternative views (Nagy, 2020).

The digital policies in Romania are more fragmented, while the legal framework needed for their fast and efficient implementation is lacking (e.g., the e-government strategy containing measures related to the governmental cloud was issued before the law on the

governmental cloud). Also, in order to implement digitalisation measures on all DESI dimensions included in Romania's Recovery and Resilience Plan, several public entities were involved alongside the Ministry of Research, Innovation and Digitalisation. DESI 2022 report on Romania (DESI 2022 Romania) highlighted the need for cooperation and integration, in order to conduct a coherent and operative implementation of the above-mentioned plan. In 2020, the Authority for the Digitalisation of Romania was established as a coordination governmental agency, also issuing trimestral reports on the state of the digitalisation of the country. DESI indicators are used as one of the monitoring tools for the successful implementation of the e-government strategy of Romania, while the Hungarian strategy specifically aims at an increase of the DESI sub-index on digital public services from 57.8 points in 2020 to 75 in 2030.

3.1. E-government policies in Romania and Hungary

E-government policies are implemented in existing administrative structures that provide services to citizens. The two case-studies have different backgrounds – integrated administrative services in Hungary (based mainly on the concept of “one-stop government” centers (Kormányablak - government window) implemented since 2011 and sector administrative services in Romania (based on regional or county branches of State agencies).

In this context, the *main goal* of the e-government strategies of the two countries is to increase the efficiency of digital public services available to citizens and businesses. This goal may seem more or less ambitious, depending on what it is compared with. For the Netherlands for example, the Digital Government Agenda (NL DIGIBETER, 2018) focused on different objectives: supporting innovation, safeguarding fundamental rights, protecting public values, and “making public services more personal” and accessible to everyone (European Commission, 2023a). While indulging in this comparison, one must keep in mind that according to the eGovernment Benchmark 2023 Insight Report (European Commission, 2023b), in terms of the overall eGovernment maturity scores, the Netherlands ranked 6th in Europe (85) while Romania and Hungary scored 65, lower than the EU27 average (70).

In the Romanian document, Proposal for a public policy on e-Government 2021-2030 (2021), this main goal is further detailed by three major objectives: 1) developing the digital public services for citizens and businesses addressing live-events up to the 4th grade of sophistication, 2) increasing the capacity of public institutions to support e-services, and 3) boosting the general digital competence of public servants, and the

specialization and motivation of IT public employees. These objectives are further detailed by 14 measures addressing: the governmental hub and interoperability, digital public registries, electronic identity, e-signature for public servants, the governmental cloud, training employees of public authorities, higher payment for IT specialists working for public authorities, adjusting laws and local regulations for a successful implementation of the e-government. This document builds on the previous strategy, Digital Agenda for Romania 2020, continuing the development of the digital public services already in place and establishing new digital services that would enable a total of 36 life events to become digital.

The most recent Hungarian strategy on e-government, the Good Governance Development Programme (part of the National Digital Strategy 2021-2030) builds on the previous programme, Digital Success, and on the digital public services already in place. It addresses six strategic areas: justice, data policy, health (Electronic Health Service Space), cultural assets (Public Collection Digitization Strategy and e-Archives), municipal development, and IT and cyber-security. It aims at achieving a “digital State” through data-driven public administration, coordinated digital transformation of the public administrations on the basis of the “once only” principle, the development of accessible and customer-centric public services on platforms, and fully implementing the SZÜF (personalized administration interface) for public administrations. In fact, the strategy targets the increased use of e-government by citizens (90% of inhabitants use e-government services). Actions to achieve the digital goals were specified in 16 action areas, grouped into five main categories: coordinated, user-centric digital development of central and regional administrations (creating barrier-free, customer-centric services); establishing a data-driven administration by further enhancing interoperable data links between public registries and relevant back-end systems; developing smart villages and smart cities; increasing the information/cyber security of government electronic services, further digital development of public services (e.g., in healthcare, transport, energy, education, culture).

Reaching the main goals and implementing these strategies are highly dependent on the already made progress in implementing e-government. Most public services in Hungary have integrated digital functionalities by either using email, a website or an application. All three functionalities are available for local public services, like utilities (water, electricity), and urban public transport, but less developed for waste management, urban management, public education and public order (Cseh, 2020). Health, social services and public administration are still at an early stage of digitalisation, but they are constantly being improved. The Electronic Health Service Space (EESZT)

was established in 2017. Since its launch, the central EESZT database added more than 2 billion patient care records, 25.000 providers have joined, around 800.000 e-prescriptions are registered daily, and the public portal is accessed by nearly 40.000 people a day (NISZ, 2024). Currently, the basis for electronic identification in Hungary is the widely used Central Identification Agent service (KAÜ). As part of this, several identification solutions are available to users, including the Client Gateway/ Ügyfélkapu, the Telephone Identification Channel (RKTA), the Electronic Identity Card (ePassport), Video-based Facial Recognition (VKTA) and the Client Gateway+. Based on user statistics, the Hungarian digital public services continue to show a growing trend, confirmed by the development of the Magyarország.hu portal, the lead webpage for digital services in Hungary: the number of direct users doubled in 2023 in comparison to 2022, while the number of cases that can be requested via an online form, exceeded the 4.600 limit (NISZ, 2024). Despite many achievements in the digital public services area, further improvements are needed since Hungary is still far from the EU average.

Such examples of digital infrastructures for implementing and expanding the e-government, already in place in Romania, are: <https://eviza.mae.ro/>, an online service for foreign citizens applying for a visa, the portal of the National Office for the Registry of Commerce for companies' registration, Ghişeu.ro for the online payment of local taxes (at the beginning of 2024 it had 2 million registered users – Ministry of Research, Innovation and Digitalisation, 2024), the Virtual Private Space for citizens and businesses at the National Agency for Fiscal Administration (ANAF), the online portal for public procurement (SEAP), the web portal of the Internal Affairs Ministry (<https://hub.mai.gov.ro/>) that allows citizens to schedule appointments for passport application, among other services, Health Services (the healthcare card has been used since 2015 while the IT Platform for Health Insurance - PIAS registered more than 18 million beneficiaries, 70.000 healthcare providers in 2024 and 700.000 services per day - including 200.000 medical prescriptions, in 2022) (Romanian Government, 2022). Still, most digital public services in Romania are a mix of digital and analogue and display significant disparities: there are local administrations, mainly of large cities, that implemented several digital services (e.g., Bucharest, Cluj-Napoca, Iaşi – Vegacomp, 2022), but also many others with a very low level of digitalisation (mostly rural local administrations).

The 2022 e-government benchmark assessment (European Commission, 2022b) reveals the need for major improvements in Romania especially in the key enablers section (eID, eDocuments, Authentic Sources and Digital Post – with a level of implementation of 24%, compared to 84% in Hungary and the EU average of 68.7%), in order to increase both

the digitalisation of governmental services and the use of digital services by citizens. The same report includes the Hungarian e-government in the “Unexploited eGov scenario”, with ongoing digitalisation and high number of citizens using e-government services; the digitalisation of life events in Hungary is at 66%, and the penetration of e-government at 81%, compared to Romania with 43% digitalisation and 17% penetration rates and to the EU average of 71% for both indexes.

The Romanian strategy addresses specific **challenges** by specific measures such as the shortage of IT specialists in public administrations by a measure on increasing their income, since the higher salaries offered in the growing ICT sector of several large cities is what attracts ICT graduates in the first place, thus causing this shortage.

However, the main concerns are related to the implementation of the strategy facing several background challenges. The low level of digital literacy of the population would be the primal challenge for Romania; while 28% of adults have at least basic digital skills, only 9% have above basic digital skills (DESI 2022 Romania). For comparison purposes, the values for the EU and Hungary were 54% and 26%, respectively 49% and 22%. This issue is partially addressed by the digital education strategies; in Romania, for example, the SMART-Edu strategy lists as one of its main goals the digital literacy of 90% of the population by 2027 (an aspect further discussed in the present paper when addressing the policies on digital education). A Eurobarometer survey (Attitudes towards the impact of digitalisation on daily lives) (European Commission, 2020b) shows that only 57% of Romanians consider they possess sufficient digital skills, a percentage much lower than the Hungarian one (67%) and the EU average (68%).

The lacking digital competences of civil servants is another challenge. In 2022, the National Agency of Public Servants applied over 3200 surveys to public servants in order to assess their level of digital skills and to identify training needs. 61.8% of respondents had never taken part in a training program in the digital domain. Among those who did finish such a program, 17.7% had been enrolled in a basic course, 16% in an intermediate one and only 3.6% in an advanced course (ANPF, 2022). This is an important issue to address since the digital skills of public servants can have a considerable impact upon the efficiency and accessibility of digital public services, as well as on keeping up with the citizens' expectations (Nica et al. 2023).

Besides, Romanian public authorities not having the legal obligation to implement e-government represents another challenge, influencing the successful implementation of the strategy. Moreover, the action plans for digitalisation are not necessarily compatible with the particularities of the Romanian institutions,

which sometimes refer to the lacking clarity of procedures or the poor collaboration between public institutions (ADR, 2021). The situation is problematic also because the Digital Agenda 2020 was only partially implemented, as mentioned in the analysed documents; for example, one of the indicators that has not been achieved is the digitalisation up to 4th level of all life events, by 2020.

The background challenges described in the Hungarian document include social factors, like the aging population. The limited access to the digital world for some groups of people that do not have access to the internet, the resources or skills to use the digital services is another issue. Hungary and Romania are among the countries with the most emphasized “grey digital divide” due to the lower usage of e-services among the elderly - countries with the “Central and Eastern European welfare regime”, where, on average, 17% of seniors use e-services (Alexopoulou et al., 2022). On a different note, according to Ayllón et al. (2023), 5.4% of children aged 6-16 in Europe were digitally deprived in 2019. However, the figures vary widely among different countries, while Hungary was 4th to last, with a 11.6% rate, Romania registered the highest rate among the analysed states, of 23.1% (still, the authors mention that this phenomenon had decreased by 13.4% in comparison to 2015).

In spite of the fact that 90.8% of Hungarian households have an internet subscription, 94.9% have a mobile phone, and the network coverage in the country is 99.2% (IDI, 2023), there are still individuals and households shunned by digitalisation. At least 800.000 households are not covered by a network of up-to-date quality, while at least 300.000 households have no network coverage at all. Thus, the National Digital Strategy 2021-2030 (Hungarian Government, 2019) states the need for a support programme for ensuring wider internet access.

The Romanian strategy identifies four categories of positive **impacts** of implementing the e-government: on the national economy and the business ecosystem, the social impact, the environmental impact, and the impact on the public budget. Increased foreign investments due to the de-bureaucratisation of public services, higher productivity, increased levels of the digital skills of the population, easier access to public services for individuals with loco-motor disabilities, decreasing CO₂ emissions are all named among the possible positive benefits.

However, these positive impacts are rather unclear to the general population. In the Digital Decade Eurobarometer survey (European Commission, 2023d), regarding the foreseen importance of digital technologies in one's life by 2030, while asked specifically about online access to public services, only 67% of Romanians replied that it will be important (the lowest share among EU respondents, much lower than

Hungary's – 77%, or the EU average – 81%). Increasing cyber-security risks are mentioned as possible negative outcomes in the strategies of both countries. However, Romanians do not seem too concerned with the matter, not in comparison to other EU citizens, at least. According to the same survey, only 64% of Romanians considered that upgraded cyber-security would ease one's use of digital technologies; yet again, the lowest percentage among the EU respondents. In comparison, 73% of Hungarians considered the impact to be significant, closer to the EU average of 77%.

The increased digital divide and its impact on individuals already included in disadvantaged groups associated with the implementation of e-government (an issue highlighted by the 2022 UN DESA E-government Survey and the 2023 EU report on the Fundamental Rights of Older Persons) remains unaddressed even though this is an issue raising concern. As shown in a Eurobarometer survey on the worries associated to expanding digitalisation (European Commission 2021b), Romanians were most concerned with online accessibility for disadvantaged categories (the elderly, people with disabilities or living in areas with no internet coverage). In comparisons, the main concerns for Hungarians were related to the safety of children, cyberattacks and cybercrime. And indeed, literature points to the fact that rapid digital development is difficult to keep up with from a legal and security point of view, which can lead to problems later on (Ellebrecht and Kaufmann, 2020).

In the Hungarian document, the main positive effect associated to the implementation of the strategy is the expansion of digital services available to the citizens (SZÜF and Kormányablak services). At the same time, the document mentions cyber-security concerns linked to the low level of digital skills in the society and among SMEs employees and owners. Thus, maintaining the analogue capabilities while also diversifying the digital public services was proposed, a measure in line with the recommendations under the 7th principle, on inclusion and accessibility, of the European Interoperability Framework (European Commission, 2017). Digitalisation of Hungarian SMEs below the EU average (Table 1) has a significant impact on their efficiency and competitiveness. In most cases, mandatory developments (e-invoices, connection of cash registers to the Tax Administration) represent a financial cost for small businesses making digitisation an expensive alternative (Sántha, 2015). The connection between the lower level of digitalisation of SMEs and lower competitiveness is also described for the Romanian SMEs in a European Investment Bank report (2023) which also emphasized that, on the other hand, a lower level of digitalisation of public services is associated with a lower incentive of local small businesses to go digital.

Increasing the digital efficiency of the public administration is important for maintaining or reaching

a higher degree of public trust (Nica et al., 2023), due to the easier access to information and higher transparency (Palmisano and Sacchi, 2024). Digitalisation could thus temper the distrust in public institutions (mostly felt by the disadvantaged groups), an aspect especially important for Romania, since it was the third to last, among the 28 European states analysed by Palmisano and Sacchi (2024), in terms of share of individuals trusting public authorities (only 21.77%). In the same analysis, Hungary was in the middle of the ranking (42%, according to the European Commission, 2024).

3.2. Policies targeting digital education in Romania and Hungary

The future success of a country's digitalisation is not primarily a question of technology, but rather of human skills - openness, learning capacity, innovativeness etc. (Csath, 2019). In fact, the EU regards digital competence as a key one for lifelong learning, while highlighting its important role in all education stages and for the entire population. Digital competence is defined as "the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (European Commission, 2019, p. 10). Digital education presents a double challenge for training and education systems: developing the digital competence of their beneficiaries and using digital technologies in teaching and learning (ETM 2020). Consequently, several Member States (including Romania and Hungary) have recently reformed or are currently in the process of reforming the school curricula related to digital competences (Eurydice, 2019).

The educational system in the two countries is similar, but with several significant differences – the age for starting the compulsory education (pre-school level) is 5 in Romania and 3 in Hungary. Primary education is composed of 5 years in Romania (starting with a preparatory year) and 4 years in Hungary. It is followed, in both countries, by the secondary education and the upper secondary levels, implying various educational paths – vocational training (more common and with more possible paths in Hungary), technological education, theoretical education, summing 1-5 years in Hungary and 3-4 years in Romania. The compulsory education is up to 16 years in Hungary and 18 years in Romania. Post-secondary non-tertiary education (1-3 years in Hungary and 3 years in Romania) and tertiary education (2-6 years in both countries) is optional (Eurydice, 2023). The national strategies for the digital education in both countries are mainly oriented towards the pre-tertiary education.

In what concerns *the main goal* of the digital education, both analysed documents – the SMART.Edu (2021-2030) strategy of Romania and the Digital Education Strategy of Hungary (2016) – focus

on the complete restructuring of education and training systems. The main expected outcome is a higher level of digital literacy: 90% of the population for Romania and more than 98% of the population aged 16-71 for Hungary. Reaching these targets would contribute to the increased economic competitiveness of both countries as a result of better education and training systems (including lifelong digital learning opportunities). The Romanian strategy gets more specific on this aspect, advancing the implementation of an adapted curriculum for emergent occupations (related to the digital transformation and the green transformation of the society) and a targeted employment rate of 84% of individuals aged 20-34, trained for emergent occupations. In the Hungarian case, the specific digital competences that need to be promoted by the education system are detailed in the more recent National Digital Strategy (Hungarian Government, 2019). Providing internet access, digital infrastructure and learning resources for all students, training teachers to use digital technology in education and supporting the digitalisation of the administrative area of the education systems are essential measures for achieving the strategic goals of these strategies. In addition, while aiming at the successful integration of the digital technologies in the everyday life of the population, both strategies emphasize the need for education in cyber-security, online safety, data protection and ethical behaviour in the digital world. In Hungary, some of these aspects were also addressed in the Digital Child Protection Strategy of Hungary, that facilitates the control of portable smart devices and of content available on the internet (parental control, teacher restrictions), thus protecting children from harmful content, online bullying etc.

Among the **challenges** that need to be overcome for successful implementation, the Romanian strategy lists: the under-funding of the public education and training system, the high rate of early school leaving, the inequalities (large differences in infrastructure and results between the elite and the disadvantaged schools) and the large digital divides between urban and rural areas, and between young and older adults. Some more specific aspects, such as the decentralized IT infrastructure of schools, associated with increasing cyber-security risks, and the low level of digital competence of some teachers are also addressed. The Hungarian strategy for digital education mentions as challenges the rejection of digital technologies in an aging society and the discrepancies between the skills required by the industry and the need to prepare the children for the future, especially in vocational education and training (VET). Other specific aspects mentioned in the document that are to be addressed include: sub-optimal internet connection, lack of digital infrastructure and services for schools (e.g., interactive displays, non-stop IT helpdesk), of tools for the digital

education of disadvantaged children, as well as of digital preparedness of teachers in VET etc.

The increasing cyber-security risks are the only possible negative **impact** mentioned in the documents in relation to the implementation of digital education policies. There are many more positive outcomes mentioned in the Romanian strategy, among which: a high-quality education system that is digitalised, flexible and capable of generating change and innovation, active citizens, well integrated into the digital labour market, and sustainable economic growth based on emerging occupations. The implementation of the Hungarian strategy would result in higher chances for students and trainees to find employment on the labour market and an increased availability of an open access curated educational content.

When comparing the two strategies, one must keep in mind the five-year gap between the issue of the two documents, that gave the Hungarian Strategy more time for implementation. However, the need for further advancement in increasing the digital skills of children and teachers is highlighted, both for Romania and for Hungary, in the section addressing digital education from the European report Education and Training Monitor (ETM, 2020). Children in both countries have lower levels of digital competence than the EU average: 57% of those aged 16-19 in Romania have at least basic digital skills compared to 73% in Hungary and to 82%, the EU average. Important differences can also be observed in terms of the steps that have already been taken. According to the same report, a Digital Pedagogical Methodology Centre was established in 2016 in Hungary. This agency developed a digital competence framework (based on the EU framework), launched a Digital Thematic Week, supported schools in implementing digital development plans and supported their collaboration with other actors for the digital education of children. It also had an important role during the COVID-19 pandemic in supporting teachers using digital pedagogy. Other action directions included the „digital culture” subject being introduced in the core curriculum in 2020 and the ongoing assessment of children’s digital competence, carried out at the upper secondary level for students in specific educational pathways, such as STEM (Eurydice, 2019).

Even before the SMART.Edu strategy, several measures were taken in Romania in order to update the curriculum, e.g., ICT became a compulsory subject in lower secondary education in 2017 and digital competences of all students in upper secondary education have been assessed since 2010 in a national final exam, equivalent of a European Computer Driving License. It is noteworthy that the Romanian curriculum had the highest number of hours related to digital competence as a compulsory subject in upper secondary education in the EU (Eurydice, 2019). Other measures were taken to address the urban-rural inequalities - e.g.,

the RoNet national programme, meant to improve the connectivity of schools in rural areas. However, as noted in the Eurydice report, improving the digital infrastructure does not imply that digital technology will be immediately integrated in teaching activities.

The online and hybrid schooling during the COVID-19 pandemic revealed the varying levels of digital competence and access of teachers and students to the digital world, in both countries. Besides, the ETM report (2020) highlighted that the shift to online learning emphasized the already present inequalities all over Europe. When referring to these inequalities, the socio-economic background (the occupation and level of formal education of parents) is still the most important factor influencing the educational outcomes of children (ETM, 2020). Romania and Hungary display very high values in what inequalities are concerned. Based on the results of PISA tests, Romania displays the largest difference in the EU in what regards the children performance in relation to their socio-economic status: only 10.8% of students from advantaged backgrounds underachieved in PISA tests, compared to 49.8% of children from disadvantaged backgrounds. Bulgaria, Slovakia and Hungary are also revealing large differences, with Hungary registering underachieving scores of 3.3%, and 32% respectively (ETM, 2023). For comparison purposes, the lowest difference was recorded in Estonia (2.1% and 7.2%), but in this case, the Estonian authorities took on an extended education reform in the 1990s (OECD, 2016) and have consistently based their development policies on supporting the digital transformation.

4. CONCLUSIONS

Both analysed countries score below the EU average in terms of digital transformation of their economies and societies, and while Hungary occupies the 22nd place in the DESI 2022 ranking, Romania seems stranded on the last place. The need for the two countries to implement new measures to increase their performance in almost all areas of the Digital Compass is more and more pressing. For now, both countries have integrated the goals and direction actions of the European digital policies in national and sector strategies, laws, plans and programmes. However, the particular national contexts and a later start, especially in the case of Romania, have contributed to a persistent digital divide between these countries and the ones more advanced at the digital transformation of their societies.

In Hungary, the policy making process has been more coordinated and centralized than in Romania, where the institutional fragmentation and the often-lacking associated legal framework resulted in delays and incomplete policy implementation. The sector approach was more present in Romania, while in Hungary, the digital policies were created under the

framework of the Digital Success Programmes that supported the cooperation between public and civil actors across sector divides, an essential aspect for successful implementation. In Romania, the creation in 2020 of the Authority for the Digitalisation followed the same goal.

In general, an optimistic view on the digitalisation of the public services and education is present in the analysed documents. While the benefits of the digital transformation are largely presented, far less attention was given to its risks and possible negative outcomes. International reports have shown that e-government may increase social inequalities, and groups of people with low digital skills might be excluded from the digital society. While the Hungarian strategy for e-government addresses this by proposing to maintain an analogue path for accessing public services, the Romanian strategy does not address the issue at all. However, a similar overoptimistic view on the digital transformation of the society was identified in a comparative study (Hofmann et al., 2020) on the e-government strategies of Denmark and Germany. While the first strategy list, as negative consequences of digitalisation of public services, the vulnerability of the interconnected IT systems and cybercrime (mentioned twice in the text), and the later mention no negative impacts, various positive consequences of the digitalisation were mentioned 72 times in the Danish e-government strategy and 7 times in the German one.

The low level of digital skills of the population is a major impediment for the rapid implementation of the e-government in Romania and Hungary, and hinders the potential economic progress from capitalizing on the new digital technologies. Moreover, large inequalities in educational outcomes in the case of children, based on their socio-economic background, and the persistent digital divide between rural and urban areas are important challenges for the implementation of the digital education policies.

Besides, both strategies on digital education are mostly oriented towards children and young adults and to a far less extent to the digital education of other demographic categories. Although many studies revealed that children born and raised in a digital world do not inevitably get a high level of digital competence (Fraillon et al., 2018), they are still generally more digitally competent than other demographic groups. The least digitally competent group represents the old adults, and this situation is not bound to change soon as both strategies address lifelong learning in a limited way.

Several recommendations found in international reports, such as “moving from small changes to transformation” (Institute for Government, 2016) can also be applied to the studied countries. For Romania this would mean the integration of as many e-government services as possible (disparate, at present), a better collaboration between the institutions that

design the strategies, the ones that implement them and the final beneficiaries, the strengthening of the central institutions in charge of digitalisation and a progress monitoring that would more clearly highlight the need for future action and course correction.

Besides, we can recommend a better communication between policy makers and the population, for raising awareness on the impact of digitalisation. As seen from the Eurobarometer surveys quoted throughout the present paper, Romanians do not seem fully aware of the magnitude of the digitalisation transformation. Overall, 40% of Romanian respondents considered that digital technologies (in general) will not be important in their life by 2030 (European Commission, 2023d), twice as much as the EU average of 20%. Besides, only 25% of Romanian respondents believed that digital tools and the internet will bring more advantages than disadvantages, a much lower share than Hungarians (39%) or the EU average (41%), a fact that might suggest that the overall optimism present in official strategies might not be perceived as such by the population. As digital technologies progress rapidly, further digital exclusion must be avoided, and a socially fair digital transformation must constitute a priority. Universal digital skills have an essential role in the socially fair digital transformation (European Commission, 2023c), thus a stronger commitment to make necessary investments in the matter is crucial. While both Romania and Hungary are among the countries struggling on many levels, as we have seen throughout the present paper, some of the issues are currently being addressed. However, digitalisation plans cannot be enough to ensure a socially fair digital transformation in the absence of a successfully implemented strategy on improving the social protection system. Besides, specific programmes should support the groups most at risk of falling behind in terms of digital opportunities (the elderly, early school leavers etc.). While targeted scholarship schemes could support the training of IT professionals. The time factor is also very important; current education needs to be adapted to the renewed needs of the labour market, which also requires the renewal of the educational syllabus and learning framework.

Based on the policy documents, strategies and action plans that we have analysed, we conclude that both countries are open to the digital transformation and are prepared for the changes to come. Most infrastructure investments are already under way (more than 90% of households are connected to the internet, network coverage is almost complete); digital services are already functioning at basic levels of government and have become widespread in education since the COVID-19 pandemic. Both countries have achieved increases in DESI sub-index scores between 2017 and 2023. However, since rapid and accelerated changes

have been on-going in the other EU countries as well, this change (while significant) is not yet reflected in the ranking.

5. ACKNOWLEDGMENTS

The research reported in this paper was supported by the Joint Research Project of the Romanian Academy and the Hungarian Academy of Sciences "The relationship between innovation ecosystem and creative industry in the development of regional centers" (2022-2024).

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SUPPLEMENTARY MATERIAL

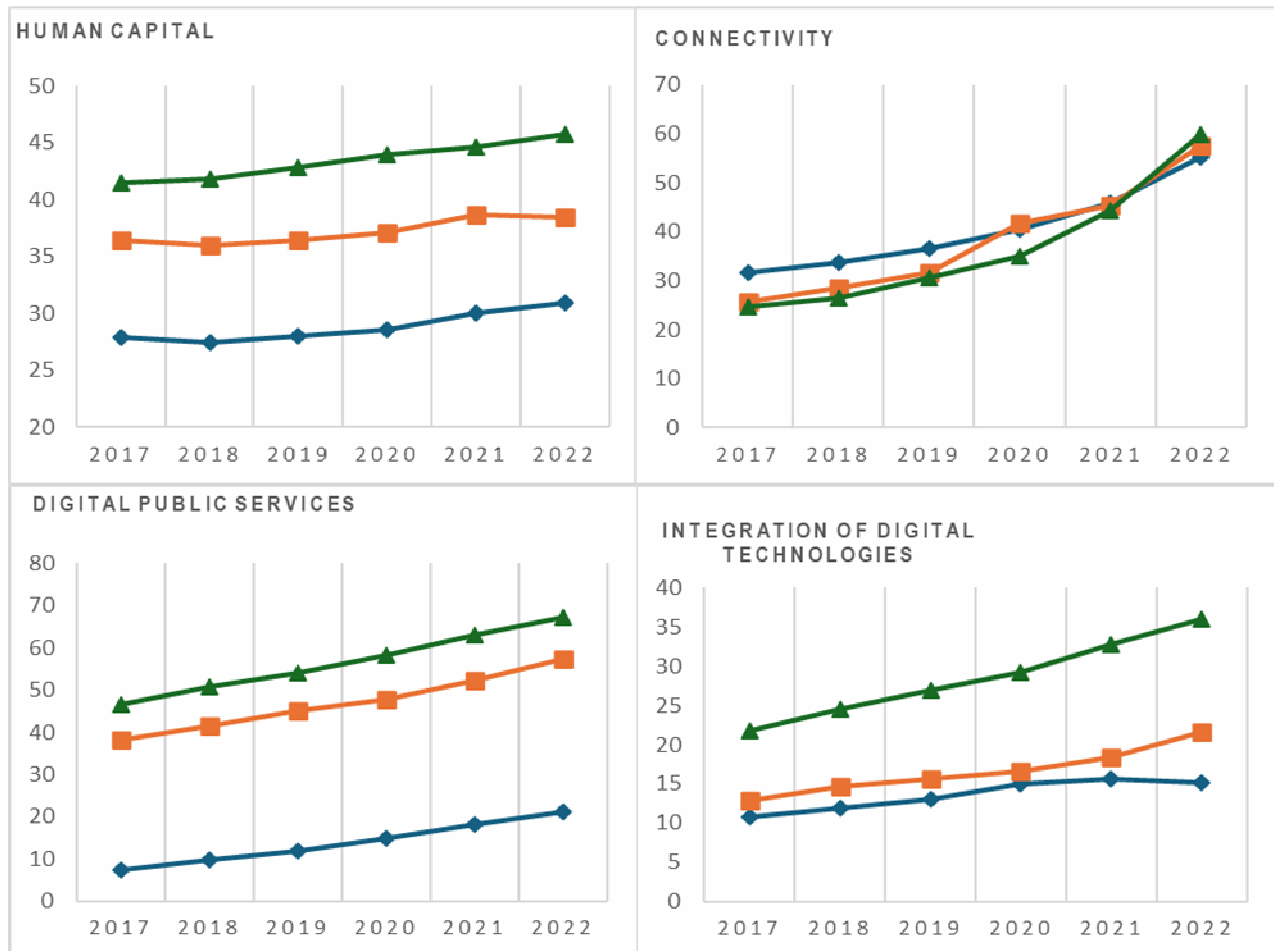


Fig. 1. The progress of the digital transformation in Romania and Hungary based on main dimensions of the DESI (weighted score (0 to 100)) (data source: European Commission, 2022a).

Table 1. Timeline of the digital policies in Romania and Hungary.

ROMANIA		YEAR	HUNGARY		MAIN EU DIGITAL POLICIES
Documents	Issued by/Author		Documents	Issued by/Author	
Strategy for Broadband 2009-2015	Romanian Government	2009	Action Plan for the information and communication sector	Hungarian Government	
		2010			A Digital Agenda for Europe (2010-2020)
		2011	Public Administration Development Programme	“Digital Welfare” Organisation	
		2014	<input type="checkbox"/> National Infocommunications Strategy 2014-2020	Association of the Chambers of Commerce and Industry	
			<input type="checkbox"/> Public Administration and Public Service Development Strategy 2014-2020	Hungarian Government	
<input type="checkbox"/> National Plan for the Next Generation Network Infrastructure	Romanian Government	2015	“Digital Success” Programme	“Digital Welfare” Organisation	A Digital Single Market Strategy for Europe
<input type="checkbox"/> National Strategy “Digital Agenda for Romania 2020”					
ANCOM’s strategy for digital communications up to 2020	ANCOM	2016	<input type="checkbox"/> Digital Education Strategy	Hungarian Government	
	(National Authority for Management and Regulation in Communication)		<input type="checkbox"/> Digital Start-up Strategy	“Digital Welfare” Organisation	
			<input type="checkbox"/> Digital Child Protection Strategy		
			<input type="checkbox"/> Digital Export Development Strategy		
		2017	<input type="checkbox"/> “Digital Success” Programme 2.0	“Digital Welfare” Organisation, Hungarian Government	
			<input type="checkbox"/> 5G Coalition		
<input type="checkbox"/> law on network security (law 362/2018)	Romanian Parliament	2018	Network and Information Systems Security Strategy (1035/2012. II. 21.)	Hungarian Government	The Digital Education Action Plan (2018-2020)
<input type="checkbox"/> law on GDPR (law 190/2018)			Artificial Intelligence Coalition		
			<input type="checkbox"/> law on GDPR		
The Strategy „5G for Romania”	ANCOM and the	2019	<input type="checkbox"/> National Digitalisation Strategy 2021-2030	Hungarian Government,	
	Romanian Government		<input type="checkbox"/> “Digital Success” for 2030 Programme	“Digital Welfare” Organisation	
				<input type="checkbox"/> Digital Agriculture Strategy	

establishment of the Authority for the Digitalisation of Romania (ADR)	Romanian Government	2020	<input type="checkbox"/> The National Strategy on Artificial Intelligence	“Digital Welfare” Organisation,	The Digital Decade policy programme (2020-2030)
			<input type="checkbox"/> establishment of the National Data Assets Agency	Hungarian Government	(monitored by DESI and the Digital Compass)
			<input type="checkbox"/> Digital Competence Framework for Education		The Digital Education Action Plan (2021-2027)
			<input type="checkbox"/> Smart Village Programme		
<input type="checkbox"/> SMART.Edu – Strategy for the digitalization of the education (2021-2027)	Romanian Government and	2021	<input type="checkbox"/> Drone Coalition	“Digital Welfare” Organisation	
<input type="checkbox"/> E-Romania. Public policy on e-government (2021-2030)	the Authority for the Digitalisation of Romania		<input type="checkbox"/> establishment of the National Knowledge Centre for Data		
<input type="checkbox"/> Strategy for the cybernetic security 2021-2026			<input type="checkbox"/> Digital AgrarAcademie		
<input type="checkbox"/> law on the governmental cloud,	Romanian Parliament		<input type="checkbox"/> Digital Network Research Strategy		
<input type="checkbox"/> law on the interoperability of the information systems		<input type="checkbox"/> Blockchain Coalition	Digital Services Act		
<input type="checkbox"/> Strategic framework for using AI in public administration (2021-2027)		<input type="checkbox"/> Smart City Platform			
<input type="checkbox"/> The strategy “SMEs in the digital economy” (2021-2027)	The Authority for the Digitalisation of Romania	In the making	<input type="checkbox"/> National Digitalisation Strategy	Digital Hungary Agency	
			<input type="checkbox"/> Digital Citizenship Programme (2023-2027)		