

Digital Skills of Civil Servants: Assessing Readiness for Successful Interaction in e-society

Yuriy Bilan^a, Halyna Mishchuk^{b,c}, Natalia Samoliuk^c

^aBioeconomy Research Institute, Vytautas Magnus university, K. Donelaičio g. 58, 44248 Kaunas, Lithuania, E-mail: y.bilan@csr-pub.eu

^bPan-European University, Faculty of Economics and Entrepreneurship, Bratislava, Slovakia, Tomášikova 20, Bratislava, Slovakia, E-mail: halyna.mishchuk@paneurouni.com

^cNational University of Water and Environmental Engineering, Department of Labor Resources and Entrepreneurship, 11 Soborna st., 33028 Rivne, Ukraine, E-mail: {h.y.mischuk, n.m.samoliuk}@nuwm.edu.ua

Abstract: In spite of the exceptional role of digital skills in the development of e-society, there is an obvious lack of agreed tools to assess the level and deficit of those digital competencies, regarding the functional responsibilities for any professional tasks. In this research, the authors tested the most ubiquitous approach to measure digital skills development, which is justified by EU experts, in DigComp 2.1. Our analysis is performed using the survey of civil servants, as a group of frontline professionals, responsible for digital society development, particularly for, e-government development. Our representative survey covered 428 civil servants in Ukraine. This group was chosen considering the high impact of e-government development on economic results (GDP and global competitiveness index), which is defined by authors with correlation coefficients of 0.649 and 0.872 respectively, in the EU. At the same time, we found that the digital skills of civil servants in Ukraine cannot be considered as well-developed, since their average best level, is equal to 6 points on an 8-point scale. The most obvious lack of digital skills, is a character for the field of competencies “digital content creation”. In addition, obstacles in public servants’ digital skills development are connected with a low level of population’s readiness to digital services and other digital tools usage. These results can be considered not only in the light of inappropriate digital competencies development in the public administration sphere but also with the methodological gaps in digital competencies measurement. Particularly, in our research, we proved that the framework for digital skills assessment should be developed using a flexible approach (optional skills of certain levels of professional orientation and complexity), but at the same time, functional responsibilities for professional tasks within the qualification characteristics of certain positions should be considered.

Keywords: digital skills; DigComp 2.1; e-society; civil servants

1 Introduction

Digital skills are becoming an important component of professional competences in almost all areas – this is emphasized by experts from the International Labor Organization (ILO) in their World Employment and Social Outlook, dedicated to transforming the world of work. Understanding the importance of such skills and the rapid development of opportunities for their implementation leads to the fact that “many governments in developing countries are investing in digital infrastructure and supporting training programs developed by the private sector to equip the workforce with digital skills” [1, p. 31]. An important factor influencing the understanding of the role of digital skills was the pandemic and the resulting limitations on traditional communication and employment opportunities. At the same time, even before the pandemic, the importance of developing IT skills was recognized internationally. Thus, in the thematic report of the UN Secretary General in 2018, attention was focused on the fact that IT has become an objective reality of life, as a result of which up to 90% of jobs will inevitably be associated with their use by 2030, and 75 to 375 million people (from 3 to 14% of the human workforce) will be forced to change professions due to the spread of IT [2, p. 12]. At the same time, a significant challenge for reaping the benefits of innovative development is that even in the most developed OECD countries, 56% of the population do not have IT skills [2, p. 3]. By the esteems of the International Telecommunication Union (ITU), a third of individuals lack basic digital skills, such as copying files or folders or using copy and paste tools; a mere 41% have standard skills, such as installing or configuring software, or using basic formulas on spreadsheets. Only 4%, are using specialist languages, to write computer programs” [3].

The low level of digital skills sometimes has a catastrophic impact on business due to sudden stops in sales and revenues because of the low development of digital communication channels with customers, underdeveloped opportunities and skills of remote activity. But digital skills shortage is particularly dangerous in the area of public administration, given the crucial importance of this area in ensuring the functioning of the economy, the social sphere and national security. The development of e-society in the context of many challenges that limit the spatial mobility of the population is becoming more than just an additional and convenient way of interaction. Improving and gaining a sufficient level of digital competence, especially for civil servants, is vital to maintain security and effectiveness in the face of large-scale threats, including pandemics, wars and other global risks.

Despite the importance of digital skills for modern society, there is no reliable and agreed Framework for Digital Competencies of the Population. With varying levels of detail according to research objectives, the ITU Digital Competence Classification (too generalized three-level digital skills scale) [3] and the updated version of the DigComp 2.1 Digital Competence Framework, developed by EU experts, in which 21 digital skills are assessed according to eight levels of mastery [4]. The disadvantage of this and other methods of assessing digital skills is their

low adaptability to the specifics of professional responsibilities, the difficulty of applying in order to identify the shortage of digital skills for a position at a certain level. At the same time, the assessment of digital skills of specialists involved in public administration is the most relevant area of relevant research, given the growing role of their professional qualifications in ensuring the development of countries. Thus, significant social progress has been made in countries where such skills are well developed in e-government systems. This is shown in the experience of Estonia, where 99% of government services are digitally based [5, p. 8].

Due to the underdevelopment and debatable methodological framework for assessing the level of digital skills, the problem of linking digital skills of civil servants and their role in the development of e-society is considered mainly in light of related issues – the formation of digital public administration, risks associated with digitalization of public administration processes, the impact of e-government on the economic success of countries, etc. At the same time, the assessment of the level of civil servants' digital skills and the lack of their digital skills to perform professional tasks belongs to those research objects to which scientific attention is many times lower than the importance for the development and security of society.

Considering this, we aim to assess the links between e-government and economic development (GDP and competitiveness) in our study, as well as to test the most ubiquitous approach to measure digital skills development, justified by EU experts in DigComp 2.1, for analysis of public servants' digital skills.

2 Literature Review

Digital skills are among those skills that determine the possibilities of professional success in various fields. Even in the pre-pandemic period, the benefits of employment with a combination of digital tools were evaluated in many professional fields. Their list has expanded significantly from the IT market and online commerce to the use of physicians for therapeutic purposes [6], significant progress in the use of digital technologies by school teachers [7], entrepreneurship education [8] and even in music with active involvement of students in musical instruments making by means of digital technologies [9]. Of course, the main area of implementation of digital tools, and hence the development of digital skills, remains the field of IT, which due to its own rapid development has given a powerful impetus to the improvement of electronic data exchange, e-commerce. As a result, it has provided rapid economic growth and enhanced macroeconomic stability in countries where the economy is based on the benefits of digital development [10-15]. This pattern is characteristic both of the economy as a whole and of the digital development of its individual segments, such as financial services [16-20], industrial technologies using robotics [21] etc. At the same time, not only in IT, but also in other activities, the use of digital technologies and, consequently,

the development of digital skills has made it possible to benefit from competitive advantages and avoid or reduce economic devastation, the risk of which is high due to the global pandemic. Under these conditions, the use of remote employment on the basis of telework [22] [23], in particular, in the form of “home office” [24] and employee training opportunities, which includes relevant professional development programs, in employer value propositions, became relevant and widespread [25].

As a result, digital skills are increasingly referred to as “must-have soft skills” [26] and not only in the professional sphere. Thus, according to experts of the European Commission, “Basic digital skills have become necessary for both daily lives and employability, setting foundations for embracing the digital world. In the near future, 9 out of 10 jobs will require digital skills” [27].

Because of the importance of digital skills, experts of the European Training Foundation emphasize that the ability to correctly apply digital skills is the basis of digital competence, which, in turn, is one of the eight key competencies for lifelong learning in the EU since 2006 [28, p. 25]. In addition, the report clearly defines the relationship between digital competence and skills: “Digital competence referred to as digital literacy, encompasses a set of basic digital skills, covering information and data literacy, online communication and collaboration, digital content creation, safety and problem solving. Digital competence is about the ability to apply those digital skills (knowledge and attitude) in a confident, critical and responsible way in a defined context ” [28, p. 25].

At the same time, while scholars focus on the development of digital skills, in the field of public administration such research focuses mainly on communication using digital capabilities, rather than the development of digital competencies of civil servants. Thus, the well-known positive consequences of the digital transformation of public administration, which is manifested in the successful use of e-government, undoubtedly include overcoming corruption and increasing transparency of public dialogue [29] [30], general improvement of public services [31] [32], increasing the opportunities for cooperation with the community to achieve various goals set in their own strategies [33], including sustainable development [34] [35], etc. Achieving these results requires high professionalism of civil servants, which prompted the relevant research. At the same time, attention paid to the development of digital skills is insufficient – such skills are analyzed mainly from the standpoint of the application of other skills typical of managerial positions. In particular, in the study of Romanian scientists, digital / IT skills are identified as the most important of the soft skills among the competencies required for employees of e-government services; of high importance with them are such skills as collaboration, problem-solving approach, customer orientation, design for solutions, flexibility, initiative, ability to innovate [36, p. 10].

The economic impact of better application of digital skills in e-government is very high. According to the study conducted by the European Commission, only part of e-government services such as electronic invoicing and e-procurement leads to very

significant budget savings: “In Denmark, electronic invoicing saves taxpayers € 150 million a year and businesses €50 million a year. If introduced across the EU, annual savings could exceed €50 billion. Meanwhile, in Italy, e-procurement systems cut over €3 billion in costs” [37].

Understanding the benefits of digital development in public administration, considerable attention is paid to the development of networks, the pressure imposed on civil servants, including their burnout [38], training of civil servants in the proper use of ICT [39] and general training in digital technology, [40] [41], digital leadership [42]. At the same time, it is common to study the impact of digital skills of civil servants on macroeconomic indicators such as GDP, as well as some partial characteristics of civil servants themselves – as it is proposed to analyze, for example, using the results in productivity and efficiency, effectiveness, inclusion and sustainability, legitimacy and trust [43] or performance indicators under conditions of improving ICT network readiness [44].

At the same time, due to the lack of a unified global framework for the assessment of digital competencies, research on their development in the field of public administration is mainly reduced to the use of the authors of too generalized characteristics of digital skills. Such approaches are often a continuation of the classification used by the ITU [3]. But even such approaches can reveal a huge shortage of digital skills. In particular, in Ukraine, on the example of which our study was conducted, the Ministry of Digital Transformation has twice conducted an analysis of digital skills development of the population. According to the organizers of the study, from 2019 to 2021, there was some progress, but, in our opinion, it cannot be evaluated as significant: the share of the population with “No skills” and “Low skills” decreased from 53.0% (15, 1% “No skills” and 37.9% “Low skills”) in 2019 to 47.8% in 2021 (11.2% “No skills” and 36.6% “Low skills”) [45, p. 27]. Only the decrease in the share of the population with completely absent skills has a certain positive effect, but the general level of the low development of digital skills of the population, of course, will not allow using all the advantages of e-government effectively. For Ukraine, such opportunities are extremely important, given the high share of the shadow economy [46], which can be most effectively eradicated by increasing transparency in relations with government. In addition, digital skills, especially their development in civil servants, will allow implementing ambitious plans for the development of information society till 2024: 100% of public services should be available to citizens and businesses online; six million Ukrainians will be involved in the digital skills development program [47].

Given the existing limitations in the methodology of research of digital competencies and the lack of methodological foundations for assessing the digital skills of civil servants, our study is aimed at assessing the willingness and readiness of civil servants to interact in e-society.

In this regard, our research tasks (RT) are:

- RT1** Examining the links between e-government and the macroeconomic success of countries
- RT2** Assessing current level and deficit of digital skills of civil servants on the basis of the most detailed framework of digital competencies used today in European countries - DigComp 2.1
- RT3** Assessing changes in the communications efficiency by the introduction of electronic services for the G2C segment (government to citizens)

3 Methodology

The answers to the research tasks were obtained by the authors using information that characterizes the results of the implementation of e-government in the international and national dimensions.

Thus, data on the E-Participation Index (the EPI) [44] and the E-Government Development Index (EGDI) [48] for 2012-2020 were used to solve **RT1**. Based on this information, the authors studied the dynamics of the digital transition of the world in four groups studied within the UN e-Government Survey. In particular, 8 years of observations allow assessing trends in the distribution of countries according to the level of development of e-government – according to the division into 4 groups: low, medium, high and very high levels of development.

The assessment of the development of e-government in the international dimension is based on these factors, given that EGDI illustrates the general readiness and capacity of national governments to use information and communication technologies (ICT) to provide public services, and EPI is frequently used to operationalize the success of government efforts to promote electronic tools of engaging citizens in policy-making, and to test theories on e-participation development and diffusion across nations.

That is, in our chosen segment of research and implementation of digital skills of civil servants (G2C), these indicators best characterize the current state of the digital infrastructure of public administration (EGDI), as well as the results of its perception by the population (EPI).

The assessment of the impact of these factors on macroeconomic results was carried out in the group of EU countries using the following results, which most comprehensively characterize macroeconomic success:

- Real GDP per capita [49]
- Global Competitiveness Index (GCI) [50]

Thus, indicators of the level of e-government (EGDI, EPI) are considered to be the independent variables and the performance indicators (GDP, GCI) are considered to be the dependent variables.

For the purpose of data comparability, the data for 2018 in which all estimated indicators are available are used. The analysis of relationships was performed on the basis of correlation analysis, in particular Pearson's correlation coefficient.

To respond to **RT2** and **RT3**, the authors conducted a survey of civil servants as a group of frontline professionals responsible for e-government development. Our representative survey covered 428 civil servants in Ukraine. The sample is formed of civil servants directly involved in e-government relations, who are undergoing advanced training at the Institute of Postgraduate Education of the National University of Water and Environmental Engineering at the request of the National Agency of Ukraine for Civil Service. Respondents were civil servants from 13 regions of Ukraine, who underwent advanced training during September - December 2021. The training of the civil servants was organized using online services in order to ensure the possibility to be involved from different regions even under the pandemic threats. Considering this fact, our review was conducted using online tools, particularly, google forms questionnaire, which does not require advanced digital skills. Therefore, even servants the minimal digital competences could provide their responses.

Thus, taking into account the total number of civil servants (registered number is 184,944 persons as of the 4th quarter of 2021, according to the National Agency of Ukraine for Civil Service [51, p. 2]), the margin of error is 4.73% at the confidence level of 95%, which indicates a high correlation for the results of the study.

Assessment of digital skills of civil servants was conducted on the basis of DigComp 2.1 - Digital Competence Framework [4]. According to it, the availability of 21 digital skills at 8 levels of proficiency was assessed (as recommended by the authors of the Framework). To facilitate the visualization of the results, we used the symbols shown in Table 1.

Table 1
Digital Competence Framework

Symbol	Digital skill
S1	INFORMATION AND DATA LITERACY
S1.1	Browsing, searching and filtering data, information and digital content
S1.2	Evaluating data, information and digital content
S1.3	Managing data, information and digital content
S2	PROBLEM SOLVING
S2.1	Solving technical problems
S2.2	Identifying needs and technological responses
S2.3	Creatively using digital technologies
S2.4	Identifying digital competence gaps
S3	DIGITAL CONTENT CREATION
S3.1	Developing digital content
S3.2	Integrating and re-elaborating digital content

S3.3	Copyright and licenses
S3.4	Programming
S4	COMMUNICATION AND COLLABORATION
S4.1	Interacting through digital technologies
S4.2	Sharing through digital technologies
S4.3	Engaging in citizenship through digital technologies
S4.4	Collaborating through digital technologies
S4.5	Netiquette
S4.6	Managing digital identity
S5	SAFETY
S5.1	Protecting devices
S5.2	Protecting personal data and privacy
S5.3	Protecting health and well-being
S5.4	Protecting the environment

In the assessment of digital skills, using the approach of the authors of the framework [4], respondents were asked to rate their own level of proficiency on a scale from 1 to 8, given that 1 is the lowest level.

To assess changes in the effectiveness of communications in the implementation of public administration through the introduction of electronic services, a traditional approach was used – self-assessment in the range from 0% to 100% of the positive impact of change. In each interval, which characterizes the increase in the efficiency of communications (1-10%; 11-20%; ...; 91-99%, as well as the threshold scores of 0 and 100%), there was found, that the percentage of respondents who indicated the presence of a corresponding positive impact, on some results of civil servants' daily work (reduction of the share of routine functions, improvement of feedback, etc.).

4 Results

As a result of the study of the links between e-government and the macroeconomic success of countries (within *RTI*), we found the following dependencies. First, as we can see, the number of countries, in which EGDI and EPI gain medium, high and very high levels, increased significantly in 2020 compared to previous years. Positive developments in EGDI in Lithuania (rank change +20), the Czech Republic (rank change +15), Poland (rank change +14), Estonia (rank change +13), and Romania (rank change +12) are particularly significant. At the same time, the most positive changes in the EPI are observed in Austria (rank change +39), Bosnia and Herzegovina (rank change +38), Croatia (rank change +34), North Macedonia (rank change +26), Ukraine (rank change +29), the Czech Republic (rank change +27), Estonia (rank change +26). However, it should be noted that in some countries there have been negative changes in these indicators, in particular Luxembourg lost 51 in

the EPI and moved from 19th place to 70, Germany lost 34 points and took 57th place; according to EGDI, the largest losses are observed in Monaco (-36).

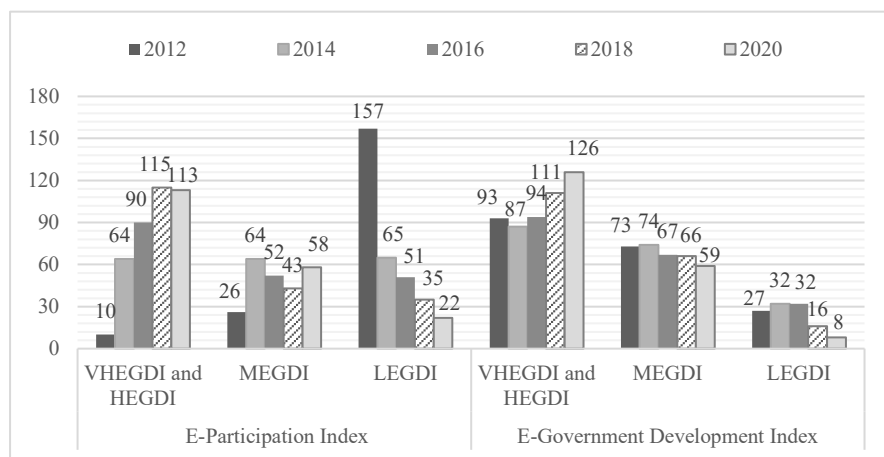


Figure 1

Dynamics of the number of countries at different levels of E-Participation Index, E-Government Development Index

As for Ukraine, its position during the analyzed period was quite unstable in the world ranking of countries for the development of e-government: 68th place - in 2012, in 2014 - 87th, in 2016 - 62nd, in 2018 - 82nd and 69th in 2020. As we can see, the rating position in 2018, was much lower than in 2016, which indicates that there are problems in ensuring effective public administration using e-government capabilities. It should be noted that the situation improved in 2020, but still did not reach the level of 2016. Such results are somewhat controversial, compared to the global dynamics of improving e-government.

Furthermore, the assessment of the correlations between e-government (according to our selected indices) and macroeconomic success of countries reveals a significant impact of e-government on GDP per capita and competitiveness of countries in the EU group (Table 2).

Table 2

Relationships between indicators of e-government, GDP per capita and competitiveness of EU countries in 2018

Countries	Indicators			
	EPI score (0-1)	EGDI score (0-1)	Real GDP per capita, euro	GCI score (1-100)
Austria	0.8258	0.8301	37720	78.9
Belgium	0.7584	0.8080	35520	76.6
Bulgaria	0.8708	0.7177	6330	63.6
Croatia	0.7697	0.7018	12200	60.1

Cyprus	0.8202	0.7736	24430	65.6
Czechia	0.6180	0.7084	17990	71.2
Denmark	1.0000	0.9150	48450	80.6
Estonia	0.9101	0.8486	14970	70.8
Finland	1.0000	0.8815	36740	80.3
France	0.9663	0.8790	32820	78.0
Germany	0.9213	0.8765	35690	82.8
Greece	0.8764	0.7833	17430	62.1
Hungary	0.7079	0.7265	12690	64.3
Ireland	0.9326	0.8287	58100	75.7
Italy	0.9551	0.8209	27030	70.8
Latvia	0.6854	0.6996	12140	66.2
Lithuania	0.8034	0.7534	13400	67.1
Luxembourg	0.9382	0.8334	84040	76.6
Malta	0.8483	0.8011	22320	68.8
Netherlands	0.9888	0.8757	41450	82.4
Poland	0.8933	0.7926	12420	68.2
Portugal	0.8989	0.8031	18190	70.2
Romania	0.7079	0.6671	8700	63.5
Slovakia	0.8090	0.7155	15510	66.8
Slovenia	0.8146	0.7714	20240	69.6
Spain	0.9831	0.8415	24880	74.2
Sweden	0.9382	0.8882	43760	81.7
United Kingdom	0.9831	0.8999	32640	82.0
Average value	0.8652	0.8015	27421	72.1
Correlation coefficient with real GDP per capita	0.5258	0.6488		
Correlation coefficient with GCI	0.6205	0.8682		

 - the value of the indicator is above average

Source: authors' calculation based on [48; 49; 50]

From Table 2 it can be seen that the values of indicators that characterize macroeconomic results are mostly above average in those countries where e-government indicators are also above average. According to the results, 11 countries from 15 where E-Government Development Index is above average (0.8015), have real GDP per capita above average (27421 euro) and 12 countries have Global Competitiveness Index above average (72.1). Exceptional links are typical only for Estonia, Italy and Portugal.

As can be seen from Table 2, there were quite strong links between these indicators in 2018, especially quite strong between the state of digital infrastructure of public administration (EGDI) and economic competitiveness (GCI), which confirms the

value of the pairwise correlation coefficient (0.8682). The positive relationship is confirmed also between civil servants’ digital competences and GDP per capita with a correlation coefficient value of 0.6488.

In response to **RT2**, we obtained the results illustrated in Figure 2. The data show the current level of digital skills of civil servants, obtained on the basis of their self-assessment. The obtained results reflect the levels of digital competences measured from 1 to 8. As you can see, most civil servants are at the 5th or 6th levels of digital skills. The best level of mastery (6) can be traced in the groups of skills “Information and data literacy” and “Communication and collaboration”. That is, civil servants at a sufficient level (6th out of 8) are able to search, analyze, use and disseminate information in the digital environment, as well as interact and communicate with others through the use of digital technologies. At the same level, they have the skills S5.3 and S5.4, i.e., with a high level of awareness, they still cannot fully determine the impact of digital technology on the environment, as well as protect themselves and others from possible dangers in the digital environment.

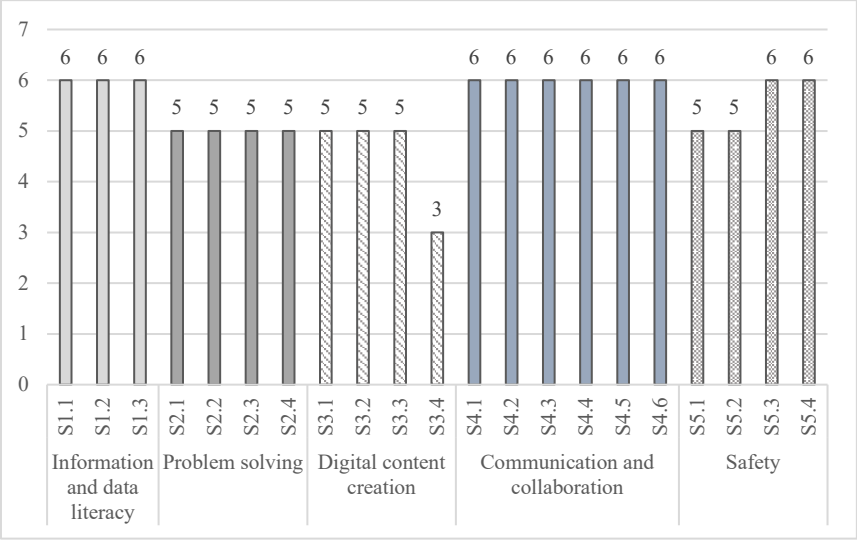


Figure 2
Average assessment of one's own level of digital skills of various types

A slight deficit (the 5th level out of 8) was found in the groups of digital skills “Problem solving”, “Digital content creation”. That is, government officials cannot always: solve technical problems with computers, software, and networks; customize digital technologies to their own needs and use them creatively. Civil servants have also difficulty in creating new and editing existing digital content in a variety of formats. And without a doubt, the lack of skills of the “Safety” group is quite dangerous in the current environment, namely the ability to protect devices, content, personal data and privacy in digital environments, the use and dissemination of personal information.

The lowest level of mastery (3rd) of civil servants is observed in the skill S3.4 - Programming, which is partly due to the specifics of their job functions that do not require the ability to write complex program codes.

The assessment of changes in the effectiveness of communication between civil servants and the public through the introduction of electronic services in the G2C segment (within **RT3**) is illustrated in Figure 3 and Table 3.

As can be seen from Figure 3, civil servants' assessment of the readiness of the national system to operate in e-government is quite critical – 67.9% of respondents believe that the development and quality of e-services is in the range of up to 50% out of 100 possible.

At the same time, the level of readiness of civil servants to provide electronic services to the population is slightly higher – only 53.8% of respondents received answers within 50% of readiness. That is, according to the results of self-assessment, civil servants are more willing to work in a digital economy, than the system itself.

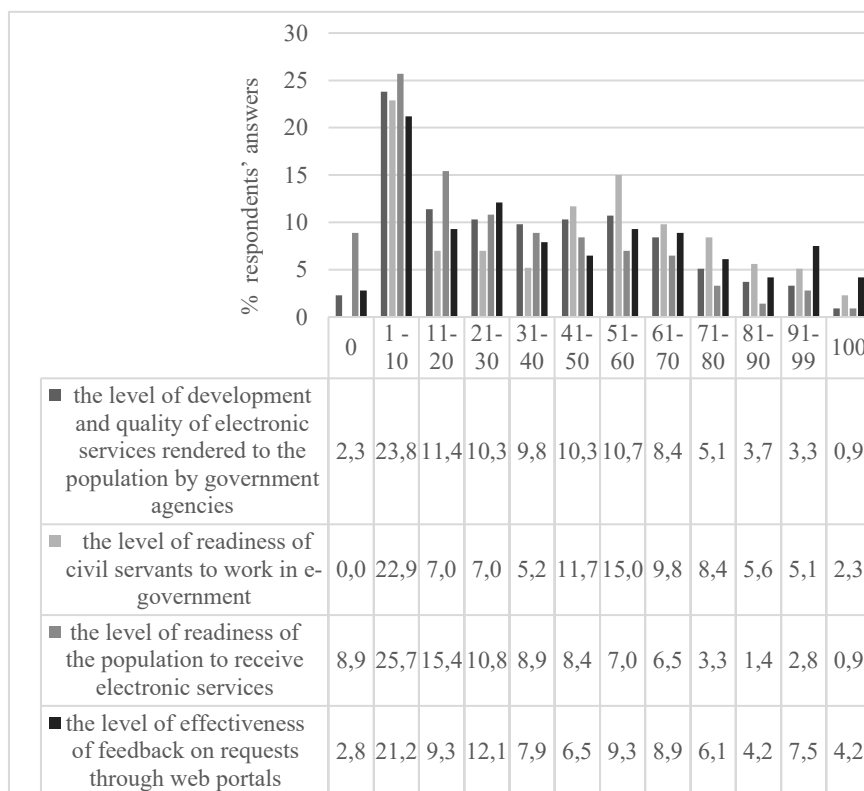


Figure 3

Assessment by civil servants of the effectiveness of communication with the public through the introduction of electronic services in the G2C segment

The level of readiness of the population to receive the services of national institutions through electronic services is extremely critical. Unfortunately, 78.1% of civil servants believe that the level of readiness of the population is in the range of 0-50%. At the same time, it is necessary to note the rather low level of effectiveness of feedback on requests through the web portal, as 59.8% of respondents rated it from 0% to 50%.

That is, in the direction of improving the efficiency of communication between civil servants and the public through the introduction of electronic services, there are still significant reserves for development.

However, civil servants' assessment of changes in labor processes due to the introduction of electronic services allows stating positive changes in this direction. As can be seen from Table 3, due to the service of the population through electronic services, the queues for reception in government agencies decreased by an average of 30.9%, as 34.2% of requests were transferred to electronic form. At the same time, the routine functions of daily work of civil servants decreased by an average of 30.2% and the efficiency of obtaining information on changes in public policy and legislation increased by 38.8%.

Table 3

Civil servants' assessment of changes in labor processes due to the introduction of electronic services in the civil service

Consequences of introduction of electronic services % of respondent's answers	Evaluation of the effectiveness of the introduction of electronic services											Mean value %	
	0%	1-10%	11-20%	21-30%	31-40%	41-50%	51-60%	61-70%	71-80%	81-90%	91-99%		100%
✓ decrease in queues for reception in government agencies	9.8	23.8	18.2	7.5	6.5	7.5	6.1	6.5	6.5	1.9	5.1	0.5	30.9
✓ requests (appeals) that have been transferred to electronic form	3.3	30.8	11.2	11.2	4.2	8.4	7.5	6.5	5.1	4.2	7.0	0.5	34.2
✓ reduction of routine work of employees	8.9	28.0	13.6	8.4	6.5	9.8	6.1	7.0	3.7	2.8	4.7	0.5	30.2
✓ increase in the efficiency of obtaining information on changes in public policy and legislation	2.3	19.2	15.9	9.3	8.9	10.3	7.9	7.9	5.1	4.7	7.5	0.9	38.8

5 Discussion

According to our findings, we can state that there are strong links between the state of the digital infrastructure of public administration (EGDI) and economic competitiveness (GCI).

Regarding GDP per capita, the results obtained allow drawing the opposite conclusions from [36] based on the study conducted on the example of the United States and Europe – “there is no correlation with GDP, but it is always hampered by the digital divide.” In 2018, such links in the EU were quite obvious, which, in contrast to the above results, may indicate a positive impact on GDP, and that such links should be assessed in homogeneous groups of countries – in our case we can state the high similarity of countries in the strategies of building e-government and, accordingly, the lack of a significant digital gap in this area in the EU. These results mean that, with high attention to the formation of a quality e-government system, such efforts have the expected positive economic consequences.

In measurements of the readiness of the civil servant to interact in e-society using their digital competencies, we found an important methodological omission of existing systems for assessing the digital skills of civil servants (as well as other professional groups) is the lack of a single, unified framework of digital competencies, which would be suitable for assessing existing skills, periodic certification of public servants and professionals in other occupational fields whose activities require digital competence. Existing approaches, including the most advanced DigComp 2.1, are too general and do not allow assessing the digital skills shortage in the relevant professional group – a shortcoming in the digital skills assessment of all employees, not just civil servants.

Except for DigComp 2.1, some other approaches are often used. They can assess only a single competence score or vice versa, many of them are multi-dimensionally structured like DigComp frameworks. In this regard, we support the point of view that the European Commission has proposed one of the most integrative frameworks of digital competences for citizens [53]. Based on their critical review of existing frameworks, Ulfert-Blank and Schmidt [53] fulfilled the conclusion aligned with our research that the measurement of digital skills and self-efficacy scale is discussible regarding application fields. Furthermore, the steep development of new technologies, particularly artificial intelligence leads to the need for constant review of digital competences frameworks. So, even the most advanced, which is used in our research, DigComp 2.1, is revised in March 2022, stressing some new skills connected with AI usage. These improvements are highlighted in some new citizens’ digital competences within DigComp 2.2 [54]. It, however, could not be used in our research due to its update in 2022. Besides, it focuses on AI technologies usage which is not typical for the professional duties of civil servants to a great extent at the current stage of their work.

However, even with the usage of the most advanced but generalized framework (DigComp 2.2), developed for all citizens regardless of their professional duties, and consequently, those should be simplified for such professionals as civil servants, we obtained very critical self-assessment results. The most obvious deficit was found in the groups of digital skills “Problem solving”, “Digital content creation” and “Safety”. The shortcomings in mastering these skills can create essential obstacles not only for the development of the public administration sphere in terms of its modernization on a digital basis. In light of growing risks in the information security field (especially in Ukraine during the war), the lack of skills aiming at safety in digital services can negatively affect this and connected spheres ensuring the national security.

Conclusions

Thus, from our study, we can conclude that in countries where the development of the digital skills of civil servants is given due attention, there can be a positive impact on the formation of macroeconomic performance and competitiveness. Such patterns are typical in EU countries and can serve as a guide to improve the systems of professional development of civil servants in the context of the formation of their digital competence for countries with economies in transition.

Considering the existing shortcomings in digital competences measurement, it is necessary to develop and use not one, but several, adapted for different professional groups, assessment frameworks, suitable for use at different levels and with different functional orientation of professional tasks. There are already attempts to create such a framework by the Ministry of Digital Transformation of Ukraine, for educators, entrepreneurs and civil servants [52]. But a detailed study of their content leads to the conclusion that these are only simplified variations of DigComp 2.1, where the consideration of professional responsibilities is done to some extent artificially – through clarifications in known formulations. A “too narrow” 3-level assessment (basic, medium, high) with gradation from A1 to C2 is used, and the list of digital competencies is also an abbreviated modified borrowing from DigComp 2.1, which obviously requires improvement and greater consideration of professional characteristics.

At the same time, we have confirmed the high motivation for action in e-society, by civil servants themselves – they rate it higher, than the institutional support for the implementation of digital dialogue with society today. Therefore, obstacles, in the form of low digital competence, of the population, as another subject of digital dialogue and existing shortcomings in internal labor processes, can be considered as barriers, that can be overcome relatively quickly, in the digital development of a society, including, improving the digital dialogue between civil servants and the public.

Acknowledgement

Funded by the EU NextGenerationEU through the Recovery and Resilience Plan for Slovakia under the project No. 09I03-03-V01-00013.

References

- [1] ILO (2021) World Employment and Social Outlook 2021: The role of digital labour platforms in transforming the world of work International Labour Office – Geneva: International Labour Organization. URL: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_771749.pdf
- [2] UN (2018) *Building digital competencies to benefit from existing and emerging technologies, with a special focus on gender and youth dimensions*. Report of the Secretary General. URL: <https://undocs.org/E/CN.16/2018/3>
- [3] ITU (2018) Measuring the information society. URL: <https://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2018/MISR-2018-Vol-1-E.pdf>
- [4] Carretero, S., Vuorikari, R., & Punie, Y. (2017) The Digital Competence Framework for Citizens. *Publications Office of the European Union*. URL: <http://svwo.be/sites/default/files/DigComp%202.1.pdf>
- [5] ILO (2020) Digital skills and the future of work: Challenges and opportunities in a post COVID-19 environment (WISIS Session 216, 29 July 2020) URL: https://www.ilo.org/wcmsp5/groups/public/---ed_emp/documents/publication/wcms_766085.pdf
- [6] Kerr, J., & Houten, A. V. (2020) Utilizing digital tools to support face-to-face care: Examining uptake within the practices of Australian psychologist. *Human Technology*, 16(1), 35-54, <https://doi.org/10.17011/ht/urn.202002242162>
- [7] Rubach, C., & Lazarides, R. (2021) Addressing 21st-century digital skills in schools–Development and validation of an instrument to measure teachers' basic ICT competence beliefs. *Computers in Human Behavior*, 118, 106636
- [8] Akimov, O. O., Karpa, M. I., Parkhomenko-Kutsevil, O., Kupriichuk, V., & Omarov, A. (2021) Entrepreneurship education of the formation of the e-commerce managers professional qualities. *International Journal of Entrepreneurship*, 25 (7), 1-8
- [9] Falkenberg, K., Lindetorp, H., Benigno Latupeirissa, A., & Frid, E. (2020) Creating digital musical instruments with and for children: Including vocal sketching as a method for engaging in codesign. *Human Technology*, 16(3), 348-371, <https://doi.org/10.17011/ht/urn.202011256768>
- [10] Roshchyk, I., Oliinyk, O., Mishchuk, H., Bilan, Y. (2022) IT Products, E-Commerce, and Growth: Analysis of Links in Emerging Market. *Transformations in Business & Economics*, 21(1), 209-227
- [11] Oliinyk, O., Bilan, Y., Mishchuk, H. (2021) Knowledge Management and Economic Growth: The Assessment of Links and Determinants of

- Regulation. *Central European Management Journal*, 29(3), 20-39, <https://doi.org/10.7206/cemj.2658-0845.52>
- [12] Tiutiunyk, I., Drabek, J., Antoniuk, N., Navickas, V., & Rubanov, P. (2021) The impact of digital transformation on macroeconomic stability: Evidence from EU countries. *Journal of International Studies*, 14(3), 220-234, doi:10.14254/2071- 8330.2021/14-3/14
- [13] Gyenge, B., Máté, Z., Vida, I., Bilan, Y. & Vasa, L. (2021) A New Strategic Marketing Management Model for the Specificities of E-Commerce in the Supply Chain. *Journal of Theoretical and Applied Electronic Commerce Research* 16(4), 1136-1149
- [14] Kitukutha, N. M., Vasa, L. & Oláh, J. (2021) The impact of COVID-19 on the economy and sustainable e-commerce. *Forum Scientiae Oeconomia* 9(2), 47-72
- [15] Kireyeva, A. A., Kredina, A., Vasa, L. & Satpayeva, Z. T. (2021) Impact of financial technologies on economic development: Theories, methods and analysis. *Journal of International Studies* 14(4), 286-303
- [16] Pakhnenko, O., Rubanov, P., Hacar, D., Yatsenko, V., & Vida, I. (2021) Digitalization of financial services in European countries: Evaluation and comparative analysis. *Journal of International Studies*, 14(2), 267-282, doi:10.14254/2071-8330.2021/14-2/17
- [17] Csiszárík-Kocsir, Á. Garai-Fodor, M., & Varga, J. (2021) What has Become Important during the Pandemic? – Reassessing Preferences and Purchasing Habits as an Aftermath of the Coronavirus Epidemic through the Eyes of Different Generations. *Acta Polytechnica Hungarica*, 18(11), 49-74, doi: 10.12700/APH.18.11.2021.11.4
- [18] Garai-Fodor, M., & Csiszárík-Kocsir, Á. (2018) The validity of value-based consumer behavioral models in the financial consciousness of the Z generation. *On-line Journal Modelling the New Europe*, 27, 107-131, doi: 10.24193/OJMNE.2018.27.05
- [19] Garai-Fodor, M. (2022) The Impact of the Coronavirus on Competence, from a Generation-Specific Perspective. *Acta Polytechnica Hungarica*, 19(8), 111-125, doi: 10.12700/APH.19.8.2022.8.7
- [20] Csiszárík-Kocsir Á. (2022) The Present and Future of Banking and New Financial Players in the Digital Space of the 21st Century. *Acta Polytechnica Hungarica*, 19(8), 111-125, doi: 10.12700/APH.19.8.2022.8.9
- [21] Smieszek, M., Dobrzanski, P., & Dobrzanska, M. (2019) Comparison of the level of robotisation in Poland and selected countries, including social and economic factors. *Acta Polytechnica Hungarica*, 16(4), 197-212

-
- [22] Avram, A., Avram, M., Avram, C. D., Popescu, L., Sitnikov, C., & Raluca Guse, G. (2021) Teleworking and its impact on labour productivity and wage income. *Transformations in Business & Economics*, 20 (3C), 372-386
 - [23] Iwashita, H. (2021) The future of remote work in Japan: Covid-19's implications for international human resource management. *Entrepreneurial Business and Economics Review*, 9(4), 7-18, <https://doi.org/10.15678/EBER.2021.090401>
 - [24] Habánik, J., Grenčíková, A., Šrámka, M., & Húževka, M. (2021) Changes in the organization of work under the influence of COVID-19 pandemic and Industry 4.0. *Economics and Sociology*, 14(4), 228-241, doi:10.14254/2071-789X.2021/14- 4/13
 - [25] Samoliuk, N., Bilan, Y., Mishchuk, H., & Mishchuk, V. (2022) Employer brand: key values influencing the intention to join a company. *Management & Marketing. Challenges for the Knowledge Society*, 17(1), 61-72, <https://doi.org/10.2478/mmcks-2022-0004>
 - [26] Kovacs, I., & Vamosi Zarandne, K. (2022) Digital marketing employability skills in job advertisements – must-have soft skills for entry level workers: A content analysis. *Economics and Sociology*, 15(1), 178-192, doi:10.14254/2071- 789X.2022/15-1/11
 - [27] European Commission (2022) Digital Skills and Jobs Platform. *Basic digital skills*. URL: <https://digital-skills-jobs.europa.eu/en/basic-digital-skills>
 - [28] Brolpito, A. (2018) *Digital skills and competence, and digital and online learning*. European Training Foundation, Turin. URL: https://unevoc.unesco.org/pub/etf_digital_competencies_english.pdf
 - [29] Androniceanu, A., Nica, E., Georgescu, I., & Sabie, O. M. (2021) The influence of the ICT on the control of corruption in public administrations of the EU member states: a comparative analysis based on panel data. *Administratie si Management Public*, (37), 41-59
 - [30] Androniceanu, A., Georgescu, I., & Kinnunen, J. (2022) Public administration digitalization and corruption in the EU member states. A comparative and correlative research analysis. *Transylvanian Review of Administrative Sciences*, 18(65), 5-22
 - [31] Badruddin, S., & Yapid, B. M. (2019) Determinants of citizen's intention to use online e-government services: a validation of UMEGA model. *Polish Journal of Management Studies*, 20(1), 119-128
 - [32] Scupola, A., & Mergel, I. (2022) Co-production in digital transformation of public administration and public value creation: The case of Denmark. *Government Information Quarterly*, 39(1), 101650
 - [33] El Ammar, C., & Profiroiu, C. M. (2020) Innovation in public administration reform: a strategic reform through NPM, ICT, and e-governance. A
-

- comparative analysis between Lebanon and Romania. *Administratie si Management Public*, 35, 75-89
- [34] Zahid, H., & Haji Din, B. (2019) Determinants of intention to adopt e-government services in Pakistan: An imperative for sustainable development. *Resources*, 8(3), 128
- [35] Burlacu, S., Popescu, M. L., Diaconu, A., & Sârbu, A. (2021) Digital Public Administration for Sustainable Development. *European Journal of Sustainable Development*, 10(4), 33-33
- [36] Pantiru, M. C. (2019) Competencies necessary for eGovernment. *National Agency of Civil Servants, Romania*. URL: http://www.mptfp.es/dam/es/portal/funcionpublica/funcion-publica/organos-colaboracion/relaciones-internacionales/union-europea/eupan/2019_final_REPORT_Competencies_necessary_for_eGov_PRES_RO.PDF.PDF
- [37] European Commission (2022) *eGovernment and digital public services*. URL: <https://digital-strategy.ec.europa.eu/en/policies/egovernment>
- [38] Kryshtanovych, M., Akimova, L., Akimov, O., Parkhomenko-Kutsevil, O., & Omarov, A. (2022) Features of creative burnout among educational workers in public administration system. *Creativity Studies*, 15(1), 116-129
- [39] Chohan, S. R., & Hu, G. (2022) Strengthening digital inclusion through e-government: cohesive ICT training programs to intensify digital competency. *Information Technology for Development*, 28(1), 16-38
- [40] Pereira, G. V., Ronzhyn, A., & Wimmer, M. A. (2022) Building Digital Governance Competencies: Baseline for a Curriculum and Master Programme. In *Scientific Foundations of Digital Governance and Transformation* (pp. 361-383) Springer, Cham
- [41] Criado, J. I., Herranz, C., & Villodre, J. (2020) Informal Virtual Learning in the Public Sector: Educating Public Servants in Digital Social Innovation Environments. *The Palgrave Handbook of the Public Servant*, 1-18
- [42] Roman, A. V., Van Wart, M., Wang, X., Liu, C., Kim, S., & McCarthy, A. (2019) Defining e-leadership as competence in ICT-mediated communications: an exploratory assessment. *Public Administration Review*, 79(6), 853-866
- [43] Marino, A., Pariso, P., & Picariello, M. (2022) Information Networking and e-Government in United Nations and Europe. In *International Conference on Advanced Information Networking and Applications* (pp. 115-120) Springer, Cham
- [44] Nam, H., Nam, T., Oh, M., & Choi, S. (2022) An Efficiency Measurement of E-Government Performance for Network Readiness: Non-Parametric

Frontier Approach. *Journal of Open Innovation: Technology, Market, and Complexity*, 8(1), 10

- [45] Ministry of digital transformation of Ukraine (2021) Digital literacy of the population of Ukraine. Report on the Results of the National Survey. URL: https://osvita.diia.gov.ua/uploads/0/2623-research_eng_2021.pdf
- [46] Mishchuk, H., Yurchyk, H., & Bilan, Y. (2018) Shadow incomes and real inequality within the framework of leadership and social change. In *Leadership for the Future Sustainable Development of Business and Education* (pp. 89-101) Springer, Cham. https://doi.org/10.1007/978-3-319-74216-8_10
- [47] Ministry of digital transformation of Ukraine (2022) Goals by 2024 [In Ukrainian]. URL: <https://thedigital.gov.ua/ministry>
- [48] UNeGovDD (2018) E-Government Development Index / E-Participation Index. URL: <https://publicadministration.un.org/egovkb/en-us/Data-Center>
- [49] Eurostat (2018) Database on Real GDP per capita. URL: https://ec.europa.eu/eurostat/databrowser/view/sdg_08_10/default/table?lang=en
- [50] WEF (2018) The Global Competitiveness Report 2018. URL: <https://www.weforum.org/reports/the-global-competitiveness-report-2018>
- [51] NADS (2021) *Information on quantitative and qualitative composition of civil servants in public authorities. IV quarter of 2021* [In Ukrainian] URL: <https://nads.gov.ua/storage/app/sites/5/DIYALNIST/KSDS/statistichni-dani-za-iv-kvartal.pdf>
- [52] Ministry of digital transformation of Ukraine (2022) *Useful links* [In Ukrainian] URL: <https://osvita.diia.gov.ua/en/korysni-posylannya>
- [53] Ulfert-Blank, A. S., & Schmidt, I. (2022) Assessing digital self-efficacy: Review and scale development. *Computers & Education*, 104626. URL: <https://doi.org/10.1016/j.compedu.2022.104626>
- [54] Vuorikari, R., Kluzer, S., Punie, Y., *DigComp 2.2, The Digital Competence framework for citizens : with new examples of knowledge, skills and attitudes*, Publications Office of the European Union, 2022, URL: <https://data.europa.eu/doi/10.2760/115376>