Dečman, M., Klun, M., and Stare, J. (2025). A latent profile analysis of DigComp dimensions and the alignment with EU digital goals: a case of Slovenia. *Administratie si Management Public*, 45, 46-68. https://doi.org/10.24818/amp/2025.45-03

A latent profile analysis of DigComp dimensions and the alignment with EU digital goals: a case of Slovenia

Mitja DEČMAN[1], Maja KLUN[2], Janez STARE[3]

Abstract: The European Union's Digital Decade strategy, structured around the Digital Compass, identifies digital skills as a key dimension to ensure that at least 80% of the population possesses basic digital competencies by 2030. According to the DESI 2024 report, only the Netherlands and Finland have already reached this benchmark, while other member states, including Slovenia, lag behind. In 2023, only 46.7% of Slovenian citizens demonstrated at least basic digital skills, highlighting the urgency of addressing the digital divide. Drawing on resource and appropriation theory and digital capital theory, this study investigates the relationship between personal and positional resources, digital skills, and ICT usage. Using data from 2,585 Slovenian respondents in the EU Survey on the Use of ICT in Households and by Individuals (EUROSTAT), we conducted a latent profile analysis (LPA) to identify patterns across the five competence areas defined in the DigComp framework. The analysis produced five distinct digital skill profiles. Results indicate that older individuals are significantly more likely to belong to low-skilled profiles, while income does not exert a strong influence. Conversely, younger and lower-income respondents showed a higher probability of belonging to semi-skilled groups characterized by weak digital design competences and overconfidence in their abilities. These findings provide empirical evidence to guide policymakers in designing targeted interventions to strengthen digital competences across demographic groups. The research also demonstrates an approach that can be replicated across EU member states to support progress toward the Digital Decade's 2030 objectives.

Keywords: digital decade, digital skills, EU, Slovenia, latent profile analysis

JEL: C54, I25, I28

DOI: https://doi.org/10.24818/amp/2025.45-03

[1] PhD; University of Ljubljana; Faculty of Public Administration; Gosarjeva ulica 5, 1000 Ljubljana, Slovenia; email: mitja.decman@fu.uni-lj.si; https://orcid.org/0000-0003-3395-4452

[2] PhD; University of Ljubljana; Faculty of Public Administration; Gosarjeva ulica 5, 1000 Ljubljana, Slovenia; email: maja.klun@fu.uni-lj.si; https://orcid.org/0000-0002-1025-9134

[3] PhD; University of Ljubljana; Faculty of Public Administration; Gosarjeva ulica 5, 1000 Ljubljana, Slovenia; email: janez.stare@fu.uni-lj.si; https://orcid.org/0000-0002-1265-9430

Introduction

Digital technology is a defining feature of the fourth industrial revolution, transforming economies, governments, and everyday life. Its pervasive influence requires policymakers to adapt strategies, frameworks, and services to ensure inclusive digital transformation. While technology drives progress, it is ultimately people who develop, manage, and use it. Consequently, digital skills and competencies have emerged as key mediators of the socioeconomic impact of digitalisation (Dodel & Mesch, 2019). Ragnedda et al. (2024) identify these skills as one of the two pillars of digital capital, a concept that views digital competencies not only as functional abilities but also as convertible assets that enhance education, employability, civic engagement, and social participation. Digital capital thus bridges technological access and broader social outcomes, reinforcing employability and inclusion (Androniceanu & Colesca, 2025; Riztia et al., 2025; Sukma & Yamnill, 2025).

Digital skills are, therefore a decisive element of a digital society. They are not merely technical proficiencies but fundamental enablers of individual and organisational success in the knowledge economy. Research shows that digital capital—the advantage gained through competent technology use—directly influences employability and social inclusion (Dobrolyubova, 2021; Riztia et al., 2025; Sukma & Yamnill, 2025). Kaztman (2010) already emphasised that digital competencies had become critical assets for social and economic participation. Identifying citizens' digital skills and the mechanisms to strengthen them is therefore essential. Moreover, any such analysis must consider the digital divide, one of the three hierarchical and circular components of Resource and Appropriation Theory (RAT) (van Deursen & van Dijk, 2015; van Dijk, 2020). RAT conceptualises digital inequality as a sequential and compounding process in which individual resources (education, income, age) shape motivational, material, and skills access to ICTs, influencing use patterns and resulting outcomes—economic, social, and cultural.

Nearly all countries have taken measures to foster a digital society. Within the European Union (EU), the Digital Decade initiative and the Digital Compass form the key strategic frameworks guiding Europe's digital transformation to 2030. Among their primary objectives are the enhancement of digital skills and competences, elaborated through initiatives such as DigComp (Vuorikari, Kluzer et al., 2022). DigComp defines digital competence as a combination of knowledge, skills, and attitudes required for the effective, critical, and safe use of digital technologies across life domains. Comparable frameworks have been developed globally, including the OECD Digital Talent and Skills Framework, UNICEF's Educators' Framework, and the UK's Self-Review Framework (Naace).

Despite these initiatives, progress remains uneven. The DESI 2024 report (European Commission, 2024a) shows that only the Netherlands and Finland have surpassed the EU target of 80% of citizens with at least basic digital skills, while most Member States remain below this benchmark. Persistent inequalities continue to limit digital access and participation, particularly among disadvantaged groups. This highlights

the need for detailed analyses to identify barriers, drivers, and effective policy interventions.

As an EU member, Slovenia aligns with these strategic objectives through its Digital Slovenia 2030 strategy (Government of Slovenia, 2023). While Slovenia performs relatively well in certain areas—such as access to online health data—DESI data (European Commission, 2024a) reveal significant disparities in citizens' digital skills. Ensuring digital inclusion across demographic and social groups remains a pressing challenge.

To address this, the present study explores the distribution of digital skills among Slovenian citizens using data from the Survey on the Use of ICT in Households and by Individuals. By applying Latent Profile Analysis (LPA), it identifies distinct digital literacy profiles across the five DigComp domains. This segmentation provides insights into the structure of Slovenia's digital capital and supports evidence-based policymaking. Specifically, the study addresses the following research questions:

- How can LPA of ICT use data reveal detailed patterns of digital skills among Slovenian citizens?
- How can these profiles guide targeted actions by Slovenian authorities to advance digital inclusion and achieve national digital transformation goals?

Section 1 explains the contextual framework of the study, and Section 2 describes the empirical research methodology and research setting. Section 3 presents the results, followed by a discussion and conclusion.

1. Contextual framework

In the rapidly evolving digital age, people's ability to use digital technologies has become an important factor for socio-economic participation in the digital age or so-called digital citizenship (Mossberger et al., 2007). Van Dijck et al. (2018, p. 2) discuss the concept of a platform society, in which platforms have become a central component of societal functions and influence social and cultural practises. This makes it necessary for governments and states to adapt their legal and democratic frameworks accordingly and for people to become competent platform users. However, the use of digital technologies is not a universal process and requires a wide range of digital skills in combination with general social competences. Therefore, it is necessary to look at this challenge through the lens of different concepts, including digital literacy, the digital divide and the digital transformation of society.

1.1 Digital literacy and digital skills

In order to tackle the problems of the digital society, it is important to define the concepts of digital literacy, digital competencies and digital skills. Digital literacy goes beyond the use of digital technologies and skills. According to Pangrazio et al. (2020), it encompasses the full range of competences in digital reading and writing techniques across different media forms that enable individuals to use digital

technologies effectively and safely. UNESCO (2022) defines digital literacy as the ability to access, manage, understand, integrate, communicate, evaluate and create information safely and accurately using digital devices and networks in order to participate confidently and critically in economic and social activities. Eshet (2004) categorises digital literacy into five dimensions: photo-visual, reproductive, branching, information, and socio-emotional literacies. These dimensions emphasise the versatility of digital skills and underline their crucial role in empowering individuals and their active participation in society. Therefore, digital literacy encompasses a broader range of skills, including information seeking, evaluation and communication, while digital competence generally refers to the mastery of digital tools and technical skills (Mbandje et al., 2023; Pesha, 2022).

According to the DigComp definition (Vuorikari, Kluzer, et al., 2022), digital competences include the "confident, critical and responsible use of and engagement with digital technologies for learning, work and participation in society". Ferrari et al. (2012, p. 84) define digital competence as "a set of knowledge, skills, attitudes, abilities, strategies and awareness required in the use of ICT and digital media to perform tasks, solve problems, communicate, manage information, behave ethically and responsibly, collaborate, create and share content and knowledge for work, leisure, participation, learning, socialising, empowerment and consumption". Digital competences therefore also include digital skills.

As Helsper and Eynon (2013) noted, most definitions of digital skills encompass both functional skills to operate and use technologies and a strategic understanding of how ICTs influence and are influenced by commercial and societal factors. However, some authors argue that digital skills are the same as digital literacy (Alkali & Amichai-Hamburger, 2004). Dodel (2022) points out that digital skills encompass more than just 'button knowledge', which refers to technical skills or the ability to navigate programmes, devices or websites, and even argues for the interchangeability of the terms 'digital skills', 'digital competence', 'digital literacy' and even 'digital citizenship'.

Following Bourdieu's theory of capital, Ragnedda et al. (2024) conceptualise digital capital as a specific form of capital that consists of two main components: Digital competences – the stock of knowledge, skills and abilities necessary to navigate, evaluate and shape digital environments, and digital technologies – the quality and type of devices, connectivity and access that individuals possess. Digital skills as building blocks of digital competences therefore act as a mechanism for the transformation of capital that reinforces or reduces social inequalities.

1.2 Digital divide

The digital divide is a crucial determinant of digital empowerment, reflecting disparities in digital accessibility and competence across demographic groups. It is typically conceptualized at three hierarchical levels (van Dijk, 2005): (1) physical access to technologies, (2) digital skills and competencies, and (3) the tangible outcomes of digital use. Dodel (2022) and Lythreatis et al. (2022) note that inequalities at lower levels influence those above, underscoring the need for a

comprehensive approach in the EU's digital transformation (Brătucu et al., 2022). Resource and Appropriation Theory (RAT) (van Deursen & van Dijk, 2015; van Dijk, 2020) further explains that motivation, access, and skills form a reinforcing cycle—positive outcomes enhance engagement, while deficits perpetuate exclusion. Merely providing access is insufficient; socio-economic factors, institutional support, and infrastructure critically affect individuals' ability to transform access into competence (Rawal, 2024; Setiawan, 2024; Shostak & Ulyanytsky, 2025).

The first level concerns disparities in physical access—devices and internet connectivity. Early discussions framed the divide as the gap between those with and without digital access (Rogers, 2001). While this gap has narrowed in developed nations—EU household internet access now ranges from 86–99% (European Commission, 2025)—access alone no longer guarantees digital participation. Accordingly, research focus has shifted toward inequalities in skills and usage (Morte-Nadal & Esteban-Navarro, 2025).

The second level examines the ability to use technologies effectively. Digital literacy, critical evaluation, and content creation are essential for meaningful engagement. Even in industrialised contexts, inequalities persist across age, education, and language (Schmölz et al., 2023). Robinson et al. (2015) argue that digital skills shape how technology reinforces or reduces social inequality, while Raihan et al. (2024) stress that the divide now lies less in connectivity and more in competency. Skill-development initiatives can mitigate these gaps; for instance, digital skills training improves self-efficacy in e-government use (Chohan & Hu, 2022). However, access and skills remain necessary but insufficient for genuine ICT empowerment (Hosman & Comisso, 2020).

The third level—the most critical—concerns outcomes of digital engagement, representing true digital empowerment (van Deursen et al., 2016). It measures how effectively individuals use digital tools for social and economic advancement and equitable change (Morte-Nadal & Esteban-Navarro, 2025). Fernandez et al. (2020) showed that computer-literate users can create more complex content than mobile-only users. Dodel (2022) reinforces that lower-level inequalities affect higher ones, suggesting that comprehensive strategies across all levels are essential for equitable empowerment.

Key socio-demographic factors influencing all levels include age, gender, education, income, and geography (Ragnedda et al., 2024). Age and gender disparities are most evident in access (Lythreatis et al., 2022), while education strongly predicts digital competence (Schmölz et al., 2023) and online engagement (Mesa, 2023). Education also moderates acceptance of e-services (Gupta, 2020) and social networks (Elena-Bucea et al., 2021). Geographical inequalities persist—rural populations in Indonesia, for example, exhibit lower digital skills than urban residents (Ariansyah et al., 2019). The notion of universally skilled "digital natives" is misleading; youth digital literacy remains uneven and linked to employment prospects (Barna & Epure, 2020; Smith et al., 2020).

1.3 Measuring digital skills

Various frameworks have been defined to measure digital skills and enable country comparisons. The European Commission's Digital Competence Framework for Citizens (DigComp) has become a key reference in Europe, defining five competence areas and multiple proficiency levels (Vuorikari et al., 2016). The modular and adaptable nature of the framework makes it valuable for policy and educational purposes. The OECD's PIAAC framework, on the other hand, situates digital problem-solving within broader literacy and numeracy contexts, allowing for global comparisons (OECD, 2019). UNESCO's frameworks focus more on digital literacy for lifelong learning, particularly in developing contexts that emphasise adaptability and inclusivity (UNESCO, 2018). These differing orientations reflect varying framework priorities, such as policy benchmarking, educational design, or global equity.

The measurement of digital skills and competencies has been widely researched in recent decades. As described by Allmann and Blank (2021), two methodologies have dominated research in this area: (1) self-assessment surveys and (2) performance tests. A combination of both is sometimes used (Hatlevik et al., 2015). Self-assessment is uncomplicated and fast (usually using surveys), but it requires careful construction of questions and is often unreliable because of the subjectivity of the respondent; for example, "How good are you at using spreadsheets?". Helsper and Eynon (2013) expressed doubts about whether a person can claim to have skills for something they have never done or, on the other hand, has done it but perceived themselves as unskilled. Furthermore, these types of questions combine an outcome with the steps needed to achieve it (Allmann & Blank, 2021). The same authors claim that the major challenge is ensuring external validity through the careful construction of items.

The performance tests are, on the other hand, more precise but take a lot of time and resources. Complex tools, such as simulations or other activities based on real scenarios, must be used (Bartolomé et al., 2021). Van Laar et al. (2022) used performance tests to assess digital skills among 13- to 18-year-olds across six European countries: Estonia, Finland, Germany, Italy, Poland, and Portugal, evaluating information navigation and processing, communication and interaction, and content creation and production. In an international computer and information literacy study, Fraillon and Rožman (2025) used a performance test focusing on grade 8 students' ability to use computers to investigate, create, participate, and communicate effectively.

Despite their utility, these methodologies face ongoing questions regarding their reliability, validity, and adaptability. For instance, ensuring construct validity—whether these tools genuinely measure the digital competencies they claim— is particularly complex given the rapidly evolving nature of technology (van Deursen & van Dijk, 2015). Frameworks often struggle to stay current, risking obsolescence as new technologies and digital practices emerge, while others, such as DigComp, evolve over time. However, even with all the updates, such revisions may lag behind

fast-developing digital technologies, such as the latest fast-developing field of artificial intelligence. Moreover, their applicability across diverse cultural and socioeconomic contexts may be uneven, especially when digital access and familiarity vary widely (Horváth et al., 2025). Performance-based approaches, although more valid, are rarely used owing to their high costs and logistical challenges. Thus, balancing theoretical rigor with practical usability remains a core issue for the reliable measurement of digital competencies.

1.4 Digital skills frameworks and evaluation models

The Digital Decade framework sets out a vision and a goal for Europe's digital transformation by 2030 with four key elements. One of these is Skills. The aim is to ensure that 80% of adults have at least basic digital skills by 2030. In addition, digital education is to be strengthened and lifelong learning programmes promoted so that people can participate effectively in the digital economy (European Commission, 2024b).

To track progress, the Digital Competence Framework for Citizens (DCF) (latest version 2.2) was developed by the European Commission to help individuals, organisations and policy makers assess and improve digital skills (Vuorikari, Kluzer, et al., 2022). The DigComp framework categorises digital skills into five key digital competence areas: Information and data literacy, communication and collaboration, digital content creation, safety and security and problem solving, which are measurable dimensions of digital capital. Each of these areas is then broken down into digital skills that are assessed using levels ranging from basic (foundation) to advanced (highly specialised). Similar areas are covered, for example, in the UK National Standards for Essential Digital Skills (UK Department for Education, 2019), namely using devices and handling information, creating and editing, communicating, transacting, and being safe and responsible online. In addition, van Laar et al. (2017), linking digital skills to 21st century skills, defined seven similar core dimensions, namely technical, information management, communication, collaboration, creativity, critical thinking and problem solving. In their well-known Internet skills framework, van Deursen and van Dijk (2015) categorise digital skills into two broad types: media-related and content-related, which also relate to the DigComp areas. The first category includes operational and informational skills, the second includes digital content creation and modification as well as social and strategic internet skills.

To assess the overall progress of the digital transformation, the EU has created the Digital Economy and Society Index (DESI), which is now one of the best-known indices for measuring the digital transformation of society. It is a composite index developed by the European Commission (EC) and assesses countries on the basis of four main dimensions (European Commission, 2022): Human Capital, Connectivity, Integration of Digital Technology and Digital Public Services. In 2023, the Digital Economy and Society Index (DESI) was significantly redesigned. It has been integrated into the State of the Digital Decade report, which is aligned with the 2030

Digital Decade policy programme, and now aims to monitor progress towards the EU's digital goals more comprehensively (European Commission, 2025) by using the Digital Compass introduced in 2021. The Digital Compass sets out clear digital targets to be achieved by 2030, focusing on four main areas (the so-called cardinal points): Skills, Digital Infrastructure, Digital Transformation of Businesses and Digitalisation of Public Services.

One of the most important data sources for the DESI Index is the "Survey on the use of ICT in households and by individuals". It aims to provide harmonised and comparable data to monitor progress towards the EU information society, understand digital inclusion and inform policy decisions. It is an annual survey carried out by Eurostat in all EU countries and some EFTA and candidate countries. The transmission of microdata to Eurostat is mandatory. The survey collects data on how households and individuals access and used information and communication technologies (ICT). It covers households with at least one member aged 16–74 and individuals in the same age group. The survey changes every year, with a different topic taking centre stage each year, e.g. cloud services, digital skills, internet security, data protection and the use of smart TVs. However, core topics such as access to ICT, internet usage, e-government and e-commerce remain unchanged.

The survey has been used in various studies analysing the impact of digital technologies on different aspects of society and development. Several studies have analysed ICT adoption and usage patterns in different countries, highlighting the digital divide based on socio-economic factors such as education, age and income (Dečman, 2018; Gounopoulos et al., 2020; Lecka, 2024). Using data from this survey, Graziella and Francesco (2025) found a positive impact of the pandemic on the use of digital technologies for public services. Gounopoulos et al. focused on digital inequalities 2020) and found that these have an impact on the use of e-government services, with factors such as education level playing an important role. Czaja and Urbaniec (2019) found that digital exclusion can result not only from a lack of access to technology but also from a lack of skills or abilities, which can lead to social exclusion or even no access to jobs. Overall, these studies emphasise the need for policies that address the digital divide and promote ICT use to improve social development and economic progress.

2. Empirical research

According to 2024 data, 94% of EU households have internet access, with the Netherlands and Luxembourg at 99%, and Greece and Croatia at 87% (EUROSTAT, 2024). The largest improvements over the past decade occurred in Bulgaria and Romania, where connectivity rose from below 60% in 2014 to over 90% in 2024. Individual internet use is also high—88% of EU citizens aged 16–74 use the internet daily. The most common activities are sending and receiving emails (80%), using instant messaging (79%), searching for goods or services (75%), and reading online news (65%). Urban–rural differences remain: while Denmark, Luxembourg, and the

Netherlands report near parity, Greece and Bulgaria show gaps of up to 15 percentage points in favour of urban areas.

The EU survey on ICT use divides digital skills into five categories—information and data literacy, communication and collaboration, digital content creation, safety, and problem-solving—based on the Digital Competence Framework (DigComp) (Vuorikari et al., 2022a). These are aggregated into a Digital Skills Indicator (DSK2), which classifies individuals as having no, limited, narrow, low, basic, or above basic skills, depending on the activities performed in the previous three months. For each category, two proficiency levels are calculated: basic and above basic.

Information and Data Literacy measures the ability to identify, locate, assess, and manage digital information (EUROSTAT, 2024). People without skills have not performed any of the following in the past three months: searching for information about goods or services, seeking health-related information, reading online news, or verifying online content. Performing one such activity yields basic skills, and performing multiple activities yields above-basic skills.

Communication and Collaboration assesses the ability to communicate and collaborate digitally while respecting cultural and generational diversity. It includes email, video or phone calls, instant messaging, participation in social networks, and civic or political engagement online. Conducting one of these activities indicates basic skills, while multiple activities indicate above-basic skills.

The Digital Content Creation category measures the ability to create, edit, and share digital content while respecting copyright. Activities include using word processing or spreadsheet software, editing photos or videos, transferring files, creating multimedia documents, using advanced spreadsheet functions, and coding. Completing one or two of these activities classifies a person as having basic skills, and three or more as above basic.

Safety category focuses on protecting personal data, privacy, health, and well-being online. Relevant activities include verifying secure websites, reading privacy policies, managing location data, limiting access to online profiles, objecting to data use for advertising, and adjusting browser settings for cookies. Performing three or more of these activities classifies users as having above basic safety skills.

Problem-solving category covers the ability to use digital tools to address needs and adapt to new technologies. Activities include installing software, adjusting device settings, shopping or selling online, using e-learning or e-banking, and job searching online. One or two activities indicate basic skills; three or more indicate above basic skills.

Two DESI indicators summarise digital skills:

- Individuals have at least basic digital skills if they achieve basic or above basic proficiency in all five categories.
- Individuals have above-basic digital skills if their proficiency is above basic across all categories.

2.1 Methodology

For our empirical study, we used data from the European survey on the use of ICT in households and by individuals, which captures the activities related to ICT usage by respondents in the last three months. We used indicators related to the digital skills defined in the survey. The source of our data was the EUROSTAT microdata set. This data collection provides valuable insights into Europe's digital landscape. The data is anonymised according to the EUROSTAT annex "Explanations on anonymisation" and is identical for all European countries except Malta and Iceland (for some indicators). The data are available on request in Microsoft Excel format.
When coding the data on a person's activity (indicator), a format is used in which the value 0 stands for a non-exercised activity and the value 1 for an exercised activity, e.g.: In the last 3 months, have you used the internet (including via apps) to send/receive emails (private purpose)? 1-Yes / 0-No. There are five indicators for information and data literacy (IL), six for communication and collaboration (CC), seven for digital content creation (DCC), six for security and safety (SF) and seven for problem solving (PS).
An area indicator is calculated for each area in the survey. An area indicator classifies a user's digital skills as "basic" if at least one of the activities (IL and CC area) or one or two of the activities (DCC, SF and PS area) are performed. An area indicator rates a user's digital skills as "above basic" if two or more of the activities (IL and CC area) or three or more of the activities (DCC, SF and PS area) are performed.
From these area indicators, EUROSTAT calculates a composite indicator for digital skills (DSK2). This composite indicator rates a person's skills as "no skills", "limited", "narrow", "low", "basic" and "above basic". For the composite indicator for digital skills, a basic level was achieved if the values of all five domain indicators were "basic" or "above basic", and an above basic level was achieved if the values of all five domain indicators were above basic.
For our analysis, we calculated additional ordinal area indicators. To perform the LPA, we used the following calculation:

- IL = (SUM (IUIF, IHIF, IUNW1, TICXND, MAX (TICCSFOI, TICIDIS, TICNIDIS)))/4
- CC = (SUM (IUEM, IUPH1, IUCHAT1, IUSNET, IUPOL2, IUVOTE))/6
- DCC = (SUM (CWRD1, CXLS1, CEPVA1, CXFER1, CPRES2, CXLSADV1, CPRG2))/7
- SF = (SUM (MAPS_CWSC, MAPS_RPS, MAPS_RRGL, MAPS_LAP, MAPS_RAAD, PCOOK1))/6
- PS = (SUM (CINSAPP1, CCONF1, IBUY, IUSELL, MAX (IUOLC, IUOLM), IUBK, IUJOB))/7

All ordinal values of the area indicators were standardised to values between 0 and 1. We exported the Excel data to an SPSS file in which we performed the analysis. The latent profile analysis was performed with Mplus 8.11 (Muthén & Muthén, 2017) using a CSV file exported from Excel. The Mplus software was used because

of its user-friendly interface and multiple output options that facilitate the latent profile analysis (LPA) process.

2.2 Research settings

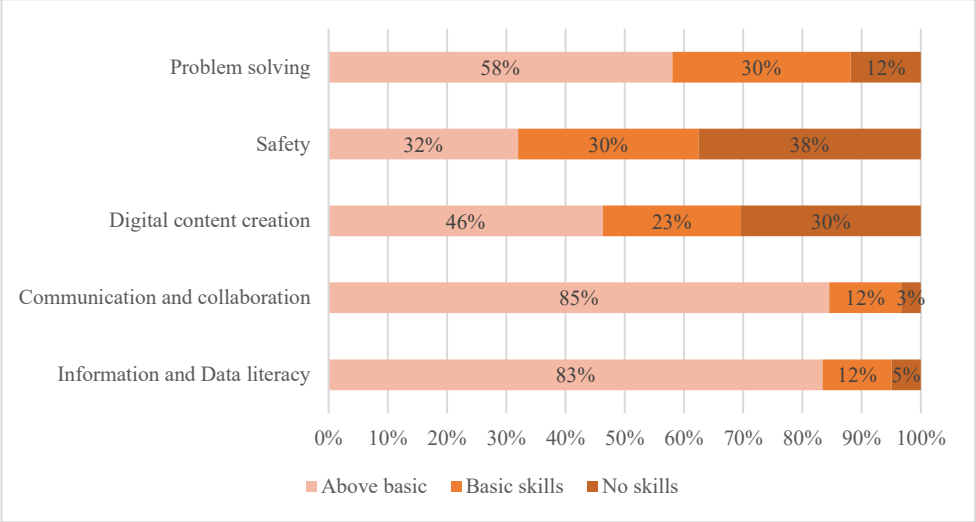
Slovenia has participated in the European survey since its inception. About 2,000 people are interviewed every year by the Statistical Office of the Republic of Slovenia. The purpose of the survey at national level is to provide information that allows conclusions to be drawn about the state of the digital society in Slovenia, i.e. how many people between the ages of 16 and 74 use the internet and its services and for what purposes, how many of them have digital skills and how many of their households have access to the internet from home.
The survey sample is based on the Central Population Register and has been stratified in two stages. The strata are defined according to the statistical region (12 regions) and the settlement type within the statistical region (five types). The number of people in each stratum is proportional to the proportion of people living in the respective statistical region and settlement type. Web-based and face-to-face survey methods were used. The sample size in 2023 was 2,880 people. As we were only interested in users who had used the internet in the last three months, our sample size was 2585.

3. Results

3.1 Basic statistics

Regarding digital skills, Slovenia is at the tail end of European countries. While the European average for basic digital skills is 55,56% (composite digital skills indicator), Slovenia reached 46,7% in 2023. Similarly, the European average for the above basic digital skills was 27,32% in 2023, which is also higher than the Slovenian average of 18,88%. Although the COVID-19 period was recognised as a huge driver of digital society in Slovenia (and other countries), after the COVID-19 period, the situation in Slovenia regarding digital skills worsened, from 49,67% of citizens with at least basic digital skills in 2022 to 46,70% in 2023 (European Commission, 2024a).
When a composite digital skills indicator is decomposed into five area indicators, a clearer picture of the situation emerges (Figure 1). As shown in Figure 1, digital content creation and safety skills are low among the Slovenian population.

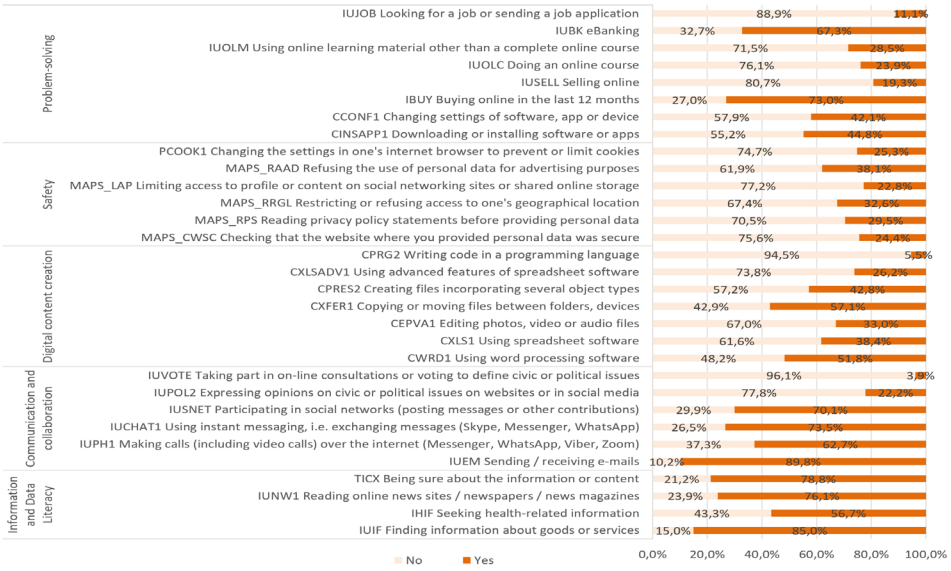
Figure 1. Percentage of individuals with basic or above-basic digital skills in each of the five area indicators



Source: European Commission, 2024a

The detailed results of the individual indicators that create area indicators, showing the conduct of a specific online activity by Slovenian citizens, are depicted in Figure 2.

Figure 2. Indicators representing the use or conduct ("Yes") of a specific online activity in the last three months



Source: European Commission, 2024a

3.2 Correlations with demographic variables

We correlated this indicator with age, income, and education levels. The results show that the composite digital skill level decreases with increasing age. Similar results were observed for income and education levels. More people are digitally skilled in the higher income and higher-educated groups. We also calculated Spearman's rank correlation between all five area indicators of digital skills and age (six classes), education (three classes), and income (five classes).

Table 1. Correlation matrix (Spearman's rho) between area digital skill indicators and demographic groups

	HH_IQ5	AGECLS	ISCED	SEX (p-value)*
IL	.215**	-.159**	.221**	.058
CC	.177**	-.387**	.115*	.008***
DCC	.294**	-.352**	.304**	.575
SF	.186**	-.235**	.180**	.864
PS	.314**	-.396**	.294**	.500
DSK2	.257**	-.340**	.267**	.686

**Mann-Whitney U test, p<.05 shows statistically significant difference between male and female*

*** p < .01*

Source: Authors

The results show that age, income, and education level are statistically significant moderators of all five digital skills areas and the composite digital skills indicator. Comparable findings in other contexts confirm that age, income and education remain decisive moderators in the appropriation of digital resources and the development of competences (Hong, 2024; Nchaga, 2025). With age, the value was negative, meaning that the older the individual, the lower the skill level. No significant difference was detected for sex, except for the content creation area. Therefore, the gender gap in digital skills in Slovenia is not problematic.

3.3 Latent profile analysis

Latent Profile Analysis (LPA) was used to identify unobserved subgroups for area digital skills within the sample based on response patterns across a set of standardised ordinal area indicators. The optimal number of latent profiles was determined using model fit indices, including the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and entropy values, as well as the Vuong-Lo-Mendell-Rubin likelihood ratio (VRML) test and theoretical interpretability. For the AIC and BIC, lower values indicate a better model fit. A significant p-value (typically $p < .05$) of the VRML test suggests that the k-profile model provides a statistically better fit than the k – 1-profile model, justifying the retention of the additional class. Additionally, entropy (values > 0.80 and marginal

value ≥ 0.70) and average posterior probability values (values > 0.70) were considered. The resulting latent profiles offer a data-driven classification of individuals, facilitating a nuanced understanding of heterogeneity within the population and informing the subsequent analyses.

The results in Table 2 show that the 5-profile model is the best option, with the lowest BIC value. The Vuong–Lo–Mendell–Rubin Likelihood Ratio Test (VLMR) indicated that the model with five profiles fit significantly better than the four-profile model (p = .00001), whereas the six-profile model did not provide a significant improvement (p = .0677), supporting the selection of the five-profile solution. The entropy for the selected five-profile solution was 0.6705, indicating a moderate degree of classification accuracy and a clear separation between the latent profiles.

Table 2. Model testing in LPA

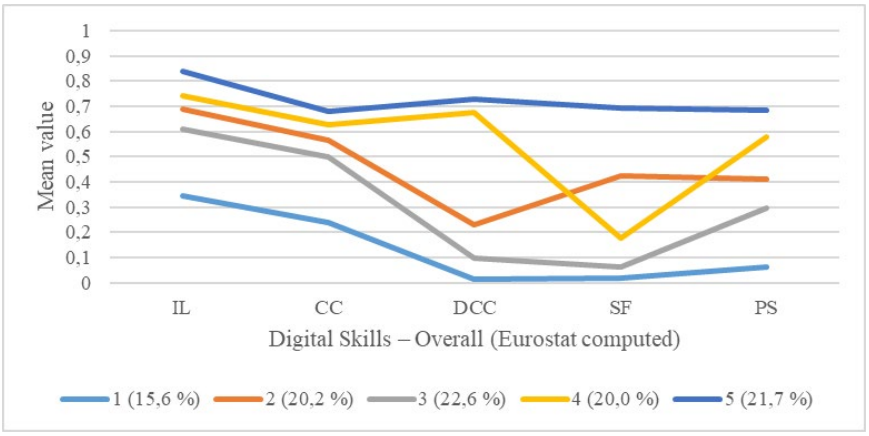
	LL	BIC(LL)	AIC(LL)	Npar	L^2	VLMR	p-value	Entropy R^2
3-Cluster	-20405.2	41140.45	40894.43	42	4672.227			0.7817
4-Cluster	-20314.6	41006.34	40725.18	48	4490.98	181.2474	<.001	0.7088
5-Cluster	**-20283.4**	**40991.09**	**40674.78**	**54**	**4428.577**	**62.4025**	**0.0001**	**0.6705**
6-Cluster	-20263.9	40999.34	40647.89	60	4389.686	38.8914	0.0677	0.6232

**LL – Loglikelihood, Npar – Number of parameters, L^2 - Likelihood ratio Chi-squared, VLMR - Vuong-Lo-Mendell-Rubin likelihood ratio test*

Source: Authors

The results in Figure 3 show the characteristics of the five classes proposed by LPA. Class 1 (low-skilled class), to which 15,6% of the respondents belonged, was characterised by consistently low mean values across all digital skill areas, especially Digital Content Creation (DCC) and Safety (SF). These participants are likely to require broad foundational support for digital literacy. Class 5, on the other hand (high-skilled), represents respondents who are very likely to be high-skilled in all five areas. Class 2 represents users who are very likely to be well-skilled in information and data literacy, communication, and collaboration, fairly skilled in safety, but unskilled in content creation. Regarding safety and problem-solving skills, we might say that they are fairly skilled. Class 3 members are quite unskilled in digital content creation and lack safety skills. Participants who belong to Class 4 are very likely to be fairly skilled in all skill categories except safety. We may call this class “skilled naive users”.

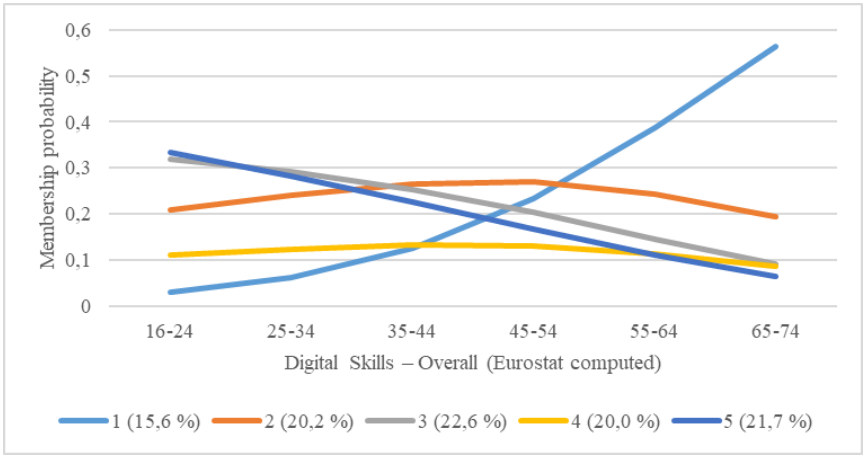
Figure 3. Digital skills profiles of the Slovenian population



Source: Authors

We tested the impact of the covariate "age class". A covariate is a variable that is not used to define latent classes but is included to examine its influence on latent class membership or to adjust for confounding (Nylund et al., 2007). Figure 4 shows that the probability of a participant belonging to Class 1 (i.e. the low-skilled class) significantly increases with age. Similarly, the probability of membership in the high-skilled class decreases with age. Age also impacted the membership probability for Class 3 (semi-skilled with low digital content creation and safety skills). However, age did not substantially impact classes 2 and 4 (semi-skilled with low digital content creation skills and skilled with low safety skills). It appears that information and data literacy skills and communication and collaboration skills are invariant across age groups.

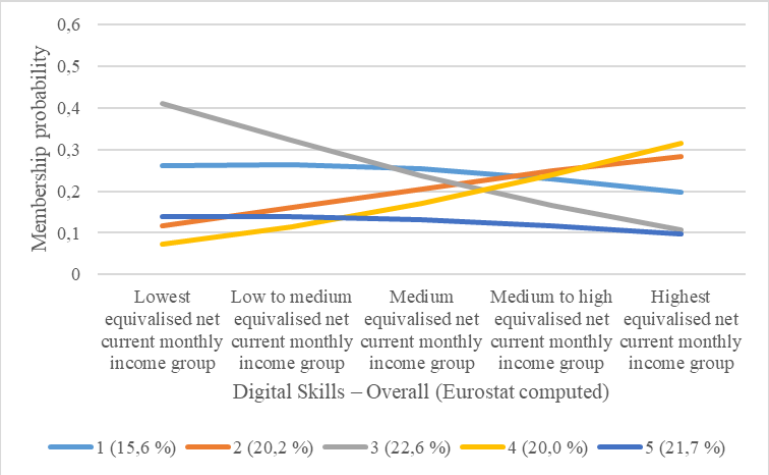
Figure 4. Impact of covariate age on class membership



Source: Authors

We further tested the impact of the covariate "income group". Figure 5 shows that the probability of membership in latent profile Class 3 (semi-skilled with low digital content creation and safety skills) decreased as a function of the income group. In contrast, the probability of membership in Classes 2 and 4 increases with income, indicating that respondents with higher incomes are more likely to be skilled in information and data literacy and communication and collaboration skills, but lack either safety skills or digital content creation skills. Interestingly, the probability of membership in Classes 1 and 5 is not highly impacted by income class, meaning that highly skilled or unskilled respondents can have very high or very low incomes.

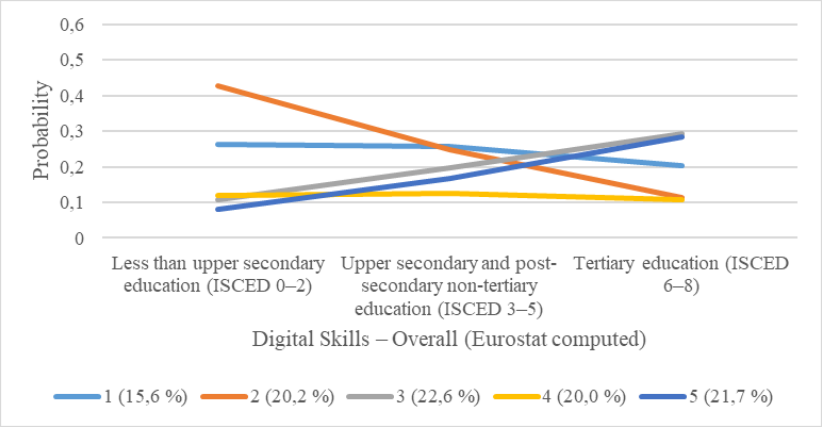
Figure 5. Impact of covariate income group on class membership



Source: Authors

Figure 6 shows that the probability of membership in latent profile Class 2 (semi-skilled with low digital content creation skills) decreased as a function of education level. In contrast, the probability of membership in Classes 3 and 5 slightly increases with education level, indicating that respondents with better education are more likely to be highly skilled in all areas or skilled only in information and data literacy, communication and collaboration skills, and problem solving. The probability of membership in Classes 1 and 4 was not highly affected by the education level. Focusing on Class 4, it appears that people with high skills in all areas except safety appear to be overconfident regardless of their education level.

Figure 6. The impact of the covariate education level on class membership



Source: Authors

4. Discussions and conclusions

This study empirically examined digital skill levels in Slovenia using the DigComp framework and latent profile analysis (LPA) on Eurostat microdata. Five distinct digital skill profiles emerged, ranging from low-skilled to high-skilled users, with intermediate profiles revealing weaknesses in digital content creation and online safety. These findings contextualise Slovenia's lag behind the EU Digital Decade target of 80% of citizens possessing at least basic digital skills by 2030. The five-profile solution was statistically robust, with entropy values above the threshold and significant VLMR test results. Notably, the high-skilled profile (Class 5) was the only group showing near-universal competence in all DigComp domains, while the low-skilled profile (Class 1) showed consistently weak engagement, particularly in digital content creation and safety areas also identified as problematic in Slovenia's DESI report (European Commission, 2024a). Intermediate profiles demonstrated strong information and communication skills but limited abilities in digital production and safety, echoing findings that users often overestimate their competence in these less visible areas (Helsper & Eynon, 2013).

Consistent with Morte-Nadal and Esteban-Navarro (2025), income and age were key mediators of digital skills. Higher-income individuals benefit from better technologies and learning opportunities, thereby accumulating more digital capital (Ragnedda et al., 2024). Conversely, low-income groups risk stagnating at basic skill levels, limiting the conversion of digital resources into social and economic capital. These findings reinforce Resource and Appropriation Theory (RAT) (van Deursen & van Dijk, 2015; van Dijk, 2020), which posits that personal and positional resources shape access, use, and outcomes of ICTs.

Our results align with DESI 2024 and with Dodel and Mesch (2019), who emphasise socio-economic mediation of digital skills. Unlike the binary DESI classification, our LPA revealed latent heterogeneity, addressing calls for a more nuanced

understanding of digital competencies (Kovács et al., 2022; Stofkova et al., 2022). The modular structure of the profiles also supports Allmann and Blank's (2021) argument that digitalisation demands a spectrum of skills—users may excel in one area while lacking in another. For instance, "skilled naive" users (Class 4) displayed advanced abilities overall but low safety awareness.

By mapping digital capital across demographic factors, this study confirms that older generations accumulate less digital capital due to weaker DigComp competences. The results empirically validate digital capital theory (Ragnedda et al., 2024), showing how age, income, and education shape the acquisition and transformation of digital resources. The findings also advance second-level digital divide research (van Dijk, 2005) by showing that inequality today concerns competencies rather than access. Despite 94% of EU households having internet access, only 55% of individuals possess basic skills (European Commission, 2024a). The segmentation supports a multidimensional understanding of digital exclusion (van Deursen et al., 2017).

This study also resonates with platform society theory (van Dijck et al., 2018), revealing persistent inequalities in skills essential for meaningful participation—particularly content creation and cybersecurity. These results challenge assumptions that frequent technology use, especially among youth, implies universal competence (Smith et al., 2020).

From a policy perspective, the results suggest that Slovenia's Digital Slovenia 2030 strategy should move from broad inclusion policies toward targeted interventions tailored to specific demographic groups, as recommended by Morte-Nadal and Esteban-Navarro (2025). The LPA showed that older individuals are more likely to belong to low-skill profiles, while younger low-income users often lack safety awareness. Thus, digital education should focus on:

- Safety and privacy training for young and advanced users;
- Content creation and productivity skills for the general population;
- Holistic digital support for older adults.

Investments in education and training are vital to ensure that digital resources are effectively transformed into competences. Evidence suggests that European funding can accelerate digitalisation and human capital development with positive social impacts (Uricaru et al., 2025). Simultaneously, automation and AI debates highlight the need for education-driven interventions to prevent deepening inequalities (Howcroft & Taylor, 2022).

Income had only a modest effect on high-skill membership, implying that educational interventions may be more effective than financial redistribution.

Despite its contributions, the study has limitations. First, Eurostat's activity-based indicators may over- or underestimate actual competencies (Vuorikari et al., 2022b). Second, its cross-sectional design restricts causal inferences regarding age or income. Third, the moderate entropy (0.67) indicates some uncertainty in classification. Future research should integrate performance-based assessments, employ longitudinal designs, and conduct comparative LPA studies across EU countries to benchmark Slovenia and guide Europe-wide digital skills strategies.

Acknowledgment

The authors acknowledge the financial support from University of Ljubljana under the Slovenian Research and Innovation Agency (Research Programme – Digital transformation for Smart Public Governance, no. P2-0426).

References

Alkali, Y.E., Amichai-Hamburger, Y. (2004). Experiments in Digital Literacy. *CyberPsychology & Behavior*, *7*(4), 421-429. https://doi.org/10.1089/cpb.2004.7.421

Allmann, K., Blank, G. (2021). Rethinking digital skills in the era of compulsory computing: Methods, measurement, policy and theory. *Information, Communication & Society*, *24*(5), 633-648. https://doi.org/10.1080/1369118X.2021.1874475

Androniceanu, A., Colesca, S. E.. (2025). Triple Helix Model and Artificial Intelligence in Public Administration. *Central European Public Administration Review, 23*(2), 63-91. https://doi.org/10.17573/cepar.2025.2.03

Ariansyah, K., Anandhita, V. H., and Sari, D. (2019). Investigating the Next Level Digital Divide in Indonesia. *2019 4th Technology Innovation Management and Engineering Science International Conference (TIMES-iCON)*, 1-5. https://doi.org/10.1109/TIMES-iCON47539.2019.9024668

Barna, C., Epure, M. (2020). Analyzing youth unemployment and digital literacy skills in Romania in the context of the current digital transformation. *Review of Applied Socio-Economic Research*, *20*(2), Article 2.

Bartolomé, J., Garaizar, P., and Larrucea, X. (2021). A Pragmatic Approach for Evaluating and Accrediting Digital Competence of Digital Profiles: A Case Study of Entrepreneurs and Remote Workers. *Technology, Knowledge and Learning*, *27*. https://doi.org/10.1007/s10758-021-09516-3

Brătucu, G., Nichifor, E., Sumedrea, S., Chițu, I. B., and Lixăndroiu, R. C. (2022). Avoiding Digital Divide in European Union through European Green Deal. *Amfiteatru Economic*, *24*(59), 77-93.

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. https://doi.org/10.1080/02681102.2020.1841713

Czaja, I., Urbaniec, M. (2019). Digital Exclusion in the Labour Market in European Countries: Causes and Consequences. *European Journal of Sustainable Development*, *8*(5), Article 5. https://doi.org/10.14207/ejsd.2019.v8n5p324

Dečman, M. (2018). The Analysis of E-Government Services Adoption and Use in Slovenian Information Society between 2014 and 2017. *Central European Public Administration Review*, *16*(2), Article 2. https://doi.org/10.17573/cepar.2018.2.10

Dobrolyubova, E. (2021). Measuring Outcomes of Digital Transformation in Public Administration: Literature Review and Possible Steps Forward. *NISPAcee Journal of Public Administration and Policy, 14*(1),61-86. https://doi.org/10.2478/nispa-2021-0003

Dodel, M. (2022). Socioeconomic Inequalities and Digital Skills. In D.A. Rohlinger and S. Sobieraj (Eds), *The Oxford Handbook of Digital Media Sociology* (p. 0). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780197510636.013.30

Dodel, M., Mesch, G. (2019). An integrated model for assessing cyber-safety behaviors: How cognitive, socioeconomic and digital determinants affect diverse safety practices. *Computers & Security*, *86*, 75-91.

Elena-Bucea, A., Cruz-Jesus, F., Oliveira, T., and Coelho, P. S. (2021). Assessing the Role of Age, Education, Gender and Income on the Digital Divide: Evidence for the European Union. *Information Systems Frontiers*, *23*(4), 1007-1021. https://doi.org/10.1007/s10796-020-10012-9

Eshet, Y. (2004). Digital literacy: A conceptual framework for survival skills in the digital era. *Journal of Educational Multimedia and Hypermedia*, *13*(1), 93-106.

European Commission. (2022). *The Digital Economy and Society Index (DESI) | Shaping Europe's digital future*. (n.d.). Retrieved 9 April 2025, from https://digital-strategy.ec.europa.eu/en/policies/desi

European Commission. (2024a). *DESI - Compare countries progress*. Shaping Europe's Digital Future. https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts/compare-countries-progress?period=desi_2024&indicator=desi_dsk_bab&breakdown=ind_total&unit=pc_ind&country=SI

European Commission. (2024b, February 6). *Digital Decade 2024: DESI Methodological Note | Shaping Europe's digital future*. https://digital-strategy.ec.europa.eu/en/library/digital-decade-2024-desi-methodological-note

European Commission. (2025). *Digital Decade DESI visualisation tool*. https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts

EUROSTAT. (2024). *Survey on the use of ICT in households and by individuals—Microdata—Eurostat*. EUROSTAT. https://ec.europa.eu/eurostat/web/microdata/survey-ict-use-households-individuals?utm_source=chatgpt.com

Fernandez, L., Reisdorf, B.C., and Dutton, W.H. (2020). Urban Internet myths and Realities: A Detroit case study. *Information, Communication & Society*, *23*(13), 1925-1946. https://doi.org/10.1080/1369118X.2019.1622764

Ferrari, A., Punie, Y., and Redecker, C. (2012). Understanding Digital Competence in the 21st Century: An Analysis of Current Frameworks. In A. Ravenscroft, S. Lindstaedt, C. D. Kloos, and D. Hernández-Leo (Eds), *21st Century Learning for 21st Century Skills* (pp. 79-92). Springer. https://doi.org/10.1007/978-3-642-33263-0_7

Fraillon, J., Rožman, M. (Eds.). (2025). *IEA International Computer and Information Literacy Study 2023: Assessment Framework*. Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-61194-0

Gounopoulos, E., Kontogiannis, S., Kazanidis, I., and Valsamidis, S. (2020). The Impact of the Digital Divide on the Adoption of e-Government in Greece. *KnE Social Sciences*, *4*(1), 401-411. https://doi.org/10.18502/kss.v4i1.6002

Government of Slovenia. (2023). *DIGITALNA SLOVENIJA 2030*. https://www.gov.si/assets/ministrstva/MDP/Dokumenti/DSI2030-potrjena-na-Vladi-RS_marec-2023.pdf

Graziella, B., Francesco, F. (2025). The Impact of the COVID-19 Pandemic on the Demand of ICT for Public Services from EU Individuals. In L. Aldieri (Ed.), *Technological Evolution: How Innovations are Changing our Future* (pp. 27-39). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-85814-7_2

Gupta, K. (2020). Impact of digital divide on e-government use intention: Moderating role of socio-demographic factors. *International Journal of Electronic Governance*, *12*(3), 224. https://doi.org/10.1504/IJEG.2020.109833

Hatlevik, O.E., Guðmundsdóttir, G.B., and Loi, M. (2015). Digital diversity among upper secondary students: A multilevel analysis of the relationship between cultural capital, self-efficacy, strategic use of information and digital competence. *Computers & Education*, *81*, 345-353. https://doi.org/10.1016/j.compedu.2014.10.019

Helsper, E.J., Eynon, R. (2013). Distinct skill pathways to digital engagement. *European Journal of Communication*, *28*(6), 696-713. https://doi.org/10.1177/0267323113499113

Hong, O.C. (2024). Adapting communication technologies to enhance social support and lifelong learning for older adults. *Journal of Digitovation and Information System, 4*(1), 32-47. https://doi.org/10.54433/JDIIS.2024100036

Horváth, L., M. Pintér, T., Misley, H., and Dringó-Horváth, I. (2025). Validity evidence regarding the use of DigCompEdu as a self-reflection tool: The case of Hungarian teacher educators. *Education and Information Technologies*, *30*(1), 1-34. https://doi.org/10.1007/s10639-024-12914-6

Hosman, L., Comisso, M.A.P. (2020). How do we understand "meaningful use" of the internet? Of divides, skills and socio-technical awareness. *Journal of Information, Communication and Ethics in Society*, *18*(3), 461-479. https://doi.org/10.1108/JICES-05-2020-0055

Howcroft, D., Taylor, P. (2022). Automation and the future of work: A social shaping of technology approach. *New Technology, Work and Employment, 38*(3), 351-370. https://doi.org/10.1111/ntwe.12240

Kaztman, R. (2010). *Impacto social de la incorporación de las nuevas tecnologías de información y comunicación en el sistema educativo*. Naciones Unidas Comisión Económica para América Latina y el Caribe (CEPAL). https://ideas.repec.org/p/ecr/col041/6171.html

Kovács, T.Z., Bittner, B., Nagy, A.S., and Nábrádi, A. (2022). Digital transformation of human capital in the EU according to the DESI index. *Issues in Information Systems*, *23*(4), 293-311.

Lecka, E. (2024). Availability and Use of Information and Communication Technologies (ICT) in Households in Central and Eastern European Countries. *Rocznik Instytutu Europy Środkowo-Wschodniej*, *22*. https://ies.lublin.pl/en/rocznik/yearbook/riesw/2024/3/5/

Lythreatis, S., Singh, S.K., and El-Kassar, A.-N. (2022). The digital divide: A review and future research agenda. *Technological Forecasting and Social Change*, *175*, 121359. https://doi.org/10.1016/j.techfore.2021.121359

Mbandje, D.C., Loureiro, M.J., and Lucas, M. (2023). Digital competence and information literacy: Clarifying concepts based on a literature review. *Educational Media International*, *60*(3-4), 306-316. https://doi.org/10.1080/09523987.2023.2324584

Mesa, D. (2023). Digital divide, e-government and trust in public service: The key role of education. *Frontiers in Sociology*, *8*. https://doi.org/10.3389/fsoc.2023.1140416

Morte-Nadal, T., Esteban-Navarro, M.Á. (2025). Recommendations for digital inclusion in the use of European digital public services. *Humanities and Social Sciences Communications*, *12*(1), 1-14. https://doi.org/10.1057/s41599-025-04576-7

Mossberger, K., Tolbert, C.J., and McNeal, R. S. (2007). *Digital Citizenship: The Internet, Society, and Participation*. The MIT Press. https://doi.org/10.7551/mitpress/7428.001.0001

Muthén, L.K., Muthén, B. O. (2017). Mplus User's Guide. Muthén & Muthén. https://www.statmodel.com/download/usersguide/MplusUserGuideVer_8.pdf

Nchaga, A. (2025). Exploring community-based learning: Opportunities and challenges. *Research Output Journal of Arts and Management, 4*(1), 42-46. https://doi.org/10.59298/ROJAM/2025/414652

Nylund, K.L., Asparouhov, T., and Muthén, B.O. (2007). Deciding on the Number of Classes in Latent Class Analysis and Growth Mixture Modeling: A Monte Carlo Simulation

Study. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(4), 535-569. https://doi.org/10.1080/10705510701575396

OECD. (2019). *PIAAC*. OECD. https://www.oecd.org/en/about/programmes/piaac.html

Pangrazio, L., Godhe, A.-L., and Ledesma, A.G.L. (2020). What is digital literacy? A comparative review of publications across three language contexts. *E-Learning and Digital Media*, *17*(6), 442-459. https://doi.org/10.1177/2042753020946291

Pesha, A. (2022). *The Development of Digital Competencies and Digital Literacy in the 21st Century: A Survey of Studies | Education and Self Development*. *17*(1), 201-220. https://doi.org/10.26907/esd.17.1.16

Ragnedda, M., Ruiu, M.L., and Calderón-Gómez, D. (2024). Examining the Interplay of Sociodemographic and Sociotechnical Factors on Users' Perceived Digital Skills. *Media and Communication*, *12*(0). https://doi.org/10.17645/mac.8167

Raihan, M.M.H., Subroto, S., Chowdhury, N., Koch, K., Ruttan, E., and Turin, T. C. (2024). Dimensions and barriers for digital (in)equity and digital divide: A systematic integrative review. *Digital Transformation and Society*, *4*(2), 111-127. https://doi.org/10.1108/DTS-04-2024-0054

Rawal, D.M. (2024). Mapping of school teachers' digital competency in the context of digital infrastructure: A systematic review and empirical study of India. Journal *of Professional Capital and Community, 9*(3), 173-195. https://doi.org/10.1108/JPCC-01-2024-0016

Riztia, T., Wardhanie, S.C., and Utama, R. E. (2025). Memahami konsep komponen human capital. *Jurnal Ilmiah Manajemen dan Kewirausahaan, 4*(2), 584-591. https://doi.org/10.55606/jimak.v4i2.4734

Robinson, L., Cotten, S.R., Ono, H., Quan-Haase, A., Mesch, G., Chen, W., Schulz, J., Hale, T.M., and Stern, M.J. (2015). Digital inequalities and why they matter. *Information, Communication & Society*, *18*(5), 569-582.

Rogers, E.M. (2001). The Digital Divide. *Convergence*, *7*(4), 96-111. https://doi.org/10.1177/135485650100700406

Schmölz, A., Geppert, C., Schwarz, S., Svecnik, E., Koch, J., Bieg, T., and Freund, L. (2023). Assessing the Second-Level Digital Divide in Austria: A Representative Study on Demographic Differences in Digital Competences. *Digital Education Review*, *44*, Article 44. https://doi.org/10.1344/der.2023.44.61-75

Setiawan, A. (2024). Integrating digital literacy and entrepreneurship in Pesantren curriculum for economic empowerment. *Edu Spectrum:* Journal *of Multidimensional Education, 1*(1), 48-55. https://doi.org/10.70063/eduspectrum.v1i1.26

Shostak, L., Ulyanytsky, A. (2025). Conceptual model of the economic mechanism of digitalization for food industry enterprises. *Business Navigator, 2025*(1), 22-34. https://doi.org/10.32782/business-navigator.80-93

Smith, E.E., Kahlke, R., and Judd, T. (2020). Not just digital natives: Integrating technologies in professional education contexts. *Australasian Journal of Educational Technology*, *36*(3), Article 3. https://doi.org/10.14742/ajet.5689

Stofkova, J., Poliakova, A., Stofkova, K.R., Malega, P., Krejnus, M., Binasova, V., and Daneshjo, N. (2022). Digital Skills as a Significant Factor of Human Resources Development. *Sustainability*, *14*(20), Article 20. https://doi.org/10.3390/su142013117

Sukma, N., Yamnill, S. (2025). Unlocking the future of insurance: The power of open data, digital transformation, and human talent. *Human Resource Development Quarterly. Advance online publication*. https://doi.org/10.1002/hrdq.70002

UK Departmenr for Education. (2019). *National standards for essential digital skills*. GOV.UK. https://www.gov.uk/government/publications/national-standards-for-essential-digital-skills

UNESCO. (2018). *A global framework of reference on digital literacy skills for indicator 4.4.2—UNESCO Digital Library*. https://unesdoc.unesco.org/ark:/48223/pf0000265403

UNESCO. (2022, June 22). *Digital literacy*. https://uis.unesco.org/en/glossary-term/digital-literacy

Uricaru, R., Murariu, A.I., and Onea, D. R. (2025). The role of European funds in accelerating digitalization and human capital development: Impact on poverty reduction and economic growth. *Proceedings of the International Conference on Business Excellence, 19*(1), 1012-1025. https://doi.org/10.2478/picbe-2025-0359

van Deursen, A.J.A.M., van Dijk, J.A.G.M. (2015). Toward a Multifaceted Model of Internet Access for Understanding Digital Divides: An Empirical Investigation. *The Information Society*, *31*(5), 379-391. https://doi.org/10.1080/01972243.2015.1069770

van Deursen, A.J., Helsper, E.J., and Eynon, R. (2016). Development and validation of the Internet Skills Scale (ISS). *Information, Communication & Society*, *19*(6), 804-823.

van Deursen, A.J., Helsper, E., Eynon, R., and Van Dijk, J. A. (2017). The compoundness and sequentiality of digital inequality. *International Journal of Communication*, *11*, 452-473.

van Dijck, J., Poell, T., and de Waal, M. (2018). *The Platform Society: Public Values in a Connective World*. Oxford University Press.

van Dijk, J. (2005). *The deepening divide: Inequality in the information society*. Sage Publications. https://www.google.com/books?hl=en&lr=&id=AwGJCgAAQBAJ&oi=fnd&pg=PA1&dq=VAN+DIJK,+Jan+A.+G.+M.+(2005).+The+Deepening+Divide:+Inequality+in+the+Information+Society,+Thousand+Oaks,+Sage.&ots=vICdOoam18&sig=ABgFRD7xHsHsC_8brL75OkkL-vc

van Dijk, J. (2020). *The Digital Divide*. John Wiley & Sons.

van Laar, E., van Deursen, A.J.A.M., Helsper, E.J., and Schneider, L. (2022). *The youth Digital Skills Performance Tests*. https://doi.org/10.5281/zenodo.7110265

van Laar, E., van Deursen, A.J.A. M., van Dijk, J.A.G.M., and de Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior*, *72*, 577-588. https://doi.org/10.1016/j.chb.2017.03.010

Vuorikari, R., Jerzak, N., Karpinski, Z., Pokropek, A., and Tudek, J. (2022a). Measuring digital skills across the EU: Digital skills indicator 2.0. *Joint Research Centre Publications Office of the European Union*, 4-26.

Vuorikari, R., Kluzer, S., and Punie, Y. (2022b). *DigComp 2.2: The Digital Competence Framework for Citizens - With new examples of knowledge, skills and attitudes*. JRC Publications Repository. https://doi.org/10.2760/115376

Vuorikari, R., Punie, Y., Carretero, S., and Van Den Brande, L. (2016). *DigComp 2.0: The Digital Competence Framework for Citizens. Update Phase 1: the Conceptual Reference Model.* JRC Publications Repository. https://doi.org/10.2791/607218