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The effects of individual and cultural factors on digital inclusion in European countries: a two-level regression analysis

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Abstract

Purpose – With digitisation, a new kind of inequality has emerged in society between people and groups of people. A lack of digital inclusion creates challenges for the economic and social development of society and citizen participation. This study analyses how the country-level cultural factors defined by Hofstede are associated with citizens' digital skills and internet usage and how they moderate the effects of age, gender, educational level and income level.

Design/methodology/approach – This comparative cross-sectional study examines digital inclusion in 22 European countries. Data from the European Social Survey (N = 37,602) are analysed using a two-level regression analysis.

Findings – The study found significant effects of demographic and socio-economic factors and country-level indulgence on digital skills and internet usage. In addition, the study shows that a high value on the indulgence index moderates the negative effect of age.

Originality/value – The digital divide has been studied widely with regard to individual-level influencing factors and international comparisons. The significance of Hofstede's cultural dimensions in terms of digitisation and digital divides has also been confirmed in previous studies. However, there is a lack of analysis combining the effects of country-level culture and individual-level demographic and socio-economic factors on citizens' digital skills and internet usage. Generally, the research emphasises the significance of national culture in digital inclusion and especially in supporting the digital inclusion of older adults.

Keywords Digital divide, Digital inclusion, Digital exclusion, Socio-economic factors, Culture, Indulgence

Paper type Research paper

1. Introduction

With digitisation, online services have become more common in both the private and public sectors, and digital interaction has in many cases replaced face-to-face interaction. Surviving in the information society and achieving beneficial internet outcomes requires access to the internet and possession of digital skills (van Deursen and van Dijk, 2009), as well as an ability on the part of consumers to engage in independent use of online services (Keeling *et al.*, 2019). However, not all citizens have the resources required for a digital society, and so digitalisation has created a new type of inequality in developed societies between individuals and groups of people (Selwyn, 2004; Helsper, 2021).

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International comparisons show that the diffusion of the internet, the increase in its use and citizens' development of digital skills have progressed at different rates in different countries in Europe (Çilan *et al.*, 2009; Cruz-Jesus *et al.*, 2018). Traditionally, studies have found gaps between southern and northern Europe, and between Northern or Western Europe and Eastern Europe (van Dijk, 2009), although the differences within Eastern Europe, for example, are also large (Ragnedda and Kreitem, 2018). Also, in new comparative reports, considerable country-specific differences in digital skills within the European Union can be seen (Digital Economy and Society Index [DESI] 2022, 2022, p. 21). The proportion of people with basic or above basic digital skills is about 80% in Finland and the Netherlands, but only slightly more than 30% in Bulgaria and less than 30% in Romania. In addition, previous studies show that the influence of individual values on internet use differs in various European countries (Choden *et al.*, 2019).

The national differences in the level of digital development can be explained from different perspectives. The dependence of digitisation development on economic factors such as gross domestic product (GDP) is obvious (Chinn and Fairlie, 2010; Cruz-Jesus *et al.*, 2018), but more versatile perspectives are also needed. According to some studies, cultural factors explain the digital divide (Zhao *et al.*, 2014) and internet diffusion (Maitland and Bauer, 2001) better than GDP per capita. However, the social and cultural determinants of digital skills and internet use have been studied very little (Scheerder *et al.*, 2017).

The present study aims to fill this gap in the research and analyse the effects of individual-level factors, cultural factors, and their interactions on individual-level digital inclusion in Europe. We approach the question using Hofstede's (1980, 2011) model, which describes the influence of national culture on people's thinking and behaviour as well as on corporate culture. It is based on an analysis of extensive cross-cultural survey data collected from IBM employees. The starting point is the observation that the patterns of correlation at the country level were fundamentally different from what was found at the individual level. For decades, the model has been developed and supplemented so that the current model includes six cultural dimensions: power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, long-term versus short-term orientation and indulgence versus restraint. The sixth and last dimension added to the model, indulgence versus restraint, describes the gratification or control of basic human desires related to enjoying life (Hofstede, 2011). It is the least studied of the dimensions, but quite essential from the point of view of digital development (Dan, 2018; Rubino *et al.*, 2020; Robul *et al.*, 2023).

We study how the country-level cultural factors defined by Hofstede link with citizens' digital skills and internet usage as well as how they moderate the effects of age, gender, educational level and income level. We examine these questions by analysing data from the European Social Survey ($N = 37{,}602$ in 22 countries) using two-level regression analysis.

2. Theoretical background

2.1 The concepts of digital divide and digital inclusion

In the discussion about digital inequality, three levels of divide are typically distinguished (van Deursen and Helsper, 2015a; Helsper, 2021). The first level is related to devices and connections, the second level to effective use and digital skills, and the third level to the outcomes or benefits of using information and communication technologies (ICTs). Recently, the importance of the second and third levels of divide has been central, although research also shows that the first level of divide is still relevant, even in developed Western countries, due to the rapid development of digital devices and peripherals as well as the expense required to maintain hardware, software and subscriptions (van Deursen and van Dijk, 2019). In addition, many different types of internet skills (Van Deursen *et al.*, 2014) and internet outcomes in many individual fields (van Deursen and Helsper, 2015a) are talked about; thus, the digital divide is related to quite a variety of issues.

The concept of digital inclusion, in turn, highlights the link between digital use and social inclusion on the one hand and social and digital exclusion on the other, and it can be defined

through four broad categories of digital resources: ICT access, skills, attitudes and extent of engagement with technologies (Helsper, 2008; 2021, p. 23). However, the components of digital inclusion have been structured in varying ways in previous studies (e.g. Thomas *et al.*, 2021; Sharp, 2022; Sabri *et al.*, 2023). The concept of digital inclusion itself is also complex, and it can be approached from various research traditions linked with differing views about society and social dynamics, the state, markets, civil society relations and public policies (Mori, 2011). The pursuit of digital inclusion can be related to various economic and social development goals of society and also issues concerning social inequalities and existing social hierarchies and power structures, as well as the challenges of various vulnerable groups in digital societies (Mori, 2011; Mariën and Prodnik, 2014; Tsatsou, 2022). In the discussion about digital inequality, the focus is often on various gaps and divisions, but Reisdorf and Rhinesmith (2020), for example, have called for a move towards solutions and asset-based approaches.

In this study, we do not examine all components of the digital divide or digital inclusion; the scope of our research is more limited. Much of the previous research has focused on the second-level digital divide, i.e. digital skills and internet usage (Scheerder *et al.*, 2017; Lythreatis *et al.*, 2022), and we also examine this. We analyse how Hofstede's cultural dimensions affect digital skills and internet use, and how cultural factors moderate the effects of citizens' age, gender, educational level and income level on these. In contrast, the effects of cultural factors on access to the internet and digital services, for example, or on the perceived benefits of using them are excluded from the scope of this study.

2.2 The importance of demographic and socio-economic factors in terms of digital inclusion

Previous studies on the factors influencing digital skills, internet use and outcomes of use have focused particularly on demographic (gender, age) and socioeconomic (educational level, household income) determinants (Scheerder *et al.*, 2017). Age is one of the key factors linked to internet usage. For example, Choden *et al.*'s (2019) study covering 25 European countries found that age influenced internet use in all countries, whilst the impact of other individual-level factors (gender, educational level, income level) was significant only in some countries. Studies have shown the effects of age on both internet use (Van Deursen and Helsper, 2015b) and internet skills (Hargittai *et al.*, 2019), and an age gap can be found in all areas of digital ability (Thomas *et al.*, 2021). However, older citizens are a diverse group and some are at greater risk of digital exclusion than others (Hargittai *et al.*, 2019). Furthermore, it should be noted that the digital divide exists in all age groups.

The gender-related gap in internet access and use is a commonly recognised challenge that particularly affects women and girls in developing countries, contributing to increasing gender inequality (e.g. ITU, 2023). There are also gender-related digital divides in European countries, however: for the share of people with basic digital skills, the gender gap is significantly smaller than the gap in age or socio-economic factors (Digital Economy and Society Index [DESI] 2022, p. 24), and it does not exist in the case of all digital devices (Van Deursen and Van Dijk, 2019). Conversely, an Australian survey has found that young women have better digital skills than young men, though females have a lower level of digital inclusion than males across all age categories and the gender gap increases with age (Thomas *et al.*, 2020, p. 18).

Several previous studies have revealed the influence of socio-economic factors on digital inclusion. A low level of education and household income together with being outside the labour market are risk factors for digital exclusion (Thomas *et al.*, 2020, p. 21). The influence of socio-economic factors on digital skills has been found in various age groups, including among young people (Hargittai and Hinnant, 2008) and older adults (Hargittai *et al.*, 2019). People with lower personal, economic and social offline resources have also perceived online services as less beneficial (Heponiemi *et al.*, 2023). Low socio-economic status is linked to poor

awareness of online risks, fewer training opportunities and weak capabilities to evaluate online content, as well as a low likelihood of using the internet in a beneficial way (Park, 2022). However, the significance of socio-economic factors is complex and differs depending on which technology is being examined. For example, according to van Deursen and van Dijk (2019), income level predicts the use of a tablet, smartphone or smart TV, but not the use of a desktop computer, laptop or game console. Furthermore, a high level of education was found to be connected not only to the perceived benefits of internet use, but also to its perceived harms (Blank and Lutz, 2018).

Overall, prior studies provide a diverse view of the factors influencing digital inclusion. In any case, it is obvious that the study of digital skills and internet usage should also consider the effects of age, gender and socio-economic status.

2.3 Hofstede's model and the influence of culture on digital inclusion

Cultural factors and their influence on the digital divide and digital inclusion can be examined from varying theoretical perspectives. Studies have focused on cultural capital, cultural status, cultural possessions, religion, ethnicity, internet use language (Scheerder *et al.*, 2017) and national comparisons. One of the most utilised approaches in cross-cultural research is Hofstede's model of organisational culture. Here, the concept of culture refers to "the programming of the human mind by which one group of people distinguishes itself from another group" (Hofstede Insights, 2022). Culture is a learned, shared and collective phenomenon.

In the latest version of Hofstede's model, six cultural dimensions are distinguished (Hofstede, 2011, p. 8) (see Table 2): "1. Power Distance, related to the different solutions to the basic problem of human inequality; 2. Uncertainty Avoidance, related to the level of stress in a society in the face of an unknown future; 3. Individualism versus Collectivism, related to the integration of individuals into primary groups; 4. Masculinity versus Femininity, related to the division of emotional roles between women and men; 5. Long Term versus Short Term Orientation, related to the choice of focus for people's efforts: the future or the present and past. 6. Indulgence versus Restraint, related to the gratification versus control of basic human desires related to enjoying life."

Previous studies applying Hofstede's model have found various associations between cultural dimensions and digital development at the national level. Studies have, for example, revealed an association between individualism and internet use (Zhao *et al.*, 2014); along with individualism, the power distance index has also been found to explain differences in e-government development between European countries (Nikolov and Krumova, 2019). Studies have also found indications of the negative effects of masculinity and uncertainty avoidance on country level digitalisation (Nath and Murthy, 2004; Rubino *et al.*, 2020), and the positive effect of long-term orientation on e-government development (Zhao *et al.*, 2014).

Studies have found that a high degree of indulgence has a positive impact on country-level digitalisation (Rubino *et al.*, 2020) and inclusive growth (Dan, 2018). According to Robul *et al.* (2023), the share of the population that makes purchases online is positively correlated with indulgence and individualism indices, as well as negatively with uncertainty avoidance, power distance, masculinity and long-term orientation. Chwialkowska and Kontkanen (2017), in turn, have found some associations between cultural dimensions and social media behaviour, and point out that the cultural dimension of indulgence vs restraint plays a vital role in shaping user responses to firm-generated content. On the other hand, in the study of Lifintsev and Wellbrock (2019), people representing nations with low indulgence values were found to have a similar attitude to the need for cross-cultural communication to people from nations with high indulgence values.

According to Bakon *et al.* (2020), most culture-related studies on information systems are concerned with the national level or the organisational level, and very little research has been

done on how cultural values explain the acceptance and use of technology at the individual level. However, some studies have combined an examination of Hofstede's cultural dimensions with the individual-level technology acceptance model (Davis *et al.*, 1989) and the concepts of the theory of planned behaviour (Ajzen, 2001). Findings by Srite and Karahanna (2006) indicated that social norms are stronger determinants of intended use of information technology in individuals who espouse feminine and high uncertainty avoidance cultural values. Furthermore, masculine values moderate the association between perceived ease of use and intention to use. In the study of Tarhini *et al.* (2017), the importance of the dimensions of masculinity/femininity, individualism/collectivism, power distance and uncertainty avoidance in terms of individual behaviour come to light. In particular, the effect of the subjective norm on intention to use depends on cultural values.

The combined effect of the indulgence index and individual-level factors on internet use has not been studied, but some individual studies have examined the association of demographic and socio-economic factors with indulgence and restraint orientation at the individual level. According to Jie and Jing (2015), males and older people have more tendencies towards restraint, while women and younger age groups have more tendencies towards indulgence. Income level or education level, on the other hand, are not connected to indulgence or restraint orientation according to the study in question. Individual studies have also examined the importance of indulgence in terms of internet use among older people, but the study by Liu *et al.* (2023), for example, found that indulgence was negatively associated with entertainment technology use among older people, contrary to expectations.

In general, many studies have analysed the digital divide in a strict sense and at the national level (Aissaoui, 2022), while research into the cultural factors behind the digital divide has been quite limited (Scheerder *et al.*, 2017). Hofstede's model of cultural dimensions has been applied in international comparative studies on digitalisation (e.g. Zhao *et al.*, 2014), and to some extent also in studies that explain the acceptance of technology at the individual level (Srite and Karahanna, 2006; Tarhini *et al.*, 2017). However, there is a lack of research on digital inclusion that combines analysis of individual-level factors, country-level cultural factors, and their interactions.

3. Materials and methods

3.1 Research questions and hypotheses

This comparative cross-sectional study examines digital inclusion in 22 European countries using a two-level regression analysis. The study analyses how the country-level cultural factors defined by Hofstede are associated with citizens' digital skills and internet usage and how they moderate the effects of age, gender, educational level and income level (see Figure 1).

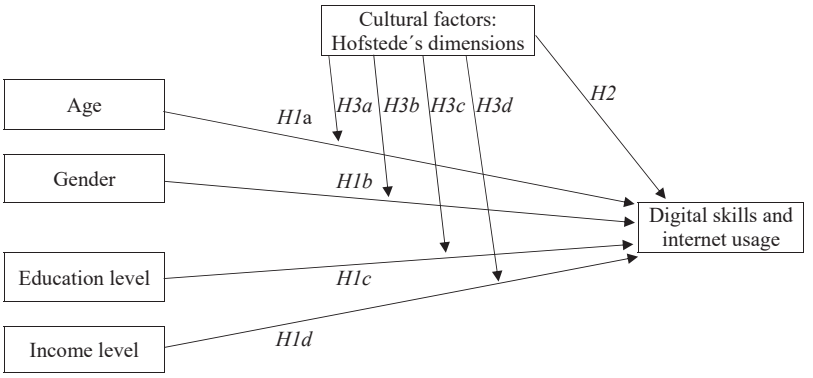
Our hypotheses are:

H1. Citizens' (a) age, (b) gender, (c) education level and (d) income level are associated with their digital skills and internet usage.

H2. Hofstede's cultural dimensions (power distance, uncertainty avoidance, individualism versus collectivism, masculinity versus femininity, long-term versus short-term orientation, and indulgence versus restraint) are associated with digital skills and internet usage.

H3. Hofstede's cultural dimensions moderate the effects of (a) age, (b) gender, (c) education level and (d) income level on digital skills and internet usage.

Hypothesis 1 is based on extensive research, according to which citizens' age, gender, education level and income level are associated with digital skills and internet use (see Scheerder *et al.*, 2017; Lythreatis *et al.*, 2022). Hypotheses 2 and 3, on the other hand, aim to fill



Source(s): Authors' own creation

Figure 1. Hypotheses

the research gap concerning the impact of culture on digital inclusion and especially on digital skills and internet usage. There is a lack of research that examines the influence of both individual-level factors and country-level cultural factors on citizens' digital skills and internet use.

3.2 Data and variables

The data are based on the 10th Round (2020–2022) of the European Social Survey. The European Social Survey (ESS) is an academically driven cross-national survey that measures the attitudes, beliefs and behaviour patterns of diverse populations across Europe. The round 10 survey included the ESS core survey and rotating modules concerning Europeans' perceptions and evaluations of democracy and digital social contact in work and family life, as well as questions about COVID-19 (European Social Survey, n.d).

The entire database includes 37,611 respondents from 22 countries: Belgium, Bulgaria, Czech, Estonia, Finland, France, Greece, Croatia, Hungary, Ireland, Iceland, Italy, Lithuania, Montenegro, North Macedonia, the Netherlands, Norway, Portugal, Slovenia, Slovakia, Switzerland and the United Kingdom. The survey employed strict random probability sampling, a minimum target response rate of 70% and rigorous translation protocols. The survey was conducted in the form of face-to-face interviews. The data were weighted in accordance with the recommendations of the European Social Survey.

The dependent variable DSIU (digital skills and internet usage) is a composite variable constructed from four items (N = 26,445) related to individuals' digital skills and internet usage: *How often do you use the internet?* (measured from 1 to 5), *How familiar are you with preference settings?* (measured from 1 to 5), *How familiar are you with advanced search?* (measured from 1 to 5) and *How familiar are you with PDF?* (measured from 1 to 5). The scale of the DSIU is from 1 to 5 and the highest values of the variables indicate high levels of digital inclusion, while low values indicate digital exclusion. The reliability of the variable (using Cronbach's Alpha) is 0.903. Country-level descriptions of DSIU are presented in Table 1.

The independent variables are presented in Table 2. The individual-level background variables are gender (1 = male, 2 = female) and age. The individual-level socio-economic factors are number of completed years in full-time education and household total net income decile for each country. The country-level factors are based on Hofstede's (1980, 2011) dimensions of culture, which were constructed from cross-cultural surveys (scale for all cultural dimensions: from 0 to 100). All variables used in the models were grand mean-centred.

Country	*N*	Mean	Std. deviation
Belgium	1,341	3.5530	1.15936
Bulgaria	2,718	2.9180	1.40550
Switzerland	1,523	3.7598	1.07315
Czechia	2,475	3.4536	1.17812
Estonia	1,542	3.2543	1.29482
Finland	1,577	3.8533	1.16325
France	1,977	3.4693	1.26944
United Kingdom	1,149	3.3465	1.21603
Greece	2,799	3.1529	1.37634
Croatia	1,592	3.1170	1.42833
Hungary	1,849	3.1941	1.43201
Ireland	1,769	3.2165	1.30458
Iceland	903	3.4016	0.91045
Italy	2,640	3.1393	1.30027
Lithuania	1,658	2.9504	1.26149
Montenegro	1,273	3.0075	1.19194
North Macedonia	1,429	2.7131	1.36494
Netherlands	1,470	3.9035	0.92631
Norway	1,411	3.8788	0.82975
Portugal	1,837	2.8181	1.47378
Slovenia	1,252	3.1575	1.27096
Slovakia	1,418	3.1027	1.43046
Total	37,602	3.2696	1.31113

Note(s): Raw data: *N*, Mean, Std deviation, Minimum = 1, Maximum = 5
Source(s): Authors' own creation

Table 1.
Description of the dependent variable DSIU

3.3 Data analysis

The analysis was carried out following the procedure for multilevel modelling. In the first phase, the null model was estimated, and the Intraclass Correlation Coefficient (ICC = 7.2%) was calculated. In the second phase, the individual-level Random Intercept Model was built, and in the third phase, the country-level variables were added to explain the variability in intercepts across countries (the country-level random model). In the fourth phase, we checked whether the slope varied across countries (the Random Slope and Intercept Model), and in the final phase we studied whether country-level factors moderated the association between individual-level predictors and the dependent variable within countries.

The individual-level factors were added into the model in two groups: the first group of variables consisted of age and gender, and the second group consisted of socio-economic variables (educational level and income level). The country-level cultural variables were added all at once, and then statistically non-significant variables were removed one by one. The Restricted Maximum Likelihood (REML) method was used as a way of estimating the parameters of the models (see Heck *et al.*, 2014, p. 19; Snijders and Bosker, 1999). Intercepts were allowed to vary, and a model of randomly varying slope was tested.

4. Results

A two-level regression analysis was conducted to examine the factors associated with citizens' digital skills and internet usage (Table 3). According to the Null Model (Model 0), the proportion of variance in welfare attitudes that lies between countries is 0.072 [ICC = 7.2%], which suggests that DSIU varies across countries. Then, the first model was constructed to examine the variability in intercepts across countries. The individual-level model (Model 1) explains 47.1% of individual-level variance and 55.6% of country-level variance. It can be

Variable	Level	Description	Values
Gender	Individual	Male = 1, Female = 2	−0.52 to 0.48
Age	Individual	Respondents' age	−33.84 to 41.16
Education	Individual	The number of completed years in fulltime education	−13.11 to 51.89
Income	Individual	a household's total net income decile in each country	−4.70 to 4.30
Power distance	Country	A higher degree indicates that hierarchy is clearly established and is executed in society. A lower degree signifies that people attempt to distribute power	−24.00 to 48.00
Individualism vs collectivism	Country	A lower degree indicates that people are expected to be loyal to the group to which they belong (collectivism). A high score indicates a weak interpersonal connection among those who are not part of a core family (individualism)	−48.60 to 18.40
Masculinity vs femininity	Country	A higher degree indicates that masculinity (such as achievements) is preferred in society, and a lower degree signifies that femininity (such as care) is valued	−46.49 to 45.41
Uncertainty avoidance	Country	A higher degree indicates that regulated behaviour is valued. A lower degree in this index shows more acceptance of differing thoughts or ideas	−33.59 to 31.41
Long-Term vs Short-Term Orientation	Country	A lower degree (short-term orientation) indicates that traditions are honoured. Societies with a high degree (long-term orientation) views pragmatic problem-solving as a necessity	−34.55 to 23.45
Indulgence vs restraint	Country	A lower degree indicates that there is more regulation of people's conduct and behaviour. Societies with a high score allow free gratification of people's own drives and emotions	−31.93 to 21.07

Source(s): Cultural values were retrieved from Hofstede Insights (2022), authors' own creation

Table 2. Independent variables: variable, level of variable, description, and values of the grand mean-centred variable

seen that females and older people have lower rates of DSIU, but people with more years of education and a higher income level have higher rates of DSIU.

In the next phase, the country-level variables were added to explain the variability in intercepts across countries. In this case, the focus of the analysis was on the country-level cultural factors (Hofstede) and whether these factors impact the remaining variability in DSIU between countries. It is noteworthy that, controlling for the other predictors in Model 2, indulgence was the only statistically significant cultural factor which affects DSIU. In countries with high indulgence, the level of digital skills and internet usage was higher than in countries with lower indulgence. Model 2 explains as much as 73.0% of country-level variance.

Since individual-level factors are significantly related to DSIU, whether the slope of individual-level predictors varies randomly across countries was also explored. According to Model 3, the slope variance of age (Wald Z = 2.39, one-tailed p = 0.09) was significant, suggesting that slopes vary across countries in the sample. In this sense, it is necessary to maintain reservations with regard to the results of the individual-level model (Model 1) and study the cross-level interaction (Model 4) that examined whether indulgence as a country-level cultural factor moderates (i.e. enhances or diminishes) the association between age and DSIU within a country. According to Model 4, the interaction between indulgence and age is statistically significant. The interaction indicates that the relationship between age and DSIU depends on the value for country-level indulgence. This means that overall age is negatively associated with DSIU at the individual level, but a higher degree of indulgence slightly buffers the effect of age on DSIU. These results can also be visualised to clarify, what is

Table 3.
Effect of the individual-level and country-level factors on DSIU

	Model 0 Null model	Model 1 Individual-level explanatory variables	Model 2 Country-level explanatory variables	Model 3 Randomly varying slope	Model 4 Cross-level interaction
Intercept (se)	3.559*** (0.088)	3.444*** (0.059)	3.458*** (0.047)	3.456*** (0.046)	3.457*** (0.047)
Gender		−0.112*** (0.013)	0.112*** (0.013)	−0.109*** (0.013)	−0.109*** (0.013)
Age		−0.028*** (0.001)	−0.028*** (0.001)	−0.030*** (003)	−0.029*** (0.002)
Education-level (in years)		0.099*** (0.002)	0.098*** (0.002)	0.096*** (0.002)	0.096*** (0.002)
Income-level (in deciles)		0.078*** (0.003)	0.078*** (0.003)	0.080*** (0.003)	0.080*** (0.003)
Individualism			ns		
Power distance			ns		
Masculinity			ns		
Uncertainty			ns		
Orientation			ns		
Indulgence			0.008* (0.003)	0.010** (0.003)	0.010** (0.003)
Individual-level variance	1.486*** (0.014)	0.787*** (0.008)	0.787*** (0.008)	0.775*** (0.008)	0.775*** (0.008)
Between-country variance	0.115*** (0.046)	0.051* (0.021)	0.031* (0.014)	0.028* (0.012)	0.029* (0.013)
Explained individual-level variance	0.000 (92.8%)	0.471	0.470	0.478	0.478
Explained country-level variance	0.000 (7.2%)	0.556	0.730	0.756	0.752
Age variance				9.179* (3.243)	4.954* (2.342)
Age*indulgence					0.0003** (0.0001)

Note(s): Significance levels: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; ns not significant, Weighted data
Source(s): Authors' own creation

happening in the data (see Figure 2). However, after the introduction of interaction terms into the model, there was still significant variability to be explained, both within countries (Wald $Z = 93.95$, $p < 0.001$, one-tailed) and between countries (Wald $Z = 2.22$, $p < 0.013$, one-tailed). The full model (Model 4) explains 47.8% of individual-level variance and 75.2% of country-level variance.

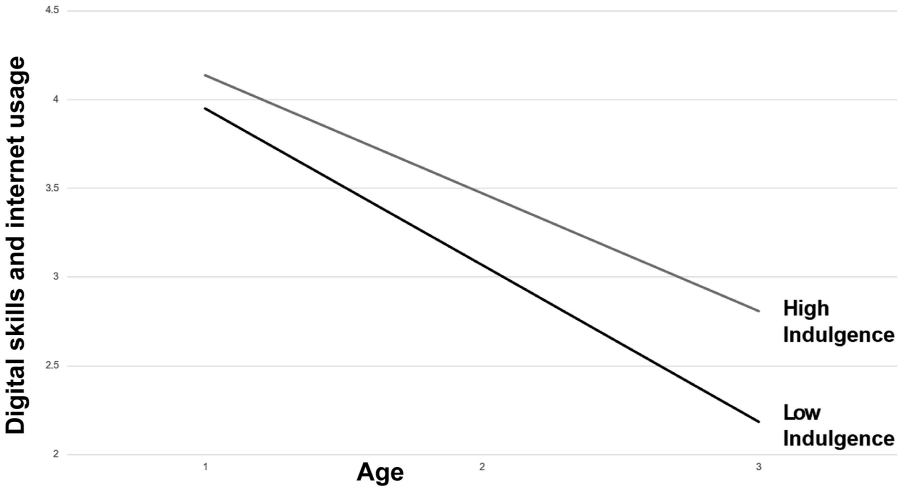
5. Discussion

5.1 Main findings

With digitisation, a new kind of inequality has emerged in society between people and groups of people. A lack of digital inclusion creates challenges for the digital economy, the development of e-government, regional development, public health and citizen participation, among other things. In this article, we looked at the factors affecting citizens' digital skills and internet usage in European countries. First, the study found that demographic and socio-economic factors have an effect, as expected based on previous research, i.e. Hypothesis 1 is supported. Second, the study shows that both individual and country-level factors are relevant in term of digital skills and internet usage, though country-level factors are less important here. Furthermore, according to the results, the country-level indulgence index seems to moderate the negative effect of age (see Figure 3). In contrast, the direct or indirect impact of the other cultural dimensions included in Hofstede's model was not significant. So, Hypotheses 2 and 3 are partially supported.

5.2 Reflection on the results

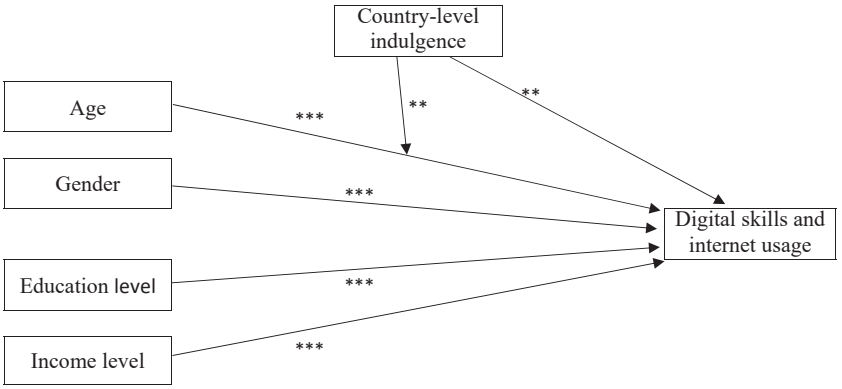
The study applies Hofstede's (2011) model of cultural dimensions to examine digital inclusion. In the past, the model has been used in studies related to country-level determinants of the digital divide (Zhao *et al.*, 2014) and, for example, in studies concerning acceptance of technology at the individual level (Srite and Karahanna, 2006; Tarhini *et al.*, 2017); however, no research has sought to explain digital inclusion by combining individual-level and country-level analysis using Hofstede's model of cultural dimensions. The use of such a



Note(s): Low = grey, high = black

Source(s): Authors' own creation

Figure 2. Visual representation of the association of age on DSIU by different levels of country-level indulgence



Note(s): ***$p < 0.001$; **$p < 0.01$

Source(s): Authors' own creation

Figure 3.
The effect of individual-level and country-level factors on digital skills and internet usage

research design reveals the multi-level nature of predictors affecting citizens' digital skills and internet usage.

The present study found that socio-economic factors are important to digital inclusion. This finding is consistent with the results of previous studies (Hargittai and Hinnant, 2008; Hargittai *et al.*, 2019; Thomas *et al.*, 2020). It also underlines the social and political nature of digital inclusion. According to Mariën and Prodnik (2014), the implementation of a digital inclusion policy should take into account social inequalities and existing power relations and establish empowerment as a key goal of digital inclusion. This also highlights the challenge related to the digital inclusion of various vulnerable groups in society (see Tsatsou, 2022).

According to our analysis, the effect of individual-level determinants is much greater than that of country-level cultural factors. This was to be expected, as it is obvious that individual behaviour is not predicted by country-level culture (Bakon *et al.*, 2020). But regardless of this fact, considering the influence of culture can be an important extension of the individual-level model. Specifically, the study revealed that the indulgence dimension has a positive effect. This finding is not surprising, as the ideal of an autonomous citizen with the resources to independently use digital services (Keeling *et al.*, 2019) and the emphasis on freedom and personal control characteristics of an indulgence culture are closely related to each other. Societies which score highly on the indulgence index allow relatively free gratification of basic and natural human desires related to enjoying life and "having fun" (Hofstede, 2011), and we can assume that various online activities, in particular those related to leisure and entertainment, are well-suited to this purpose. It is therefore understandable that, among the dimensions of culture, only indulgence is associated with digital skills and internet usage. This result is also consistent with previous studies, according to which cultural indulgence exerts a positive and significant influence on country-level digitalisation (Rubino *et al.*, 2020) and the degree of development of digital marketing systems (Robul *et al.*, 2023).

It can be assumed that the use of leisure-related applications explains why indulgence reduces the negative impacts of age on digital skills and internet usage. According to Zhou *et al.* (2015), cultural indulgence strengthens the effect of hedonic value on affective commitment in social virtual worlds and also weakens the effect of utilitarian value. A population-based survey by Viklund and Forsman (2022) found statistically significant associations between, in particular, independent and informal internet use and all dimensions of subjective well-being (i.e. perceived meaningfulness, happiness and life satisfaction). So, it can be assumed that in cultures

that favour the pursuit of pleasure and personal well-being, informal use also offers older adults the opportunity to maintain digital skills and digital inclusion.

Strengthening digital inclusion and overcoming digital divides is a difficult societal challenge. We can attempt to respond to it through various political measures, training and design tailoring (Hustad *et al.*, 2019). The possibility of receiving social support and formal help with the use of ICTs is central to the prevention of digital inequality at the individual-level (e.g. van Deursen *et al.*, 2014). Interventions that aim to increase access, improve access quality, strengthen digital skills and overcome social exclusion play a key role in increasing digital inclusion and preventing digital exclusion (Park, 2022). These measures should be targeted at the broad population, but especially at people and groups with the greatest risk of digital exclusion. The study indicates that focus should be directed towards older adults and persons with low socio-economic status. Cultural factors must also be considered, especially in supporting the digital inclusion of older adults. In the case of poor and socially marginalised groups, additional financial support, social support and social policy measures can also be pivotal in reducing social and digital exclusion. In addition, our results indicate that the elimination of gender-related digital inequality should still be considered one of the goals of digital inclusion programs.

The association of indulgence orientation with digital skills and internet usage may be partly related to pleasure-producing digital activities such as internet gaming. So, developing games aimed at older user groups could be one way to increase digital inclusion. On the other hand, we must be careful when making practical conclusions based on country-level factors. For example, according to Kuo *et al.* (2022), the game preferences of players in different cultures cannot be explained using Hofstede's model of cultural dimensions. In any case, the fact that the influence of indulgence on internet use and skills is greater specifically for older people is something that should be taken into account when aiming to support the digital inclusion of the elderly population. Games aimed at broad population groups, including the elderly, may be one way to do this.

Overall, the digital inclusion of all citizens can be promoted through many measures at different levels. The European Union's digital inclusion policy includes various activities that promote the development of accessible technologies and assistive technologies strengthen citizens' digital skills and increase social inclusion among disadvantaged people (European Commission, n.d.). In addition, national strategies and various regional and local practical actions are crucial. According to our research, most of the variation in digital skills and internet usage is explained by individual factors, and the influence of factors related to national culture is smaller. In this sense, creating policies at the European level can be considered reasonable. On the other hand, it is important to emphasise the significance of country-level measures. Since the effect of ageing on digital skills and internet use depends on national culture and especially on country-level indulgence, national strategies that take cultural factors into account are also needed to support the digital inclusion of the elderly.

5.3 Limitations

The research design has some limitations. First, the research is based on ready-made materials from a European social survey, and thus the study was not able to use a validated digital inclusion index, or a measure based on concept analysis. Digital skills were examined using only three questions, although in reality digital skills cover many different skills at various levels (van Deursen *et al.*, 2014). On the other hand, strength of the research is the extensive and comprehensive multinational material used. Without such data, it would not have been possible to combine the examination of country-level culture and individual-level factors.

Second, culture can be approached from many different perspectives and Hofstede's model represents only one perspective on it. Hofstede's dimensions were identified by

studying the cultural values of a multinational company, and many phenomena related to cultural capital, religion, language and ethnicity, for example, were excluded from the examination. Some researchers have also argued that Hofstede's model does not take into account the flexible and changing nature of culture, and that equating culture to nations is problematic (Catalin, 2012). Furthermore, it should be noted that Hofstede's model cannot be applied to an individual in isolation but only to individuals (plural) or groups as a generalisation (de Mooij, 2013; cf. Venaik and Brewer, 2013).

Third, the study does not analyse regional differences within countries, though previous studies have identified regional digital divides within Europe as well as factors that influence it (Vicente and Lopez, 2011; Lucendo-Monedero *et al.*, 2019). When considered together, these limitations emphasise the need to study the significance of cultural factors in the emergence of digital inclusion and digital inequality in more detail in the future.

Finally, one limitation relates to the use of a population-based research design in the study of digital inclusion. Over time, non-user populations have become more concentrated in vulnerable groups (Helsper and Reisdorf, 2017), and Park (2022), for example, has stated that digital inclusion policies and ICT development are often based on serving the broad population and not so much the needs of special groups. This kind of survey study does not yield information about the factors linked to the level of digital inclusion among the groups of people who are at the greatest risk of social and digital exclusion. For example, the question of the effects of culture on digital skills and use of the internet among different ethnic or cultural minorities is outside the scope of such research.

5.4 Conclusion

The influence of culture on the diffusion of technology has been known for a long time (e.g. Maitland and Bauer, 2001; Nath and Murthy, 2004). In contrast, the question of how national culture contributes to digital inclusion and prevents digital inequality has been little studied. This is challenging, because culture is a multidimensional phenomenon and its effects are somewhat indirect. In any case, the importance of digital inclusion is clear, and cultural factors should be taken into account in policy programmes and practical development work.

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