

Analysis of Peculiarities of Digital Skill Gaps and Unemployment

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Abstract

This paper examines whether weaker digital skills and digital-use practices are associated with higher unemployment across European Union countries, and whether this association differs by gender and age. The empirical focus is on three observable digital indicators included in the analytical workbook: email use, social media use, and online news use. The analytical design is descriptive rather than causal: the purpose is to identify cross-country patterns that can inform management, labour-market and digital-inclusion debates in the digital era. For each EU country, sex and age group, a separate bivariate ordinary least squares regression is estimated for several age intervals. The results show that lower digital skills are more often associated with higher unemployment where the country-level relationships are statistically significant. The pattern is strongest and most regular for social media and email-related indicators, while online news produces a less uniform but still meaningful pattern. Men display more frequent significant associations in the older age group, especially for email and social media, suggesting that digital exclusion among older workers may interact with sectoral employment patterns, job-search technologies and age-specific labour-market constraints. The paper contributes by linking basic digital capabilities to labour-market inclusion.

Keywords: digital skills; unemployment; digital exclusion; gender; ageing workforce; European Union; OLS; management change

1. Introduction

Digital transformation changes how work is organised, how job opportunities are found and how organisations communicate with employees, applicants and public institutions. In the digital era, even basic online capabilities such as using email, engaging with social communication channels and accessing online information may become labour-market resources. European Commission (2026) highlights the importance of digital skills in shaping Europe's Digital Future. These capabilities are not equivalent to advanced digital competences, but they represent a practical minimum for participating in digitally mediated employment processes (International Labour Organisation, 2026).

The management relevance of digital skills is therefore broader than the internal digitalisation of firms. Organisations depend on a labour force that can communicate through digital channels, respond to online recruitment systems, access training, understand institutional information and adapt to digitally coordinated work. When some groups are less digitally included, digital transformation may unintentionally reinforce inequalities in employment access and labour-market resilience.

This paper investigates the association between digital skills and unemployment in the EU-27. It focuses on three indicators: Email, SocialMedia and OnlineNews included in the analytical workbook. The author revises if lower levels of these indicators are associated with higher unemployment, and whether the association differs between men and women and between prime-age individuals aged 25-54 and older individuals aged 55-74.

The paper contributes by showing that digital transformation in management cannot be evaluated only through firm-level technology adoption, but also through workers' ability to participate in digitally mediated labour markets.

The paper seeks to answer the question - how are lower email, social media and online news-related digital skills or use associated with unemployment across EU countries, and how do these associations differ by gender and age group?

In general, the paper is structured into such sections. The literature review is placed under the Section 2. Research methods are presented under Section 3. Later on, the results are presented under the Section 4. Discussion and Conclusions are presented under the last Sections: Section 5 and Section 6.

2. Literature Review

2.1 Digital transformation, skill demand and employment

The relationship between digital transformation and unemployment is best understood through changes in labour demand, task content and worker capabilities. A central contribution of the task-based literature is the distinction between routine tasks, which are more exposed to computerisation, and non-routine tasks, which are often complemented by digital tools. Autor, Levy and Murnane (2003) show that computerisation substitutes for routine cognitive and manual tasks while complementing non-routine problem solving and complex communication. This perspective is important for the present study because basic digital participation, including email use and online information search, can be interpreted as a minimum capability for functioning in labour markets where communication, applications and administrative procedures are increasingly digital.

The broader automation literature reinforces the idea that technology does not have a uniform employment effect. Autor (2015) argues that automation can replace labour in some tasks while complementing workers in others, which means that the employment consequences of digitalisation depend on task structure and worker adaptability. Goos, Manning and Salomons (2014) provide European evidence that job polarisation is linked to routine-biased technological change and offshoring. Their findings suggest that workers concentrated in routine-intensive occupations may face stronger adjustment pressures when digital systems reorganise work and reduce demand for certain middle-skill tasks.

Firm- and sector-level studies also show that digitalisation can create and destroy jobs at the same time. Biagi and Falk (2017), using data for ten European countries, find that ICT and e-commerce activities did not generally reduce employment and that some technologies were associated with job creation. Piva and Vivarelli (2018) show that technological change can have labour-friendly effects in Europe, especially where innovation is connected with more dynamic sectors, although capital formation can also have labour-saving consequences. Balsmeier and Woerter (2019) show that digitalisation can increase demand for highly skilled labour while reducing demand for lower-skilled labour. These studies indicate that digital transformation is not only a matter of technology adoption, but also a question of whether workers have the skills needed to benefit from new forms of work organisation.

The labour-market value of digital skill is supported by evidence on returns to ICT capability. Falck, Heimisch-Roecker and Wiederhold (2021) find measurable returns to ICT skills, showing that digital competence has economic value beyond general education. For the present paper, this implies that weaker digital participation may be associated with worse employment outcomes because digitally excluded workers are less able to search for vacancies, communicate with employers, complete online procedures, access training or adjust to digitally mediated work.

2.2 From digital access to digital skills and digital outcomes

Digital divide research has moved from a narrow focus on internet access to a broader focus on skills, uses and outcomes. DiMaggio, Hargittai, Neuman and Robinson (2001) identify internet inequality as a major social issue because online resources are unevenly distributed across social groups. Hargittai (2002) develops the concept of the second-level digital divide, showing that individuals differ not only in whether they have internet access but also in how effectively they can find information online. This distinction is directly relevant to the indicators used in this study. Email, social media and online news use are not complete measures of advanced digital competence, but they are observable behavioural indicators of participation in digital communication and information environments.

Van Deursen and van Dijk (2011) show that internet skills are unevenly distributed and that skill differences are linked to broader patterns of social inequality. Van Deursen and van Dijk (2014) argue that as access becomes more widespread, inequality increasingly shifts toward differences in types and intensity of internet use. Scheerder, van Deursen and van Dijk (2017) synthesise this literature by distinguishing first-level divides in access, second-level divides in skills and use, and third-level divides in tangible outcomes. Labour-market status is one such outcome, because digital skills may affect job search, employability, earnings, access to public services and participation in training.

Helsper (2012) provides a useful theoretical bridge between digital exclusion and labour-market inequality. Her corresponding fields model argues that digital and social exclusion reinforce each other across economic, cultural, social and personal fields. In labour-market terms, people with weaker education, income, occupational position or social networks may also have lower digital capability, while lower digital capability can further restrict access to employment opportunities. This circular relationship supports the interpretation that digital skill gaps are not only individual deficits but also part of broader structures of social and employment inequality.

2.3 Digital skills, job search and labour-market matching

The relevance of basic digital capability becomes clearer when job search and labour-market matching are considered. Vacancies, applications, curriculum vitae submission, employer communication and public employment services are increasingly mediated through online platforms. Kuhn and Skuterud (2004) provide early evidence that internet job search was not clearly associated with shorter unemployment durations after accounting for worker characteristics. Also, European Parliament (2017) aims that the most of population members would have basic digital skills. This finding is important because it warns against assuming that access to online job search automatically improves employment outcomes, especially when disadvantaged job seekers lack the skills or networks needed to use online systems effectively.

Later studies suggest that online job search became more effective as digital recruitment matured. Kuhn and Mansour (2014) find that internet job search improved over time, especially when used to contact networks and send resumes. Suvankulov, Lau and Chau (2012), using evidence from Germany and South Korea, find that internet job search is associated with higher re-employment probabilities and shorter unemployment durations. These results suggest that digital job-search capability becomes more important when employers, public services and applicants increasingly rely on online channels.

Social media use may also be connected with employment outcomes, although its interpretation is more ambiguous than email use. Nikolaou (2014) shows that social networking websites are used in job search and recruitment, including by both job seekers and recruiters. Social media can therefore proxy access to informal vacancy information, weak ties, professional visibility and network-based search. De Marco et al. (2023) provide more recent evidence that digital skills shape online access to the labour market, showing that job seekers with stronger digital skills are better positioned to secure jobs online and less likely to suffer negative search-related outcomes such as burnout. This supports the use of social media as an indicator of broader digital inclusion rather than only personal activity.

Online news use is less directly linked to recruitment than email or social media, but it can capture access to information. In labour markets, information about economic conditions, policy changes, training opportunities and vacancies can affect search behaviour and expectations. Therefore, online news use is interpreted in this paper as an information-access indicator. It should not be treated as a direct job-search skill, but it remains relevant because labour-market participation increasingly requires the ability to find, evaluate and act on digital information.

2.4 Gender and age as dimensions of digital labour-market inequality

Gender and age are important because digital skill gaps do not affect all workers in the same way. Hargittai and Shafer (2006) show that gender differences can appear not only in actual online skill but also in perceived skill. Perceived skill matters for labour-market participation because confidence in digital ability can influence whether job seekers use online platforms, submit applications electronically or engage with digital recruitment procedures. Gender differences in digital labour-market outcomes may also reflect occupational segregation, career interruptions, care responsibilities and unequal access to training.

Age differences are equally central. Hargittai (2002) finds that age is associated with differences in internet skill, while Friemel (2016) shows that the digital divide remains especially relevant among older adults. For the 55-74 age group analysed in the present paper, weaker digital participation may interact with age discrimination, obsolete occupational skills, health constraints and transitions into inactivity or retirement. As a result, unemployment may capture only part of the labour-market effect of digital exclusion among older people. Some older individuals may leave the labour force instead of appearing in unemployment statistics. Czaja and Urbaniec (2019) also presents digital exclusion in the labour market in European countries.

These gender and age mechanisms justify the disaggregated empirical design used in this paper. Estimating relationships separately by sex and age group makes it possible to observe whether basic digital-use indicators are more strongly associated with unemployment in some labour-market segments than in others. This is important because aggregate country-level relationships may hide differences between prime-age and older workers, or between men and women whose employment trajectories are shaped by different social, occupational and institutional constraints.

2.5 Research gap and contribution of the present study

The reviewed literature establishes four important points. First, digital transformation changes labour demand and tends to reward workers with stronger cognitive, communication and ICT-related capabilities. Second, digital inequality is no longer only about access; it increasingly concerns skills, forms of use and tangible outcomes. Third, online job search and digital recruitment make basic digital participation relevant for labour-market matching. Fourth, gender and age shape both digital inclusion and labour-market vulnerability.

However, the literature leaves room for descriptive cross-country evidence linking basic digital-use indicators to unemployment by gender and age. Many studies focus on advanced ICT skills, firm-level technology adoption (OECD, 2023), earnings or online job-search behaviour in individual countries. Less attention is given to whether simple and observable indicators such as email use, social media use and online news use are associated with unemployment patterns across EU countries. This paper addresses that gap by treating these indicators as practical measures of digital participation and by examining their country-level association with unemployment separately for men, women, mid-age individuals and older individuals.

The contribution is descriptive rather than causal. The paper does not claim that lower email, social media or online news use directly causes unemployment. Instead, it identifies where digital participation and unemployment move together strongly enough to motivate deeper modelling and targeted policy attention. This is useful for management and policy debates because digital transformation cannot be assessed only

through firm technology adoption. It must also be assessed through the capacity of workers and job seekers to communicate, search, learn and participate in digitally mediated labour markets.

3. Research Methods

3.1 Data and country coverage

The data for research was collected from the Eurostat (2026) database and includes the information about the skills level and unemployment level per country, gender and age. The empirical analysis containing country-level regression outputs for unemployment and three digital indicators: Email, SocialMedia and OnlineNews. The research is limited to EU-27 countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

The digital variables should be interpreted as digital skill or digital-use indicators rather than direct psychometric measures of competence. This distinction is important. Email, social media and online news use are practical behavioural indicators of participation in digital communication and information environments. They are suitable for descriptive comparative analysis, but they should not be interpreted as complete measures of advanced digital competence.

3.2 Model specification

For each country, gender, age group and digital variable, the following bivariate OLS regression is estimated:

$$\text{Unemployment}_{i,t} = \beta_0 + \beta_1 \text{DigitalSkill}_{i,t} + \varepsilon_{i,t} \quad (1)$$

where $\text{Unemployment}_{i,t}$ denotes the unemployment indicator for country i in year t , and $\text{DigitalSkill}_{i,t}$ denotes the corresponding digital indicator. The model is estimated separately rather than pooled, because the analytical aim is to compare country-specific associations by gender and age group rather than to impose a common EU-wide slope.

Because the Eurostat (2026) reports the level of the digital-skill or digital-use indicator. When β_1 is positive and statistically significant, the relationship should be used as evidence that lower digital skills means unemployment.

Statistical reliability is evaluated using $p(F)$, with $p(F) < 0.05$ treated as statistically significant. R-squared is used as a descriptive goodness-of-fit statistic for each country-level bivariate equation.

The estimates should not be read as causal effects because the bivariate equations do not control for education, sectoral composition, macroeconomic shocks, labour-market institutions, unemployment-benefit systems, migration, regional structure, retirement patterns or unobserved country-specific dynamics. The results should be read as comparative evidence that identifies where digital skill gaps and unemployment move together strongly enough to motivate deeper modelling.

4. Results

4.1 EU-level summary

Table 1 summarises the country-level regressions. A positive lack effect means that weaker digital skill or use is associated with higher unemployment. The table reports both the number of significant equations.

Table 1: Summary of statistically significant country-level effects

Skill	Age group	EU countries	Male significant	Female significant	Both significant	Neither significant
Email	25-54	27	12	11	11	15
Email	55-74	27	15	8	7	11
SocialMedia	25-54	27	14	13	11	11
SocialMedia	55-74	27	15	8	6	10
OnlineNews	25-54	27	11	9	8	15

OnlineNews	55-74	27	13	9	6	11
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This indicates a stable prime-age pattern: where the relationship is statistically reliable, weaker digital participation is linked to higher unemployment. For the 25-54 group, all significant Email, SocialMedia and OnlineNews lack effects are positive for both men and women.

The 55-74 group is more heterogeneous. Email is significant in 15 male and 8 female country models. SocialMedia shows the same pattern, with 15 significant male models and 8 significant female models. OnlineNews is significant in 13 male and 9 female models, with positive lack effects in 11 male and 7 female models. This suggests that older labour-market groups contain additional mechanisms, including retirement, inactivity, health constraints and sectoral displacement, which may weaken the direct digital-skills association.

4.2 Country patterns where weaker digital skills are linked to higher unemployment

Table 2 lists countries where the lack effect is positive and statistically significant. It also reports cases where the statistically significant effect has the opposite sign. This distinction is necessary because the underlying regression is estimated using the level of digital skill or use.

Table 2: Significant positive lack-of-skill effects and opposite-sign cases by digital indicator, age group and gender

Skill	Age group	Gender	Countries where lower skill/use is associated with higher unemployment	Countries with significant opposite sign
Email	25-54	Male	Croatia, Cyprus, France, Greece, Ireland, Italy, Malta, Netherlands, Poland, Portugal, Slovenia, Spain	None
Email	25-54	Female	Croatia, Cyprus, France, Greece, Ireland, Italy, Netherlands, Poland, Portugal, Slovenia, Spain	None
Email	55-74	Male	Bulgaria, Croatia, Cyprus, France, Greece, Italy, Latvia, Netherlands, Poland, Portugal, Slovenia, Spain	Denmark, Finland, Hungary
Email	55-74	Female	Bulgaria, Cyprus, Greece, Latvia, Netherlands, Poland	Denmark, Sweden
SocialMedia	25-54	Male	Bulgaria, Croatia, Cyprus, Greece, Ireland, Italy, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovenia, Spain	None
SocialMedia	25-54	Female	Bulgaria, Croatia, Cyprus, Czechia, Greece, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Slovenia, Spain	None
SocialMedia	55-74	Male	Bulgaria, Croatia, Cyprus, Greece, Ireland, Italy, Latvia, Netherlands, Poland, Portugal, Slovenia, Spain	Finland, Hungary, Sweden
SocialMedia	55-74	Female	Bulgaria, Cyprus, Greece, Latvia, Netherlands, Slovakia	Romania, Sweden
OnlineNews	25-54	Male	Belgium, Bulgaria, Cyprus, Estonia, France, Greece, Ireland, Italy, Lithuania, Poland, Portugal	None
OnlineNews	25-54	Female	Belgium, Croatia, Cyprus, Estonia, Greece, Ireland, Italy, Poland, Portugal	None
OnlineNews	55-74	Male	Bulgaria, Croatia, Cyprus, Greece, Italy, Latvia, Netherlands, Poland, Portugal, Slovenia, Spain	Czechia, Hungary
OnlineNews	55-74	Female	Belgium, Bulgaria, Croatia, Cyprus, Greece, Netherlands, Poland	Romania, Sweden

4.3 Interpretation by digital indicator

The results are summarised following the indicators: email, social news and online news related.

Email-related digital capability is directly connected to formal labour-market participation because job applications, recruitment communication, public employment services and employer correspondence often depend on email. For the 25-54 group, 12 male and 11 female EU country models are significant and all significant effects have the expected sign. For the 55-74 group, the pattern is more male-centred: 15 male models are significant, compared with 8 female models, and 12 male models show a positive lack effect.

Social media use is more ambiguous than email because it captures both communication and broader digital participation. Nevertheless, it shows the most frequent significant relationships in the prime-age group: 14 male and 13 female country models are significant for age 25-54. For the 55-74 group, significant relationships again appear more often among men. This may indicate that social-media use proxies broader digital inclusion, network access and informal labour-market information.

Online news is best interpreted as an information-access indicator rather than a direct job-search skill. It shows fewer significant cases than SocialMedia and Email in the 25-54 group, but it still identifies several

countries where weaker information access is associated with higher unemployment. In the 55-74 group, significant positive lack effects remain visible, especially among men, but opposite-sign cases appear in some countries.

5. Discussion

The findings suggest that basic digital participation should be treated as part of employability in the digital era (OECD, 2025). Email, social media and online news are not advanced technological skills, but they shape access to employment information, communication with employers, awareness of opportunities and ability to interact with institutions. For management research, this means that digital transformation should not be studied only as a firm-level adoption process. It also needs to be understood as a labour-market matching process in which workers and jobseekers differ in their ability to participate.

The gender comparison is not uniform. In the prime-age group, significant effects often appear for both men and women. In older groups, male equations are more frequently significant. This should not be interpreted as proof that women are less affected by digital exclusion. Instead, it may reflect the fact that unemployment indicators among older women are more strongly shaped by transitions into inactivity, caring histories, retirement eligibility or sectoral labour-force attachment.

The age comparison is central. The 25-54 group is closer to active labour-market participation, so digital skills are more likely to be observed through job search and employment matching. In the 55-74 group, unemployment is only one possible outcome of digital exclusion. Some digitally excluded older individuals may leave the labour force rather than remain officially unemployed. Therefore, future studies should also analyse inactivity, retirement transitions and long-term unemployment.

For managers, the results imply that digital transformation initiatives should include basic capability-building, not only the introduction of new systems. Recruitment, onboarding, reskilling and internal communication strategies should be designed with different age and gender groups in mind.

For public employment services, the findings support targeted digital inclusion measures. Email use, basic online communication and information-access training may appear elementary, but they remain relevant for job matching and institutional access. Older workers may require more personalised and practice-based support because their employment risk is shaped by both digital exclusion and age-specific labour-market barriers.

For policy makers, the cross-country variation suggests that one EU-level intervention is unlikely to fit all national contexts. Countries with statistically significant positive lack effects may require stronger digital upskilling programmes linked to unemployment services, while countries with weak or opposite-sign associations may require diagnostic research into sectoral structure, inactivity and social-protection design.

6. Conclusion

This paper provides descriptive EU evidence on the relationship between digital skills and unemployment by gender and age. The results indicate that where country-level relationships are statistically significant, weaker digital skill or use is usually associated with higher unemployment. The pattern is especially visible for email and social-media indicators and is more frequent among men in the older age group. Online news use shows a less uniform but still relevant pattern.

The main implication is that digital transformation creates management and policy challenges beyond technology adoption. Digital inclusion is part of employability, labour-market access and organisational adaptability. The contribution is to show how basic digital skills can be connected to management change, workforce participation and the social sustainability of digital transformation.

The paper has several limitations. First, the analysis is bivariate and country-specific. It does not control for education, occupation, industry, income, macroeconomic shocks or institutional arrangements. Second, the

digital indicators measure use or behavioural participation rather than directly tested skill proficiency. Third, the country-level time series are relatively short and may be sensitive to missing observations, pandemic-period shocks and national reporting differences. Fourth, unemployment may be an incomplete outcome for the 55-74 group because digital exclusion may also lead to inactivity or retirement rather than measured unemployment.

Future research should estimate pooled panel models with country and year fixed effects, add education and sectoral controls, distinguish unemployment from inactivity, and test whether digital skills mediate the relationship between age, gender and labour-market outcomes. Microdata would allow stronger analysis of individual-level data determining whether the country-level associations observed here reflect individual employability mechanisms or broader national digitalisation patterns.

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