

## Article

# SUPPORTING OLDER WORKERS THROUGH AGE-INCLUSIVE EDUCATION IN THE DIGITAL ERA

## Apoyo a los trabajadores mayores a través de una educación inclusiva por edad en la era digital

NATALIIA TKALENKO<sup>1</sup>, MARIIA BALYTSKA<sup>2</sup>, MARTINA RAŠTICOVÁ<sup>3</sup>,  
NATALIIA VERSAL<sup>4</sup> & PETIA GENKOVA<sup>5</sup>

**Abstract:** Digital transformation of businesses is changing not only processes but also professions. As a result, the workforce must adapt to these changes. Older workers aged 55+ are particularly vulnerable, as their level of digital skills remains low: on average in the EU, at least basic digital skills are held by 44,3% of those aged 55-64 and 28,1% of those aged 65-74. The figures for above basic digital skills are even lower: 18,1% and 9,4%, respectively. At the same time, the data confirm the potential of flexible, non-formal, and workplace-based learning opportunities to support older workers' inclusion. A growing share of adults report organizing their own learning or engaging with non-formal providers, reflecting increasing personal initiative and the need for tailored, accessible formats. Age-inclusive strategies in higher education and adult training programmes can thus play a key role in addressing digital skill gaps and supporting longer, more adaptive working lives. Case analysis shows that although universities actively implement U3A practices, there is a need for their wider adoption, especially in the area of digital education.

**Keywords:** Digitalization, older workers, digital skills, lifelong learning, adult learning.

**Resumen:** La transformación digital de las empresas está modificando no solo los procesos, sino también las profesiones. Como consecuencia, la fuerza laboral debe adaptarse a estos cambios. Los trabajadores mayores de 55 años son particularmente vulnerables, ya que su nivel de competencias digitales sigue siendo bajo: en promedio, en la Unión Europea, el 44,3 % de las personas entre 55 y 64 años y el 28,1 % de aquellas entre 65 y 74 años poseen al menos competencias digitales básicas. Las cifras correspondientes a competencias digitales superiores a las básicas son aún más bajas: 18,1 % y 9,4 %, respectivamente. Al mismo tiempo, los datos confirman el potencial de las oportunidades de aprendizaje flexibles, no formales y basadas en el lugar de trabajo para favorecer la inclusión de los trabajadores mayores. Un número creciente de adultos informa que organiza su propio aprendizaje o participa en iniciativas no formales, lo que refleja una mayor iniciativa personal y la necesidad de formatos personalizados y accesibles. En este sentido, las estrategias inclusivas con enfoque etario en la educación superior y en los programas de formación para adultos pueden desempeñar un papel fundamental en la reducción de las brechas de competencias digitales y en el

---

<sup>1</sup> Kyiv National University of Technologies and Design.

<sup>2</sup> Taras Shevchenko National University of Kyiv.

<sup>3</sup> Mendel University of Brno.

<sup>4</sup> Taras Shevchenko National University of Kyiv / Mendel University in Brno. Main contact: [nataly.versal@gmail.com](mailto:nataly.versal@gmail.com)

<sup>5</sup> University of Applied Sciences.



apoyo a trayectorias laborales más prolongadas y adaptativas. El análisis de casos demuestra que, si bien las universidades aplican activamente prácticas de la Universidad de la Tercera Edad (U3A), es necesario fomentar una adopción más amplia, especialmente en el ámbito de la educación digital.

**Palabras clave:** Digitalización, trabajadores mayores, competencias digitales, aprendizaje a lo largo de la vida, educación de adultos.

## 1. Introduction.

Digitalization reshapes the nature of professions, substantially altering the labour market landscape, occupational structures, and required skill sets. It increases the demand on workers to engage in continuous professional development, lifelong learning, and adaptability to maintain relevance within evolving technological and economic contexts. These changes present significant opportunities, including improved job quality, enhanced flexibility, reduced physical strain, and advanced decision-making processes facilitated by artificial intelligence and other emerging technologies. However, digital transformation simultaneously introduces profound challenges, particularly for vulnerable demographic groups, notably older workers aged 55 and above, who often face greater barriers in adapting to rapidly shifting professional environments.

Older workers remain disproportionately at risk of exclusion from the labour market due to several interconnected factors, such as prevailing age discrimination, skill obsolescence, limited digital proficiency, and restricted access to updated labour market information (OECD, 2024). The need for continuous upskilling is exacerbated by demographic trends pointing to a substantial increase in the proportion of older workers within developed economies. Data from the European Commission (2024) underscores this vulnerability, indicating that only 44,3% of individuals aged 55-64 and 28,1% of those aged 65-74 possess at least basic digital skills. These figures further decline dramatically when assessing advanced digital proficiency, revealing a persistent and concerning skills gap.

Given these conditions, it is imperative to develop proactive and inclusive policies promoting career resilience and sustained employability for older workers. According to the McKinsey Global Institute (2017), institutional frameworks supporting lifelong career adaptability, encompassing both organizational policies and governmental initiatives, are crucial to successfully navigating the complex dynamics of digital transformation. Effective policy approaches include fostering age-inclusive hiring practices, providing targeted and accessible reskilling opportunities, and supporting flexible work arrangements conducive to extended and productive working lives (OECD, 2024).

Empirical evidence illustrates substantial cross-country disparities regarding older adults' digital proficiency and lifelong learning participation within the European Union. Countries such as Finland, Denmark, and the Netherlands exhibit robust institutional support structures enabling higher engagement in continuous learning among older populations, while member states like Romania, Bulgaria, and Poland demonstrate significantly lower levels of digital skills and participation in adult education (European Commission, 2024). These disparities highlight systemic inequalities and variations in resource allocation, policy priorities, and institutional capacities, necessitating tailored national strategies and targeted interventions.

Moreover, gender-based differences further complicate the landscape, as women generally demonstrate slightly higher engagement rates in adult learning compared to men. However, variability remains considerable across individual countries, reflecting deeply embedded structural and socio-cultural barriers to equitable education and professional development opportunities. Therefore, nuanced, gender-sensitive policies and interventions are essential to promote inclusive lifelong learning and digital empowerment across demographic subgroups.

Effectively addressing the multifaceted implications of digitalization requires coordinated actions encompassing policy development, organizational practices, and educational interventions specifically tailored to older adults' needs. By prioritizing inclusive, accessible, and responsive educational frameworks, institutions and policymakers can significantly mitigate the adverse effects of digital transformation, enhancing older workers' competitiveness, job satisfaction, and overall quality of life in contemporary labour markets.

### **1.1. Digital transformation of the labour market.**

The nature, composition, and dynamics of the global labour market are undergoing substantial transformation under the influence of a series of interrelated macro-level trends. According to the comprehensive findings presented in the Future of Jobs Report 2023 by the World Economic Forum (WEF, 2023), labour markets worldwide are increasingly shaped by a combination of technological, economic, environmental, and demographic forces. These macro-trends are expected to have a profound and lasting effect on employment structures, occupational profiles, and skill requirements across diverse sectors and geographic regions.

The World Economic Forum's analysis categorizes these forces into four principal domains: (1) accelerated technological advancement, (2) intensifying economic and geopolitical volatility, (3) the structural transition to environmentally sustainable ("green")

economies, and (4) the demographic shift associated with ageing populations in both advanced and emerging economies. Collectively, these trends are forecast to drive extensive restructuring across industries and occupational sectors. The report projects that approximately 23% of jobs globally are expected to be transformed, either through expansion, contraction, or redefinition, within the next five years (WEF, 2023).

The Future of Jobs Report is based on a survey of 803 companies operating across 27 distinct industries in 45 countries, offering a detailed and representative overview of employers' expectations and strategic responses to these emerging challenges. Among the 16 macro-trends identified in the report, several are particularly relevant for the present analysis, especially those situated at the intersection of digitalization, workforce transformation, and demographic change. These include: the increased adoption of new and frontier technologies (such as artificial intelligence, robotics, and automation), the expansion of digital infrastructure and access, the mainstreaming of Environmental, Social, and Governance standards into core business operations, and the ageing of populations across developed and developing economies.

The anticipated effects of these macro-trends are multifaceted and uneven. A key concern raised in the report is the potential for labour market imbalances driven by accelerated digitalization and automation, which may exacerbate existing skill mismatches and render specific occupations or sectors obsolete. According to the data summarized in Table 1, technological and digital transformation trends are perceived by employers as the most influential drivers of business change over the 2023-2027 period. Specifically, 86.2% of surveyed organizations cited the increased adoption of new and frontier technologies as a major factor expected to shape their operational strategies, while 86.1% highlighted the broadening of digital access as a critical enabler of transformation (WEF, 2023, p. 21).

Despite this widespread recognition of technological change as a driver of business transformation, the anticipated direct impact of specific technologies on employment levels is more moderate. For instance, although innovations such as big data analytics, cloud computing, and artificial intelligence are projected to be adopted by more than 75% of companies by 2027, their respective expected impacts on employment stand at 36.4% and 33.7%. These figures suggest a nuanced view among employers, who foresee not only job displacement risks but also the creation of new roles and opportunities requiring advanced technical and analytical capabilities.

In contrast, the broader institutionalization of ESG standards, encompassing environmental responsibility, corporate ethics, and social inclusion, is seen as having a relatively stronger and more direct influence on employment. While this macrotrend was cited by a slightly smaller share of respondents (80,6%) as a driver of organizational transformation, it is expected to yield the highest employment impact, with 52,2% of organizations anticipating that ESG adoption will significantly affect workforce structures and job content (WEF, 2023). This finding points to the growing centrality of sustainability-related practices in reshaping job roles, generating demand for “green” skills, and redefining organizational expectations concerning employee competencies in areas such as environmental compliance, stakeholder engagement, and sustainable production.

Interestingly, the demographic trend of ageing populations, recognized by 51,6% of respondents, was expected to have the lowest impact on employment, cited by only 16,9% of employers as significantly transformative. This comparatively modest figure may reflect an underestimation of the long-term effects of population ageing on labour supply, productivity, and organizational adaptability. Given the projected increase in the proportion of older workers in many advanced economies, and the associated challenges of skill obsolescence, age discrimination, and workplace inclusivity, this demographic trend may warrant more serious strategic consideration than it currently receives in the planning frameworks of major employers.

In sum, the interplay of these macrotrends underscores the urgency of equipping current and future workers with adaptable skill sets through sustained investment in upskilling and reskilling initiatives. As structural changes accelerate, particularly in technologically intensive and ESG-oriented sectors, ensuring workforce resilience will depend on agile education and training systems, inclusive employment policies, and a proactive approach to managing demographic change. The data presented by WEF (2023) thus provides both a diagnostic framework and a strategic imperative for rethinking how labour markets respond to global transformations over the coming decade.

**Table 1.**

*Perceived impact of selected macrotrends on business transformation and employment (2023–2027),  
% of organizations surveyed*

<b>Macrotrends</b>	<b>Macrotrends driving business transformation, share of organizations surveyed (%)</b>	<b>Expected impact of macrotrends on jobs, 2023–2027, share of organizations surveyed (%)</b>
<b>Increased adoption of new and frontier technologies</b>	86,2%	36,4%
<b>Broadening digital access</b>	86,1%	33,7%
<b>Broader application of Environmental, Social and Governance (ESG) standards</b>	80,6%	52,2%
<b>Ageing populations in advanced and emerging economies</b>	51,6%	16,9%

Sources: WEF, 2023, p. 21

From a demographic perspective, most developed countries are experiencing a marked increase in the proportion of older workers within their total labour force, driven by rising life expectancy, declining fertility rates, and extended working lives. As a result, older adults are expected to comprise a growing share of the economically active population, necessitating targeted strategies to ensure their productive participation in digitalizing economies. Yet, employers' current assessment appears to underestimate the broader consequences of this shift, especially as it relates to the transformation of occupational requirements and the distribution of skills across age cohorts.

The rapid development of digital technologies, including artificial intelligence, robotics, and machine learning, has introduced profound changes to the structure and organization of work. As digitalization intensifies, occupations are being redefined, new competencies are required, and conventional career pathways are increasingly disrupted. These changes are particularly consequential for older workers, who are more likely to be employed in roles involving routine or repetitive tasks - precisely those most susceptible to automation (Autor, 2015; Frey & Osborne, 2017). As a result, this group is at heightened risk of displacement or marginalization if not adequately supported through upskilling and lifelong learning.

The integration of artificial intelligence and other frontier technologies into workplace operations also demands substantial adaptability and the acquisition of new digital competencies. However, research indicates that older employees tend to exhibit lower levels of digital literacy compared to their younger counterparts, which may hinder their ability to transition into emerging job roles or engage effectively with evolving work environments

(Coulter & Shure, 2024). Furthermore, barriers such as age-based stereotypes, reduced training access, and declining self-confidence in learning new technologies compound the risks of exclusion for this demographic group.

Empirical data support these concerns. As demonstrated in Table 2, which presents cross-national data for EU member states, there are significant disparities in digital skill levels among older adults aged 55-64 and 65-74. In the Netherlands, for instance, 76,76% of individuals aged 55-64 possess at least basic digital skills, compared to only 14,96% in Romania. Similarly, the share of individuals within the same age group demonstrating above basic skills reaches 46,7% in the Netherlands but drops to a mere 3,06% in Bulgaria. These discrepancies highlight the uneven landscape of digital preparedness among older populations across Europe and underscore the urgency of targeted interventions to address these gaps.

This variation is even more pronounced among the older cohort aged 65-74, where digital engagement levels are generally lower across the board. For example, in Finland and Denmark, countries with strong traditions of inclusive lifelong learning, more than 50% of individuals in this age group report having at least basic digital skills. In contrast, in countries such as Poland, Romania, and Bulgaria, the corresponding figures fall below 15%, with above basic skills virtually absent. These patterns reveal persistent inequalities in access to digital learning opportunities and infrastructure, and they point to the risk of deepening socio-economic exclusion among older citizens if these disparities are not addressed through inclusive policy design.

It is important to recognize that digital exclusion among older adults is not merely a technical issue, but a structural challenge with implications for economic resilience, intergenerational equity, and social cohesion. As artificial intelligence and digital tools become increasingly embedded in public services, civic participation, and labour market entry points, ensuring that older populations are not left behind becomes both a moral and practical imperative. Public and private stakeholders must therefore work in concert to reduce these disparities through sustained investment in lifelong learning systems, the design of age-inclusive digital training programmes, and the removal of institutional and cultural barriers to participation.

**Table 2.***Digital skill levels among older adults in EU countries (2023), by age group, %*

Country	At least basic digital skills		Above basic digital skills		Gap between at least basic and above basic digital skills	
	Individuals, 55 to 64 years old	Individuals, 65 to 74 years old	Individuals, 55 to 64 years old	Individuals, 65 to 74 years old	Individuals, 55 to 64 years old	Individuals, 65 to 74 years old
European Union	44,31	28,19	18,11	9,44	-26,2	-18,75
Austria	56,47	37,68	23,84	11,06	-32,63	-26,62
Belgium	48,94	39,06	18,06	12,61	-30,88	-26,45
Bulgaria	23,12	7,3	3,06	0,26	-20,06	-7,04
Cyprus	24,04	11,12	13,53	2,68	-10,51	-8,44
Czechia	58,99	25,63	24,74	5,31	-34,25	-20,32
Germany	44,51	32,58	14,23	8,54	-30,28	-24,04
Denmark	61,98	47,22	31,75	19,14	-30,23	-28,08
Estonia	44,75	22,67	15,22	5,87	-29,53	-16,8
Greece	33,53	12,84	9,72	2,04	-23,81	-10,8
Spain	53,8	32,83	25,94	14,64	-27,86	-18,19
Finland	73,92	50,24	40,93	17,35	-32,99	-32,89
France	47,9	34,79	17,82	12,63	-30,08	-22,16
Croatia	35,98	17,89	8,67	2,74	-27,31	-15,15
Hungary	43,7	28,43	15,98	7,57	-27,72	-20,86
Ireland	46,74	47,53	26,37	21,57	-20,37	-25,96
Italy	38,5	19,33	17,55	7,66	-20,95	-11,67
Lithuania	32,54	15,15	9,68	3,69	-22,86	-11,46
Luxembourg	51,06	39,26	23,25	11,27	-27,81	-27,99
Latvia	29,23	14,53	5,49	1,66	-23,74	-12,87
Malta	38,09	21,87	19,65	5,16	-18,44	-16,71
Netherlands	76,76	66,54	46,7	28,85	-30,06	-37,69
Poland	23,96	12,55	9,12	3,25	-14,84	-9,3
Portugal	38,01	18,52	15,54	4,49	-22,47	-14,03
Romania	14,96	6,17	3,62	0,77	-11,34	-5,4
Sweden	63,29	36,77	27,84	10,84	-35,45	-25,93
Slovenia	33,08	17,06	9,05	2,97	-24,03	-14,09
Slovakia	38,23	18,77	11	4,79	-27,23	-13,98

Source: European Commission, 2024; authors' calculation

While employers currently project only limited employment impact resulting from ageing populations (WEF, 2023), the interaction between demographic ageing and digital transformation suggests a far more complex and consequential reality. Without proactive measures to enhance digital inclusion and skill adaptability among older workers, labour markets risk facing a dual challenge: underutilization of a growing segment of the workforce and widening inequalities that threaten broader socio-economic stability. Addressing this gap

will require comprehensive, data-driven strategies that recognize the specific vulnerabilities of older adults and place them at the centre of the digital transition.

Descriptive statistics reveal substantial disparities in digital skill levels among older age groups across EU countries (Table 3). For individuals aged 55-64, the average share possessing at least basic digital skills is 43,6%, while only 18,1% demonstrate above basic skills. The gap between these two indicators averages – 25,5 percentage points, confirming that advanced digital proficiency remains limited within this group. Among the older cohort (65-74), the average share of individuals with at least basic skills drops to 27,2%, and only 8,5% have above basic skills, resulting in a similarly wide gap of -18,7 percentage points. Notably, the standard deviation and skewness values indicate high variability across countries, particularly among those aged 65-74, where digital inequality is even more pronounced. These findings highlight the persistent digital divide in later life stages and the need for targeted lifelong learning strategies to bridge these gaps.

**Table 3.**

*Descriptive statistics for digital skill indicators for age cohort 55-64 and 65-74 (27 EU countries, 2023)*

Indicators	At least basic digital skills		Above basic digital skills	
	Individuals, 55 to 64 years old	Individuals, 65 to 74 years old	Individuals, 55 to 64 years old	Individuals, 65 to 74 years old
Mean	43,56	27,20	18,09	8,50
Median	43,7	22,67	15,98	5,87
Standard Deviation	15,30	14,90	10,65	7,05
Sample Variance	234,19	222,02	113,45	49,70
Skewness	0,37	0,76	0,96	1,23
Range	61,8	60,37	43,64	28,59
Minimum	14,96	6,17	3,06	0,26
Maximum	76,76	66,54	46,7	28,85
Count	27	27	27	27

Source: authors' calculation based on European Commission, 2024

According to recent OECD data (2024), workers aged 45 and older are increasingly reconsidering their career paths, with nearly half planning to change jobs within the next three years. This heightened mobility reflects the labour market's dynamic response to economic and technological changes.

Digitalization presents not only challenges but also opportunities. It offers significant potential for older workers by enabling more flexible work schedules, reducing physical strain through automation, and enhancing their rich experience with AI-powered decision-support systems. These advantages can extend working lives, improve job quality, and better leverage the valuable knowledge and experience of older employees (OECD, 2024; European Commission, 2021; McKinsey Global Institute, 2017).

Given this dual impact, policymakers and businesses must develop targeted strategies to support older workers in the digital economy. Effective training programmes, inclusive workforce practices, and policies that promote lifelong learning and technological literacy will be essential to harness the full potential of digital transformation across all age groups. Such measures will ensure that older workers are able to successfully transition and thrive in evolving labour markets (OECD, 2020; Coulter & Shure, 2024).

To maximize the positive potential of digital transformation and mitigate its negative consequences, it is crucial to prioritise inclusive policy measures, effective learning programmes, and adaptive workforce practices. Such comprehensive approaches will empower all workers, especially older individuals, to succeed in an era of ongoing technological advancement and contribute meaningfully to a dynamic and resilient labour market.

## **2. Formal, non-formal, and informal approaches in adult learning provision.**

Adult education systems are characterized by the involvement of a diverse array of actors that collectively contribute to the provision of learning opportunities across the life course. These actors operate within various formal, non-formal, and informal learning contexts, thereby supporting a multifaceted and adaptive infrastructure for adult skill development and knowledge acquisition.

At the core of formal adult education are accredited institutions such as schools, vocational education and training colleges, and universities. These institutions typically offer structured, curriculum-based programmes that culminate in recognized qualifications or certifications. Formal learning opportunities are governed by national education frameworks and often adhere to quality assurance mechanisms that ensure standardization, accountability, and the alignment of curricula with labour market requirements. For adult learners, particularly those seeking to change careers or acquire advanced credentials, formal institutions serve as a foundational component of lifelong learning systems (Cedefop, 2023).

Alongside formal institutions, non-formal education and training providers play an increasingly significant role in meeting the diverse and evolving needs of adult learners. Non-formal education refers to organized learning activities that occur outside the established formal system but still follow structured pedagogical approaches. Examples include community education programmes, continuing education centres, and specialized training offered by private or public sector organizations. These providers are often more flexible and responsive to immediate labour market demands, offering modular, short-duration, or part-time courses tailored to specific skills. Their relevance is particularly evident in contexts

where rapid technological change necessitates ongoing upskilling and reskilling (Cedefop, 2024).

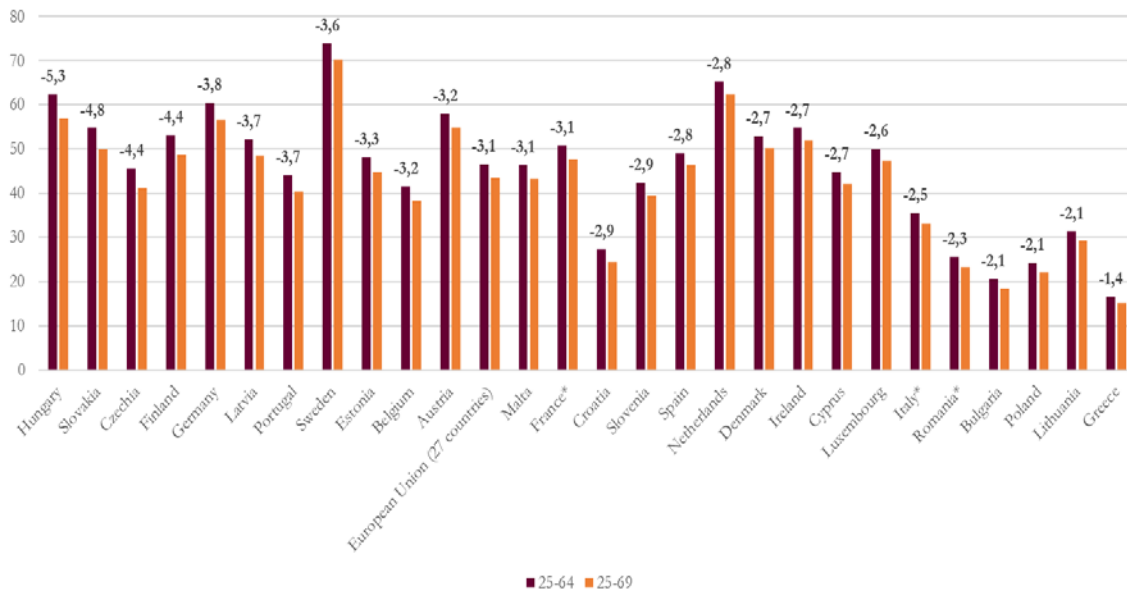
Employers constitute another vital pillar in adult learning ecosystems, particularly through the provision of workplace-based training. Companies may organize in-house training sessions, subsidize participation in external courses, or provide access to digital learning platforms. Such initiatives are typically oriented toward enhancing job performance, productivity, and innovation within the enterprise. Furthermore, employer-supported learning aligns educational content with real-world applications, thereby enhancing the employability of workers and supporting organizational competitiveness in dynamic economic environments.

Beyond institutional and employer-based provision, adult learning is also facilitated by a range of other public and private stakeholders. These include professional associations, chambers of commerce, non-governmental organizations, trade unions, and local or regional authorities. Such entities frequently offer training in professional ethics, compliance, civic engagement, and specialized technical fields, thereby complementing more conventional educational structures. The engagement of these actors contributes to the diversification and decentralization of adult learning provision, supporting access to education for hard-to-reach or underrepresented groups.

Finally, a growing segment of adult learning occurs through informal and self-directed means. Individuals may pursue learning autonomously through personal study, online courses, open educational resources, peer-to-peer knowledge exchange, or experiential learning in daily life. Informal learning often reflects intrinsic motivation and is typically unaccompanied by formal certification. Nevertheless, it plays an essential role in cultivating adaptive capacities and lifelong learning mindsets, especially in an era of digital transformation and knowledge-based economies (Cedefop, 2023; 2024). The data reveal a consistent decline in participation in education and training when extending the age group from 25 to 69, indicating lower engagement among older workers (Fig.1).

On average across the EU-27, the participation rate drops by 3,1 percentage points. The largest gaps are observed in Hungary (minus 5,3 pp), Slovakia (minus 4,8 pp), and Czechia and Finland (minus 4,4 pp each), highlighting significant challenges in engaging workers aged 65-69 in lifelong learning. Even in countries with high overall participation (e.g., Sweden and the Netherlands), the age-related drop remains notable.

Figure 1.

*Age-related gap in adult education participation across EU countries*

Source: authors' calculation based on Eurostat, 2022a

Between 2007 and 2022, both men and women aged 25-64 in the EU demonstrated a steady increase in participation in formal and non-formal education and training (Table 4). The average rate for men grew from 34,6% to 44,5%, while for women it increased from 35,4% to 46,9%. Despite similar dynamics, women consistently reported slightly higher levels of participation throughout the period.

Among men, the most notable progress was observed in Hungary, where the participation rate rose from 8,3% to 66,3%, as well as in Germany and Ireland. However, declines were registered in Bulgaria and Slovenia. Sweden maintained a leading position with male participation reaching 71,2% in 2022.

For women, participation increased even more steadily, with Hungary again showing one of the most significant improvements (from 9,6% to 58,5%). Sweden topped the list, with 76,8% of women aged 25-64 participating in learning in 2022. Notably, fewer countries showed declines among women compared to men.

**Table 4.***Trends in participation in education and training by gender in EU countries (2007-2022)*

Country	Males					Female				
	2007	2011	2016	2022	Trend	2007	2011	2016	2022	Trend
<b>European Union (27 countries)</b>	33,7	40,8	43,6	46,0		32,0	39,5	43,8	47,2	
Belgium	41,2	38,6	44,2	37,8		39,8	36,9	46,2	45,4	
Bulgaria	37,9	27,5	24,5	19,3		35,0	24,6	24,7	22,0	
Czechia	41,6	37,2	49,5	47,4		33,6	37,0	42,6	43,9	
Denmark	43,9	55,2	48,3	52,7		45,1	61,8	52,6	53,3	
Germany	48,3	52,8	51,8	60,0		42,4	47,6	52,2	60,9	
Estonia*	36,9	46,1	37,0	40,8		46,7	53,3	50,7	55,5	
Ireland*		24,5	53,6	53,4			24,4	54,1	56,1	
Greece	14,3	10,3	15,9	15,7		14,6	13,1	17,5	17,6	
Spain	30,8	38,8	44,0	48,2		31,0	36,6	42,9	50,2	
France*	36,4	50,2	48,7	50,1		33,8	50,8	53,8	51,5	
Croatia	21,4		32,5	22,8		21,1		31,1	31,7	
Italy*	22,2	37,3	44,0	37,0		22,2	34,0	39,1	34,5	
Cyprus	43,0	43,1	56,6	54,1		38,2	41,5	40,4	36,4	
Latvia	25,9	26,9	42,7	47,1		39,0	37,3	51,9	57,1	
Lithuania	28,7	23,4	23,5	25,0		38,7	33,1	31,9	37,4	
Luxembourg*		71,6	48,1	49,0			68,5	48,1	51,0	
Hungary*	8,3	43,0	58,7	66,3		9,6	39,4	52,7	58,5	
Malta	34,6	37,7	36,7	46,4		32,8	34,1	35,7	46,5	
Netherlands	47,5	62,8	64,7	64,0		41,6	55,8	63,5	66,5	
Austria	44,0	48,7	61,1	57,5		39,9	47,6	58,8	58,6	
Poland	21,3	23,2	25,2	22,0		22,4	25,2	25,7	26,6	
Portugal	27,0	43,5	47,6	45,5		25,9	45,2	44,7	43,0	
Romania*	6,9	8,0	6,4	25,6		7,9	8,0	7,5	25,7	
Slovenia	38,1	34,5	44,1	39,1		43,1	37,9	48,3	46,0	
Slovakia	45,3	41,4	46,8	55,6		42,8	41,9	45,3	54,0	
Finland	48,9	48,5	48,0	47,5		61,3	63,1	60,2	58,9	
Sweden*	70,8	69,2	59,5	71,2		76,1	74,4	68,2	76,8	

Source: Eurostat, 2022b

The gender comparison reveals that the gap has not only narrowed but, in many cases, reversed in favor of women (Table 5). In 2022, women's average and median participation rates were higher than those of men, although variability remained similar. These findings underscore the need to sustain and further support gender-inclusive lifelong learning policies, especially in the context of digital transformation and aging workforces.

Table 5.

*Descriptive statistics for participation in education and training by gender in EU countries (2007-2022)*

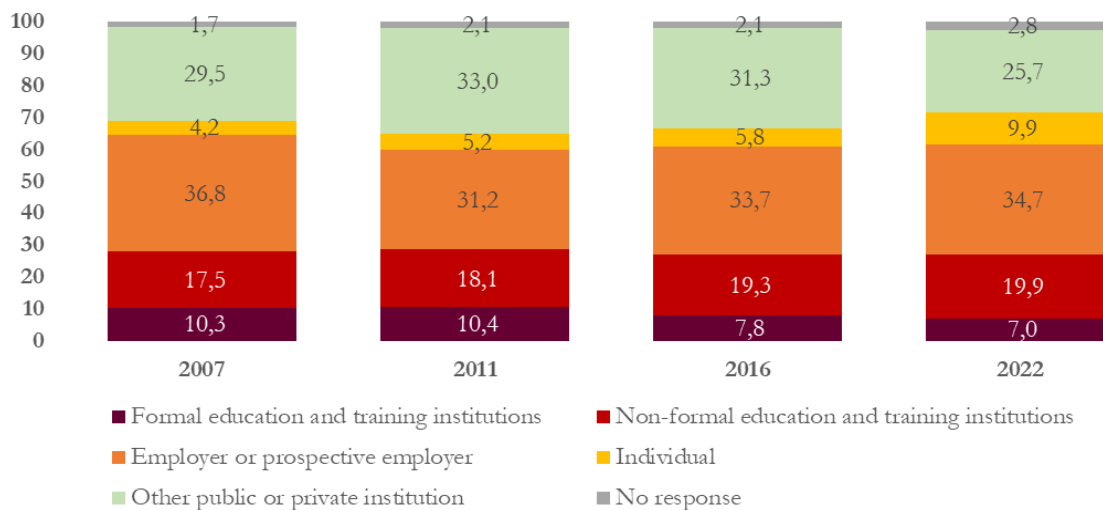
Indicators	Males					Female				
	2007	2011	2016	2022	Trend	2007	2011	2016	2022	Trend
Mean	34,608	40,1538462	43,1	44,4851852		35,384	41,27308	44,08889	46,87407	
Median	36,9	40,1	46,8	47,4		38,2	38,65	46,2	50,2	
Standard Deviation	14,3059114	15,7141778	14,1219415	14,8797669		14,92544	15,82622	14,10871	14,20351	
Sample Variance	204,6591	246,935385	199,429231	221,407464		222,7689	250,4692	199,0556	201,7397	
Skewness	0,05281829	-0,0302071	-0,9081691	-0,3745696		0,459974	0,080473	-0,780051	-0,29585	
Range	63,9	63,6	58,3	55,5		68,2	66,4	60,7	59,2	
Minimum	6,9	8	6,4	15,7		7,9	8	7,5	17,6	
Maximum	70,8	71,6	64,7	71,2		76,1	74,4	68,2	76,8	
Count	25	26	27	27		25	26	27	27	

Source: authors' calculation based on Eurostat, 2022b

Figure 2 presents the distribution of formal and non-formal education and training activities by provider in EU countries, based on respondents' answers in the Adult Education Survey (AES). The data reflect the diversity of institutional settings through which adults engage in learning, including employers, education institutions, and individual arrangements.

Figure 2.

*Distribution of formal and non-formal education and training activities by provider in EU countries (2007-2022)*



Source: authors' calculation based on Eurostat, 2022c

Among the most frequently cited providers of adult education and training are employers and prospective employers, underscoring the continuing importance of workplace-based learning as a cornerstone of adult skill development. This mode of provision not only facilitates timely access to relevant training but also allows for direct alignment between employee skill enhancement and organizational needs. Employer-sponsored education often reflects the dynamic requirements of contemporary labour

markets, particularly as technological innovation reshapes occupational roles and expectations. Within this framework, training is typically embedded in daily professional routines, ensuring contextual learning that is both efficient and responsive to industry demands. As a result, workplace-based training serves as a key mechanism for fostering employability, enhancing performance, and supporting lifelong learning trajectories, particularly among older workers seeking to remain active in digitalizing economies.

In parallel, non-formal education and training institutions contribute substantially to the adult learning ecosystem. These institutions include community colleges, training centres, professional development providers, and third-sector organizations that design and deliver structured learning experiences outside traditional academic pathways. Their pedagogical models often emphasize flexibility, learner-centredness, and accessibility - attributes that are particularly relevant for adults balancing work, family, or other responsibilities. Non-formal providers play a critical role in upskilling and reskilling processes by offering short-term, modular, or customized courses that address specific competency gaps. Such formats have gained increased relevance in the context of rapid technological change and the growing need for targeted digital skills training. Furthermore, non-formal institutions frequently act as intermediaries that facilitate transitions between informal learning environments and more formal educational qualifications, thereby expanding access to credentialed learning for adult populations.

Beyond these primary categories, a notable proportion of adult learners report engagement in learning activities organized by a diverse array of public and private sector actors. These include local governments, non-governmental organizations, trade unions, religious institutions, and private enterprises offering specialized training services. The involvement of such a wide range of stakeholders reflects the increasingly pluralistic nature of the adult education landscape, where no single institution holds a monopoly over knowledge transmission. This diversification broadens opportunities for learners to access education that is tailored to their personal goals, professional development needs, and socio-cultural contexts. It also aligns with contemporary policy frameworks that advocate for collaborative, multi-stakeholder approaches to lifelong learning.

Importantly, survey data also reveal a growing prevalence of self-directed learning among adult populations. A significant share of respondents indicated that they had independently organized or initiated their learning activities, often relying on digital platforms, open educational resources, or informal peer networks. This trend reflects a shift towards learner autonomy and proactive engagement in skill acquisition, driven by the

widespread availability of online tools and resources. Self-directed learning represents not only a response to gaps in formal provision but also an expression of personal agency in shaping one's educational journey. It is increasingly recognized as an essential component of modern adult learning systems, particularly in the context of rapid digitalization, where continuous, individualized learning is required to keep pace with evolving knowledge and labour market demands.

### **3. Case Studies of Age-Inclusive Educational Initiatives.**

Case studies demonstrate how age-inclusive education supports older workers in adapting to digital change. The examples include initiatives by academia on lifelong learning and digital upskilling for ageing populations.

These cases highlight practical strategies, such as flexible training formats, mentoring, and intergenerational learning, that help older adults remain active in evolving labour markets and reduce age-related digital inequality. It is important to emphasize that there is no universally applicable framework or standardized set of recommendations for adult learning, as evidenced by the findings of Pihlainen et al. (2022).

While the primary focus of this chapter is on age-inclusive education for older workers in the context of digital transformation, it is also vital to highlight broader initiatives that reflect the diversity of approaches to lifelong learning and digital upskilling across different institutional settings. The following case studies, though not exclusively centred on the workforce or labour market integration, provide valuable insights into how education systems and public institutions address the needs of ageing populations through inclusive and adaptive learning models.

The first case illustrates how Mendel University in Brno (MENDELU), Czech Republic, implements comprehensive lifelong learning strategies and digital upskilling programmes tailored specifically for older adults. Established in 1919, MENDELU has historically specialized in applied sciences, particularly agriculture, forestry, and economics. However, over recent decades, the university has expanded its educational outreach through structured programmes that address evolving demographic trends and technological shifts, particularly those affecting older adult learners.

Central to these initiatives is the Institute of Lifelong Learning at MENDELU, established as a specialized academic unit responsible for developing educational opportunities beyond traditional student cohorts. Since 2003, the institute has systematically organized educational programmes within the framework of the University of the Third Age (U3A), a model specifically designed to accommodate the diverse learning interests of older

populations. With annual enrollment consistently exceeding 1,300 senior participants, the U3A demonstrates sustained societal interest and robust institutional commitment to lifelong learning (MENDELU, n.d.-a).

The educational offerings at the U3A are notable for their adaptability and thematic breadth. The programme structure comprises a foundational three-year educational track, supplemented by an optional two-year advanced continuation curriculum. Both tracks provide courses delivered by faculty from multiple disciplinary areas, effectively combining theoretical insights and practical skill development. Furthermore, the curriculum is continuously refined in response to participant feedback and societal trends. To cater to diverse learner interests, MENDELU has introduced specialized thematic one-year courses such as “Garden and Health” and “Man and the World”. Additionally, shorter modules lasting one semester offer focused learning in specific domains including foreign language proficiency, floral arrangement, and photography, promoting both personal enrichment and practical competencies (MENDELU, n.d.-a).

Beyond these structured educational tracks, MENDELU launched the South Moravian Senior Academy to meet the specific learning needs of individuals aged 50 and above. The academy focuses on delivering practical knowledge relevant to daily life and civic participation, addressing topics such as personal safety, financial literacy, and effective interaction with public services. Courses cover practical areas including fire safety and crime prevention, traffic rules and safe mobility, guidance on navigating social welfare and pension systems, and basic first aid instruction (MENDELU, n.d.-b). By targeting such tangible skill sets, the academy fosters greater self-efficacy and social integration among older adults.

A distinguishing characteristic of MENDELU’s lifelong learning strategy is its systematic emphasis on intergenerational educational practices. The Intergenerational University programme, established as a pilot initiative, is particularly illustrative of this approach. Its main objective is to foster meaningful dialogue and cooperative learning between older adults and their grandchildren, typically aged between 9 and 13 years. By facilitating shared educational experiences, the initiative promotes mutual understanding, supports social cohesion, and narrows generational divides. Presently, MENDELU offers two structured intergenerational modules, each encompassing six sessions hosted at various campus locations. The programme provides immersive, experiential learning opportunities, particularly within natural science disciplines. Activities include microscopy workshops, exploration of herbal medicine, agricultural practices such as dairy farming, and educational visits to university laboratories and arboretums. A supplementary summer edition of the

Intergenerational University expands these experiences further. Participants engage in outdoor educational activities that include ecological exploration in forested areas, artisanal cheese-making workshops within university laboratories, and creative sessions dedicated to environmental sustainability through upcycling techniques (MENDELU, n.d.-c).

MENDELU's commitment to lifelong learning extends to active engagement in cross-border and European Union-funded educational initiatives, further embedding the university's activities in broader regional development frameworks. Between 2021 and 2023, MENDELU executed a significant cross-border educational project aimed at enhancing digital competencies among secondary school educators and their students. This initiative strategically targeted skill development in information technology, digital security awareness, and effective practices for online instruction. By directly upgrading teachers' digital proficiency, the project strengthened educators' capacity to prepare students adequately for digitally intensive labour market demands. Ultimately, this cross-border collaboration positively influenced youth employability within the Slovak-Czech border region, illustrating MENDELU's broader institutional role in addressing societal challenges through targeted education interventions (MENDELU, n.d.-d).

Collectively, MENDELU's case exemplifies a coherent institutional strategy for promoting lifelong learning, digital upskilling, and social inclusion among older adults. By combining structured academic programming, flexible course formats, and innovative intergenerational initiatives, the university effectively supports older learners in adapting to technological change and participating actively in contemporary socio-economic contexts. This comprehensive model underscores higher education's potential to serve as a proactive agent for inclusive education, lifelong skill acquisition, and regional social development in ageing societies.

The second case originates from Germany and highlights lifelong learning strategies implemented by Osnabrück University of Applied Sciences (Hochschule Osnabrück), a prominent educational institution located in Lower Saxony. Founded in 1971, the university has consistently pursued its core mission of delivering applied, practice-oriented education and professional development. The university has cultivated an environment supportive of continuous professional growth and lifelong education.

Central to this institutional strategy is the Professional School of Osnabrück University, which offers targeted continuing education programmes designed specifically for working professionals. The Professional School emphasizes flexible learning formats, practical applicability, and responsiveness to the evolving demands of contemporary

workplaces. It employs innovative methodologies such as microlearning, problem-based learning, and blended learning formats, reflecting a commitment to learner-centered education that is adaptive to individual needs and professional circumstances (Schaper, 2022).

One significant example illustrating the university's dedication to professional continuing education is the EURESTMA (European Research Managers) certificate programme. Delivered in collaboration with Tampere University in Finland and Sorbonne Université in France, EURESTMA is structured as an advanced studies course awarding 15 European Credit Transfer and Accumulation System (ECTS) credits. The programme integrates online instructional modules with face-to-face workshops conducted in Osnabrück and Brussels, thus facilitating an international exchange of experiences and best practices. A distinguishing component of EURESTMA involves participants designing and implementing institutional change projects. These projects primarily address themes of leadership, digital transformation, and strategic research management, thus reinforcing the practical applicability and transformative potential of the programme for participants and their home institutions (Ziegele, 2024).

Beyond individual programmes, Osnabrück University actively engages in broader networks supporting lifelong education and continuous professional development. Notably, the institution participates in an inter-university continuing education network, enabling both academic and administrative staff at Osnabrück University and its partner institutions to access structured opportunities for professional development. This collaborative network supports mutual learning, capacity building, and institutional improvement, fostering innovation and quality enhancement within participating higher education institutions (Osnabrück University, n.d.).

The university further strengthens its institutional commitment to lifelong learning and professional development through the Center for PhD and Postdoc Career Development (ZePrOs). ZePrOs provides structured mentoring programmes, career planning resources, and specialized training workshops tailored explicitly to the needs of doctoral candidates and early-career researchers. Such structured career development initiatives enhance participants' professional competencies, promote effective integration into academic and industry contexts, and contribute significantly to individual and institutional research excellence.

Additionally, Osnabrück University's ongoing commitment to lifelong learning aligns with broader societal trends emphasizing digital literacy, professional adaptability, and

educational inclusivity. By integrating contemporary pedagogical approaches and innovative digital learning tools, the institution proactively addresses skill gaps within rapidly changing professional landscapes. This approach enables learners from diverse professional backgrounds to adapt effectively to technological advancements and evolving labour market requirements, underscoring the university's role as a responsive and socially accountable educational institution.

Osnabrück University of Applied Sciences exemplifies how higher education institutions can successfully integrate lifelong learning principles into their educational mandates. By combining flexible, learner-centered instructional methods, structured professional development frameworks, and robust international collaborations, the university significantly contributes to professional enhancement, academic excellence, and social advancement, thus reflecting best practices in contemporary continuing education strategies.

The third case of lifelong learning development in Eastern Europe comes from Ukraine, where there is a well-established tradition of adult education supported by universities, academia, certification centres, etc. Four main formats are typically offered: professional development through training and seminars, vocational retraining, acquisition of a new qualification based on a previous degree, and full second-cycle higher education.

Taras Shevchenko National University of Kyiv (TSNUK) stands out as a national leader in this field, offering the full range of educational formats mentioned above. In recent years, TSNUK has expanded its offerings to adult learners to include certificate programmes, some of which have been specifically designed in response to the country's wartime conditions since 2014 and, more intensively, since the full-scale Russian invasion in 2022. While many of these programmes focus on psychological resilience and adaptation, two initiatives in particular address digital transformation. The first, "Business in the Digital Environment", is a free course specifically designed to support internally displaced persons (IDPs) affected by the war. Beyond enhancing foundational knowledge in business creation, process management, and digitalisation, the programme plays a vital social role by fostering economic self-reliance and professional reintegration for vulnerable populations. The course is delivered by lecturers from the Faculty of Economics and invited experts, ensuring both academic quality and practical relevance (TSNUK, n.d. - a). The second, "Digitalisation of Management as a Tool for Business Recovery and Development", is a paid programme that equips participants with digital tools for marketing, sales, management, and IT business

analysis. It is intended to improve the effectiveness of business operations under digital transformation (TSNUK, n.d. - b).

Chernihiv Polytechnic National University (CPNU) represents a significant educational and scientific hub within Ukraine's Chernihiv region, distinguished by its active commitment to lifelong learning and proactive response to contemporary social and economic challenges. Established initially as a technical educational institution, CPNU has systematically evolved, expanding its educational scope and integrating innovative pedagogical strategies to address emerging societal needs. Today, it serves as a comprehensive educational center, promoting accessible and adaptive learning opportunities for diverse populations.

The complex socio-economic conditions arising from the ongoing conflict in Ukraine have significantly influenced the university's educational priorities and outreach strategies. Specifically, CPNU has taken a proactive stance by developing targeted retraining and adaptation programmes for internally displaced persons (IDPs). Recognizing the acute need to facilitate IDPs' integration into local communities and labour markets, CPNU has structured its educational offerings to provide relevant, practical skills that support social cohesion, employment opportunities, and economic resilience within the region.

Central to these efforts are specialized certificate programmes explicitly designed to address urgent societal and labour market demands. Notable among these offerings is the certificate programme "IT Project Management", aimed at equipping participants with competencies essential for managing complex technological projects, mastering strategic planning, and navigating the digital transformation of business operations. This programme is particularly relevant given the rapid digitalization observed across various industries, necessitating skilled professionals capable of leading and implementing sophisticated technological solutions (CPNU, n.d.-a).

Complementing this initiative is the "Cybersecurity" programme, designed to impart practical knowledge and skills related to information security and cyber threat prevention. As cybersecurity emerges as a critical area of professional expertise globally, this programme supports workforce preparedness by addressing gaps in technical proficiency, thus strengthening organizational and regional capacities to counteract cyber vulnerabilities.

Additionally, CPNU offers the educational programme "Developing Digital Literacy among the Population of Chernihiv Region", which explicitly targets bridging the region's digital divide. This initiative underscores CPNU's commitment to inclusive education,

ensuring that diverse community members can access essential digital competencies required in contemporary economic and social contexts.

Another strategically important educational offering is the training course “Business Management: Modern Trends and Models”, which provides participants with current methodologies and practical tools relevant to contemporary enterprise management and project execution. By introducing learners to advanced business practices, CPNU actively contributes to enhancing local entrepreneurial capabilities and regional economic development.

A notable and impactful programme implemented by CPNU is “TURBO: Educational Program for the Development of Small and Medium-Sized Businesses” (CPNU, n.d.-b). Developed within the framework of the international initiative “Universities’ Response to Major Disruptions: Building Resilient Higher Education to Respond and Manage Societal Crises”, the TURBO programme aims specifically to strengthen the resilience of local businesses, particularly those relocated due to conflict-related disruptions. This programme provides participants with comprehensive knowledge and practical skills necessary for effectively managing business activities during periods of uncertainty and crisis. It supports displaced entrepreneurs through tailored educational interventions, equipping them with robust strategies for business continuity and sustainable growth.

Beyond individual programmes, CPNU’s institutional approach to lifelong learning embodies a broader commitment to social responsibility and regional development. By actively engaging with community stakeholders, local businesses, and international partners, CPNU has successfully positioned itself not merely as an academic institution but as a critical agent for regional resilience, social integration, and economic revitalization. Through these targeted educational interventions, the university significantly contributes to the adaptive capacities of communities affected by socio-economic disruptions, supporting individuals in acquiring relevant professional competencies and facilitating their integration into evolving local economies.

Chernihiv Polytechnic National University exemplifies how educational institutions can effectively leverage their academic resources and societal engagement to respond dynamically to urgent social and economic challenges. Its structured lifelong learning initiatives demonstrate an institutional capacity for innovation, inclusivity, and responsiveness, ultimately enhancing both individual well-being and regional socio-economic sustainability.

#### 4. Conclusions.

The chapter shows that digital transformation is not age-neutral in its labour market effects. While technological change can improve job quality, expand flexibility, reduce physical strain, and support longer working lives, these benefits are distributed unevenly. Older workers are expected to adapt to increasingly digital workplaces while often entering this transition with weaker digital foundations and lower participation in education and training. The analysis confirms that this disadvantage becomes particularly visible after the age of 55 and deepens further among those aged 65–74. Across the European Union, both basic and above-basic digital skills remain markedly lower in these age groups, limiting not only their digital participation but also their opportunities for occupational mobility, retraining, and career continuity.

At the same time, the findings suggest that the problem cannot be reduced to technical competences alone. More fundamentally, the chapter points to an inequality in access to learning opportunities across the life course. In many countries, participation in education and training declines with age precisely when labour markets demand more frequent upskilling, greater digital confidence, and the ability to navigate continuous technological change. The gap between at least basic and above-basic digital skills is also important: even where initial digital inclusion has been achieved, progression towards more advanced and work-relevant competences remains limited. For older workers, this creates a structurally weaker position in adapting to digital change.

Another important conclusion concerns the role of national context. The chapter identifies substantial cross-country variation in both digital skills and participation in lifelong learning among older adults. Some countries combine stronger digital preparedness with better developed lifelong learning systems, while others show persistently lower participation and weaker outcomes. This means that digital ageing should not be interpreted only through individual motivation. It is equally shaped by institutional arrangements, policy priorities, resource availability, and the extent to which learning opportunities are designed for adults with different working background. Gender patterns add further complexity: although women in some contexts report slightly higher participation in adult learning, this tendency is not consistent across countries and does not remove broader structural inequalities.

The chapter also makes clear that the format and provider of learning matter. Formal education alone cannot meet the reskilling needs of ageing societies. For older workers, effective support is more likely to come from flexible, modular, practice-oriented, and accessible learning environments. In this respect, workplace-based training, non-formal

education, intergenerational learning, and self-directed learning should be viewed not as secondary options, but as central components of an age-inclusive learning ecosystem. Their importance lies not only in transmitting digital knowledge, but also in strengthening confidence and helping adults connect new skills with concrete professional and everyday tasks.

The case studies reinforce these conclusions by illustrating several transferable principles of age-inclusive education. The example of Mendel University in Brno shows how universities can support continued educational participation in later life through intergenerational initiatives and third-age learning. Osnabrück University of Applied Sciences demonstrates the value of flexible and professionally oriented lifelong learning structures. The Ukrainian cases add a further dimension by showing that universities can play a particularly important role in periods of disruption, when digital literacy, adaptive learning opportunities, and community-oriented initiatives become essential for resilience and social inclusion. Collectively, the cases show that universities can act not only as knowledge providers, but also as platforms of inclusion, adaptation, and social stabilization.

Taken together, the findings support a broader interpretation of age-inclusive education. It should not be seen as a marginal or compensatory response for those who have already fallen behind. Rather, it should be treated as a strategic component of labour market adaptation in ageing and digitalizing societies. Supporting older workers in the digital era requires a shift from reactive compensation to continuous inclusion throughout the life course. Universities, employers, policymakers, and community actors all have a role in developing pathways that combine flexibility, accessibility, practical relevance, and respect for adults' prior experience. The chapter therefore leads to a clear conclusion: digital transformation will be more sustainable, equitable, and socially productive only if older workers are recognized not as passive recipients of support, but as an essential part of Europe's human capital and long-term development.

### **Acknowledgement.**

This publication is based upon work from COST Action CA21107 “Work inequalities in later life redefined by digitalization” (DIGI-net), supported by COST (European Cooperation in Science and Technology).

## Referencias bibliográficas.

- Autor, D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. *Journal of Economic Perspectives*, 29(3), 3-30. <https://doi.org/10.1257/jep.29.3.3>
- Cedefop. (2023). *European guidelines for validating non-formal and informal learning* (Cedefop reference series No. 124). Publications Office of the European Union. <http://data.europa.eu/doi/10.2801/389827>
- Cedefop. (2024). *Terminology of European education and training policy: A selection of 430 key terms* (3rd ed.). Publications Office of the European Union. <https://data.europa.eu/doi/10.2801/991753>
- Coulter, S., & Shure, N. (2024). *Technology adoption, job quality, and the ageing workforce* (Centre for Microsimulation and Policy Analysis Working Paper No. CEMPA5/24). <https://www.iser.essex.ac.uk/wp-content/uploads/files/working-papers/cempa/cempa5-24.pdf>
- CPNU. (n.d.-a). *Center rozvytku karyeri* [Center of career development]. <https://robotachntu.stu.cn.ua/internship/>
- CPNU. (n.d.-b). *TURBO: Osvitnia prohrama dlia rozvytku maloho i serednogo biznesu v dii. Sotsialne pidprijemnytstvo: Vid idei do misii* [TURBO: Educational program for the development of small and medium-sized businesses in action. Social entrepreneurship: From idea to mission]. <https://stu.cn.ua/news/turbo-osvitnya-programa-dlya-rozvytku-malogo-i-serednogo-biznesu-v-diyi-soczialne-pidprijemnyctvo-vid-ideyi-do-misiyi/>
- European Commission. (2019). *The future of work? Work of the future!* Publications Office of the European Union. <https://digital-strategy.ec.europa.eu/en/library/future-work-work-future>
- European Commission. (2024). *Digital Economy and Society Index (DESI): Indicators dataset* [Data set]. Digital Decade. <https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/indicators>
- Eurostat. (2022a). *Participation rate in education and training by age* [Data set]. [https://doi.org/10.2908/TRNG\\_AES\\_101](https://doi.org/10.2908/TRNG_AES_101)
- Eurostat. (2022b). *Participation rate in education and training by sex* [Data set]. [https://doi.org/10.2908/TRNG\\_AES\\_100](https://doi.org/10.2908/TRNG_AES_100)
- Eurostat. (2022c). *Distribution of non-formal education and training activities by provider* [Data set]. [https://doi.org/10.2908/TRNG\\_AES\\_170](https://doi.org/10.2908/TRNG_AES_170)
- Frey, C. B., & Osborne, M. A. (2017). The future of employment: How susceptible are jobs to computerisation? *Technological Forecasting and Social Change*, 114, 254-280. <https://doi.org/10.1016/j.techfore.2016.08.019>
- McKinsey Global Institute. (2017). *Jobs lost, jobs gained: What the future of work will mean for jobs, skills, and wages*. McKinsey & Company. <https://www.mckinsey.com/featured-insights/future-of-work/jobs-lost-jobs-gained-what-the-future-of-work-will-mean-for-jobs-skills-and-wages>
- MENDELU. (n.d.-a). *University of the Third Age*. Institute of Lifelong Learning. <https://icv.mendelu.cz/en/senior-education/university-of-the-third-age/>
- MENDELU. (n.d.-b). *South Moravian Senior Academy*. Institute of Lifelong Learning. <https://icv.mendelu.cz/en/south-moravian-senior-academy/>
- MENDELU. (n.d.-c). *Intergenerational University*. Institute of Lifelong Learning. <https://icv.mendelu.cz/en/senior-education/intergenerational-university/>
- MENDELU. (n.d.-d). *Increasing the digital skills of teachers and pupils*. Institute of Lifelong Learning. <https://icv.mendelu.cz/en/research-and-projects-at-ill/projects/increasing-the-digital-skills-of-teachers-and-pupils/>

- OECD. (2020). *Promoting an age-inclusive workforce: Living, learning and earning longer*. OECD Publishing. <https://doi.org/10.1787/59752153-en>
- OECD. (2024). *Promoting better career choices for longer working lives: Stepping up not stepping out* (Ageing and Employment Policies). OECD Publishing. <https://doi.org/10.1787/1ef9a0d0-en>
- Osnabrück University. (n.d.). *Further training and personnel development*. <https://www.uni-osnabrueck.de/en/university/working-at-osnabrueck-university/further-training-and-personnel-development>
- Pihlainen, K., Ehlers, A., Rohner, R., Cerna, K., Kärnä, E., Hess, M., & Müller, C. (2022). Older adults' reasons to participate in digital skills learning: An interdisciplinary, multiple case study from Austria, Finland, and Germany. *Studies in the Education of Adults*, 55(1), 101–119. <https://doi.org/10.1080/02660830.2022.2133268>
- Schaper, N. (2022, May 12). *Moderne Lernformen: Hochschul- und Wissenschaftsmanagement* [PowerPoint slides]. Hochschule Osnabrück. [https://www.hs-osnabrueck.de/fileadmin/HSOS/Studium/Studienangebot/Studiengaenge/Masterstudiengaenge/WiSo/Hochschul-\\_und\\_Wissenschaftsmanagement/Kolloquium/22/3\\_HWM\\_Moderne\\_Lernformen\\_2022-05-12.pdf](https://www.hs-osnabrueck.de/fileadmin/HSOS/Studium/Studienangebot/Studiengaenge/Masterstudiengaenge/WiSo/Hochschul-_und_Wissenschaftsmanagement/Kolloquium/22/3_HWM_Moderne_Lernformen_2022-05-12.pdf)
- TSNUK. (n.d.-a). *Biznes u tsyfrovomu seredovyshchi* [Business in the digital environment]. Institute of Postgraduate Education. <https://ipe.knu.ua/sertyfikatni-programy/biznes-u-tsyfrovomu-seredovyshhi.html>
- TSNUK. (n.d.-b). *Dydzhytalizatsiia upravlinnia yak instrument vidnovlennia ta rozvytku biznesu* [Digitalisation of management as a tool for business recovery and development]. Institute of Postgraduate Education. <https://ipe.knu.ua/sertyfikatni-programy/dydzhytalizatsiya-upravlinnya-yak-instrument-vidnovlennya-ta-rozvytku-biznesu.html>
- World Economic Forum. (2023). *The future of jobs report 2023*. <https://www.weforum.org/reports/the-future-of-jobs-report-2023/>
- Ziegele, F. (2024, June 26). Training for European research managers [LinkedIn post]. LinkedIn. [https://www.linkedin.com/posts/frank-ziegele\\_training-for-european-research-managers-activity-7239874108916666381-F\\_-Z](https://www.linkedin.com/posts/frank-ziegele_training-for-european-research-managers-activity-7239874108916666381-F_-Z)