Digitalization of Services and the Creation of New Barriers: Upskilling and Reskilling as A Way to Mitigate The Digital Divide

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Abstract

Digital transformation is increasingly an imperative for the success of modern organizations to improve efficiency, optimize resources, and enable data-driven decisions. Supported by significant public and private investments, digital transformation is driving a wide range of opportunities, but also a number of significant challenges. In an increasingly interconnected society, new technologies such as artificial intelligence are accelerating the process of automation, introducing new operating models and potentially threatening traditional jobs, raising ethical issues and creating new cultural and social tensions. This research aims to describe how the rapidity of current technological changes can create a digital divide [5] that excludes those segments of the population that do not have access to IT tools or lack the appropriate skills to use them [14]. Countless reports and statistics show that Italy is at the bottom of the league in terms of digital literacy, both globally and in Europe, and highlight how many workers do not have the advanced basic skills needed to perform at their best. In addition, the Italian scenario ignores a further gap in terms of developed digital skills, producing only about 25 % of annual graduates in Science, Technology, Engineering and Mathematics (STEM) subjects [11]. These shortcomings, on the one hand, create barriers to adapting to the new tools and, on the other hand, highlight the skills gap even more, making the whole process of digital transformation socially discriminatory for the part of the population that is weaker and more reluctant to adopt new technologies [9] if it is not accompanied by adequate training and reskilling. Italian programs aimed at creating an inclusive ecosystem capable of enabling all citizens to actively participate in the digital revolution will also be examined, highlighting how they are integrated into an organic complex of initiatives aimed at increasing skills. Finally, the paper explores the need for continuing education in both the public and private sectors, and how the synergy between academia and business can direct a positive contamination that can provide the right tools to minimize the digital skills gap.

Keywords: *digital divide, upskilling, reskilling, ICT, social exclusion, educational inequality*

1. Introduction

The digital transformation of services is reshaping economies and societies, offering vast opportunities but also deepening inequalities. In Italy, low digital literacy rates and a shortage of STEM (Science, Technology, Engineering and Mathematics) graduates create significant barriers to digital inclusion, limiting both individual opportunities and national competitiveness. The digital divide extends beyond mere access to technology, encompassing disparities in education, income, and geographic location, which disproportionately affect vulnerable populations such as older adults, low-income groups, and rural communities. To address these challenges, upskilling and reskilling initiatives are essential to equip individuals with the digital competencies needed for active participation in the evolving workforce. While government programs, corporate training efforts, and academic collaborations are working toward bridging the gap, their impact remains fragmented. A more cohesive and strategic approach is required to ensure equitable access to digital opportunities. This paper examines the complexities of the digital divide, evaluates Italy's position relative to European benchmarks, and assesses the effectiveness of existing policies and initiatives. It highlights the importance of continuous learning, cross-sector partnerships, and ethical considerations in fostering an inclusive digital society, ultimately advocating for a comprehensive strategy to close the digital skills gap and promote sustainable digital growth.

2. Digital Divide: A Multidimensional Phenomenon

2.1 Definition and Typologies: Access, Use and Quality of Digital Skills

The digital landscape presents vast opportunities for enhancing data management, education, and communication. The Internet grants access to an immense collection of information, empowering marginalized communities to showcase their skills, engage in public discourse, and further their education. Additionally, access to the Internet is closely tied to fundamental rights such as freedom of expression and information. Without digital access, these rights risk becoming obsolete in contemporary society [14]. While digital technologies can expand personal freedoms, they also introduce risks like misinformation, privacy violations, and unequal accessibility [13,16]. Traditionally, the digital divide was measured in terms of access to technology, but it has evolved to encompass disparities in digital literacy and meaningful engagement. Socioeconomic factors, including income, education level, and geographic location, further amplify these inequalities, with low-income individuals, rural populations, and older adults being particularly vulnerable to digital exclusion. To bridge this divide, it is essential to provide motivation, training, and tailored support. A social justice framework can help address these ICT inequities by advocating for equitable resource distribution and systemic reforms. Policymakers should prioritize investments in underserved communities, promote digital literacy initiatives, and utilize community spaces to facilitate inclusive digital access. A comprehensive approach, considering both structural and individual barriers, is necessary to build a more equitable digital society [14].

2.2 The "Digital Exclusion" Effect: More Vulnerable Segments of the Population

While digital advancements can improve well-being, independence, and health, particularly for older individuals, disparities in access create significant inequalities. Although age is often cited as a primary factor, other elements such as education, income, gender, and generational status also play a crucial role in determining digital accessibility [16]. Fang's research investigates the structural and social inequalities of the digital divide, seeks to deepen theoretical perspectives on ICTs, explores digital literacy practices, and proposes policies to mitigate disparities [5]. The rapid digital transformation poses a major challenge to achieving an inclusive society, as it increases social and economic divides by highlighting gaps in digital accessibility and competence.

2.3 The Digital Divide in Italy: Data, Trends and European Comparison (North vs. South)

According to the latest Digital Decade Report (2024), Italy ranks among the EU Member States with the lowest levels of basic digital skills due to territorial, socio-economic, and educational disparities. Only 45.8% of Italians possess basic digital competencies placing Italy fifth from last in Europe lagging approximately 10 percentage points behind the EU average. Specifically, only 59% of individuals aged 16–24 and 54% of those aged 25–54 possess at least basic digital skills. Moreover, Italy remains at the bottom of the EU ranking for ICT graduates, with an average of 1.5% compared to the EU's 4.5%, making it even more challenging to meet the EU 2030 target for ICT specialists. Additionally, the Italian ICT job market suffers from low business attractiveness. To address these challenges, Italy's national strategy focuses on improving digital skills in schools, reskilling and upskilling workers through initiatives like the New Skills Fund and the Digital Skills Syllabus (targeting public employees), and offering incentives for SMEs to hire innovation managers [6]. However, achieving meaningful progress will require sustained commitment, substantial investment, and efforts to tackle the socio-economic disparities hindering Italy's digital development. Ethical concerns surrounding the digital transition have been analyzed by the European Group on Ethics in Science and New Technologies, an advisory body to the European Commission. Several reports such as Ethics of Information and Communication Technologies (2012), New Health Technologies and Citizen Participation (2015), and Future of Work, Future of Society (2018) emphasize the importance of non-discrimination and digital inclusion, particularly for those in vulnerable positions. The Council of Europe's report *Human Rights, Participation, and Well-being of Older People in the Age of Digitization* (2020) specifically examines the challenges faced by older adults in the digital transition and suggests pathways for overcoming these barriers. Furthermore, the European Declaration on Digital Rights and Principles for the Digital Decade (2023) outlines new digital rights for citizens and workers, reinforcing democracy in the digital age through inclusive participation and ensuring rights such as digital education, online work, and secure digital access. These initiatives reflect Europe's ambition to uphold strong social responsibilities in both the public and private sectors, an approach also echoed by global organizations such as the OECD, UNESCO, and the WHO [16].

3. The Italian Case: Digital Illiteracy and Qualification Challenges

3.1 Basic Skills vs. Advanced Skills: Where Is the Biggest Gap?

As mentioned in sub-section 2.3, the Digital Decade Report (2024) places Italy fifth-to-last on the European scale of basic digital literacy [6]. Its country-specific statistics echo those reported by the Digital Economy and Society Index (DESI, 2024), a tool developed by the European Commission to monitor digitalization progress in EU countries. According to the latest DESI, only 45.8% of the population aged 16-74 possess basic digital level skills versus an EU average of 55.6% [21]. This data confirms the historical negative trend and stresses the need for decisive change in Italy's digital skills preparedness, as emphasized by the European Commission [12]. Moreover, as highlighted by ISTAT, the regions of Southern Italy present an even more critical situation, with only 36.1 % of the population possessing basic digital skills, highlighting a significant gap with the rest of the country [11]. Albeit the Italian university system has historically failed to produce a sufficient number of IT professionals, the lack of digital skills in question mainly concerns basic digital skills used on a daily basis. These include knowing how to use a search engine, sending emails with attachments, installing software, and using online collaboration tools. The structural gap in Italy also negatively affects the use of digital public services, the spread of teleworking, and competitive advantage trends for businesses. The lack of basic digital skills ultimately marginalizes a large portion of the population, making current mundane tasks virtually impossible to perform. These include accessing online public services for administrative purposes, limited employment opportunities, and online professional training that requires the use of digital tools. Furthermore, basic digital illiteracy brings forth negative effects including economic burdens to maintain analog and digital services in parallel production increased exposure to scams and misinformation, and increased generational and territorial gap due to the inability to actively participate in a digital society.

3.2 The Deficit in STEM Degrees: Causes and Economic Consequences

Italy is a country with a large deficit of STEM graduates. The main causes can be traced to several interrelated factors. Persistent gender stereotypes continue to discourage many young female students from pursuing STEM pathways, significantly narrowing the potential talent pool. Additionally, weak school guidance often leaves students without the support needed to explore or commit to these disciplines, which are frequently perceived as too difficult or unappealing. Traditional, theory-heavy teaching methods further diminish student engagement by failing to show the practical relevance of scientific subjects. Compounding this is the weak connection between academic studies and the labor market, with many young people struggling to see clear professional opportunities tied to STEM degrees. Limited investment in technical universities evidenced by the fact that Italy has only four Polytechnics results in fewer resources for research, laboratories, and hands-on projects compared to other advanced nations. Finally, complex university access processes and high dropout rates, often due to the challenging nature of STEM programs and inadequate early preparation, further reduce the number of students completing these degrees. The low number of graduates in STEM disciplines in Italy is a significant obstacle to the country's economic growth. In a global context increasingly focused on technological innovation, digitization and sustainability, the shortage of technical skills limits the ability of the Italian production system to compete in international markets. This mismatch between labor supply and demand also penalizes young people, who often find themselves without qualified opportunities or prefer to emigrate abroad to enhance their skills. The low presence of STEM graduates also affects the country's ability to attract foreign investment: in fact, multinational companies tend to favor territories with a high availability of technical personnel. In short, the shortage of STEM graduates is not only an educational problem, but a real economic and strategic emergency for Italy's future.

3.3 The Problem of Cultural Resistance to Digital Innovation

Cultural resistance to digital innovation is a profound obstacle to the modernization of the country. This is not only a technical or infrastructural problem, but above all a deep cultural resistance. In many contexts, especially in public administration and small businesses, a conservative view prevails, which sees digital change as a threat rather than an opportunity. Distrust of new technologies translates into slow adoption of digital tools, little investment in training and a general distrust of innovation

processes. This attitude is often linked to the high average age of the workforce. In fact, the average age of Italian public administration workers is about 50.7 years. This figure shows significant aging compared to the past: in 2001, the average age was 44.2 years. Currently, 77.9 % of public employees are at least 40 years old, while 16.9 % are over 60. Only 5 % of workers are between the ages of 18 and 29, and 14 % are between 30 and 39 [18]. The oldest administrations are central administrations, with an average age of 54.3 years, while the youngest are found in the armed forces and police force, with an average age of 44 years [1]. Other factors hindering digital innovation are the fragmentation of the production fabric and a managerial culture that is not very risk-oriented. The result is a delay in improving the efficiency, competitiveness and quality of services offered, both public and private. Overcoming this resistance requires a profound cultural change, supported by education, communication and inclusion policies, to make people understand that digital does not replace humans, but enhances their capabilities.

4. Strategies for Digital Inclusion: Models of Intervention and Best Practices.

4.1 Government and Non-Government Initiatives: Creating an Inclusive Ecosystem

International organizations and NGOs play a critical role in addressing the digital divide. During a Human Rights Council panel on digital literacy's role in upholding freedom of expression, panelists emphasized its importance in enabling individuals to access, evaluate, and disseminate information effectively. United Nations Deputy High Commissioner Nada Al-Nashif highlighted digital literacy as a tool for exercising fundamental rights, while Tawfik Jelassi (UNESCO) underscored its role in fostering critical thinking and countering misinformation. Panelists also discussed strategies such as integrating literacy programs into education systems and promoting multi-stakeholder collaboration. Additionally, they raised concerns about the misuse of digital technologies for censorship, disinformation, and surveillance, stressing the need for open, secure, and inclusive online environments. In 2023, UNESCO published its first comprehensive assessment of the 2019 Recommendation on Open Educational Resources (OER). This framework has proven instrumental in addressing global challenges, such as the COVID-19 pandemic, and remains relevant as AI technologies reshape education. The third UNESCO World OER Congress, themed Digital Public Goods: Open Solutions and AI for Inclusive Access to Knowledge, aligns with the UN's Global Digital Compact and highlights ethical concerns regarding AI's impact on education and information access. The Congress explored how OER can integrate AI responsibly while adhering to UNESCO's R.O.A.M. principles (Rights, Openness, Accessibility, and Multi-stakeholder participation).

4.2 Corporate Digitization Programs and the Role of the Private Sector. The Importance of University-Business Collaboration.

A notable initiative in this domain is the Innovation, Education, and Skills (IES) Project by the UNESCO Chair in Bioethics and Human Rights, established in both Pontifical Athenaeum Regina Apostolorum and *Università Europea di Roma*, EucA, and Social Warning. This project, one of the winners of the Academic Equivalence Mobility Information Centre (CIMEA) initiative in collaboration with the Conference of Italian University Rectors (CRUI) and the Ministry of University and Research (MUR), aims to combat educational and digital poverty in marginalized areas of Rome and Lazio. It introduces innovative teaching methodologies and digital labs for technical and vocational schools, supported by university students as mentors. This initiative fosters digital and soft skills while offering tutors a valuable volunteer experience, ensuring that the younger generation is not left behind in the digital age [19]. Digital literacy must equip individuals with the ability to critically assess information credibility, starting from early education. Even digital natives require structured training to develop a critical approach to technology. Universities should integrate digital competencies across disciplines including law, economics, and pedagogy to ensure well-rounded digital preparation. Lifelong learning initiatives should address digital literacy gaps, particularly for individuals without formal educational opportunities. Furthermore, workforce development programs must focus on reskilling and upskilling to prevent job displacement due to technological advancements [16].

5. Upskilling and Reskilling: The Key to Inclusive Digitization.

5.1 The Gap between Supply and Demand for Digital Skills: What Is Missing in the Labor Market

Italy's low ranking on basic digital skills and its cultural and educational divide with STEM educational pathways are a few of the key factors that hinder the country's labor market and economic development [10]. In 2022, out of about 219,000 ICT job ads, only 44,000 recent BA graduates or high school graduates possessed resumes in line for an effective response. Italian universities offer ICT courses that represent only 7% of the educational options, with strong gender inequality: out of 100 graduates in cybersecurity, only 6 are women [9]. Companies struggle to find specialized professionals, slowing innovation processes and reducing productivity. In fact, Italy has a low percentage of ICT specialists in the total workforce, at 4.1%, lower than the EU average of 4.8% [21]. While finding difficulties in recruiting, only 54.7% of Italian companies provided ICT training to their employees in 2021, compared to 65.3% of the European average. This digital skills shortage limits the adoption of advanced technologies such as artificial intelligence, with more than 30% of Italian companies reporting a lack of skills as the main obstacle to AI adoption [11].

5.2 The Role of Companies in the Continuing Education of Workers

To reduce this gap, coordinated action between institutions, universities and businesses is needed, focusing on targeted training, continuous updating and inclusiveness to ensure equitable and sustainable digital growth. Companies specifically play a key role in workers' continuing education, as investing in their development not only improves individual skills, but brings strategic benefits to the entire organization. The benefits identified include increased productivity, as upskilling enables employees to perform tasks more efficiently, with fewer errors and streamlined processes. Improved job satisfaction and motivation also emerged, since workers who see their company investing in their development tend to feel more engaged and valued. Moreover, fostering an environment that supports professional growth contributes to reduced turnover, helping retain talent and lowering recruitment and onboarding costs. Finally, continuous skill development enhances the organization's ability to adapt to evolving market demands, ensuring long-term competitiveness and resilience. Companies can make use of interprofessional funds, financial resources earmarked for employee training, managed by authorized bodies established by employer and union associations. These funds enable companies to finance training, refresher courses and continuing education interventions, helping to improve the skills of the workforce and maintain the company's competitiveness in the market.

6. Discussion and Recommendations

6.1 The Importance of Dialogue between Institutions, Businesses, and Academia

Continuous collaboration between academic institutions and businesses enables curriculum updates that align with industry demands, ensuring students gain both theoretical knowledge and practical skills. Beyond technical expertise, such partnerships foster entrepreneurial thinking and adaptability, bridging the gap between workforce skills and employer expectations. Similarly, government engagement with businesses and academia is crucial for crafting effective policies. Programs like the EU's Horizon Europe demonstrate how multi-sector cooperation leads to science-based, industry-informed regulations that address global challenges. While some critics argue that business involvement may compromise academic independence or favor corporate interests [15], these risks can be mitigated through transparent governance and ethical oversight. Instead of excluding businesses from education and policymaking, a balanced, inclusive approach is essential to driving innovation, economic progress, and responsible policymaking.

6.2 The Creation of Digital Hubs and Innovation Networks

European Digital Innovation Hubs (EDIHs) function as centralized support centers, helping businesses and public organizations navigate digital transformation and boost their competitiveness [3]. By providing technical expertise, innovation support, including funding guidance and training and sustainable digital solutions, EDIHs assist companies in refining their operations, products, and services. Although EDIHs primarily operate at the regional level, they are embedded within a broader European network, enabling them to offer localized assistance while benefiting from international collaboration. Under the Digital Europe Programme, 136 hubs became operational in early 2023, with an additional 15 hubs introduced later. Funding for these hubs is equally shared between the EU and national, regional, or private stakeholders. The EDIH network fosters collaboration among businesses, public sector organizations, and various stakeholders. This effort is further supported by the Digital

Transformation Accelerator (DTA), which manages an online portal offering resources such as the Digital Maturity Assessment tool to monitor digital progress. Additionally, EDIHs work closely with other networks, including the Enterprise Europe Network (EEN) and European Industrial Clusters (EIC), to provide comprehensive support for small and medium-sized enterprises (SMEs). A guidance document is currently being developed to further enhance these collaborations.

7.1 Summary of the Main Research Findings

The paper explores how the rapid digital transformation, while offering significant opportunities, is increasing social inequalities in Italy due to persistent digital illiteracy, a shortage of STEM graduates, and cultural resistance to innovation. It highlights that Italy ranks among the lowest in Europe in digital skills, with severe disparities based on age, income, geography, and education level. The lack of both basic and advanced digital skills limits public access to digital services, weakens labor market competitiveness, and enhances social exclusion. The paper stresses the urgency of coordinated upskilling and reskilling initiatives, emphasizing the role of businesses, educational institutions, and public policy in fostering digital inclusion. Despite various national and international efforts, such as training programs and digital literacy campaigns, the overall impact remains fragmented. We advocate for a comprehensive, cross-sector strategy involving continuous education, public-private-academic collaboration, and culturally adaptive policies to reduce Italy's digital skills gap and ensure inclusive participation in the digital society.

7.2 Final Considerations: Toward Ethical and Inclusive Digitization and the Role of Future Policies

Ethical digitization must place human dignity, autonomy, and inclusiveness at its core. As automation and AI reshape labor and public life, policies must be rooted in justice and equity, ensuring that technological change enhances rather than undermines social cohesion. This requires inclusive education models, targeted upskilling and reskilling for vulnerable groups, and active participation of citizens in shaping digital environments. Future policy must also guard against digital surveillance, misinformation, and bias, promoting transparent governance and the responsible use of emerging technologies. It is more necessary than ever to make present the ethical imperative of a greater awareness of the duty of care to better contribute to the common good. In a world where respect for ethical values is often absent, and where the economic dimension frequently prevails over the values of solidarity and shared human flourishing, we advocate for both ethical and political call to action. We may be tempted to think that human dignity, solidarity, or vulnerability are abstract ideals detached from the digital domain. Yet, across philosophical, legal, historical, and sociological traditions, these principles persist as universal values capable of guiding the development of technologies that respect and serve people as learners, workers, and citizens. Through ethical foresight and social responsibility can digitization truly serve the common good and foster a future in which human flourishing is at the center, improving social and digital inclusion.

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