



State of the Art Review (WP2)

Higher education institutions/Universities
Responses to Digitalization (IO1)

Italy Country Report

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List of Abbreviations

AI	Artificial intelligence
ESCALATE	Coordinated Higher Institutions Responses to Digitalization, Erasmus+ KA2 - Cooperation for innovation and the exchange of good practices, KA203 - Strategic Partnerships for higher education
EU	European Union
ICT	Information and Communication Technologies
IO	Intellectual Output
IT	Information Technology
AICA	Italian Association for Computer Science and Automatic Calculation
ISTAT	Italian National Institute of Statistics
UNIMIB	Università degli Studi di Milano-Bicocca / The University of Milano-Bicocca
R&D	Research and Development
R&D&i	Research and Development and Innovation
RIS3	Research and Innovation Strategies for Smart Specialisation
STEAM	Science, Technology, Engineering, Arts and Mathematics
STEM	Science, Technology, Engineering and Mathematics
UAH	University of Alcala de Henares
UPV / EHU	University of the Basque Country
VET	Vocational Education and Training
WP	Work Package

1. Introduction

WP2 (IO1) is focused on the analysis of how universities respond to digitalization. Thus, we seek to (1) identify the problems associated with digitalization, (2) explore how these are impacting universities (educators and students), (3) review how these skills are taught within mainstream education, (4) identify and review existing practices.

In the Digital Economy and Society Index (DESI) of 2020¹, Italy ranks 25th out of 28 EU Member States. Two indicators are quite positive, connectivity and digital public services, while the others still have low scores. The country is in a good position in terms of 5G readiness, as all pioneer bands have been assigned and the first commercial services have been launched. Moreover, Italy is placed in a relatively high position in the offer of digital public services (e-government).

However, significant weaknesses exist in terms of human capital, where it has lost two places and now ranks last in the EU. Compared to the EU average, Italy has very low levels of basic and advanced digital skills. These gaps in digital skills are reflected in the modest use of online services, where Italy remains well below the EU average. The ranking of the country remained unchanged from the previous report (26th place out of 28 Member States). Similarly, Italian companies are experiencing delays in the use of technologies such as the cloud and big data, as well as in the adoption of e-commerce.

Italy performs particularly well in connectivity, with an overall score of 50.0 it ranks 17th out of EU Member States. Compared to 2018, the overall take-up of fixed broadband increased by one percentage point. The spread of fixed broadband went from 9% in 2018 to 13% in 2019. Coverage of next generation access networks (NGAs) continued to increase, but only by one percentage point, reaching 89% of households and thus exceeding the EU average (86%) by three percentage points.

¹ European Commission - Digital Economy and Society Index (DESI) - 2019 Country Report, Italy <https://ec.europa.eu/digital-single-market/en/scoreboard/italy>

In 2019, at the political level, attention has grown towards enhancing the digitization of the Italian economy and society. The launch of new important initiatives is to be emphasized, in particular the establishment of a new Ministry for technological innovation and digitization, with coordination functions. In December 2019, the Ministry presented the "Italy 2025" strategy², a five-year plan that places digitization and innovation at the center of "a process of structural and radical transformation of the country"³.

² Strategia per l'innovazione tecnologica e la digitalizzazione del Paese
https://innovazione.gov.it/assets/docs/MID_Book_2025.pdf

³ *ibidem*, p. 6

2. Methodology

In the preparation of the report, different research techniques were used in order to analyse the context of the Italian Government Digitalization Strategy and the Universities' responses. Desk research was conducted during September and October 2020 using internet based searches that brought up statistics and reports by entities such as the European Commission and other Italian public organisations. Thorough desk research has been carried out in order to check all possible and relevant channels for information on digitalization and universities' initiatives and plans to become more digital.

The results of the Internet-based searches were quite heterogeneous, but mainly included official websites of the Italian Government and Public Associations, as well as some key publications by well-known organisations and authors. The relevant results were then analysed in detail and narrowed down to the sources mentioned at the end of this report. The outdated reports were discarded as well as the information that did not explain their methodologies or indicate the references used. As a result we relied heavily on results using reports by the European Commission and Government webpages as well as publications by consultancy firms such as Burning Glass Technology and PWC and sector specific reports then also deepened and presented as best practice by the main Italian associations for IT, Automatic Calculation and Digitalization process.

2.1 Expert Interviews

Qualitative research has also been carried out through interviews with experts from universities and experts/technicians involved in the development of national programs. The experts were selected according to their availability and relevance of their inputs to this report.

The following questions were used to guide each of the interviews:

- Problems associated with digital transformation, what barriers do you encounter at university? (leadership, resources, internal structure, analogue procedures, digital training ...)
- Impact of digitalization on teachers and students
- How are digital skills taught within traditional university education?
- Do you develop new courses on digital topics in anticipation of new skills needs?
- Do these courses train people in digital skills or "something else"? In which case, in what? Are they optional or compulsory courses?
- Do you develop new support materials / itineraries for students in anticipation of the new skills of the future?
- Political framework - does it help? Is it a barrier? How should it change to promote digital transformation in universities?
- What other elements would help in the digital transformation?
- Do you have any good practice at the university? (Innovative and open source solutions for teachers and students; New training opportunities derived from digitalization; Sector response to the labor market; Innovations in skills, policy design and governance of the education system; The ethics of digitalization; Digital transformation plan / strategy)

2.1.1 Elena Ippolito, Co founder and Senior Project Manager of iBicocca

iBicocca⁴ is a project of the University of Milan-Bicocca which organizes activities and events dedicated to students enrolled in all bachelor's, master's and doctoral courses. Its goal is to spread the culture of innovation by sensitizing students to acquire certified transversal skills that can be used in the labour market.

2.1.2 Roberto Bellini, Innovation Competence Advisor, Board Member at AICA - Osservatorio delle Competenze Digitali

AICA⁵ (i.e., Italian Association for Information Technology and Automatic Calculation) is the most important Association in Italy in the IT sector. Founded in 1961, AICA is a non-profit association whose purpose is the development of computer knowledge in all its scientific, application, economic and social aspects. AICA is accredited for the ECDL Full Standard, e4job, e-CF Plus and EPM certification schemes.

2.1.3 Marco Gui, associate professor in Media Sociology at University of Milan - Bicocca, coordinator of Benessere Digitale Research Center.

Benessere Digitale⁶ (i.e., Digital Wellbeing) is a Research Center that deals with the relationship between digital media and quality of life. The Center has created several interdisciplinary research projects, in four areas of interest: Digital wellbeing at school, Smartphone and quality of life, digital skills, ICT and learning.

2.1.4 Elisabetta Marafioti, Professor of Management, University of Milan Bicocca; Vice-President of Graduate Degree Management and Design of Services, University of Milan Bicocca; Project Manager, coordinator of a European Project, SMARTUP; Director of Master in Management and Digital Transformation - University of Milan Bicocca.

⁴ <http://ibicocca.it/>

⁵ <https://www.aicanet.it/>

⁶ <https://www.benesseredigitale.eu/>

3. The potential impact of digitalization

Digital transformation is generating a fierce debate among education providers, policy-makers, economists and industry leaders about its societal impact. As digitalization disrupts society ever more profoundly, concern is growing about how it is affecting issues such as jobs, wages, inequality, health, resource efficiency and security. Current estimates of global job losses due to digitalization range as high as 2 billion by 2030 (World Economic Forum). There is currently great uncertainty, with concerns also about its impact on wages and working conditions.

3.1 Digital Transformation and Digital Skills for Job

In 2012, a process of digital transformation began in Italy. On 1 March 2012, the Italian Digital Agenda (ADI) was established, which was structured around six strategic axes: 1) infrastructure and security, 2) eCommerce, 3) eGovernment, 4) computer literacy and digital skills, 5) research and innovation, 6) smart cities and community.

The Agency for Digital Italy (AgID) was established by decree law n. 83 by 22 June 2012⁷, and has become the only implementing body of the Italian Digital Agenda with its function to "*promote digital innovation in the country and the use of digital technologies in the organization of the public administration and in the relationship between this, citizens and businesses, in compliance with the principles of legality, impartiality and transparency and according to criteria of efficiency, cost-effectiveness and effectiveness. It collaborates with the institutions of the European Union and carries out the tasks necessary for the fulfillment of the international obligations assumed by the State in matters of competence*".

These initiatives follow the first law that regulates the digital transformation of the Italian Public Administration. The CAD - Digital Administration Code (d. lgs. n. 82/2005)⁸ is a single text that brings together and organizes the rules concerning the computerization of the public

⁷ https://www.agid.gov.it/sites/default/files/repository_files/leggi_decreti_direttive/dl-22-giugno-2012-n.83_0.pdf

⁸ http://www.cip.srl/documenti/Codice_Amministrazione_Digitale_D.lgs._85-2005.pdf

administration in relations with citizens and businesses, while the "Three-year Plan for Information Technology in the Public Administration 2019-2021" contains a series of initiatives and tools to support public administration innovation through the use of digital technologies.

Smart working in the Public Administration is closely linked to the broader debate on the digital transformation of the country and the related skills of all citizens.

An updated photograph of the Italian situation is provided by the 2019 edition of DESI (the Economic and Digital Society Index defined by the European Commission). It analyzes five indicators: connectivity, human capital, Internet use, integration of digital technologies and digital public services.

Connectivity relates to the coverage and use indicators of both fixed and mobile broadband, **human capital** relates to indicators on the presence of digital skills in the population, the **use of the Internet** relates to indicators that measure the use of the Internet by the population for purposes not related to public services, the **integration of digital technologies** concerns indicators on the availability and use of online public services.

Digital culture and related literacy are multiplying factors for the activation of a virtuous circle: the more users are able to perceive the benefits of digitalization of services, the greater the demand for innovation and the faster the Public Administration. will tend to adapt to these needs. But, to do all this, it is necessary to strengthen the skills of public employees by increasing the propensity to use technologies by users.

This constitutes a strong motivational element in terms of self-learning of collaborators; in fact, it allows them to experience the effort of training no longer as a requirement prescribed by the employer but as a desired support for a more independent management of their time and the organization of daily life.

Italy ranks 24th among the 28 EU Member States in the European Commission's DESI for 2019.

Italy is in a good position, albeit still below the EU average, in terms of connectivity and digital public services. Compared to the 2018 data where Italy had an overall score of 38.9, the 2019 data show that Italy has grown by 5 points, thus reaching 43.9 points.

However, it appears that three out of ten people still do not use the internet regularly and more than half of the population does not have basic digital skills. This lack of digital skills is also reflected in a lower use of online services, where in fact little progress has been made.

The 2014-2020 Digital Growth Strategy dedicates a chapter to digital skills as a fundamental acceleration program for the country's digital transformation, which focuses on a strong synergy between the public and private sectors.

By basic digital skills we mean the ability to use information and communication technologies with confidence and a critical spirit for work, leisure and communication. Basic digital skills are thus the skills required of all citizens to be able to actively participate in the information and knowledge society and exercise digital citizenship rights.

The Agency for Digital Italy (AgID) has created an official translation into Italian of the European model that identifies the basic digital skills of citizens. This model is called European Digital Competence Framework for Citizens, also known as DigComp (the latest version is 2.1)⁹.

It is divided into five areas: information and data literacy, collaboration and communication, digital content creation, security and problem solving. Each of these areas encompasses levels of mastery such as basic, intermediate, advanced and highly specialized.

This framework was inspired by the Syllabus "Digital Skills for Public Administration" created by the Office for Innovation and Digitization of the Department of the Public Function with the aim of describing the minimum set of knowledge and skills that each public employee does not IT specialist, should possess to actively participate in the digital transformation of public administration.

⁹ To deepen and consult the DigiComp 2.1 model, see the text by S. Carretero, R. Vuorikari and Y. Punie "DigComp 2.1 - The reference framework for citizens' digital skills", AgID (2018).

The DigComp Framework has 5 dimensions:

- Dimension 1: Competence areas identified to be part of digital competence
- Dimension 2: Competence descriptors and titles that are pertinent to each area
- Dimension 3: Proficiency levels for each competence
- Dimension 4: Knowledge, skills and attitudes applicable to each competence
- Dimension 5: Examples of use, on the applicability of the competence to different purposes

This Framework is the best known and most used result for the definition and measurement of digital skills, and on it some European projects have built measuring instruments. However, none of these created a statistically and consolidated test. It still appears urgent to have a validated tool to measure digital skills. The Fastweb-Bicocca project¹⁰ defined by Gui and Fasoli aims to provide an answer to this need. This test is also based on the DigComp framework, but it has the merit of statistically measuring critical digital skills (also called content-related skills). The test is provided to Universities and schools students. To answer the test questions, students had to answer multiple choice questions. Moreover, subjects had to evaluate online typical situations, like screenshots of real websites, analyze pages of search engine results, as well as evaluate web addresses and prove their knowledge of the mechanisms underlying well-known sites and often used by young people (e.g. Facebook, YouTube, Wikipedia etc.)¹¹. The debate on measurement of critical skills is still open, but this project is one of the most promising and interesting answers to the problem (the topic is also addressed in the interview with Prof Gui).

¹⁰ Gui, M., & Fasoli, M. (2017). Il test Fastweb-Bicocca: la costruzione e la validazione di uno strumento per la valutazione della competenza digitale. In M. Scarcelli, & R. Stella (a cura di), Digital literacy e giovani. Strumenti per comprendere, misurare, intervenire (pp. 133-148). Franco Angeli, <http://hdl.handle.net/10281/183177>

¹¹ Gui & Fasoli, op. cit. p. 5.

4. Current policy and educational/universities responses

Digitalization is transforming the skills needed by Europe's working population to successfully engage in the world of work in a globalized modern economy. In this context, higher education institutions play a key role in providing the digital skills required by the labour market in the globalized modern economy. Consequently, national education systems must swiftly and appropriately respond to the challenges digitalization poses.

For the first time, Italy has adopted a National Strategy for Digital Skills¹², document approved by Ministerial Decree of the Minister for Technological Innovation and Digitalization, since the 21 of July 2020. A fundamental step for the implementation of organic, multi-sectoral and effective interventions in a key area for the country's economic and social development. The Strategy was created to reduce the gap with other European countries (Italy is in last place in the DESI 2020 in the Human Capital Area and 37th in the UN ranking on e-Government), to break down the digital divide between the different areas of national territory, support maximum digital inclusion and promote education on the technologies of the future.

In this context, Repubblica Digitale (i.e., Digital Republic)¹³ is born, the national strategic initiative promoted by the Department for digital transformation of the Presidency of the Council of Ministers with the aim of combating the digital divide of a cultural nature present in the Italian population, to support maximum digital inclusion and promote education on technologies of future, accompanying the country's digital transformation process.

As part of the "Italy 2025" Strategy¹⁴, the initiative aims to:

¹² <https://repubblicadigitale.innovazione.gov.it/assets/docs/national-strategy-for-digital-skills.pdf>

¹³ <https://repubblicadigitale.innovazione.gov.it/>

¹⁴ https://innovazione.gov.it/assets/docs/MID_Book_2025.pdf

- reduce the phenomenon of digital illiteracy to dimensions at least similar to those present in the European countries of reference, favoring the development of the necessary digital skills of workers;
- significantly increase the percentage of ICT specialists experienced in emerging technologies reaching the levels of many other European countries.

The initiative is divided into a series of activities carried out in collaboration with other public and private entities. The National Coalition established as part of the Digital Republic adheres to the Digital Skills and Jobs Coalition of the European Commission¹⁵.

These are the basic principles of the National Strategy for Digital:

- Digital Education: computer culture and digital skills are essential requirements for full citizenship. The public and private sectors must invest to foster skills development as they are determining factors for growth, competitiveness, creation of public value, and the well-being of the country. Also, schools, universities, and the media should contribute to fighting all forms of digital illiteracy.
- Digital Citizenship: digital technology can foster the development of a new form of citizenship based on quality information, participation in deliberations, civic engagement, and a more effective relationship between citizens and public administration; digital technology centered around citizens' rights may become the common language in the dialogue between citizens, public administrations and businesses, and contribute to reducing inequalities.
- Ethical, human and non-discriminatory digital: digital can become an opportunity for equality and the growth of communities and individuals; public and private should contribute to the removal of all social, economic, geographical, technological, and cultural obstacles that can foster inequality between citizens not only in the use of public and

¹⁵ <https://ec.europa.eu/digital-single-market/en/national-local-coalitions>

private digital services but also in the access to the opportunities offered by the digital era.

4.1 Ongoing Initiatives of University and Higher Education

Among the institutional initiatives that seek to introduce training paths that integrate ICT and specific areas of knowledge:

- there is a low demand for vocational training degrees, which currently are not considered suitable and cannot be compared to other degrees;
- within some companies, in some IT departments, CdS were established in which IT and economic culture are combined together;
- three-year degree courses in the corporate economic sector with a strong ICT and AI focus were recently announced or are in the process of being launched.

In recent years, alongside the curricular training offer, numerous training initiatives have been developed in the universities, in close collaboration with the private sector. These initiatives, often grouped under the Academy label, tend to take the form of learning organizations in which students and teachers are encouraged to create, for the duration of the training course, real communities of practice which are capable of enhancing everyone's specific skills and inclinations, and transforming them into resources for the common cultural growth.

A first survey conducted as part of the work of the Repubblica Digitale has surveyed more than 25 Academies, in 14 Regions, with the involvement of the national and multinational industrial and service sectors, both ICT and non-ICT related. In addition, there are a significant number of initiatives aimed at spreading digital culture among particular segments of the population (for example, initiatives aimed at bringing female students closer to computer science and engineering studies) and observatories aimed at classifying best practices, projects, and experiences of digital innovation.

In order to promote the diffusion of digital culture through training courses, the following macro-areas of intervention were identified as the basis from which to proceed with developing an innovation process:

- Digitalization of the school system
- Development of students' digital skills and culture
- Digital training of teachers
- Strengthening ICT training as part of transversal skills and pathways
- Strengthening orientation programs for high school graduates
- Cooperation between School and University

Furthermore, a new set of indicators will be identified to measure the impact of the planned initiatives. These actions will take into account the new processes and training needs that have emerged during the Covid-19 pandemic.

The impact can be measured on the basis of these indicators:

- qualification of incoming and outgoing orientation paths;
- innovation in pedagogy through ICT technologies and delivery of new services for students (cooperative work, availability of online materials, support for student assistance, support for classroom delivery of lessons);
- modification and adjustment of the current training offer to the needs of the jobs affected by digital transformation;
- strengthening training courses strongly oriented towards industrial research and innovation;
- strengthening human capital and infrastructure in terms of researchers involved in ICT teaching and scientific activities and its applications;
- adjustment of analysis models of the Observatories.

4.2. Offer of digital skills as University courses

In order to understand and accurately describe the offer of the digital skills promoted by the analysed university champion, it is appropriate to consider how Italy is positioned in terms of digitization compared to other European countries.

According to the Digital Economy and Society Index (DESI), promoted by the European Commission, Italy is one of the countries that shows the greatest backwardness in terms of digitization. DESI is the result of several variables that contribute to determining the digital performance of a certain country. Although in the last report on the 2018 data, Italy recorded an improvement of a few percentage points, it only ranks 24th among the 28 member states.

The actors called into question to reduce the digital gap are different from private companies to policymakers. Undoubtedly, a very important role in this scenario is played by universities which, by carrying out a self-analysis of the educational offer proposed in the digital field on the one hand, and of the most requested digital skills by companies on the other, can help reduce mismatch. occupational. This virtuous circle would have positive repercussions at the national level in terms of GDP, improving the digitization indexes (and not only) that place Italy in the European and international rankings.

On the basis of the data collected on courses and teachings proposed by the universities included in this paper, it is possible to highlight some relevant aspects of current training in the digital environment offered to the new generations.

The following are the main results that emerged from the analysis. Given the limited number of universities observed, it is not possible for us to generalize our observations to the whole of Italy. However, considering the common traits among the universities observed in terms of course structure and teaching content, the study allows us to understand at least in part some characteristics of the national university system, giving us the opportunity to offer useful recommendations for its renewal.

1. Supply of digital skills overall poor in compulsory courses

Beyond the Polytechnic Universities, which by definition offer a consistent number of basic and advanced digital courses and courses, the majority of universities offer a basically low number of digital courses, in line with the relative courses of study. If we look at the basic digital skills, which our research requires by many professionals, we note that the offer is rather scarce. Typically, basic digital courses are offered in preparation for subsequent years or, in the case of humanities or health professions courses, are offered without a particular long-term educational program. The supply of basic digital skills does not exceed 1% of the total mandatory supply of the universities analyzed.

2. Many digital courses are free to choose, among these the courses in Digital Transformation Culture emerge

There is a tendency on the part of institutions to leave a large part of the course teachings, in some cases all, to be chosen by the student.

Among these, the presence of courses that offer education in the digital field is frequent. It is also noted that study courses close to areas typically "touched" by technology and digital technology are introducing Digital Transformation Culture courses aimed at providing digital skills useful for the student's future career. An example is the "Organization and digitization of multimedia showcases" teaching in the Cultural Heritage course of the University of Milan or the "Digital Strategy" teaching in the Communication Design course of the Politecnico di Milano. These courses are typically not compulsory, but are part of the elective teaching groups.

3. Polytechnics hold the largest number of advanced digital courses, but they do not neglect the Digital Transformation Culture

It is not difficult to imagine that the most varied offer of skills basic and advanced digital courses belong to the courses provided for in the courses of the Polytechnic Universities. What is interesting to note is that even in the Polytechnics there is a growing predisposition towards teaching skills in Digital Transformation Culture. The latter are designed to train students in

compliance with multidisciplinary subjects that intersect transversal skills with potential opportunities for growth and social impact. The introduction of courses such as "Technologies, communication and society" from the Turin Polytechnic and "Architecture for Smart City" from the Milan Polytechnic is an excellent sign. It means that technical universities are addressing digitization as a broad topic, which is not limited to the mere learning of technical skills, but involves economic, political, ethical and social issues, offering a more varied spectrum of skills (e.g. soft skills) and a preparation more suited to the world of work today.

5. Critical points and Gaps in Policy Response

Within the European Union, the European Commission's Digital Economy Society Index for 2018 shows that EU countries face deep digital development gap and therefore, it should invest more in digital and also complete the Digital Single Market as soon as possible to boost Europe's digital performance". Even more, the same disparity is seen on digital skills, "while Nordic countries and the U.K. have populations with notably advanced digital skills, almost half of all Europeans still lack basic technical competences", according to the index.

5.1. The current situation in Italian University and Higher School

The lack of digital skills, both basic and advanced, results in a reduced availability and use of online services. Consequently, it is necessary to increase the resources of the school and the university system so as to make digital skills an essential element for the digital transformation of the public and private sector.

- In 2018/2019, there were 320 courses of study (CdS) in the ICT sector out of a total of 10,260. There are almost no training courses integrating ICT and specific areas of knowledge; there is a very low demand for Vocational Training degrees. Although the number of enrollments shows a positive trend in constant growth, the gap between graduates and the job market demand is very high: according to the estimates of the "Digital Skills Observatory" 2019; in the ICT sector there is a shortage of about 15,000 graduates. It should also be emphasized the need to encourage and support women to undertake training in the technical and ICT sectors so as to ensure inclusive and diverse development of our society.
- With regard to the IT environment outside the specialist CdS, IT culture is absent from the teachings in 60% of the business CdS and 70% of the humanistic CdS. Regardless of the academic/disciplinary area of these courses, when evaluating the contents, IT area covers 7% of the courses in mathematics, physics, statistics, 3.4% of those in business, 10% of

those in digital communications, and 2% of all other scientific, humanistic and legal courses.

5.2. Expert opinions on the gap

To better understand the policy responses and how the world of education is facing the problem we asked experts their opinion during the interviews. The responses show that one of the main causes of the gap is the lack of digital education in the schools, or in any case a low level of digital education, and that universities try to make up for. Another issue outlined by the experts is the cultural barrier caused by the high average age of the Italian population. Here are the experts' answers to the questions asked.

Elena Ippolito mainly dealt with the theme of cultural problems. Indeed, when we asked: “How can the existing digital skills gap in our country be bridged?” Elena Ippolito replied that, first of all, it is a cultural and age problem of the population. There are more and more PA services but also banks, post offices, etc. which are digital, but which seniors are unable to use. Then, it is a training problem, not only the schools do not train, but also other institutions. For example, iBicocca had proposed to the councilor of the Municipality of Milan to set up free digitization laboratories for citizens, especially the elderly, they had thought of blocks of lessons where former iBicocca students would teach, a basic level of digital training and a more advanced one (but project not went through because of the Covid). Ippolito thinks that you cannot leave people at the mercy of technologies without adequate training, the web has many pitfalls, there is no need to train, there is not even social support, there are only voluntary associations that deal with training some citizens. Another important issue is that there are no funds and there is no political will because there are no returns.

Another problem is to convince the elderly to attend these courses, it could be useful to involve aggregation realities (for example, clubs, neighborhood committees, town halls) where the over go to spend time. Ippolito claims that decentralizing can be a solution, for example one of the

Municipalities of Milan tried to do this type of activity. It becomes increasingly necessary to train students so that they are the ones to transmit, to train them in public speaking, in interacting in groups, so that in turn they can train the elderly.

Roberto Bellini instead stressed the importance of recent political initiatives to address the gap. We asked Roberto Bellini: “How deep is the digital gap and how can we cover it?”. Bellini answered that the gap is 5 years, but still to be discovered. In his opinion, the Repubblica Digitale is a serious political response and has this as its focus. Bellini thinks that there is a general lack of digital skills, however, the work started 5 years ago by the Digital Skills Observatory is an important reality and is bearing fruit, and this indicates a state of maturity. In addition, Repubblica Digitale appointed the Italian representative in the National Coalitions for Digital Skills and Jobs¹⁶, which has existed for 5 years. In his opinion, a movement has begun in institutional, national terms, before it was only at the local level that some figures moved, for local or market interests, it is the first time this has happened in Italy.

Marco Gui highlighted the lack of knowledge about the critical skills that universities and schools do not provide adequately. Indeed, when we asked him: “How are universities or schools addressing the digital gap?” Gui answered that universities have developed their own tools to provide University Credits to cover the required digital skills. But in his impression there is still a strong indecision on what digital competence means: regarding the division he talks about, if we talk about Medium-related skills then we have the ECDL, if we talk about Content-related skills, that is digital citizenship, on this the Universities do not have the objective clear, they provide 3 University Credits for technical and IT skills, but digital citizenship is a very different thing, there is no clarity on what the priority is.

Gui claims that in the 90s the priority was to give everyone a software tool to work, the Office package for example, now can we afford not to know the Network Law, or how does a social algorithm work? In his opinion no. It is a strong decision to make. Is the technical side dominated

¹⁶ <https://ec.europa.eu/digital-single-market/en/national-local-coalitions>

only by specialists or by everyone? In his opinion, it is important to give critical skills, students do not yet know how the business models of social networks work, or the operating logic of network algorithms. Finally, Gui thinks that this gap comes mainly from schools. He said: “Of course, there is a need to include Media Education (ME) in school curricula, it is essential, it does not exist, a lot has been spent on buying equipment (IWBs for example) but nothing on Media Education, it is urgent now.”

Elisabetta Marafioti also insisted on the faults of the schools regarding the gap, caused by a wrong way of teaching. She explained that in high school there is the ECDL license, which is an entry point, now all high schools do it. Unfortunately this subject is often presented in an unconvincing way, this causes students to move away from the subject. Marafioti thinks that digital literacy should be given in a different, non-notional way with tests, as they do. Even the Civics course that has been introduced is done in the wrong way, students should discuss some situations and decide together with the teacher what is the best approach, and then explain what the underlying reasons are. Digital transformation should be included in all courses across the board.

In conclusion, expert opinions are all quite united by elements in common: cultural and age problems, lack of adequate teaching modalities, lack of digital literacy. But positive and hopeful aspects are recent national initiatives like the Digital Skills Observatory and Repubblica Digitale, and many local initiatives like iBicocca or Gui’s projects on digital literacy.

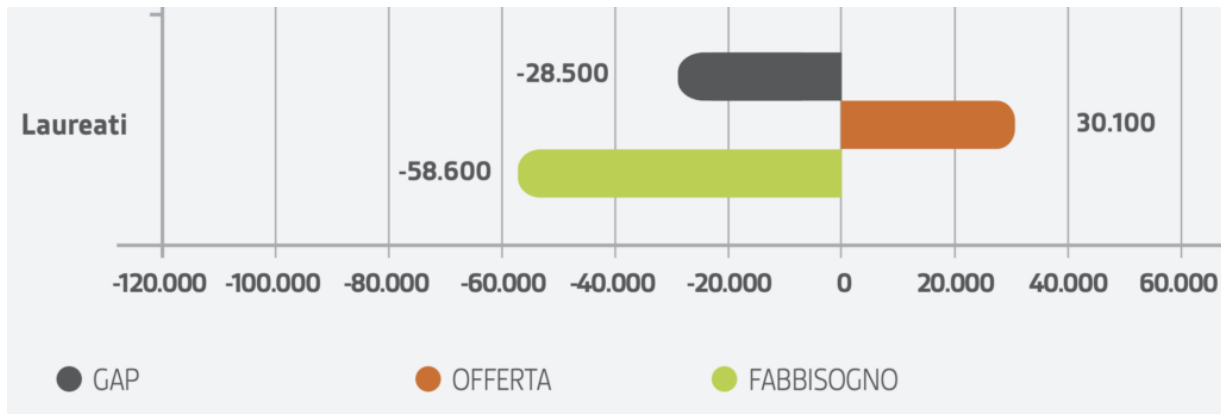
6. Good practice identified locally and nationally

6.1. The Observatory on Digital Competencies

To accelerate digital, it is necessary to accelerate on who has the skills to enable it. New professions, new skills, more experienced professionals (graduates and non-graduates), more quality training, more soft skills are necessary and urgent factors to reduce the gap between demand and supply of digital skills. Not only does the implementation of digital projects delay due to a shortage of personnel with adequate skills, but it increases unemployment or the underutilization of the workforce with obsolescent skills.

In a unitary project, which places the theme of Digital Culture and its role in the Italian training and entrepreneurial system at the center of reflection, the fifth edition of the Digital Skills Observatory (2019) updates and focuses on the analysis of the digitalization of skills required both in the management processes of information systems and in the functional areas of an organization. AICA, Aintec-Assinform, Assintel and Assinter, together with the Agency for Digital Italy and the Ministry of Education, University and Research have collaborated side by side to propose new elements of knowledge and evolution scenarios to guide the policy initiatives to address the needs of the 4.0 labor market and answer the main training questions: Which skills are in greatest demand? For which skills that will be required in the future should new training courses be organized? Where do IT graduates and graduates find work? How to attract young people to professions with a high digital content or to secure employment?

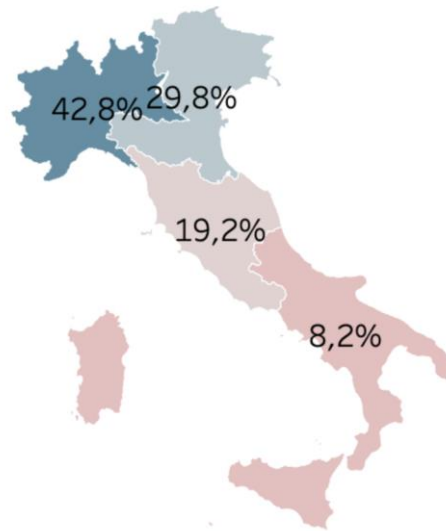
The job market of professions in the ICT sector is in contrast with the problems encountered by many economic sectors. In fact, the demand for work by businesses exceeds the supply that the training system, especially the university one, is able to produce. The data from the digital skills observatory are very clear in this regard: between 2019 and 2021 there was a negative difference between the demand and supply of ICT graduates of approximately 28.5 thousand units; this means that it is unlikely that a policy will be able to intervene in the short term to satisfy the needs of the market, and that companies will have to follow and identify alternative ways to meet their needs.



Specifically, 2019 shows a demand for ICT professions totaling 106 thousand units, substantially in line with 2018.

In the different professional families into which the ICT professions required by companies are divided, it is possible to observe those that have a higher growth rate in 2019; in particular, the Data Specialist, the DevOps Expert, the Quality Assurance Manager and the Blockchain Specialist have a growth rate of over 70% between the first and fourth quarter of 2019, followed by Digital Educator, Cloud Computing Specialist, Product Owner and Solution Designer which also stand at high growth rates (between 35 and 55%).

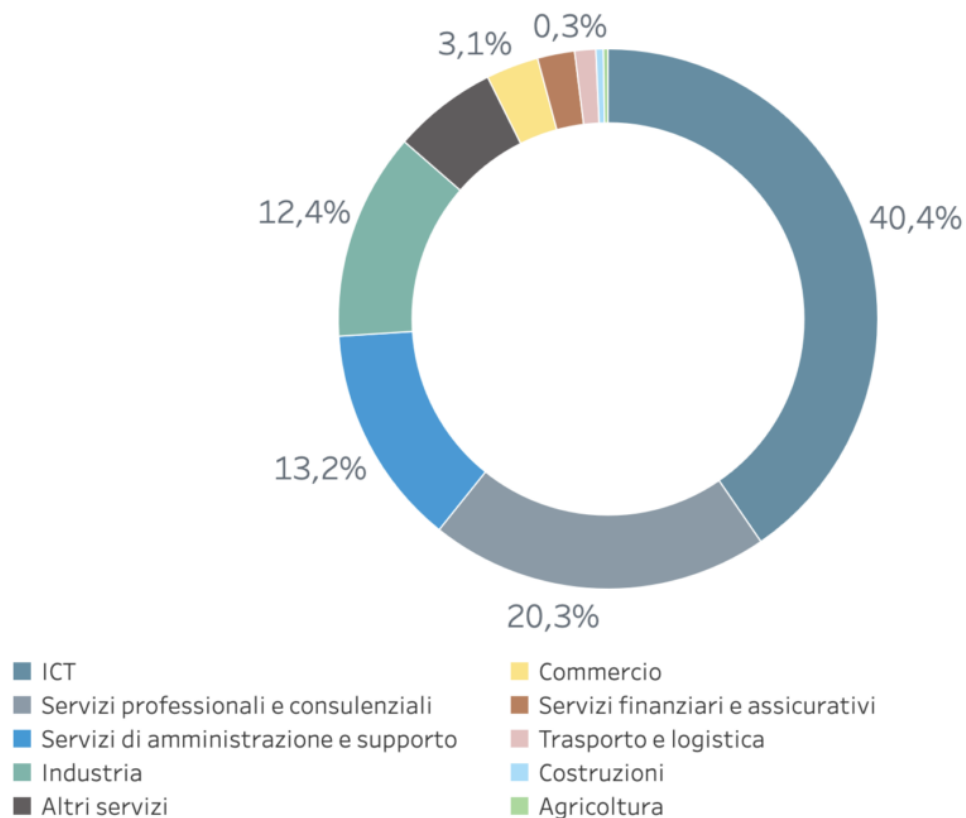
The demand from companies is very diversified both in the territory and in the economic sectors. The territorial differences are substantially in line with the general trend of the labor market, highlighting a high gap between the north, center and south of the country. The North West excels with a percentage share of about 43% of job vacancies; in this territory it is the Lombardy region that has the most significant share (35%). The north east follows with 29%, with Veneto and Emilia Romagna accounting for approximately 16 and 11% respectively. The center stands at 19% (in this case Lazio is the region with the highest requests, 10.5%) while the south and the islands have only about 8%, of which 3% of job offers are found in the Campania region, certainly the most significant of this territory.



Percentage share of advertisements by macro territorial area

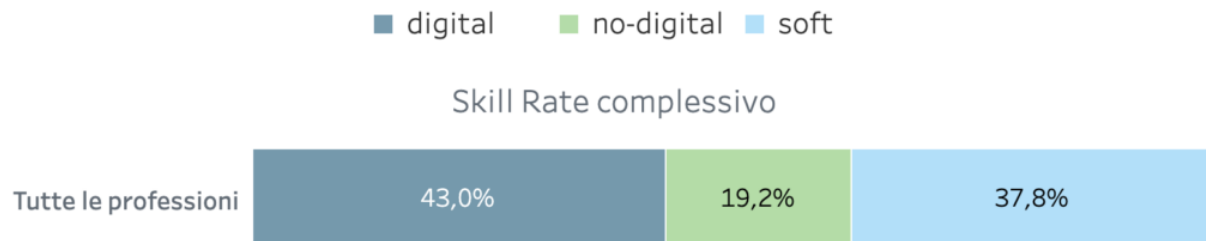
ICT is - as expected - the prevailing economic sector with about 40% of job offers. This is followed by professional and consulting services, administration and support services and industry respectively, with percentage values of approximately 20%, 13% and 12%. The other economic sectors cover the remaining demand equal to 15%. The relationship between economic sectors and the territory fully reflects the presence of the various sectors in our country. For example, demand in industry is higher in percentage terms in the north east (about 17%) and in the north west (12%), while it is between 9% and 10% in the center and south and islands.

Dal quarter 2019 Q1 al 2019 Q4



Percentage share of ads by economic sector

With regard to the skills required in job offers, an indicator is proposed in the observatory that allows you to have a first summary view of the skills required by companies for the ICT professions, both overall and for each profession: the Digital Skill Rate (DSR). This indicator shows the relevance of digital, non-digital and soft professional skills. The analyzes show a distribution of skill demand for all professions equal to 43% of digital skills, 19.2% of non-digital and 37.8% of soft skills.



As we can imagine, the data on the importance of skills is very diversified for the different ICT professional families analyzed. On the one hand, for more distinctly managerial professional families, soft skills are more relevant, while for more technical ones, the main demand is for digital and non-digital skills. On the other hand, soft skills (such as teamwork, creativity, responsibility, etc.) are becoming increasingly relevant for the choice of technical profiles. In fact, these are called to contribute more and more in a multidisciplinary context, which requires a vision capable of showing how technical solutions are a contribution to growth and innovation of management and business processes.

At the same time, we are witnessing the growth in demand for new technical skills in particular related to the world of big data, artificial intelligence, IoT, robotics and cloud computing, to name the main ones. If we previously indicated some professions with a higher rate of growth in demand - and certainly some of them are closely linked to these worlds - the analyzes carried out on the skills required highlight the emergence of the demand for new skills for many ICT professions. Especially for development activities, skills related to the management of large volumes of data and AI techniques emerge (artificial intelligence, machine learning, computer vision, python, hadoop, hive, IoT, Scala, to name a few).

In summary, we are faced with an evolution that has different connotations: (i) difficulty in finding resources, (ii) emergence of new professions and skill changes required for many existing ones, (iii) great relevance of soft skills for ICT professions .

These aspects have to do with what is now called the digital transformation that is becoming more and more pervasive in the lives of people, companies and society. It is a transformation

that certainly requires training new specialist skills, but above all to grasp that it is a profound cultural change.

In the drama of the current moment due to the sudden emergency due to COVID-19, we are witnessing a response, both from the educational system and from companies, of enhancing digital technologies, in order not to interrupt ongoing activities. Entire courses of university studies and - more generally - education are offered online; companies are implementing many smart-working actions, to name the most obvious initiatives. In a few days, reality led us to use digital technology to not stop the country, and certainly these experiences are making some skills that “struggled” to develop. Learning by doing is today, for some aspects of digital, required and favored by reality. What is happening is not only limited to the use of some technologies to cope with a highly critical social situation, but also to the growth of many questions about its correct use and its validity, especially in educational and training courses. This opens up many questions of great interest that represent - and will certainly represent in the future - an important contribution to the cultural change that the digital transformation is imposing. A challenge that can be really taken up if the awareness of its value, its limits and its potential in the different areas of our life, personal, corporate and social, grows.

7. Recommendations for action

Unesco, in its recent study (*Fau, S, Moreau, Y., Managing tomorrow's Digital Skills: what conclusions can we draw from international comparative indicators? Working Papers on Education n. 6, Parigi, 2018: Unesco*), summarized some key elements to ensure a wide dissemination of the necessary digital skills to face the challenges of the future. Starting from that reference literature, it is possible to highlight that the level of digital skills can be mainly influenced by the factors described below.

The set of these factors is attributable to two macro-dimensions of the intervention of the policy maker:

- transversal policies - which promote the creation of an environment conducive to development of digital skills (quality of infrastructures, willingness to carry out activities online, quality of content available online);
- sectoral policies, focused on education and on their connection with the labor market (age of approach to ICT for learning, degree of use of ICT by teachers, availability of digital devices for learning).

Focusing on sectoral policies is It is possible to identify three areas as the **main drivers intervention: integration of ICT, overcoming the generation gap learners - teachers / trainers, adequate curricula and educational projects.**

In this sense it is possible to outline a scenario in which education systems and training are able to truly innovate.

Such a scenario could be inspired by two elements:

- Concentration of resources on objectives clearly defined and measurable;

- Consultation with all stakeholders of interest (schools, businesses, trade associations of category, etc.)

7.1. Possible areas of intervention

ICT integration

- Intervene both on infrastructures and on processes, including significant changes in techniques,
- equipment and software and their integration into learning processes.
- Finding the right mix of learning traditional and use of technology
- Choose software solutions actually adequate to the educational and training objectives

Overcoming the learner-teacher gap

- Ensure the sustainable and effective introduction of technology in learning environments
- Enhance digital skills of teachers
- Spreading methods of "digital" teaching

Curricula adhering to the labor market

- Developing "new" skills related to rapid digital changes that characterize the IV revolution
- industrial, spreading digital skills with a high inclusive potential and in line with demand
- and the job offer.
- Overcoming the teaching of skills digital as making technical skills part of a course
- Focus learning programs / training on / with / for digital skills advanced

With regard to the need to make curricula adhere to the demand of the labor market, it seems appropriate that the education and training systems orient their offer, not only and not so much towards specific disciplines (eg. STEM), as much as towards **interdisciplinary integration**, capable of passing training for technical skills (eg. intended as basic skills, part of a course of computer science or technology).

It is essential to develop integrated skills such as programming and the development of "logical thinking" to keep pace with evolving technologies. The development of these skills should form an integral part of the majority of educational and training curricula, a kind of mainstream education of the new citizen.

Finally, as a crucial element to obtain the expected results from the enhancement of digital skills, it is essential to define curricula firmly anchored to the needs of the labor market and digital citizenship.

A data-driven understanding of the labor market in terms of skills available / to be made available is in fact essential to develop education and training programs aimed at ensure the employability of individuals (and, in so doing, the competitiveness of businesses). In particular, it becomes strategic to promote collaboration between government, education and training institutions and businesses, encouraging joint action between these actors.

The direction taken by Italy to develop a national repertory of education and vocational training qualifications with skills firmly anchored to an innovative classification system of work processes (Atlas of work and qualifications) represents an innovative method for promoting social dialogue and listening to the needs of the production system by linking skills (intended as learning objectives of education and training courses) to the real work activities of production processes (<https://atlantelavoro.inapp.org/>).

7.2. Elements of the innovative approach for education and training systems

Involvement of all stakeholders: the different sectors of public administration and research, the wide range of non-governmental actors, businesses, professionals and trade associations.

Systems for measuring policy outcomes firmly anchored to the objectives set: adopt observation metrics to examine the relationship between innovation and dissemination of digital skills and policy outcomes.

8. References

Name of organisation	Type of organisation	Expert's position	Interview date	Mode of interview (telephone, mail, etc.)
Placement office of Bicocca University	Not for profit	Head of the office	10/10/2020	in person
Ibicocca	Not for profit	Founder	8/10/2020	telephone
AICA - Italian Association for Informatics and Automatic Calculation	Association	Head of professional Systems	9/10/2020	telephone
Bicocca University	Department of Management	Full Professor and european projects expert	13/10/2020	telephone
Digital Republic	National strategic initiative promoted by the Department for digital transformation of the Presidency of the Council of Ministers	Main proposer and creator of the initiative	13/10/2020	telephone

[1] <https://maunimib.unimib.it/percorsi-formativi/madim-2/>

[2] <https://www.unimib.it/didattica/master-universitari/master-attivati-aa201718/smartup-international-master-entrepreneurship>

[3] <https://mages.unimib.it/>

