

**A research on innovative skills and best practices to enhance HE students employability, flexibility and transversal capabilities and develop effective digital workbased approaches**

## **Case of Italy**

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Digital Transformation, Industry 4.0 and Human Resources Management: Innovative skills to enhance HE students' employability, flexibility and transversal capabilities



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## Introduction

This report describes the current situation of awareness and development of Industry 4.0 in Italy. It covers aspects related to statistical and economic indicators of digitalisation level, national strategic planning documents, policies and law, educational events and projects relevant in the context of Industry 4.0, an overview of companies and best practices of digital transformation and implementation of Industry 4.0 concept. Moreover, the report summarizes knowledge and skills that should be purposefully developed to support the successful introduction of Industry 4.0 into the economics and industrial competitiveness of the country.

The report is based on a systematic analysis of information sources published between 2018 and 2022. The following information sources were identified as being of interest for the current report:

- studies of experts in the field;
- websites of companies, higher education institutions, government institutions, and projects;
- articles in the media;
- books;
- projects' reports;
- Italian legal framework, decisions and policies adopted by the Italian government;
- scientific publications and reports;
- specific literature for the public sector and Industry 4.0.

## 1. Statistics and economic indicators on digitalisation and digital skills

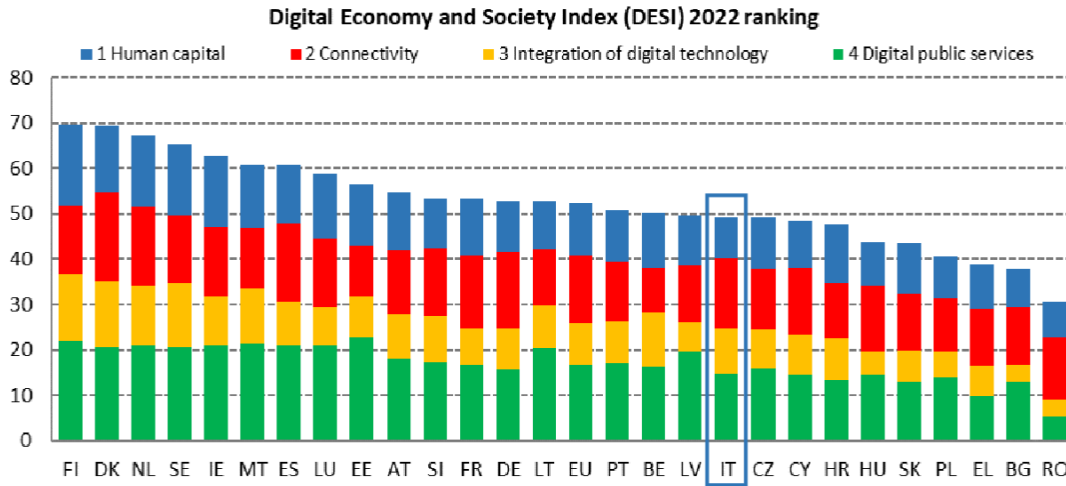
The first analysis related to this study concerns the Italian score in composite indexes and indicators relevant to digitalization and Industry 4.0 readiness.

In DESI 2022, Italy ranks 18th out of 27 EU Member States. In the last 5 years (2017-2022), Italy's score has risen from 28.2 to 49.3, recording the most consistent progress among all EU countries, although it remains below the European average (52.3) and Spain (60.8), France (53.3) and Germany (52.9).

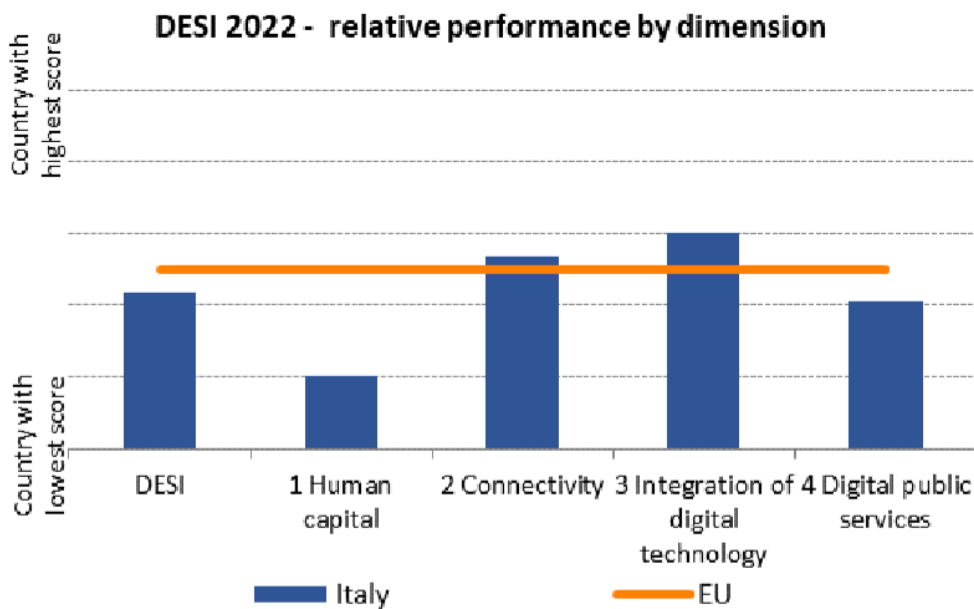
In particular, Italy shows a good level of connectivity (significant progress in 5G coverage and fast broadband) and positive progress in the integration of digital technologies (high diffusion of electronic invoicing and cloud services, still weak use of big data and artificial intelligence and the spread of e-commerce). However, in terms of human capital and digital public services, Italy is still below the European average: in fact, there is a lag in basic digital skills and ICT graduates and in the provision of digital public services for citizens.

In the 2022 edition of the Digital Economy and Society Index (DESI) calculated by the European Commission, Italy ranks 18th among the 27 EU Member States. According to the European Commission, "Italy is gaining ground and considering the progress of its DESI score over the last five years, it is advancing at a very rapid pace." In fact, Italy is the country that has recorded the most consistent progress from 2017 to 2022, with a score that has gone from 28.2 to 49.3. Nevertheless, Italy's score is still 3 points lower than the European average (52.3) and Spain (60.8), France (53.3) and Germany (52.9).

The DESI index is structured as follows:



Italy is still lagging substantially behind the EU average in terms of human capital and digital public services. In the Connectivity and Integration of Digital Technologies, on the other hand, Italy is above the European average. Below, the details for each size.



**Human capital: lagging behind in basic digital skills and ICT graduates**

If Italy is in 18th place in the DESI total, in the 'human capital' dimension it remains 25th out of the 27 Member States.

The gap in basic digital skills has a particular impact on the result: only 46% of the population has basic digital skills (54% the EU average). This gap narrows if we consider digital skills above basic ones (23% vs 26% in the EU). In addition, Italy has a very low percentage of graduates in the ICT sector: only 1.4% of Italian graduates choose ICT disciplines, representing the lowest figure in the EU. In the labour market, the percentage of ICT specialists is 3.8% of total employment, still below the EU average (4.5%).

On the other hand, the presence of women in the digital sector is closer to the European average: ICT specialists represent 16% of the total, compared to an EU average of 19%.

### ***Connectivity: Strong advances in 5G coverage and fast broadband***

Italy is in 7th place for 'connectivity', with a score of 61.2, slightly higher than the European average (59.9). The most significant progress was in 5G coverage, which rose from 8% in 2020 to 99.7% of populated areas in 2021, compared to an EU average of 66%. On fast broadband coverage, Italy has reached 97%, above the EU average by 7 percentage points, while very high-capacity fixed network coverage is still low: only 44% of households are covered (70% the EU average).

### ***Integration of digital technologies***

**High diffusion of electronic invoicing and cloud services, the use of big data and artificial intelligence and the spread of e-commerce are still weak.** With reference to the digitalization of businesses, Italy rises to eighth position with a score of 40.7, higher than the EU average (36.1). 60% of Italian SMEs have a basic level of digital intensity, above the EU average of 55%. In addition, almost all (95%) of Italian companies use e-invoicing (almost three times more than in the EU, as of 2020) and more than half (52%) use cloud services (34% at EU level). The use of digital technologies for environmental sustainability is also relatively widespread in Italian companies (60%), although lower than the EU average (66%). However, Italy remains weak in the field of big data (used by 9% of Italian companies compared to an EU average of 14%) and artificial intelligence (6% vs 8%) and also remains below the EU average in the spread of e-commerce (13% of SMEs in Italy vs 18% in the EU).

### ***Digital public services for businesses and workers***

Italy ranks 19th in the field of digitization of the Public Sector, with a score of 58.5, below the EU average (67.3). Despite continued progress, only 40% of Italian internet users use digital public services, well below the EU average of 65%. The results are better than the European average in terms of open data, reaching a score of 92% (81% the EU average), while as far as the availability of pre-filled forms is concerned, Italy is still below the European average (with a score of 48 vs 64). As far as the supply of digital public services to businesses is concerned, Italy is in line with the EU figure, with a score of 79 (82 for the EU). On the other hand, the gap with the EU average is slightly higher in relation to the provision of digital public services for citizens (67 in Italy compared to 75 in the EU).

These results do not yet reflect the impetus that the National Recovery and Resilience Plan should give to initiatives for the digitalisation of public administration and its services.

### ***Italy's score in composite indexes and indicators relevant to innovation and talent development***

Italy ranks only 28th in the "Global Innovation Index 2022" ranking. Our country is penalized by its performance in terms of infrastructure, policies to support business investments, market capitalization and the number and value of venture capital investments. On the other hand, there was better performance in terms of innovation in industry, where Italy ranks first in terms of industrial diversification.

In particular, there is a significant gap with the United Kingdom, Germany and France, which are in 4th, 8th and 12th place respectively. In the list of the top 30 countries for innovative propensity, Italy does better only than Spain and the Czech Republic.

Countries to which we should be aligned also because Italy, with its wealth of SMEs with very high added value, has a very high score for the creation of products but very low in attracting capital from abroad.

Italy could really attract capital from all over the world, without losing control of the company, which is the real reluctance of our entrepreneurs in approaching the capital market, where the investor, in addition to providing financial resources, can make his knowledge and relationships available to entrepreneurs to support and accelerate their growth projects.



Specifically, the seven categories of investigation concern:

1. Business sophistication (R&D investments, net inflows of foreign direct investment)
2. Market Sophistication (size of GDP, intensity of local market competition)
3. Infrastructure (roads, hospitals, school buildings, energy efficiency)
4. Human capital and research (state investment per pupil, quality of scientific and research institutions)
5. Institutions (political stability and security, ease of starting a business)
6. Creativity Output (Value-Added Brands, Industrial Design Applications, Trademark Applications)
7. Knowledge and technology (patent applications, increased labour productivity, software spending)

According to the report, Italy is performing poorly in terms of infrastructure, policies to support business investment, market capitalization and the number and value of venture capital investments. A situation that reflects the choice by foreign investors not to focus on a country where doing business is more difficult than in others, and in this we should also work in terms of reputation.



Italy ranks first in terms of industrial diversification. However, if we look at industrial diversification, Italy is at the top of the ranking. Incentives to support business innovation, such as those introduced with the Industry 4.0 Plan (now Transition 4.0), have certainly contributed to this primacy.

On the other hand, policies that support business are crucial for the economic development of a country.

From salaries to the gender gap, that's holding us back. Some surveys attempt to assess the attractiveness of international professionals based on six factors: enable, attract, grow, retain, vocational and technical skills, and global knowledge skills. At the top of the podium are Switzerland (first), Singapore (second) and the United Kingdom, third despite Brexit and the risks of flight of human capital announced after the break with the European Union. Italy is only in 40th position, disadvantaged by the first two yardsticks of the report: enable and attract, to make talent flourish and attract. If we talk about the enable factor, the possibility of making international professionals work

well, our country ranks in 62nd position thanks to the negative push of poor cooperation between employees and companies (108th position), the ratio between salary and actual productivity (114th) and interaction between government and companies (as seen above, even in third last position out of almost 120 countries).

## 2. National strategic planning and regulatory documents

It is essential to understand the concept of digital transformation in the workplace and to this end we mean a process of technological transformation that transversally affects the work fabric. At the heart of the process are technologies, but the latter generate important cultural impacts in the lives of each of us. In fact, digital transformation has revolutionized any market and company, operating in the provision of services or in the manufacture of material goods. It has changed the way we shop, the way we relate to others, the way we live.

In Italy, the national strategic planning for Industry 4.0 and associated regulatory documents have been developed to support the digital transformation of the industrial sector. Here are some of the main documents and initiatives:

### *National Enterprise 4.0 Plan:*

The National Enterprise 4.0 Plan was launched by the Italian government in 2016 and aims to support the digital transformation of businesses through a series of measures focused on four main pillars:

1. Human capital: promote training and development of digital skills within companies.
2. Innovation: support the research and development of enabling technologies, as well as the uptake of technological innovations by businesses.
3. Digitalization: foster the adoption of digital technologies such as IoT, cloud computing, big data, and 3D printing.

4. Access to credit: facilitate access to credit for companies investing in digital transformation projects.

*Regulatory documents:*

1. Budget Law: every year, the Italian Budget Law includes tax provisions and incentives to promote Industry 4.0. These can include tax breaks for investments in digital technologies and incentives for research and development.

2. Sectoral legislation: specific regulations have been introduced in key sectors such as manufacturing, energy, transportation, and healthcare to regulate the adoption of digital technologies and ensure safety and regulatory compliance.

3. Regional initiatives: some Italian regions have developed their own strategies and initiatives to promote Industry 4.0 at the local level, including regional policies, innovation funds and business support programs.

*Guidelines & Information Documents:*

In addition to regulations and incentive policies, information documents and guidelines have also been developed to support businesses in understanding and adopting digital technologies. These documents provide practical information on how to initiate digital transformation projects, identify investment opportunities, and manage associated risks.

In detail the Industry 4.0 Plan represents a crucial industrial policy strategy for Italy, aimed at promoting digitalization and strengthening the competitiveness of the production fabric. Here are some key takeaways:

*Innovation:*

- Hyper and Super-depreciation: supports and incentivizes companies that invest in new capital goods, tangible and intangible assets (software and IT systems) functional to technological transformation.

- Nuova Sabatini: facilitates private investment in technologies and goods related to Industry 4.0.

- Innovation Credit: encourages private spending on research, development and innovation.
- R&D tax credit: rewards those who invest in the future through research and development activities.
- Reward those who invest in the future: incentives for those who invest in new products and processes.

#### *Competitiveness:*

- Guarantee Fund: expands the credit possibilities for companies.
- ACE (Aid to Economic Growth): boosts the capital of companies.
- IRES, IRI and Cash Accounting: they free up resources to support competitiveness.
- Productivity Wage: Increase your salary to regain productivity.

#### *Expected Benefits:*

- Greater flexibility: production of small batches at large-scale costs.
- Increased speed: from prototype to mass production through innovative technologies.
- Increased productivity: reduction of set-up times, errors and downtime.
- Better quality: real-time monitoring of production.
- Increased competitiveness: functionality from the Internet of Things.

In summary, the Industry 4.0 Plan represents a pact of trust between the Government and Italian companies that want to grow and innovate, driving innovation and competitiveness in the digital age.

As for pure attractiveness, Italy shows its weakness in the ability to convey foreign brains (94th), in technology transfer (the channel that integrates innovations into the production system, 107th) and above all in business opportunities for women: we are at the penultimate step of the panel, better only than Bosnia-Herzegovina. Other weaknesses emerge from the tax burden (115th), talent retention (93rd position) and the actual skills of managers: Italy's 103rd position reflects, according to the research, a concentration of power in the hands of executives favoured more by private ties than by qualifications or awards won in the field. Ballast that also penalizes excellence, such as the presence of specialized clusters (fourth in the world), the push of the new generations of entrepreneurs (eighth) and the decent positioning of our universities (23rd) despite a lower-than-average expenditure on training.

Therefore, we cannot talk about digital transformation without talking about a real industrial revolution. It is fundamental to understand the regulation related the digital transformation investments to improve productivity in workplaces. In the Western world and so also in Italy, until a few years ago, three Industrial Revolutions were recognized:

1. The first (from 1750 to 1830) which, thanks to the invention of the steam engine, made it possible to industrialize production in the textile and metallurgical sector;
2. The second (from 1850 to 1914) which, thanks to the discovery of electricity, some chemicals and the internal combustion engine, revolutionized the world of energy sources;
3. The third (from 1970 to 2000) which, thanks to the birth of information technology, contributed to the spread of computers and the consequent automation of many processes.

Between 2011 and 2016, a new concept was introduced, that of the Fourth Industrial Revolution. This revolution stems from a different use of the tools born – and improved exponentially – in the Third Industrial Revolution. In essence, it was born thanks to the process of digitization of many aspects of daily life.

The pivot that revolves around the reorganization of workplaces is linked to the Fourth Industrial Revolution, which concerns intelligent collaboration between machines, people and computers. Reference is therefore often made:

1. from a production point of view, the use of integrated systems that connect all the technological components of a production line with the software used by all business groups;
2. from a daily point of view, to the Internet of Things (or Internet of Things), i.e. the extension of the Internet to the world of objects that surround us daily (cars, watches, shoes, thermostats, street lamps and postal bulletins).

Digital transformation and the Fourth Industrial Revolution are therefore concepts that intersect. The latter hinges on big data, a mass of data of such size that it requires particularly advanced technologies to be deciphered. Also, for this reason, companies are equipping themselves with software and databases capable of producing and storing huge amounts of data, increasingly up-to-date IT security systems and powerful business intelligence tools, i.e. IT platforms capable of intelligently normalizing and manipulating large amounts of data. At the same time, this is why the computers and smartphones we use on a daily basis are also becoming more and more powerful.

Overall, Italy's national strategic planning and regulatory documents on Industry 4.0 reflect the country's commitment to supporting innovation and competitiveness in the industrial sector through digital transformation.

### 3. The effects of the regulation and investments of digital transition in Italy

The Fourth Industrial Revolution will bring numerous benefits in terms of productivity. With the same inputs, companies will be able to produce more outputs and improve their quality. The consulting firm McKinsey estimates that Europe alone could increase its GDP by €3.6 trillion by 2030 thanks to technological innovation. Much of the boom will be linked to the development of Artificial Intelligence.

At the same time, as in all previous revolutions, there will also be negative aspects. The effects of such a profound technological revolution are and will be disruptive:

1. Many professional figures are destined to disappear, especially in the field of administration and production. A large part of the less specialized figures will be lost. On the other hand, there will be a strong demand for new types of professionalism. In particular, there will be strong demand in finance, management, information technology, engineering. McKinsey estimates that, by 2030, 62 million new full-time jobs linked to technological innovation could be created in Europe;
2. In an increasingly digitalized world, soft skills, i.e. skills that are not really technical, will become fundamental. In particular, the ability to manage complex problems, to work in a team, to allocate one's time effectively and efficiently will be crucial. This presupposes a radical change in the school curricula provided so far;
3. The labour market, as we have known it in the twentieth century, will change radically, especially from two points of view. The flexibility of the job market will increase more and more: within the same company, workers will constantly change their roles and the transition from one company to another will be observed more and more. In addition, tools such as smart working, facilitated by IT tools, now within the reach of all organizations, will play a fundamental role.

In fact, it will be required of the workers who make up the labour market, to change the way you work and open up to new challenges. Even when a real change of role will not be required, the average worker will have to develop flexibility and open-mindedness such as to absorb the necessary knowledge (the so-called know-how) to ride the digital transformation process.

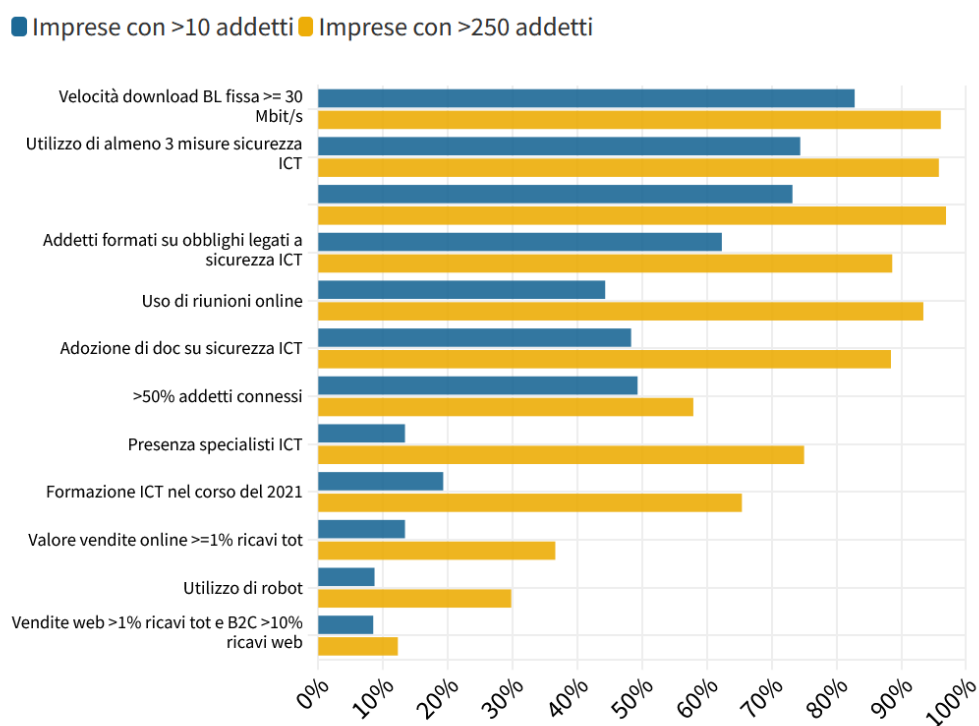
In Italy, a nation with a high manufacturing vocation (to learn more, you can read the article on the structure of the Italian economy), regulations have been promulgated to manage the transition to the Fourth Industrial Revolution. As in other advanced economies, efforts have been made to encourage innovation and minimise negative impacts on the world of work. In the coming years, the aim is to have a greater number of PhDs, university students, students enrolled in Technical Institutes and managers specialized in I4.0 (Industry 4.0) topics.

Despite some positive results and the good intentions of governments, much still needs to be done to convert the entire production and training system to new technologies. The Public Administration has not yet managed to digitize most of the processes. There is a strong cultural resistance exerted by a part of the population: a large component



of society suffers from digital illiteracy. Finally, there is no ecosystem of start-ups and incubators comparable to that of other developed countries. Investing more public resources in the education system becomes an essential strategic choice in the long term.

Below is a graph highlighting the main indicators of the digital transition in Italy between companies with at least 10 employees and companies with at least 250 employees in 2022.



ISTAT

ITALIA IN DATI  
I dati che aiutano a capire l'Italia

In 2022, 69.9% of small and medium-sized enterprises (SMEs) adopt at least 4 out of 12 digital activities (69.1% in the EU). With reference to the 12 indicators per class of employees, the largest gaps are found, to the detriment of SMEs (companies with 10-249 employees), in the presence of ICT specialists, in the decision to invest in ICT training during the previous year, in the use of online meetings and specialized documentation on the rules and measures to be followed on IT security.

In general, Italian companies are increasingly using the web. Compared to 2019, the share of SMEs in which more than 50% of employees have access to the Internet for

work purposes in 2022 has increased by almost 23%, matching the growth rates of large companies (from 40% to 49% and from 47% to 58%, respectively). Fixed broadband with speeds of at least 30 Mbit/s is used by 82.8% of 10+ companies, compared with 96.1% of larger ones.

The adoption of robotics and the use of ICT specialists remain stable compared to 2020. Companies with more than 10 employees using robots are 8.7% (6.3% the EU average). Companies with more than 10 employees employ ICT specialists are 13.4% (21% the EU average).

In 2022, 13.0% of SMEs made online sales for at least 1% of their total turnover (12.7% in 2021) and 17.7% of SMEs active in e-commerce made 13.5% of their total revenues online. Overall, 18.3% of companies with at least 10 employees made online sales with a turnover of 17.8% of total turnover, respectively 22.8% and 17.6% at EU level.

In 2022, 15.7% (10.1% in 2019) of companies with at least 10 employees and 33.1% of companies with at least 250 employees (21.7% in 2019) said they had had at least one cyber-attack or intrusion from outside during the previous year. 74.4% of Italian companies with at least 10 employees use at least three ICT security measures, in line with the European average (74.0%). There is a strong uptake of less sophisticated security measures, such as authentication with strong password (83.9%, 82.2% in 2019) and data back-up (80.0%, 79.2% in 2019). The shares of companies adopting advanced security measures are lower.

Italy, preceded only by Portugal, is at the top of the European ranking on environmental sustainability applied to the use of IT tools. 74.9% of companies adopt green behaviors in the choice of technology, also evaluating its environmental impact; In addition, 59.9% of companies combine the assessment of the environmental impact of ICT services or equipment, before selecting them, with the adoption of measures that affect the consumption of paper or energy from information technologies.

#### 4. Educational events related to Industry 4.0

Training on Industry 4.0 is of fundamental importance in Italy for several reasons:

- Business competitiveness: Industry 4.0 technologies and practices, such as the Internet of Things (IoT), data analytics, 3D printing, and advanced robotics, are crucial for improving operational efficiency, reducing costs, and improving the quality of products and services offered by Italian companies. Training enables companies to acquire the skills needed to adopt and take full advantage of these technologies.
- Innovation and technological development: Italy has a rich industrial tradition, but in order to remain globally competitive, it must continue to innovate and adopt the latest technologies. Industry 4.0 training is essential to ensure that Italian companies remain at the forefront of innovation and technological development.
- Creation of skilled jobs: the adoption of Industry 4.0 requires highly skilled personnel who can handle emerging technologies and make the most of the opportunities offered by digital transformation. Training makes it possible to create a skilled and skilled workforce, thus contributing to job creation and reducing unemployment.
- Environmental sustainability and social responsibility: many of the technologies associated with Industry 4.0, such as automation and process optimization, can help reduce the environmental impact of industrial activities. Industry 4.0 training can help Italian companies develop more sustainable solutions and integrate social responsibility practices into their operations.
- Support for SMEs and the local industrial fabric: small and medium-sized enterprises (SMEs) make up a significant part of the Italian industrial fabric. Industry 4.0 training can support SMEs in adopting innovative technologies and digital transformation, allowing them to remain competitive in the global market and contribute to the country's economic growth.

Overall, Industry 4.0 training is essential to ensure the competitiveness, innovation and sustainability of the Italian industrial sector in the rapidly evolving global context.

In Italy, there have been numerous training events related to Industry 4.0, aimed at raising awareness among companies and professionals on new technologies and practices in the context of the fourth industrial revolution. These events include conferences, workshops, seminars, and trainings, organized by both government bodies and academic institutions and private companies.

Here are some examples:

- Specialized conferences and fairs: events such as "SMAU" (International Innovation and Digital Exhibition) and "MECSPE" (Trade Fair specialized in production processes) often include sessions and workshops dedicated to Industry 4.0, presenting the latest technologies and solutions for businesses.
- University courses and vocational trainings: numerous universities and training institutes offer specific courses on Industry 4.0, covering topics such as the Internet of Things (IoT), advanced robotics, 3D printing, data analytics, and industrial cybersecurity.
- Government initiatives: the Italian government has promoted several initiatives to support the adoption of Industry 4.0, including awareness campaigns and funding for research and development projects. These initiatives often also include training and information events aimed at businesses.
- Collaborations between industry and academia: many Italian companies have collaborated with academic institutes to offer training and research programs on Industry 4.0. These collaborations can include joint workshops, research projects and doctoral programmes focused on topics related to the digital transformation of industry.
- Online webinars and events: especially during the COVID-19 pandemic, many organizations have moved their training events online, offering virtual webinars and courses on Industry 4.0 to allow businesses and professionals to access training remotely.

The scene is constantly evolving, with new initiatives and opportunities being developed to support the digital transformation of Italian companies.

Here are some specific training events related to Industry 4.0 in Italy in 2022:

- **Training Bonus 4.0:** the Ministry of Economic Development **has introduced the** enhanced Training Bonus 4.0. This tax credit is due for expenses incurred in projects started after May 18, 2022. Training must be provided by qualified entities outside the company, such as Competence Centers and European Digital Innovation Hubs. Training activities can also be carried out in "e-learning" mode with adequate controls on participation and the results achieved.
- **MADE Competence Center Industry 4.0:** The center organizes various events showcasing technologies related to Industry 4.0. Some upcoming events include:

- **Demo Experience – Generative AI in Manufacturing** (21 February): Enhance the company's data assets.
  - **Demo Experience at MECPSE - Accelerating Growth** (March 7): Practical Strategies for Implementing Artificial Intelligence in SMBs.
  - **Technology Aperitif – Machine learning and big data for predictive maintenance** (12 March): Explore opportunities and constraints.
  - **Technological Aperitif – Environmental Sustainability** (4 April): Discussion on the challenges and opportunities related to environmental sustainability in industry.
  - **Technology Aperitif – Artificial Intelligence for Manufacturing** (7 May): Real applications and opportunities.
  - **Technology Aperitif – Cybersecurity** (6 June): Address the challenges and opportunities related to cybersecurity.
- 
- **Industry 4.0 Webinars:** it is possible also to participate in webinars that explore specifically the Industry 4.0 paradigm and compare ongoing experiences in other European countries.
  - **Industry 4.0 360 Summit:** this event discusses innovation, technological paradigms, and sustainability, exploring solutions and business models for a resilient and sustainable future in the twin transition era.
  - **Other events:** The CNI organized information seminars on hyper-depreciation and other topics related to Industry 4.0.

## 5. International and local projects on Industry 4.0

The global pandemic that hit Italy from 2020, from many points of view, could turn into an important opportunity to be seized. In fact, the emergency situation in Italy has pushed many companies and the PA itself to invest more in the digital transition. Smart

working and instant messaging programs have become the norm for most businesses; the Government has started to create numerous apps to manage the relationship between citizens and PAs. Even the smallest companies are realizing the importance of structuring digital processes also by national and international projects.

In fact, to fill this need, several projects have been launched in Italy both internationally and nationally to promote Industry 4.0 and support the digital transformation of companies. Here are some examples:

#### *International projects:*

- Horizon 2020: Italy has participated in numerous projects funded by the European Union under the Horizon 2020 program, which included several sectors related to Industry 4.0, such as the Internet of Things, advanced robotics and the digitalization of production processes.
- European Structural and Investment Funds (ESIF): These funds promote economic and social cohesion among member states. They can be used for projects related to Industry 4.0, such as training, research, and technology adoption.
- International partnerships: many Italian companies have established partnerships and collaborations with companies, research institutes and international organizations to develop joint projects on Industry 4.0. These partnerships often also involve knowledge exchange and best practice programs.

#### *National projects:*

- National Enterprise Plan 4.0: the Italian government has launched the National Enterprise 4.0 Plan to support the digital transformation of Italian companies through tax incentives, financial breaks, and training support. This plan includes a number of measures to promote investment in enabling technologies such as IoT, robotics, cloud computing, and 3D printing.
- Regional Funds: The Italian regions have allocated specific resources for projects related to Industry 4.0. These funds can be used to develop digital infrastructure, promote research and training, and support the competitiveness of local businesses.
- Hubs and Competence Centers: hubs and competence centers on Industry 4.0 have been established in various Italian regions, with the aim of providing

support to companies in the adoption of digital technologies and innovation. These centers offer consulting, training and technical assistance services to companies wishing to implement projects related to Industry 4.0.

- R&D projects: numerous academic institutions and research institutions in Italy conduct research projects on Industry 4.0, with the aim of developing new technologies, solutions and innovative business models. These projects often involve collaboration between academia, industry, and public institutions.
- Technological clusters and districts: in some Italian regions, clusters and technological districts focused on Industry 4.0 have been established, with the aim of promoting collaboration between companies, research institutes and public bodies to encourage the development and adoption of digital technologies.

The commitment of government, businesses and academic institutions to promote innovation and digital transformation of the industrial sector continues to be a priority for the country. Italy's recovery and resilience plan, planned to relaunch the country after the COVID-19 pandemic, is the largest in the entire European Union: it amounts to €191.5 billion and as much as 25.1% of this amount (i.e. €48 billion) is earmarked for the digital transition.

Certainly, Italy's demographic trend and the continuing aging of the population will not help to achieve this transformation in the short term. Nevertheless, the economic and social benefits that would be derived from the implementation of this transition, for example in terms of fintech, are too positive not to invest much of the country's energy in this direction.

The digital maturity of companies is at a good level: it almost reaches the average of 3 (2.85) on a scale of 1 to 5 (maximum digital maturity). However, the size of the companies assessed is a very important variable: the level of digitalization, in fact, increases as the size increases, and this means that for smaller companies the innovation process is slower, especially due to skills shortages.

This is among the results that emerged from an analysis carried out by Confindustria's Digital Innovation Hubs - the network of 23 hubs at regional level based at Confindustria associations, which aims to disseminate digital skills to companies, with a focus on SMEs - through a test by the Politecnico di Milano on a sample composed of 58% micro-small enterprises and 42% medium-large enterprises. More than 2/3 of the realities analyzed are located in the North, with a clear prevalence in the North-West,

a fifth in the South and islands and the remaining 11% in the Center. The top three sectors in terms of number of companies analysed (mechatronics and mechanics, metallurgy, chemicals, rubber and plastics) account for half of the sample considered and almost a quarter belongs to the mechatronics and mechanics' sector.

If we look at the level of digitalization of the companies interviewed, divided by sectors, it emerges that, although with small differences, the most advanced sectors (index slightly above or close to 3) are: 1. Means of transport, mobility and logistics, 2. ICT, digital and innovative services, 3. Mechatronics and metalworking. This is followed by: Life Sciences and Pharmaceuticals, Chemistry, Rubber and Plastics, Agri-Food, Metallurgy, Paper and Wood Industry, Textiles and Fashion, Trade, Building and Construction.

Companies in all sectors have digitized the production and research and innovation phases in particular.

From the analysis of the corporate strategy, some critical issues emerge that highlight the need to implement the corporate culture and skills for the transition:

- Just under 1/3 of companies consider Industry 4.0 part of their business strategies;
- Only 4 out of 10 companies recognise, develop and reward Industry 4.0 skills;
- For 7 out of 10 companies, Industry 4.0 does not involve internal and external supply chain actors;
- Just under 50% of the mapped companies believe that their corporate culture is based on Industry 4.0;
- More than 6 out of 10 companies have developed a smart product;
- Industry 4.0 strategies are defined by more than half of the companies by the owners and 30% by the general management.

With reference to the constraints that limit the start of digital transformation processes, companies report: lack of skills (43%), cost of investments (42%), corporate culture (29%), market knowledge (24%), low propensity of the supply chain to integrate (18%), identification of external partners (18%), knowledge of incentives (13%), risk of failure (9%), lack of market maturity (8%), security (7%), legal aspects (3%).

Companies are in the midst of the so-called twin transition, green and digital, which are also the two major drivers that drive investments and competitiveness in Italy and



Europe and are closely connected to each other, as told by the vice president of Confindustria for Digital. For this reason, it is essential to accelerate digitization and above all to focus decisively on the development of a Data Economy, which enhances the enormous amount of information collected by companies and public administrations through the Internet of Things, Artificial Intelligence and the Cloud. It is the natural evolution of 4.0, but it must be supported with the creation of adequate skills both through school and university courses, and with the upskilling and reskilling of human resources already employed.

The results achieved are certainly the effect of the policies for transformation 4.0, which have activated investments and which in the absence of the Plan would not have been carried out with the same intensity. But the involvement of SMEs in innovation processes, skills, investments in 4.0 technologies, and the creation of a digital culture remain the priorities to be addressed. It is also clear that there is a need to accelerate the integration of the supply chains that represent the Italian way to competitiveness and the digital and ecological transition of the production system: it is precisely in the supply chains that many small businesses find the way to grow. In this context, given the speed of technological innovation, it is essential to continue to work with a clear vision, ensuring that the production system has a Plan that supports its competitiveness and a network of DIHs that with their know-how continue to support companies in these challenges.

## 6. Industry 4.0 and higher education

Industrial technologies speak of integration, companies require multidisciplinary skills: schools can only respond to change by offering new models of technical training 4.0. The consequence seems logical, but it underlies a new and far-sighted didactic vision. An evolutionary path where companies, educational networks and territory intertwine experiences and intentions to ferry students towards the ideal job in the connected factory.

Industry 4.0 has had a significant impact on higher education and universities in Italy, as it requires the adaptation of academic programs and graduates' skills to the needs of the digital and technologically advanced labour market. Here are some ways in which Italian universities are addressing this challenge:

- Updating curricula: Universities are revisiting and updating their curricula to include courses and academic programs that cover key Industry 4.0 topics, such as the Internet of Things (IoT), robotics, data analytics, 3D printing, and cybersecurity. This ensures that graduates are well prepared to meet the challenges and opportunities offered by digital transformation in the workplace.
- Advanced Laboratories and Infrastructure: Universities are investing in the creation of advanced laboratories and infrastructure to allow students to gain practical skills on emerging technologies related to Industry 4.0. These labs provide a hands-on learning environment where students can experiment with IoT devices, robots, 3D printers, and other innovative technologies.
- Collaborations with industry: Universities are establishing partnerships and collaborations with companies and research institutes to develop concrete projects in the field of Industry 4.0. These collaborations allow students to work on real-world projects, gain hands-on experience, and get in touch with the needs and challenges of the industry.
- Doctoral and research programs: Universities offer doctoral programs and conduct advanced research on topics related to Industry 4.0, thus contributing to knowledge generation and innovation in the field of digital technologies and industrial transformation.
- Continuing education and lifelong learning: Universities offer continuing education and lifelong learning programs for professionals and workers who want to update their skills and stay on top of technological changes in Industry 4.0.

Such as at ITS Lombardia Meccatronica in Sesto San Giovanni (MI), where the new digital laboratory created by Schneider Electric gives further concreteness to a range of training tools already attentive to the current labour market.

Training 4.0 means synergy between school and business. The synergy between companies, training and trade associations, of which we are virtuous representatives, is the key to our mission. We work to ferry the students to the end of the annual and two-year courses with the certainty that there are important professional opportunities waiting for them. And this happens because each initiative is guided by the concrete needs of local companies.

The foundation integrates the best local expressions in terms of technical institutes, universities, accredited research and training institutions, local administrations, and industry. More than 120 entities, including Schneider Electric, have come together to perfect the complexity of resources generated by true digital transformation professionals.

The showcase dedicated to the digital industry is just the latest step in the collaboration between Schneider Electric, ITS Lombardia Meccatronica and the entire Salesian training world. A network consolidated in 2014, the year of the foundation of the Lombard ITS, which embraces the entire regional territory in the evolution of training needs. From secondary school to the tertiary concept of technical-vocational education, the global company is fully aligned with the strategic objectives of the post-diploma reality.

In the last six years, we have seen quantitative and qualitative growth, from two to 15 courses. This is to meet the demand for professionals who know how to apply the basic skills of mechatronics to modern digital technologies to optimize business processes, achieve energy savings and carry out preventive maintenance. Schneider Electric provides the nervous system of this ecosystem of solutions. On the contrary, the lifeblood that underlies every smart application, i.e. energy and operational efficiency in all its forms.

Not only technology, but transversal skills. The trump card therefore remains the teaching model: designing ad hoc study plans through a careful analysis of needs, guided by a technical-scientific committee that evaluates the necessary skills and training paths to obtain them. This is the only way to create technicians who can be defined as proponents of change, in possession of the necessary drivers to support the digitization of companies, especially small and medium-sized ones, in a 360-degree technological and cultural approach.

What is special about these young people? The secret ingredient is soft skills. The complexity of the digital approach requires horizontal and multifaceted skills, useful for overcoming the sectoral verticalization of secondary education. We are talking about technological integration and overall plant vision, combined with the humanistic side of relational and managerial skills.

In summary, Italian universities and schools are playing a fundamental role in preparing a qualified workforce that can be adapted to the needs of Industry 4.0, through the

updating of curricula, the creation of advanced infrastructures, the promotion of research and collaborations with industry.

Some interesting cases of training opportunities and initiatives:

#### *A 4.0 technical training lesson at Schneider Electric.*

In this case the effectiveness of the training initiative and its completeness passes through an applicative didactic approach, based on case histories, projects and the presence of technicians in the classroom. More than 50% of the teachers come from the world of work, as well as the on-the-job training proposal. In fact, 40% of the hours (minimum 800 for two-year courses and 400 for annual courses) take place in the company through internships and apprenticeships.

The company becomes an integral part of the school world, ensuring maximum individualization of the training course. By hosting the students for so many hours, businesses like Schneider Electric contribute to building their personal and professional profile. Another aspect of that tailor-made training that projects young people towards direct integration into the company.

The change in Italian industry therefore requires advanced technological solutions and integrated skills. The meeting point of this synergistic movement is the new showcase in Sesto San Giovanni. Let's work together on the issue of the professionalizing supply chain of the manufacturing industry. Schneider Electric's laboratory is not only functional to the ITS training proposal, but to all the courses activated, depending on the type of educational path.

Thus, was born an integrated training service for the business world that has its roots in the historic manufacturing vocation of Lombard city. A marriage that is still a happy one, despite the years of the economic boom being a distant memory.

At the Sesto San Giovanni headquarters, everything responds to the purposes of the present day, we are drivers for the entire training chain. In fact, the showcase will involve different sectors to enhance EcoStruxure's technological integration, combined with the creative dimension of true technical training 4.0.

### *Industry 4.0 training for companies and professionals*

Luiss Business School Executive program in business management and innovation for the training of managers and entrepreneurs on business management, innovation and sustainability.

The Executive programme in business management and innovation, created by Intesa Sanpaolo in collaboration with Luiss Business School, is launched: a training course dedicated to managers and entrepreneurs who intend to strengthen their skills for innovative and sustainable management of the company.

The aim of the training program, in the face of a market scenario completely transformed by the pandemic, is to support SMEs in the adoption of new organizational and economic models capable of making their business sustainable and competitive.

10 modules of the course, lasting a total of five months, will be dedicated to general management and strategic orientation in light of a market scenario completely transformed by the pandemic, while another four will focus on topics related to innovation, from open innovation to industry 4.0 and artificial intelligence, from digital transformation to circular economy and ESG.

Intesa Sanpaolo's commitment to training stems from the conviction that the acquisition of new skills is a strategic factor for companies to face the market and competition, especially at a particular time like the current one in which, also thanks to the resources put in place by the PNRR, a great opportunity is opening for the repositioning and relaunch of the Italian economy.

The first editions of the Executive programme in business management and innovation will start between the end of 2021 and the beginning of 2022 in Lazio and Abruzzo, Veneto and Friuli Venezia Giulia, Emilia Romagna and Marche.

In the first half of 2021, Intesa Sanpaolo Formazione promoted 22 advanced training courses, involving around 500 companies for over 2500 hours delivered. Overall, it has involved over 19,000 young people and professionals and more than 4,500 companies, providing more than 660,000 hours of training.

The program offers a 5-month distance learning training course, at the end of which there will be an in-person networking event: 10 modules will be dedicated to general management and strategic orientation to show how classic areas of business administration must be reinterpreted today in the light of the pandemic, another 4 will focus on innovation issues, from open innovation to industry 4.0 and artificial intelligence, from digital transformation to the circular economy and ESG. The head of Intesa Sanpaolo's Banca dei Territori Division says that there is a need for new skills, to face the market and competition, it has become a strategic factor for companies. In Italy, compared to other industrialized countries, training is often underestimated and is generally more in demand and present in large companies than in smaller companies. But in order to maintain a high level of competition, the industrial fabric needs to keep up to date, ready to learn about new opportunities and look for new business frontiers. As the Intesa Sanpaolo Group, we are convinced that investments in training are an important driver of growth and this path that we will offer to small and medium-sized companies together with the Luiss Business School stems from the conviction that, also thanks to the resources deployed by the NRRP, we have a great opportunity to reposition and relaunch the country's economy. The issue of skills creation is crucial in this historical moment to allow and support a recovery and structural growth of the country, after the setback due to the Covid-19 pandemic and in the face of a not particularly prosperous past from this point of view. As the institution responsible for training the leaders of today and tomorrow, we must continue to work in this direction, leveraging the European and national interventions of NextGeneration EU and NRRP and taking advantage of the assistance of major partners, such as Intesa Sanpaolo, to bring home the result: a renewed country with finally sustainable growth.

## 7. DigiWork. Best Practices of Digital Transformation in Italy

Best practice for digital transformation and implementation of the Industry 4 concept in Italy		
1	<b>Best practice name:</b>	National Strategy for Digital Skills 2021-2026 in Italy
2	<b>Sector:</b>	e-skills in both the private and public sectors, including e-leadership skills and digital jobs
3	<b>Organization implementing/ disseminating the practice:</b>	Department for Digital Transformation - Presidency of the Council of Ministers of Italy <a href="https://innovazione.gov.it">https://innovazione.gov.it</a>
4	<b>The goal:</b>	This national strategy is implemented jointly with the collaboration of Ministries, Regions, Provinces, municipalities, universities, research institutes, companies, professionals, the National Public Broadcasting, associations and the various public sector organizations, the organisations belonging to the Italian Coalition for Digital Skills and Jobs under the direction of the Technical Steering Committee of

		<p>the 'Repubblica Digitale' programme coordinated by the Department for Digital Transformation.</p>
<p>5</p>	<p><b>Description / Focus:</b></p>	<p>The Italian Strategy for Digital Skills is aimed to fight the cultural digital divide affecting the Italian population through supporting digital inclusion, to support the e-skills development throughout the higher education and training cycle, to promote key competences development for the future and increase the percentage of ICT specialists (especially in emerging technologies). Another objective is to ensure that the entire working population has basic digital skills for the new needs and ways of working.</p> <p>This Strategy has been drafted jointly with the collaboration of Ministries, Regions, Provinces, municipalities, universities, research institutes, companies, professionals, the National Public Broadcasting, associations and the various public sector organizations, the organizations belonging to the National Coalition, and with the informal exchanges with the European Commission, under the direction of the Technical Steering Committee of the “Repubblica Digitale” initiative and the coordination of the Department for Digital Transformation. It develops some of the objectives of the 2026 Digital Italy strategy of the Minister for innovation and digital transition.</p>



		<p>The strategy identifies four lines of intervention, coherently with the four pillars of the European Coalition for Digital Skills and Jobs:</p> <ul style="list-style-type: none"> <li>● <b>Higher Education and Training</b> - for the development of e-skills for young people within the mandatory education cycles (working group is coordinated by the Ministry of Education and the Ministry of University and Research)</li> <li>● <b>Active workforce</b> - to ensure adequate e-skills in both the private and public sectors, including e-leadership skills (working group is coordinated by the Ministry of Economic Development and Department for Public Administration)</li> <li>● <b>ICT specialist skills</b> - to enhance the country's ability to develop skills for new markets and new jobs, with a specific focus on emerging technologies and key competencies for future jobs (working group is coordinated by the Ministry of University and Research and the Ministry of Economic Development)</li> <li>● <b>Citizens</b> - to develop the digital skills needed to exercise citizenship rights and promote active participation in the democratic life (working group is coordinated by the Department for Digital Transformation).</li> </ul>
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		<p>For each line of intervention are associated priorities and lines of action. The Strategy has then been complemented by an <b>Operational Plan</b> including <b>targets for 2025</b>, based mainly on both DESI and Eurostat indicators like the following:</p> <ul style="list-style-type: none"> <li>• Equip 70% of the population with at least basic digital skills and bridge the gender skills gap in the ICT sector.</li> <li>• To double the rate of Italian citizens with advanced digital skills (78% of young people with higher education, 40% of workers in the private sector and 50% of civil servants).</li> <li>• Increase the number of graduates in ICT three times; and four times for the number of female graduates and increasing twofold the share of companies active in the field of big data.</li> <li>• Double the share of companies that uses big data; and double the employment of digital experts and ICT specialists in small and medium sized enterprises (SMEs).</li> <li>• Increase five times in the share of the population using public digital services (64%).</li> <li>• Increase in the use of the Internet and the ability to use computers also for older people: 84% in the 65-74 age group.</li> </ul>
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		<p>The Plan addresses the <b>41</b> lines of action identified in the Strategy through <b>111</b> actions and provides a dashboard of over <b>60</b> indicators to monitor the impact on the 4 lines of intervention. Each action also includes appropriate milestones, result indicators and target values. The dashboard is based on the indexes included in the Digital Economy and Society Index (DESI) of the European Commission and the Digital Maturity Indexes (DMI) elaborated by the Digital Agenda Observatory.</p>
<b>6</b>	<b>Target groups:</b>	<p>Digital skills for the labour force.</p> <p>Digital skills for ICT professionals and other digital experts.</p> <p>Digital skills in education.</p> <p>Digital skills for all</p>
<b>7</b>	<b>Dissemination / implementation method:</b>  <i>Note: If needed.</i>	<p>The <b>implementation model</b> of the Plan allows to update the operational plan on a six-monthly basis, evaluating the general impact of the whole plan and the effectiveness of the actions and improving them where necessary, and considering the ever-changing context according to the Plan-Do-Check-Act (PDCA) continuous improvement model.</p>

<p><b>8</b></p>	<p><b>Results / impact with a focus on:</b></p> <ol style="list-style-type: none"> <li><b>1. sector</b></li> <li><b>2. individuals, like students or employees</b></li> </ol> <p><i>Note: If needed, if we have results we can write.</i></p>	
<p><b>9</b></p>	<p><b>Sustainability:</b></p> <p><i>Note: If needed, if we have results we can write.</i></p>	
<p><b>10</b></p>	<p><b>What were the obstacles?</b></p> <p><i>Note: If needed, if we have results we can write. What</i></p>	<p>Difficulties in investments on digitalization.</p> <p>Financial costs.</p> <p>Lacking digital culture at managerial level.</p>

	<p><i>were the difficulties in introduction?</i></p>	<p>Sustaining private investments in advanced digital technologies.</p> <p>Diffidence on innovative working processes supported by digital tools.</p>
<p><b>11</b></p>	<p><b>What innovative skills (if any) the described above best practice might have developed to enhance students' employability?</b></p> <p><i>Note: Please list skills only we mark the skills.</i></p>	<p>Digital strategies</p> <p>Digital Skills</p> <p>Innovative operational plans</p> <p>Stakeholders' involvement in digital reorganisation</p> <p>New digital jobs</p> <p>Digital transformation in workplaces</p>
<p><b>12</b></p>	<p><b>References (pls insert a link to more data on the practice)</b></p>	<p><a href="https://digital-strategy.ec.europa.eu/en/policies/digital-skills-coalition">https://digital-strategy.ec.europa.eu/en/policies/digital-skills-coalition</a></p> <p><a href="https://digital-skills-jobs.europa.eu/en/about/national-coalitions/italy-national-coalition-digital-skills-and-jobs-repubblica-digitale">https://digital-skills-jobs.europa.eu/en/about/national-coalitions/italy-national-coalition-digital-skills-and-jobs-repubblica-digitale</a></p>

		<p><a href="https://digital-strategy.ec.europa.eu/en/policies/desi">https://digital-strategy.ec.europa.eu/en/policies/desi</a></p> <p><a href="https://digital-skills-jobs.europa.eu/sites/default/files/2021-09/DSJC%20Community-led%20Event%20Outcome%20Italy%20v1.0.pdf">https://digital-skills-jobs.europa.eu/sites/default/files/2021-09/DSJC%20Community-led%20Event%20Outcome%20Italy%20v1.0.pdf</a></p> <p><a href="https://ec.europa.eu/eurostat">https://ec.europa.eu/eurostat</a></p> <p><a href="https://ec.europa.eu/info/strategy/recovery-plan-europe_en">https://ec.europa.eu/info/strategy/recovery-plan-europe_en</a></p>
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Best practice for digital transformation and implementation of the Industry 4 concept in Italy		
1	<b>Best practice name:</b>	Industry 4.0, Enterprise 4.0 and Digital Transition 4.0 (2020-2025) in Italy
2	<b>Sector:</b>	e-skills in both the private and public sectors, including e-leadership skills and digital jobs
3	<b>Organization implementing/ disseminating the practice:</b>	Ministry of Economic Development - <a href="https://www.mise.gov.it">https://www.mise.gov.it</a>  Ministry of Economy and Finances <a href="https://www.mef.gov.it">https://www.mef.gov.it</a>
4	<b>The goal:</b>	Industry 4.0 national program has set up a series of policy instruments that can tackle the low level of penetration of digital technologies in the country. Firms cannot fully benefit from advanced technologies if they do not also have a sufficiently skilled workforce.  The Training Tax Credit 4.0 and the tax credit for activities of R&D, innovation, or design recognise a tax discount to firms that invest in human capital,

		<p>either by offering structured training to their workers, or by hiring a more skilled workforce. The range of eligible expenses is broad and therefore can adapt well to the company's actual needs. The Training Tax Credit 4.0 further contains special provisions for SMEs, including the possibility to post expenses sustained by the employer in training. Some SMEs, however, may be reluctant to apply because of the costly requirements in terms of documentation to be submitted for support. Other provisions of the Industry 4.0 reform package which more explicitly aim at supporting firms in their technological investment can also be a source of learning within the firm. Often this takes the form of learning from suppliers.</p>
5	<p><b>Description / Focus:</b></p>	<p>The Italian Government has recently introduced a set of ambitious industrial policy projects with the objective of igniting a radical shift of the Italian productive system towards the use of new and high value-added technologies. The set of reforms goes under the name of Industria 4.0, then amended by Enterprise 4.0 and Transition 4.0 follow-up plans. The reforms tackle a major challenge of the Italian production and skills system, i.e. the average low productivity and limited product diversification of Italian firms, which in turn translates into weak demand for skills in most sectors, and skill shortages in others. Industria 4.0 can positively affect the</p>



		<p>demand for skills in the country by helping smaller firms to become more innovative, connected to the world technology frontier and open to international markets (OECD, 2018).</p> <p>To achieve these results, Industria 4.0 policy initiatives have put in place a series of tools and instruments that include: incentives for technological acquisitions, tangible and intangible capital (including R&amp;D, design and innovation) tax credits, tax incentives for training activities in the digital technologies, credit schemes for SMEs, the creation of digital innovation hubs and competency centres.</p> <p>A review of all Industry 4.0 measures would go well beyond the scope of the present study, but it is important to highlight that the Plans are built around the rationale that firms cannot adopt or benefit fully from advanced “Industry 4.0” technologies if they do not also have a sufficiently skilled workforce and a suitable organisational structure. In this light, two of the proposed Industry 4.0 financial instruments have special interest for the purpose of this study: the Training Tax Credit 4.0 (“Credito Formazione 4.0”) and the R&amp;D, Innovation and Design Tax Credit (“Credito d’imposta ricerca, sviluppo, innovazione e design”). With the Training Tax Credit 4.0, the Government seeks to foster investment by companies in training on digital and enabling technologies (a broad list of areas technological</p>
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		<p>areas is provided) (Gazzetta Ufficiale, 2019). The tax credit amounts to a certain percentage of the incurred training expenses, with percentages varying according to the company's dimension:</p> <ul style="list-style-type: none"> <li>· 50% of expenses for small businesses (up to an annual maximum of € 300,000);</li> <li>· 40% of expenses for medium-sized enterprises (up to an annual maximum of € 250,000);</li> <li>· 30% of expenses for large companies (up to an annual maximum of € 250,000).</li> </ul> <p>The rate increases to 60% of the eligible expenses, across firm sizes, if the training involves disadvantaged employees. All companies can apply (with few exceptions). The earned credit can only be appropriated in the form of discounts on the firm's tax liability or social contributions for the following years. The scope of eligible expenses is broad: the labour cost of workers in training, both as learners and as teachers, for the hours concerned by the training activity; (almost) all operating costs related to the training activity, including travel expenses, supplies directly related to the project, depreciation of tools and equipment used, or overheads (administrative costs, rents); the costs of consultancy services related to the training project, including those aimed at assessing the training needs and developing the training plan.</p> <p>The activities can target both the development of</p>
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		<p>new skills, and the consolidation of existing ones.</p> <p>These features translate into very flexible and versatile training pathways, which can well adapt to the company's actual training needs. The possibility to pitch the costs of workers that are either teaching or learning provides a double advantage to those firms that organise and deliver the training activity internally.</p> <p>Importantly, as of 2020 costs related to the entrepreneurs' training are eligible as well. These features mild the concerns that training tax credits distort firms' decisions away from informal learning (which is likely preferred by SMEs) towards externally provided, formal training (Stone, 2012).</p> <p>On the downside, the measure requires firms to submit some documentation that SMEs may fail to assemble appropriately: a certification to workers, attesting their attendance to the activity; a document describing the way the activity was organised; proofs of the expenses incurred in the training activity, as certified by a professional accountant; a collective agreement governing the training activity, which may be more complicated to set up in firms where there are no unions' representatives. Lastly, little is currently known about the firms that are benefiting from the tax credit, nor about its effectiveness in terms of firms' outcomes, which calls for a renewed effort to</p>
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		<p>monitor and evaluate the measure.</p> <p>The Ministry of Economic Development (MISE) further provides a tax credit for activities of R&amp;D, innovation, or design by the firm, as long as these happen within technological domains that are connected to the fourth industrial revolution and the green transition. Recently amended in design, tax credit rates currently range from 6% to 12% of the volume invested, and are different for different activities (fundamental research, industrial research and experimental development; technological innovation; design) and different expenditure thresholds. The measure covers investments in both tangible and intangible assets.</p> <p>The measure is of relevance for this study because it provides an incentive to hire qualified R&amp;D personnel, as the labour costs of these employees, as well as those of external collaborators, consultants and R&amp;D groups, qualify for R&amp;D tax relief.</p> <p>No special provision is made for SMEs. While SMEs are found to react more strongly (i.e. to produce more R&amp;D for each Euro of tax credit) than large firms (Appelt et al., 2020[90]), they may be more sensitive, once again, to the cost of compliance with the policy requirements. These include a certificate showing that the assets possess certain technical skills.</p>
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<p><b>6</b></p>	<p><b>Target groups:</b></p>	<p>Entrepreneurs.</p> <p>Professionals and digital services' experts.</p> <p>Workers.</p> <p>Civil servants.</p>
<p><b>7</b></p>	<p><b>Dissemination / implementation method:</b></p> <p><i>Note: If needed.</i></p>	<p>The <b>implementation model</b> of the national initiative Industry 4.0, Enterprise 4.0 and Transition 4.0 allows to update the operational plan on a six-monthly basis, evaluating the general impact of the whole plan and the effectiveness of the actions and improving them where necessary, and considering the ever-changing context according to the Plan-Do-Check-Act (PDCA) continuous improvement model.</p>
<p><b>8</b></p>	<p><b>Results / impact with a focus on:</b></p> <ol style="list-style-type: none"> <li><b>1. sector</b></li> <li><b>2. individuals, like students or employees</b></li> </ol> <p><i>Note: If needed, if we have results, we can write.</i></p>	

9	<p><b>Sustainability:</b></p> <p><i>Note: If needed, if we have results we can write.</i></p>	
10	<p><b>What were the obstacles?</b></p> <p><i>Note: If needed, if we have results we can write. What were the difficulties in introduction?</i></p>	<p>Difficulties in investments on digitalization.</p> <p>Financial costs.</p> <p>Lacking digital culture at managerial level.</p> <p>Sustaining private investments in advanced digital technologies.</p> <p>Diffidence on innovative working processes supported by digital tools.</p>
11	<p><b>What innovative skills (if any) the described above best practice might have developed to enhance students' employability?</b></p>	<p>Industry 4.0 practical applications</p> <p>Enterprise and digital transition</p> <p>Digital skills</p> <p>Innovative operational plans</p> <p>Stakeholders' involvement in digital reorganisation</p> <p>New digital jobs</p> <p>Linked workplaces and dematerialization of working processes</p>

	<i>Note: Please list skills only we mark the skills.</i>	
<b>12</b>	<b>References (pls insert a link to more data on the practice)</b>	<a href="https://www.oecd.org/els/emp/skills-and-work/adult-learning/Raising_skills_in_SMEs_Italy.pdf">https://www.oecd.org/els/emp/skills-and-work/adult-learning/Raising_skills_in_SMEs_Italy.pdf</a> <a href="https://ati.ec.europa.eu/sites/default/files/2020-06/DTM_Industria4.0_IT%20v2wm.pdf">https://ati.ec.europa.eu/sites/default/files/2020-06/DTM_Industria4.0_IT%20v2wm.pdf</a> <a href="https://oa.inapp.org/bitstream/handle/123456789/862/INAPP_Cirillo_Fanti_Mina_Ricci_Digital_technologies_and_firm_performance_Industry_4.0_in_the_Italian_economy_2021.pdf?sequence=2&amp;isAllowed=y">https://oa.inapp.org/bitstream/handle/123456789/862/INAPP_Cirillo_Fanti_Mina_Ricci_Digital_technologies_and_firm_performance_Industry_4.0_in_the_Italian_economy_2021.pdf?sequence=2&amp;isAllowed=y</a> <a href="https://www.finanze.gov.it/export/sites/finanze/.galleries/Documenti/Varie/dfwp6-1_ultimo.pdf">https://www.finanze.gov.it/export/sites/finanze/.galleries/Documenti/Varie/dfwp6-1_ultimo.pdf</a>

## References

- Amendola C., Casalino N., La Bella S., Savastano M. (2021), Innovazione dei processi lavorativi e ruolo degli artefatti nei modelli di cultura organizzativa: un'indagine empirica sulla trasformazione digitale della Pubblica Amministrazione, rivista PROSPETTIVEINORGANIZZAZIONE, special issue Artefatti come Man in the Mirror?, ISSN 2465-1753.
- Armenia S., Casalino N., Gnan L., Flamini G., (2020), "A systems approach to the Digital Transformation of Public Administration", in Prospettive In Organizzazione "Le sfide del management pubblico: nuovi modelli organizzativi", vol. 14, ISSN 2465-1753.
- Baskerville R., Capriglione F., Casalino N. (2020), "Impacts, challenges and trends of digital transformation in the banking sector", Law and Economics Yearly Review Journal - LEYR, Queen Mary University, London, UK, vol. 9, part 2, pp. 341-362, ISSN 2050-9014.
- Bertocchi E., Caroli M., Casalino N., Falà S., Giovannetti M., Infante K., Orsi A., Mariotti E., Massimi F., Manzo V., Pizzolo G., Sellitto G.P. (2022), "Accelerating Transparency and Efficiency in the Public Procurement Sector for a Smarter Society: eNotification and ESPD Integration for Developing e-Procurement", in Howlett R., Jain L.C. (eds), "Smart Education and e-Learning 2022", vol., Smart Innovation, Systems and Technologies book series (SIST), vol., Springer, Singapore, Online 2190-3026, Print ISSN 2190-3018.
- Borin B., Caroli M., Casalino N., Cavallari M., Di Carluccio N., Di Nauta P., Pizzolo G. (2022), "A New Approach to Enhance the Strategic Impact of Digital Education in Universities and to Foster the Development of a High Performing Common EU Smart Education Ecosystem", in volume Smart Education and e-Learning - Smart Pedagogy edited by Uskov, Vladimir L., Howlett, Robert J., Jain, Lakhmi C., pp. 211-229, Springer Nature, Singapore, doi 10.1007/978-981-19-3112-3\_20, ISBN print 978-981-19-3111-6, ISBN online 978-981-19-3112-3.



Bratta B., Romano L., Acciari P., Mazzolari F. (2020), The Impact of Digitalization Policies. Evidence from Italy's Hyper-depreciation of Industry 4.0 Investments, DF Working Paper n.6, Roma, MEF

Bugamelli M., Cannari L., Lotti F., Magri S. (2012), The Innovation Gap of Italy's Production System. Roots and Possible Solutions, Questioni di economia e finanza n.121, Roma, Banca d'Italia

Casalino N. (2023), "La Digitalizzazione del Settore Finanziario", capitolo del volume "Diritto Pubblico dell'Economia" a cura di Mirella Pellegrini, sez. Sostenibilità e Innovazione, Collana di Diritto e Economia, n.36, II edition, pp. 337-355, Wolters Kluwer, Cedam, ISBN 9788813382247.

Casalino N., Armenia S., Di Nauta P. (2021), "Inspiring the Organizational Change and Accelerating the Digital Transition in Public Sector by Systems Thinking and System Dynamics Approaches", in Uskov V.L., Howlett R.J., Jain L.C. (eds), "Smart Education and e-Learning 2021", vol. Smart Innovation, Systems and Technologies book series (SIST), vol 240, Springer, Singapore, pp. 197-214, <https://doi.org/10.1007/978>

Casalino N., Bednar P.M. (2015), "Managerial governance and transparency in public sector to improve services for citizens and companies", Open Review of Management, Banking and Finance, Regent's University, London, UK, pp. 45-59, ISSN 2058-7422.

Casalino N., Cavallari M., De Marco M., Ferrara M., Gatti M., Rossignoli C. (2015), "Performance Management and Innovative Human Resource Training through Flexible Production Systems aimed at Enhancing the Competitiveness of SMEs", IJKM, IUP Journal of Knowledge Management, vol. XIII, No. 4, October 2015, pp. 29-42, ISSN 0972-9216.

Casalino N., Gasparri C., Rubichi V., Pizzolo G. (2017), "Organization of Processes Digitization and e-Invoicing Services for an Effective Digital Transformation of Public Sector", DIGITCULT - SCIENTIFIC JOURNAL ON DIGITAL CULTURES, vol. 2, n. 1 (2017), pp. 53-62, Aracne editore, DOI: 10.4399/97888255045145, ISSN: 2531-5994.

Casalino N., Nagy H., Borin B. (2018), "Strategic and organizational effects of environmental regulation on operational processes of sustainable MSEs", LAW AND ECONOMICS YEARLY REVIEW JOURNAL, Queen Mary University, London, UK, vol. 7, part 2, pp. 365-388, ISSN 2050-9014.

Casalino N., Pizzolo G., Pineiro F.J., Zielinski J., Smater M., Vassileva M., Seykova D., Hajduk M., Vagas M., Tuleja P. (2019), "Transfer of Technology and Innovation to Increase the Competitiveness of SMEs", SCIENTIFIC LETTERS OF ACADEMIC SOCIETY of Michal Baludansky, vol. 7, No. 1, pp. 23-27, ISSN 1338-9432.

Casalino N., Pizzolo G., Pineiro F.J., Zielinski J., Smater M., Vassileva M., Seykova D., Hajduk M., Vagas M., Tuleja P. (2019), "Increasing the Competitiveness of Small and Medium-Sized Companies by Implementing Collaborative Robots", Scientific Letters of Academic Society of Michal Baludansky, vol. 7, No. 1, pp. 18-22, ISSN 1338-9432.

Casalino N., Zuchowski I., Labrinos N., Muñoz Nieto A.L., Martín-Jiménez J.A. (2019), "Digital strategies and organizational performances of SMEs in the age of Coronavirus: balancing digital transformation with an effective business resilience", LAW AND ECONOMICS YEARLY REVIEW JOURNAL - LEYR, Queen Mary University, London, UK, vol. 8, part 2, pp. 347-380, ISSN 2050-9014.

European Commission (2022) Digital Economy and Society Index (DESI) 2022, Italy.

European Commission (2022). Digital Transformation Scoreboard 2022: EU businesses go digital: Opportunities, outcomes and uptake.

European innovation scoreboard 2022, Country profiles: Italy at: <https://ec.europa.eu/docsroom/documents/45907/attachments/1/translations/en/renditions/native>).

Gaddi M., Garbellini N., Garibaldi F. (eds.) (2018), Industry 4.0 and its Consequences for Work and Labour. Field research report on the implementation of Industry 4.0 in a sample of Italian companies, Bologna, Fondazione Sabattini.

Gaddi M., Garibaldi F., Garbellini N. (2020), The Italian Experience in Implementing Industry 4.0, UCJC Business and Society Review, 17, n.2, pp.52-69

Gal P., Nicoletti G., Renault T., Sorbe S., Timiliotis C. (2019), Digitalisation and productivity. In search of the holy grail - Firm-level empirical evidence from EU countries, OECD Economics Department Working Papers n.1533, Paris, OECD Publishing.

Global Innovation Index (2022). Global Innovation Index: Tracking Innovation through the COVID-19 Crisis. Available at: [https://www.wipo.int/edocs/pubdocs/en/wipo\\_pub\\_gii\\_2021.pdf](https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021.pdf)

Goos, M., Manning A. (2007), Lousy and Lovely Jobs: The Rising Polarization of Work in Britain, *Review of Economics and Statistics* 89(1), 277-282.

Guellec D., Panov C. (2018), Innovation Policies in the Digital Age, OECD Science, Technology and Innovation Policy Papers n. 59.

Harrison R., Jaumandreu J., Mairesse J., Peters B. (2014), Does innovation stimulate employment? A firm-level analysis using comparable micro-data from four European countries, *International Journal of Industrial Organization* 35, 29-43.

Hausman J. (2001), Mismeasured Variables in Econometric Analysis: Problems from the Right and Problems from the Left, *Journal of Economic Perspectives* 15(4), 57-67.

Hermann, M., Pentek, T., and Otto, B. (2015), "Design Principles for Industrie 4.0 Scenarios: A Literature Review", Working Paper n. 1, Technische Universität Dortmund Fakultät Maschinenbau, Audi Stiftungslehrstuhl Supply Net Order Management.

Holland P.W. (1986), "Statistics and Causal Inference", *Journal of the American Statistical Association* 81(396), 945-960.

Hong, S., Oxley, L., and McCann, P. (2012). "A Survey of the Innovation Surveys", *Journal of Economic Surveys*, 26: 420-444.

Incentivi per gli investitori: il Piano nazionale Industria 4.0 <https://investorvisa.mise.gov.it/index.php/it/home-it/incentivi-per-gli-investitori-il-piano-nazionale-industria-4-0>.

Istat (2017), La performance congiunturale dei settori produttivi, in Istat, Rapporto sulla competitività dei settori produttivi. Edizione 2017, Roma, Istat, pp.33-40.

Istat (2018), Innovazione, nuove tecnologie e occupazione, in Istat, Rapporto sulla competitività dei settori produttivi. Edizione 2018, Roma, Istat, pp.55-101.

Jäger, A. Moll, C., Som, O., and Zanker, C. (2015), Analysis of the impact of robotic systems on employment in the European Union, DOI: 10.2759/516348.

Kagermann, H., Wahlster, W., and Helbig, J. (2013), Securing the future of German manufacturing industry. Recommendations for implementing the strategic initiative. Final report of the Industrie 4.0 Working Group, Acatech – National Academy of Science and Engineering.

Lachenmaier S., Rottmann H. (2011), Effects of innovation on employment: A dynamic panel analysis, International Journal of Industrial Organization 29(2), pp. 210-220.

Ministero Sviluppo Economico [http://www.sviluppoeconomico.gov.it/images/stories/documenti/guida\\_industria\\_40.pdf](http://www.sviluppoeconomico.gov.it/images/stories/documenti/guida_industria_40.pdf).

MISE (2022). La diffusione delle imprese 4.0 e le politiche, available at: <https://www.mise.gov.it/images/stories/documenti/Rapporto-MiSE-MetI40.pdf>.

MISE (2022). Piano Nazionale impresa 4.0. available at <https://www.mise.gov.it/index.php/it/industria40>.

Neubig T., Galindo-Rueda F., Appelt S., Criscuolo C., Bajgar M. (2016), Fiscal Incentives for R&D and Innovation in a Diverse World, OECD Taxation Working Papers n. 27.

Pellegrini M., Uskov V., Casalino N. (2020), "Reimagining and re-designing the post-Covid-19 higher education organizations to address new challenges and responses for safe and effective teaching activities", Law and Economics Yearly Review Journal - LEYR, Queen Mary University, London, UK, vol. 9, part 1, pp. 219-248, ISSN 2050-9014.



Piano Nazionale Industria 4.0 - Governo Italiano Presidenza del Consiglio ....  
[https://www.governo.it/sites/governo.it/files/industria\\_40\\_MISE.pdf](https://www.governo.it/sites/governo.it/files/industria_40_MISE.pdf).

Piano Nazionale Industria 4.0 – MISE, [mise.gov.it](https://www.mimit.gov.it) [https://www.mimit.gov.it/images/stories/documenti/Piano\\_Industria\\_40.pdf](https://www.mimit.gov.it/images/stories/documenti/Piano_Industria_40.pdf).

Piano Nazionale Industria 4.0 – MISE, [mise.gov.it](https://www.mimit.gov.it) [https://www.mimit.gov.it/images/stories/documenti/2017\\_05\\_16\\_network.pdf](https://www.mimit.gov.it/images/stories/documenti/2017_05_16_network.pdf)

