

**Proceedings of the  
19th European Conference on  
Knowledge Management  
University of Padua, Italy  
6-7 September 2018**



**VOLUME ONE**

**Edited by  
Dr Ettore Bolisani  
Dr Eleonora Di Maria  
Dr Enrico Scarso**

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**Proceedings of the  
19th European Conference on Knowledge Management  
(ECKM 2018)  
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## **Preface**

These proceedings represent the work of researchers participating in the 19th European Conference on Knowledge Management (ECKM) which is being hosted this year by University of Padua, Italy on 6-7 September 2018.

ECKM is a recognised event on the international research conferences calendar and provides a valuable platform for individuals to present their research findings, display their work in progress and discuss conceptual and empirical advances in the area of Knowledge Management. It provides an important opportunity for researchers and practitioners to come together to share their experiences of researching in this varied and expanding field.

The first day will be opened with a keynote presentation by Simone Strambach of Philipps-University Marburg, Germany who will be speaking on *“Combinatorial Knowledge Dynamics in Social and Sustainability Innovation - Context Matters”*. Antonella Padova from EY, Italy, will then speak on the second day about *“From Knowledge Management to Community Management: Turning Challenges Into Opportunities”*.

With an initial submission of 285 abstracts, after the double blind, peer-review process there are 113 Academic Research papers, 18 PhD Research, 5 Non-Academic, 3 Work in Progress papers and 1 Late Submission published in these Conference Proceedings. These papers represent truly global research in the field, with contributions from Argentina, Australia, Austria, Bahrain, Bosnia and Herzegovina, Brazil, Canada, China, Colombia, Croatia, Czech Republic, Cyprus, Denmark, Finland, France, Germany, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Kazakhstan, Latvia, Lithuania, Malaysia, Mexico, Netherlands, Nigeria, Norway, Poland, Portugal, Qatar, Romania, Russia, South Korea, Slovakia, South Africa, Spain, Sudan, Sweden, Switzerland, Taiwan, Thailand, Uganda, UAE, UK, and USA.

We wish you a most interesting conference.

**Dr Ettore Bolisani**  
**Dr Eleonora Di Maria**  
**Dr Enrico Scarso**  
University of Padua  
Italy

*September 2018*

# Knowledge Management to Compete in the Digital era: Skills Evolution of Enterprise Systems

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**Abstract:** National Industry 4.0 Plan is contributing to introduce new digital industrial technologies within the enterprise sector. This has brought the researchers and the experts of the sector to study as the business equilibriums are evolving and what new emergent professionalisms can be. On this basis, the paper aims to identify these skills and analyze professional's dynamics, in order to achieve a higher level of competitiveness on the national manufacturing sector 4.0 stage. National Industry 4.0 Plan provides significant incentives aimed at strengthening R&D investments and incentivizing new technologies investments, as well as developing new skills among the professionals who will play a primary role in the "new 4.0 companies". Therefore, Industry 4.0 does not only intend to promote investments in new machinery and technologies, but, in parallel, to modify both, the productive and organizational paradigms, to effectively manage the indispensable and delicate process of cultural and organizational transformation. In other words, the goal is to transform all the processes into a continuous sequence of interconnected inter-digitally phases, which will be managed by an inter-functional group that has complete responsibility for it. This target is to be considered as a result of a training process across all company levels, which, according to a bottom up approach, stimulates a process of new skills creation and increases the sense of belonging to the company. This process also accompanying the profound changes of non-technological nature, which, however, are a presupposition and consequence of technology. In this perspective, the paper intends to set up a desk analysis - where the main focus are the national SMEs - aimed at better identifying the necessary skills to achieve a higher competitiveness level in the landscape 4.0 and, consequently, analysing the evolution of the professionalism that are characterizing the evolution of the enterprise systems.

**Keywords:** digital era, National Industry 4.0 plan, skills evolution, knowledge management, digital process, SME competitiveness

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## 1. Introduction

New digital industrial technologies implemented by the National Industry 4.0 Plan, has pushed the academic and the business world, to ask itself question about the potentials changes as much as in education and professional skills inside companies.

Considering that, the manufacturing industry is involved in a wider and competitive globalization process, the adoption and testing of new skills is a strategic lever (Wallner & Gerold, 2016) for providing new job opportunities, responding to market needs and introducing new services and products (Lorentz, et al., 2015). On this basis, the paper aims to identify these skills and analyze professional's dynamics, in order to achieve a higher level of competitiveness on the national manufacturing sector 4.0 stage.

In particular, the study, after discussing about the digitalization process that is characterizing the world economy, performs a desk analysis about the skills required by the companies and, therefore, the emerging professional skills.

## 2. The digitization process as an opportunity to fight the crisis

At present, the digitalization process represents one of the major corporate targets. It enables businesses to turn challenges into opportunities in terms of competitiveness. In its broaden sense, digitalization may be used without distinction to identify the global information processing trend and to denote both, the use of digital technologies in the organizational framework and, in parallel, the application of such technologies for redesigning the way of doing business (Meregalli & Salviotti, 2017, p.13).

Autonomy and digitalization concepts, which are the emblems of the fourth Manufacturing Revolution, must be related to the configuration as well as the integration of processes where to apply different digital solutions.

The Information and Communications Technologies (ICT) implement linked to business, represents a new organizational paradigm for enterprises and not a mere competitive edge for medium-term outlook, but instead, it allows to deal with changing as much as potential future risks in a more conscious way. In this perspective, digitalizing business activities means plan and manage cooperatively and integrated, both the internal processes such as the numerous tasks involved in the same organization, and the external ones like customers and suppliers. For this reason, it is possible to assume that digitalization can be considered as a basic way to reach the target with a better chance of success. Furthermore, digital programs implementation allows to enjoy twofold benefits: on the one hand improves business process efficiency through boosting staff productivity, and on the other hand increase the internal innovation capacity which is often restricted in activities with low added value. In this way it is possible to reach both, new commercial borders and others markets.

In this scenario, it has to be considered that achieving business objectives depends, above all, on management, competitiveness and educational background staff (Zaugg, 2009). In order to remain in the market, it is essential provide a life-long training of all staff intended as the acquisition of new skills (Beaumont, 1993).

So, there is a mutual relationship between staff training and the organizational set-up development, which affects present and future business performances.

### 3. The role of competences for Industry 4.0

The National Industry 4.0 Plan aims at an increasing digitalization of the entire value chain and the interconnection between people, things and systems through a real-time data exchange (Dorst, et al., 2015). With this mind, the entire productive system acquires artificial intelligence (A.I.) in order to conform itself independently to context shifts. That is the reason why, the business management is increasingly focused on flexible production systems and automatics check operations. In order to compete with an ever –changing panorama, the HR management plays a central role to improve competitiveness as well as business’ performances because it became functional in having available an active and skilled workforce to pursue the objectives set (Armstrong & Taylor, 2014). The 4.0 Business Plan development creates opportunities as much as challenges related to the production process automation and linked to political, economic, social, technical, environmental and legal factors as well. Hecklau *et al* (2016), as a result of a comparative study on literature, have elaborated a template in which skills are classified in categories in a forward-looking perspective (Hecklau et al., 2016).

**Table 1** Derivation of core competencies for identified challenges

Category	Required Competences
Technical competences	State of the art knowledge
	Technical skills
	Process understanding
	Media skills
	Coding skills
Methodological competences	Understanding IT security
	Creativity
	Entrepreneurial thinking
	Problem solving
	Conflict solving
	Decision making
	Analytical skills
Research skills	
Social competences	Efficiency orientation
	Intercultural skill
	Language skill
	Communication skills
	Networking skills
	Ability to work in a team
	Ability to be compromising and cooperative
Ability to transfer knowledge	
Personal competences	Leadership skills
	Flexibility
	Ambiguity tolerance
	Motivation to learn
	Ability to work under pressure
	Sustainable mind-set and compliance

The previous table identifies four principal skills categories (technical, methodological, social and personal) and, for each of these, determines a set of those needed to adopt a 4.0 approach.

In addition, the template represents an efficient tool in skills gap analysis which are required by Industry 4.0 plan. This tool has been designed in order to evaluate every single employee, considering that such skills are specific ones and, therefore, it is impossible to extend them to the entire workforce.

Additionally, it is also demonstrated a strong correlation between digital skills and soft skills (Sousa, M.J., 2018), which are both transversal to the professions that are connote by advanced professionalism: openness to change, knowledge of English, problem solving, team working, creative thinking, public speaking, manage time and customers communication.

### 3.1 Skill in digital era: Status quo and business needs evolution

The move towards the Industry 4.0 model shows that businesses, in order to manage work processes, transform themselves in “cyber-physical systems” which represent the interaction between hardware, software and people.

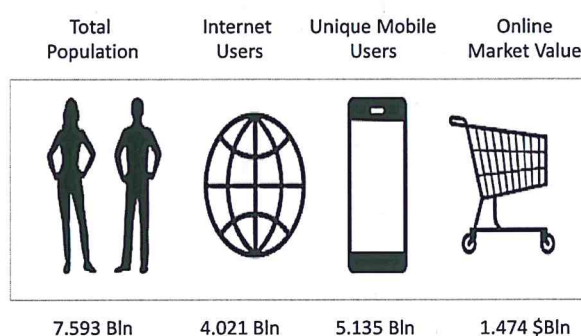
Companies will need to address changes introduced by the Industry 4.0’ challenge. In Italy, these changes will influence enterprises in terms of organization and customers approach.

In order to obtain relevant results in business and performance, it will be necessary that organization increase their smart ability by creating new professional skills which join together in an organic and productive manner.

At a countrywide level, the issue of skills is particularly critical because, on the one hand it will increase the already existing gap between required skills and those available on the labor market and, on the other hand it creates a problem related to the businesses ability to manage such new competences, involving, above all, their cultural system.

The European Commission tracks the evolution of EU Member States in digital competitiveness through the Digital Economy and Society Index (DESI) in which, the human capital, is one of the five monitored dimensions. In 2016, Italy ranked 25<sup>th</sup> in DESI with just one point more compared to 2015.

In 2018, according to Global Web Index data, the number of internet users has been growing until register up to 4 billion. This figure represents more than half of the global population and 5 million devices are online users.



**Figure 1:** Global Web Index data - Source: Own Elaboration based on U.S. Census Bureau, Eurostat, Facebook, Techrasa, & Google data (2018)

Comparing 2016 and 2017 data, results that Italian people use internet for reading news website, online newspaper and magazine (79%), consulting social network (74%), accessing at online banking services (56%). In 2017 has been growing the number of uses who achieve online transaction (+20%), and it demonstrate the increasing bent for e-shopping. The following graph shows the results.

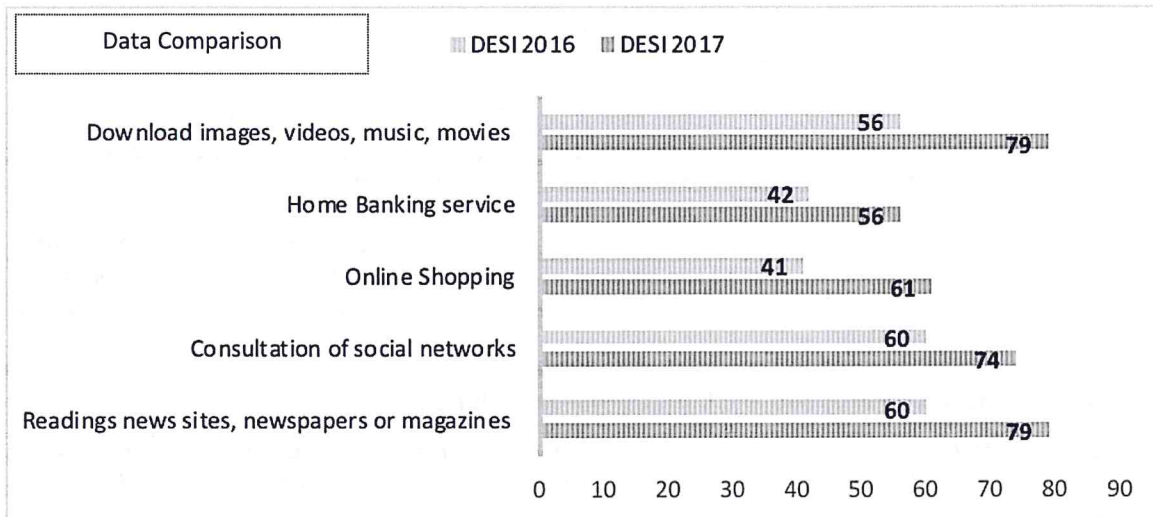


Figure 2: Online users activities- Source: Own elaboration based on Digital Economy and Society Index data

The global e-commerce value is estimated to be USD 1.474 billion and more than 1.77 billion of buyers which grew by 8% compared to 2017 (Statista Digital Market Outlook, 2018).

A research by Osservatorio Agenda Digitale del Politecnico di Milano, shows that the 86% of Italian people access to the network once daily. At global level, emerge that users spend between 6-7 hours a day in surfing through

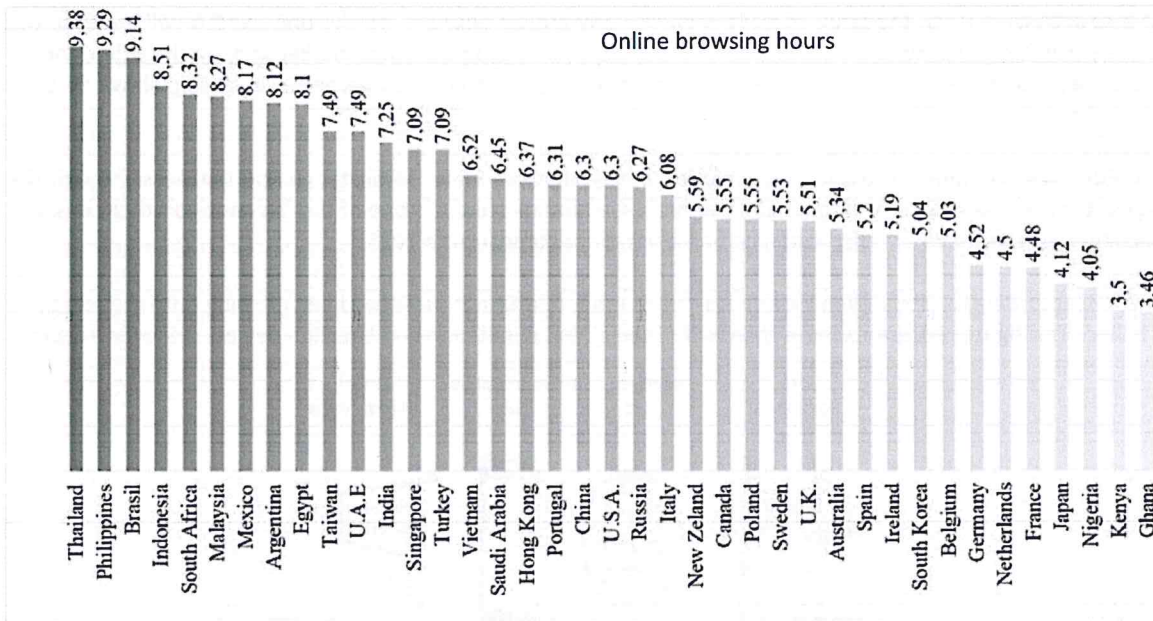


Figure 3: Online browsing hours by Country-Source: Own elaboration based on Global Web Index data (2018)

As the graph show, the most connected Countries are Thailand, the Philippines and Brazil with more than 9 hours of online surfing. Furthermore, the developing Country are those with greater users of internet. Nigeria, Kenya and Ghana report the lesser time of web connection probably due to the gap of infrastructure, but also because a handful of people can use internet.

The number of Italian citizen with digital skills remains unchanged (+1%) and it still below the European average (56%).

In order to measure more precisely the Italian citizen's internet use and digital skills, the Osservatorio Agenda Digitale del Politecnico di Milano, in collaboration with Doxa, has led an analysis (Osservatorio Agenda Digitale, 2017) on a sample of adult population between 18 and 74 years old.



It has been measured the digital skills in four different dimensions, which are the same investigated by the European Commission, considering E-skills in managing file and digital information, the digital communication management, familiarity.

The following graph shows that the widespread E-skills are those related to digital communication management as well as digital information and file management and, at list, the familiarity with online services.

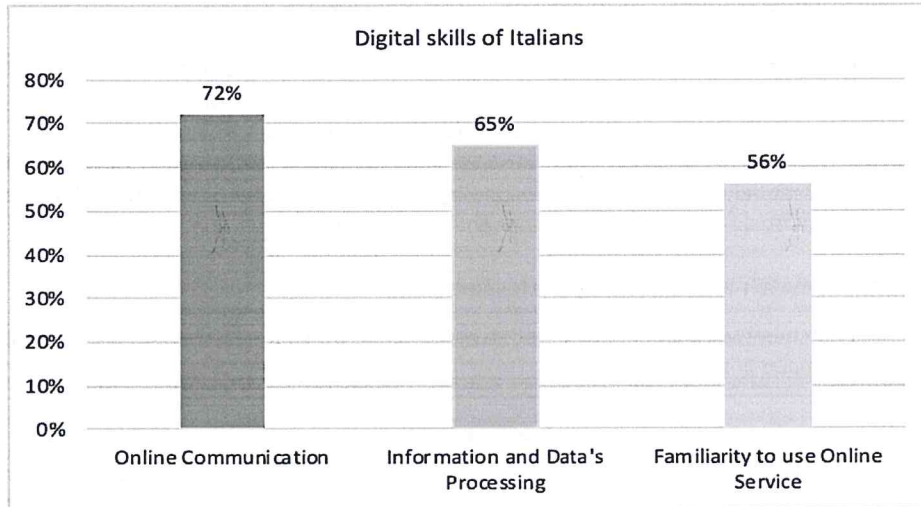


Figure 4: Digital skills of Italians- Source: Own elaboration base on Osservatorio Agenda Digitale della School of Management del Politecnico di Milano data (2017)

The level of digital competence has a considerable impact on the internet use and, in this field, Italy result to be the second to last: around 66% of Italians know how to process information data, 49% is able to use spreadsheet and a 15% can writing software (programming). The following graph shows the results.

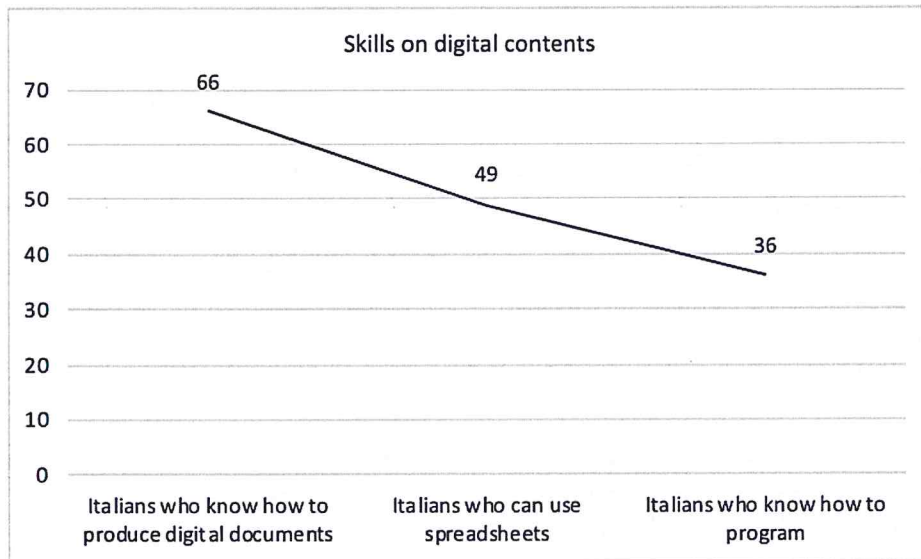


Figure 5: Skills on digital contents- Source: Own Elaboration based on Digital Economy and Society Index data.

Moreover, should be considered that most Italians with digital skills is under 55 with an age ranging from 18 to 34 years old.

On the basis of such data, it is being important to question about the skills which are necessary for business, in order to respond to technological change, and, on the world stage, what are the competences requested by businesses as a key for the Industry 4.0 success. A recent meta-study by (Hecklau, et al., 2017) demonstrates that the most requested skills in the worldwide are the communicational and cooperative ones (59%) and, in second place there are the programming skills.

Nowadays, being able to cooperate plays a central role for the businesses operating. Telecommuting which implies working with less face-to face contact, it is a big challenge in terms of relation management as well as staff engagement and shared responsibilities.

The increase of virtual workspace implies abilities in communication and collaboration which are necessary for the job quality in heterogeneous and dynamics task groups of the Industry 4.0. Moreover, the way to interact will be redesigned by (among others) co-working areas, virtual teamwork and online platform for freelancer.

According to Modis, English tongue as well as a mix of digital, technological and soft skills are the most requested one from businesses. Furthermore, the same study demonstrate that some social aspects are relevant for enterprises, such as the understanding of the processes (25%) and creativity (18%).

Before the Industry 4.0 model, in the Science & Technology Studies field, it has been stressed how much social innovation represents a "socio-material" key component" (Orlikowski, 2007).

### 3.2 Job: Digital mismatch and emerging professionalism

In Italy, the ICT mismatch between labor supply and demand, slows down the businesses' digitalization process, and it is destined to expand in the next future.

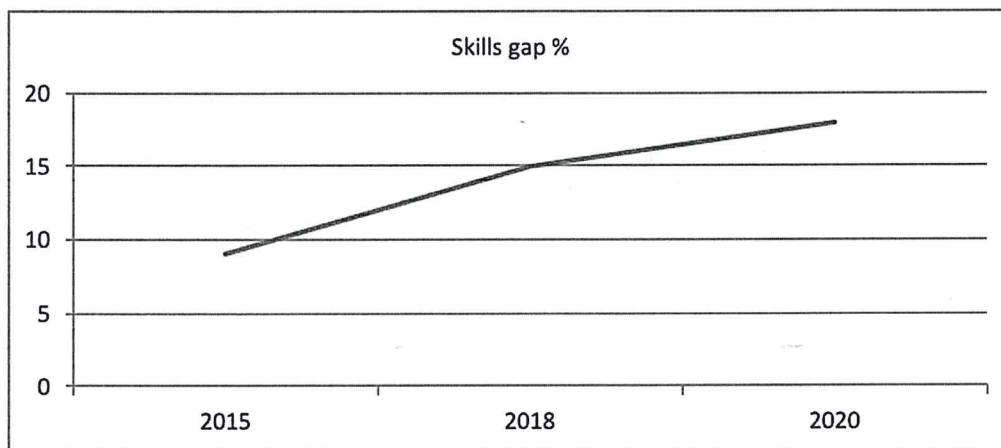


Figure 6: Skills gap (%)- Source: Own elaboration based on Modis Consulting data (2017)

The graph highlights that the gap between supply and demand in terms of skill, will move from 9% in 2015 to 18% in 2020. In other words, this means that even though the 28,000 new jobs created in 2016, and others 57,000 requested in 2017 and 2018, around 135,000 working positions will remain unapplied (Modis & Group, 2017). In order to bridge the gap, it is useful to question about what the necessary professionals for the business world are. The professional ICT demand grows averagely a 26% every year, with peaks of 90% with regard to the new professional profiles such as Business and Data Analyst, which demonstrate the data-driven trend in the enterprises. The demand for Cloud Computing, Cyber Security, IoT, Service Development, Service Strategy specialists as well as robotic and A.I, increase averagely a 56%. Developers, System Analyst and ICT Consultant represent more than two thirds of the total demand. The most market-requested professionals are Programmers, followed by Programmers Analyst, Collaborator in informatics, Help Desk Specialist, Hardware/Software Engineers, Technical Consultant, Web Developer, Analyst and System Engineers.

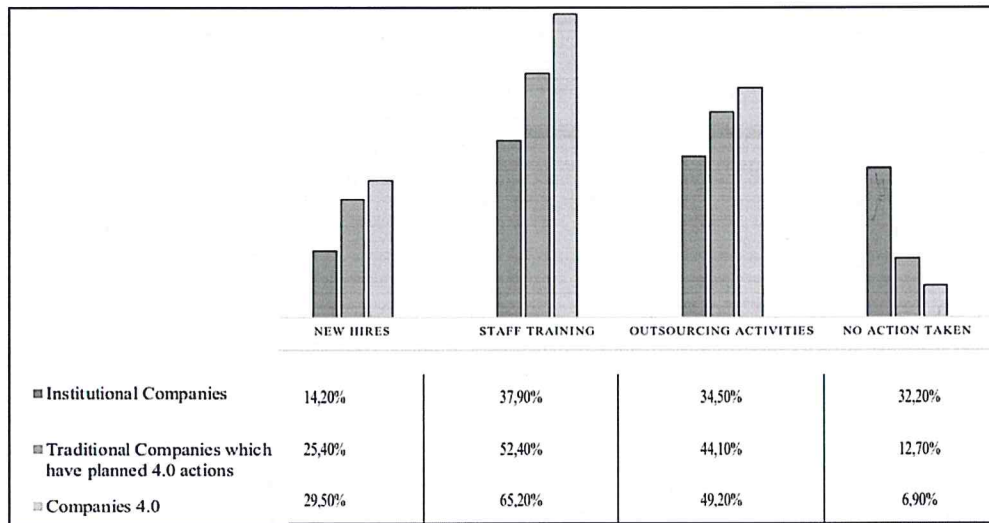
In the past three years, job portal sites have registered about 175,000 advertisements from businesses which looked for ICT professionals, with an average annual growth rate of 26%: two thirds of the researches were for Developers, System Analyst and ICT Consultant. Therefore, it is possible to confirm that digital skills are the most required from businesses, registering a constantly evolving trend: a 56%-90% more depending on the professionals requested.

Moreover, 40% of companies complain about the supply inadequacy. In Italy, just a few hundred people have graduated in IT engineering (62% graduate versus 38% high school graduate) compared to more than 4,000 job opportunities offered. In terms of competences, the highest mismatch is recorded for specialists in mathematics,

computer science, physics and chemistry (57% of the profiles sought are considered difficult to find), followed by engineers (39.1%) (Unioncamere-ANPAL, 2018).

Furthermore, it is highlighted that digitalization effects do not just concern the creation of new professions (Aica, 2018); i.e. Key management personnel need digital competences to manage business functions effectively.

The graph below shows the ways in which companies have faced the skills issues, by type of company.



**Figure 7:** Methods by which companies have faced critical issues in skills, detail by type of business. Percentage values. - Source: (MISE, 2018)

The graph highlighted that the companies 4.0 are characterized by greater dynamism both in terms of recruitment and staff training. This aspect finds its maximum expression, naturally, from the analysis of the innovative paths. As for innovations, the introduction of 4.0 technologies is associated with a significant changes of both the production processes and the company organization. At the same time, the presence of subjects that carry out R & D activities in companies 4.0 is much higher.

#### 4. Conclusion, limitations and further research

The first section has demonstrated that introducing digital technologies generate twofold positive effects: productivity growth and innovation capacity inside businesses.

Furthermore, it has been highlighted that, in order to obtain better results in terms of performance, it is necessary that organizations increase their smart ability by creating new professional skills which join together in an organic and productive manner. The skills issue is particularly critical because of the gap between required skill and those are available on market, and also, because this gap will be extending in the near future.

The paper has analyzed both technical and soft skills which are requested for the upgrading at Industry 4.0 plan by focusing on the professionals required in Italy. The analysis highlighted that in the current process of change, digital skills represent one the most requirement requested although, the longer required professionals are those with a high technical and digital profile. It also emerged that, in the coming years, technological and demographic factors will profoundly influence the evolution of the labor market.

The employment impact related this transition will be as more positive as great will be the preparation and availability of the skills useful for the digital economy growth. Hence, besides to investing in specialized skills, it will be necessary to restructure training courses and support the digital updating of many workers through continuous training.

In order to reap the benefits of this change, it becomes essential to be able to identify and constantly update the necessary skills for the competitiveness of the company. According to this statement, this paper has to be considered as a first step for further empirical research which aims to define KPIs that can be systemically fed, with a view to measure the company needs in terms of skills and competences.

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