POLITECNICO DI MILANO

School of Industrial and Information Engineering

Master of Science in Management Engineering

DIGITAL TECHNOLOGIES AND THE ENVIRONMENT: DESK RESEARCH ON DIGITAL TECHNOLOGIES DIFFUSION IN THE ITALIAN CONTEXT

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SUMMARY

EXECUTIVE SUMMARY

The introduction of automation and the new digital technologies coming from the Fourth industrial revolution are analysed from the job situation perspective in term of how this phenomenon is changing and influencing the job environment. I focus my analysis on the Italian context to provide a snapshot of the scenario. When writing my work, I joined the University2business, being part of Digital360 group, in the preparation of the third edition research on digital and entrepreneurship themes entitled: Il futuro è oggi: sei pronto?

State of art

The context of reference shows a scenario in which our world is experiencing a period of continuous transformation that have a strong influence on the economy, modifying those that are the existing models in the employment field. This change is the result of the new digital technologies spread, that promote also the boost of automation. Therefore, it allows a new collaborative paradigm in work field that lead to the creation of both new figures and jobs. The main turning point is the emergence of a new business model whose impact is evident on the employment landscape and skill requirement. For sure, this revolution has created mixed feelings. Recent discussion about the impact of these disruptive changes on employment have often polarized opinion: on the one hand who foresee limitless opportunities, on the other hand who foresee massive labour substitution and displacement jobs. Even those jobs that are less directly affected by technological change and have a stable employment situation may require a new skill definition in a few year as the ecosystem, within which they operate, will change. For this reason, the retraining and skill raising program and lifelong learning program will be important to support workers shifting to new roles and to acquire the strategic skills necessary to manage these new concepts. It is clear how this phenomenon is a cross sectorial issue and how the digital skills become more and more relevant. Their diffusion and the level of preparation of workers are two factors to be carefully considered. In addition, it is necessary that business leaders and their organization will also aware about the evolution of the technologies and change of the scenario.

The resulting situation, not being prepared to face the challenges of the technological change due to the lack of knowledge, could be unemployment and growing inequality. Therefore, the ability to reskill and upskill workers is critical in order to seize the opportunity offered by these trends.

Many countries have undertaken significant effort to answer to this need of preparation. Italy is far from European leaders for the offer of this type of course and below the European average. However, this would not be enough: the main problem is to prepare students, the future workforce, for new demand and needs coming from companies, since new jobs are arising and new companies' need have to be satisfied. A reform in education system is undoubtedly difficult, but even more effective. This action is fundamental because is not possible to exploit all the benefit of the current digital revolution by waiting for the next generation's workforce to become better prepared. Some action at university level are already did focusing in STEM field, but improving just this part was found not to be sufficient to absorb the needs coming from the labour market. Different actions are needed because of the advance of digital revolution and the consequent mismatching phenomenon. This mismatching is related to companies that offers jobs without finding who has the skill to cover them. The lack of prepared students, who are able to cover new roles and have those required skills, is the biggest challenge to overcome. In fact, for the success of digital transformation a ready and adequate human capital is necessary.

Objectives and research questions

Universities and companies, along with the government, have to be the main actors of change in our country to take advantage of this digital revolution. The purpose of this study is to provide a vision of what is the state of diffusion and awareness of digital skills and themes that characterize this revolution. In particular it is studied the gap between the demand from companies, regarding the new skills, and the offer that students represent. At this point, it is necessary to ask whether this gap that companies find in seeking and having resources with the adequate preparation is only the fault of the students or whether the university system that cannot provide the students to those that are the new requests. To answer this question, I have also looked at what is the situation of Italian universities regarding the offer of courses dealing with new digital themes. Therefore, the research questions that I have set out are:

- Which is the students awareness relate to these digital themes?
- What is the need of companies and their awareness about the change brought by the digital disruption?
- What is the educational offer of universities in digital themes?

Methodology

The research is based on a data collection through a survey produced by University2business. This survey is focused on digital and entrepreneurial knowledge and willingness. It were interviewed:

- 2163 university students
- 251 HR managers

The collected data were processed and the relevant information were extracted considering the questions regarding the digital issue. In this way, it was possible to give a vision of students' awareness and those that are the expectations of companies.

Regarding the educational offer of universities in digital themes, I conducted a desk research on 73 universities across Italy, analysing the programs offered by the courses to provide an overview of the digital themes spread. Furthermore, it was analysed the diffusion by different faculty class, computing the percentage of digital academic credit offered.

FACULTY GROUP	
Scientific group - SCI	Humanistic group - HUM
Engineering group - ENG	Economic group - ECO
Computer science group – COMP.SC.	Other group - OTH

$$\frac{University\ ranking_{faculty}[CFU]}{Width\ of\ academic\ offer_{faculty}[CFU]} = \%Digital\ academic\ credit$$

Where :

$University\ ranking_{faculty}$

$$= \sum_{i=1}^{n} CFU_{Academic\ course} * [\#digital\ topics_{CORE} * \alpha + \#digital\ topics_{NO\_CORE} * \beta]$$

α = 1 if the themes is threated in a core way

β = 0,25 if the themes is threated in a no-core way

$Width\ of\ academic\ offer_{faculty}$

$$= \#bachelor's\ degree\ courses_{faculty} * 180cfu$$

$$+ \#master's\ degree\ courses_{faculty} * 120cfu$$

$$+ \#single\ cycle\ master's\ degree\ courses_{faculty} * 300cfu$$

Results and consequences

The current situation shows that from the point of view of companies there is awareness of change and the need to have new skills within the working environment. The 53,4% of the HR manager says that the depth knowledge of one or more area of digital innovation in choosing a new graduate profile is very important. Moreover, if we adds up the 19,1% who says that it is crucial, the percentage of the companies that research these skill become relevant. However, nearly 75% of HR respondents admit that finding candidates with the skills required is difficult or even very difficult. On the other side, about 40% of students recognize that digital innovation will have an incremental impact on current business, but this awareness is not accompanied by knowledge. According to the survey outcome, the percentage of students, who has a deep knowledge or is studying some digital issue, results always smaller than the percentage of student who never heard the subject or who hear only something.

If we compare these results to those indicated by HR managers, as shown in the table, that indicates which are the most important areas of digital innovation for the development of their company over the next three years; students disclose a low level of preparation. In most cases, the higher percentage of the answer is concentrated in the never heard and something heard columns. This means that the most of the student have not the knowledge necessary to satisfy the companies' request. Except for social media that are well known by student, with more that 50% that have a deep knowledge or that are learning about it. Moreover, data register an increase in the use of them by student compared to 2015.

		HR Responses	Never Heard	Something Heard	I am learning	Deep knowledge
1-	Big Data Analytics	46,2%	62,0%	24,4%	10,9%	2,7%
2-	Digital Marketing	42,2%	35,4%	44,3%	17,1%	3,2%
3-	Industry 4.0	34,7%	73,8%	15,9%	7,9%	2,4%
4-	Internet of Things	27,9%	64,8%	21,4%	9,4%	4,4%
5-	Social media	25,1%	18,6%	27,0%	26,9%	27,4%
6-	Cloud Computing	24,7%	55,8%	27,9%	12,4%	3,8%
7-	e-Invoicing & dematerialization	22,7%	48,9%	34,9%	13,4%	2,8%
8-	ePayments & Blockchain	19,1%	85,5%	9,8%	3,9%	0,7%
9-	Augmented & Virtual Reality	9,2%	63,2%	24,1%	10,3%	2,5%
10-	Cognitive Computing	8,4%	73,0%	17,7%	8,5%	0,8%
11-	UI-UX design	5,2%	84,0%	9,7%	5,4%	0,9%

The study regard the universities has in part confirmed the fact that the Italian university system is not able to provide the students with the skills and knowledge needed to meet the demands of the companies. Most areas of technological innovation are covered by courses in a marginal way, which in the analysis it is defined as no-core way.

Then, the total digital credits offered by faculties from all universities are related to the total credits offered to the student by faculties, obtaining a percentage of digital credit provide always below 10% for all faculties. Moreover, it can be seen that the spread of the digital areas analysed are not homogeneously distributed with respect to faculties.
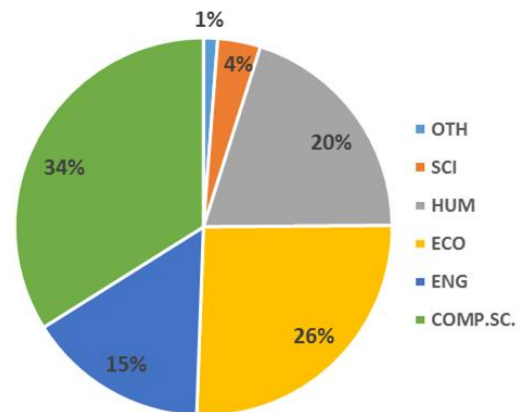
Since the changes in this revolution is cross sectorial it is necessary to insert digital study path where they lack and make the course more effective. This number shows that there is some work to do to align basic knowledge with innovation, increasing interdisciplinary skills, developing soft skill intertwined with digital content.

The main outcomes:

- University students interviewed show that their preparation on the new digital themes and drivers is slow.

- Social media is an area in which students have a good preparation, recording a higher knowledge related to the average of the other themes mapped, and an increase in their use compared to 2015 data.

- Software development showed an increase among all students in the different faculty groups

- Companies require candidates with the new digital competences, considering Big data analytics, Digital marketing, Industry 4.0 and IoT the fundamental areas over the next three years. The knowledge of soft skills linked to digital is equally important

- 53% of HR respondents claim that digital competences in a graduate student are very important and the 19% consider them fundamental. There is, however, a difficulty in finding adequate candidates, as reported by 75% of respondents. This is a validation of mismatching between companies demand and student offer

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- University research has highlighted the lack of digital issues and drivers in study program
- University research has shown a strong heterogeneity of digital teaching among faculty groups
- The biggest implication is that university teaching offer is not able to cover the real needs that come from the present context, and this situation increase the mismatching among the company demand and the student offer.

CHAPTER 1 - INTRODUCTION

The introduction of automation and the new digital technologies coming from the Fourth industrial revolution are analysed from the job situation perspective in term of how this phenomenon is changing and influencing the job environment. This subject has been the object of a lot of research that are being created with the aim of analysing the current scenario and future impacts. The main issues of these researches are the theme of digital technologies disruption and automation and the pace of these changes. In order to describe what experts look forward on this situation and to understand which are the real needs, three researches have been taken as a reference:

- The future of jobs. Employment, skills and workforce strategy for the Fourth industrial revolution – Global challenge insight report, January 2016 – World economic forum
- A future that works: automation, employment, and productivity – Mckinsey global institute, January 2017 – McKinsey&Company
- Tecnologia e lavoro: governare il cambiamento – The European house – Ambrosetti, 2017 – Ambrosetti club

Impact of Fourth industrial revolution

The context of reference shows a scenario in which our world is experiencing a period of continuous transformation in employment. This transformation will certainly have a strong influence on the economy, modifying those that are the existing paradigms. This trend of change is more properly called Fourth industrial revolution. The revolution is based on the spread of digital and new technologies and affect all the advanced countries, in particular their economic activities and the labour sectors. The beginning of this change can be coincide with the advent of Industry 4.0 and with the approval of its industrial plan in Germany.

Regarding this revolution, the spread of the digital technologies carries an increase of automation. The term automation refers to all those technologies capable to manage mechanical systems and physical or logical processes with variable complexity, reducing the need for human intervention. This kind of innovation was already present with the advent of the third industrial revolution.

However, with the fourth industrial revolution there has been a further change: the innovation is not only related to mechanical system, but innovation has begun to diffuse in the form of integrated systems with software and networked dimension.

Furthermore, the development of automation has created also a new collaborative paradigm between man and machine. This new way of working facilitates the worker and improves performance. Automation and technological development lead to the creation of both new professional figures and jobs. This was possible thanks to the emergence of new technology based companies and the digital world. Nowadays, automation is one of the most important driver for business development and competitiveness. The diffusion of automation in companies has led to a growing demand for specialized personnel and capable of interfacing with technology and digital language.

Actually, the real innovation is the birth of a new business model with the impact on the employment landscape and skill requirements. This new model was born mainly thanks to the development of the web and the advent of new digital technologies that potentially change the way in which some jobs are carried out. They have established the birth of new companies that are partially or completely digitized. Even the most traditional companies, such as the fashion and publishing industry, have converted part of their business on digital. In addition, companies no longer see platforms such as Facebook and Instagram as simple social networks, but as new channels through which companies implement their marketing and communication strategies. This type of platforms have become very important to the subscribers since they allow a large number of users to be able to personalize the message of the offer. Therefore, the use, understanding and integration of these technologies plays a strategic role.

The Fourth industrial revolution has not only brought this type of modification, indeed more than others, all those technologies that together help to create the industry 4.0, are having a strong impact on businesses and industrial sectors. We are talking about big data, cloud computing, IoT[1], additive manufacturing; moreover the development of advanced analytics tools connected to cloud platforms has allowed to accelerate and improve the process in the field of search. Yet, the development of sensors and their interconnection has allowed creating new production control systems, increasing efficiency. From this point of view, the research conduct by WEF[2] highlight the

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[1] Internet of Things
[2] World Economic Forum

main technological drivers of change. Some of these drivers have already helped to change the way of work. For example, think about mobile internet or cloud technology allows more efficient service delivery and increase workforce productivity. Again, another driver that nowadays is fundamental is the computing power and Big data: they are necessary to realize the full potential of technological advances in order to make sense of the huge amount of data these innovation generates. Related to this latest driver is also the development of the IoT technology, which with the use of sensors is able to gather a great amount of data, allowing the opportunity to see patterns. Some other technologies are put in place in this year, but the real impact will be relevant in the next years. In this case, reference is made to advanced robotic, artificial intelligence and machine learning. This new automation age is characterized by the fact that robots and computer can, not only perform a range of routine physical work activities in a better and more efficient way, but they are also able to perform activity that includes cognitive capabilities. With recent development in these topics, technologies will do things that we thought only human could do, and some robots that are more flexible can be used to perform tasks that were previously thought to be too difficult for machines.

For sure, this revolution has created mixed feelings, who supports it fully and who pays attention to the risks that it may entail. The increase in automation connected to the launch of this digital revolution has the potential to improve business processes, productivity and efficiency. However, it also brings negative aspects. Among these negative aspects, there is the reduction in human capital demand, which justify that sense of fear due to human machine substitution. Recent discussion about the impact of these disruptive changes on employment have often polarized opinion: on the one hand who foresee limitless opportunities, on the other hand who foresee massive labour substitution and displacement jobs. This reduction concerns both the manual worker and the workers employed in administrative tasks. Another of the features of this Fourth revolution is the impact on white collars, not touched by the changes of the Third industrial revolution. White collars activities become low value added, because of the introduction of hardware and software integrated systems capable to replace the task in a more efficient way. The greatest concern, due to the reduction in demand for less skilled staff, is the rise of social disagreements.

According to Jeremy Rifkin[3], the risk in the future will be to talk about work only to a few highly specialized professionals.

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[3] American economic and social theorist, writer, public speaker, political advisor, and activist.

Since a revolution is underway, it is possible to speak about a more or less latent feeling of fear, generated by continuous development of technology and the increase level of automation. What is most frightening is the effect of human-machine replacement and the consequences that this phenomenon may have on the country's economy, business and people. It is also true that this widespread sense of fear is not new. In fact, also during the first industrial revolution in the United Kingdom, the people feared the use of the automatic filaments. Again, for example, in the 1964, the US president Lyndon B. Johnson established a national commission to establish the impact of technology on the economy and employment. Even at that time, there was the believe that automation did not have to destroy jobs but "can be the ally of our prosperity if we will just look ahead"[4]. However, history teaches that these revolutions have always brought improvements.

This fact is also confirmed by the words of Marco Taisch[5] who states that the consequence of this scenario may be that of a decrease in the number of jobs in favour of the machine. However, thanks to the new technologies and automation achieved, a company can achieve a higher level of efficiency. This brings greater gain that can be used to grow and create work.

Secondly, he adds that the other factor to keep in mind is that even more automated companies cannot ignore human labour. The substitution risk will only affect repetitive professions, but with the possibility to reallocate operators into supportive work. The more intellectual professions will instead benefit from this increase in automation. An example may be the doctor who will be less engaged in certain activities if it is substitute by a machine and will be able to devote more attention to other functions, increasing its productivity. Some repetitive activities are either disappearing or diminishing, which is true, but in the end, all industrial revolutions have always produced benefit in terms of employment. Therefore, work there will be but new skills will need. [6]

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[4] Source: A future that works: automation, employment, and productivity – Mckinsey global institute, January 2017 – McKinsey&Company
[5] Professor of operation management and advanced & sustainable manufacturing systems at Politecnico di Milano and member of the steering committee of the National Plan Industry 4.0
[6] Source: http://firstonline.info/News/2017/09/23/industria-4-0-taisch-polimi-la-tecnologia-non-fara-sparire-il-lavoro-/MTFfMjAxNy0wOS0yM19GT0w

Pace of change

Automation has always been seen as a force capable of changing the daily work activities of everyone, and the development of digital technology has a clear connection with this topic. The theme that remained and which remains unclear today, concerns the impact that these new technologies may have on employment and on the productivity in the global economy. This situation contributes to the creation of a sense of uncertainty about these changes.

The pace and extent of automation and as a consequence the impact on works will vary across different activities, occupation and skill levels. Definitely, automation will not happen suddenly, and five key factors[7] will influence the pace and the extent of its adoption:

- Technical feasibility: the technology used in order to automate specific activity has to be integrated and adapted into a solution. Only when this new solution reach the required performance level, it is possible to use in the workplace. to better understand: for typical work activities, the integration of sensors it is necessary and thus solution that integrated specific capabilities in context, must be engineered

- Cost of developing and deploying solutions: the cost to develop specific solution requires investments. This use of capital can vary between the decision of develop a new hardware technology, usually more expensive; or to develop a new software, generally adopted earlier due to the lower cost required. Anyway, over time, both hardware and software costs decline, making solutions competitive with human labour for an increasing number of activities.

- Labour market dynamics : the labour cost associated to the work activities that could be potentially automated, is affected by the complex dynamic of labour market. Labour supply varies in terms of skills that are influenced by intrinsic talent, by education and training. Therefore, the pace of the spread of automation is influenced by the time and money required in order to learn new skill to people.

- Economic benefits : the adoption of new technologies and automation could allow increasing profit, productivity, reaching higher quality, reducing variability, reducing waste, higher customer satisfaction

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[7] Source: A future that works: automation, employment, and productivity – Mckinsey global institute, January 2017 – McKinsey&Company

- Regulatory and social acceptance: it is necessary to remember that the rate of adoption of new technologies can be affected by contextual factors, such as regularly approval and the reaction of users. It is not uncommon that the adoption of new technologies brings a series of laborious changes. This type of change requires changes in organizational processes and practices; government policy can slow adoption. Moreover, even if the workers are compliant with the use of new technology, change their activities requires dedicated effort. The last aspect to not under estimate is the interaction. In the case of automation, individuals may feel uncomfortable about a new world where machines replace human interaction in some intimate activities.

The rapid pace of this innovation and the belief of some that this increased automation brings labour substitution and job displacement creates a fear of the human machine replacement, as we said before. Ambrosetti club, in his research, translates this fear in a percentage value, called risk of automation. This value represents the level of workers that risk of losing their work: to estimate the impact of the phenomenon the starting point has been the estimation of workers who will be lost due to automation and those that could be created thanks to the opportunities offered by the technology world. Through these estimates, it is possible to trace a profile of the characteristics of job that result in a substitution risk[8]. An employment has a low risk of substitution if:

- The work carried out has characteristics of non-repetition
- Creative and innovative skills required for the job
- Intellectual and operational complexity of the activities carried out
- Relational and social skills (empathy, persuasion, negotiation)

From this scenario, it emerges that activities that will have less impact on automation will be health-related, like psychology or surgery for example. The main reason is that this type of job is typically characterized by activities that are more complex and requires a strong relational component, creative and innovative skills. Instead, among the most at risk professionals, there would be math engineers, accountants, credit analysts who have a high level of education but easily replace jobs with digital innovations. In Italy, one of the sectors most affected by the automation is banking. The innovation of Internet banking systems and smartphone devices connected to the Internet led to a reduction in staff and a change in the work done in a branch. Tour operator and travel agency sectors

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[8] Source: Tecnologia e lavoro: governare il cambiamento – The European house – Ambrosetti, 2017 – Ambrosetti club

follow closely due to the diffusion of web platform, such as eDreams or Skyscanner, that change the habits of the customers who are able to organize a trip without the help of an intermediary. Until arriving at a case of disrupted innovation represented by Airbnb, which has add a new solution for accommodation. These are only some example about how the context is changing.

Another study focus his attention on the jobs that most suffered the impact of automation. The study by Frey and Osborne[9], estimates that the telecommunications companies are among the most automated professions, but also workers employed in the transport sector and in administrative jobs are subject to the automation. From this research, it is interesting to note that automation is no longer a phenomenon that concerns only workmanship, but it also involves higher specific occupations that may also require a high level of education. Some example could be the Offline information collector, or consultant for the preparation of tax return or accountant. Instead from the point of workers less likely to risk automation, it is easy to understand that the activity that are more difficult to automatize are those more complex that still require a strong presence of human. The main example in this case are the supervisor for risk prevention fire, doctors, supervisor role.

Moreover, the result of WEF research regarding the employment trend highlights that due to the accelerating pace of transformation there is a significant relative growth in some job families and significant decline in others. The computer job family will have until 2020 a high growth based on data analysis and software application development, then computing power and big data analytics constitutes a significant driver of employment growth. The mobility industry will have a significant growth in transportation and logistics roles. Maintenance and installation jobs instead will come face to face with the efficiency saving and labour substituting aspect of Internet of Things, IoT. Whereas financial and investors sector will undergo a significant shift of roles, with a major job growth for computer and mathematical roles such as data analysts and database and network professional.

This research also explicit the main new and emerging job categories, that will be expected to become critically important. Two types of jobs stand out, the first is data analysts, which companies expect will help them to make sense and derive insights from the huge amount of data generated by technological disruption. The second is specialized sales representatives, as practically every industry will need to become skilled in commercializing and explaining their offers in detail due to

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[9] The future of employment: how susceptible are jobs to computerisation, September 2016 – Carl Benedikt Frey and Michael Osborne

innovative technical nature of product themselves. Other new specialities frequently mentioned include new types of human resources and organizational development specialist and engineering specialist. What also this research confirm is that the skills profile of many jobs in the sector will change.

In order to have an idea of how activities can change through automation and usage of the new digital technologies, McKinsey in its research provide some cases coming from different sector. Two example of this are as follows[10].

In an aircraft maintenance scenario, the automation could raise safety, improve defect detection and reduce time wasted on walking and waiting. In fact, in the not automated scenario, technicians have to do visual inspection about wear or defects, remove manually some part to perform quality checking and they have also to carry out administrative tasks. All these activities required a huge amount of time on walking around the aircraft. Automation could have a high impact. Through it could be possible to use robots in order to scan the aircraft using an image process algorithm. Again, automation could enable technicians to centralize in the command centre all maintenance decision. Much of the routine work that technicians accomplish, especially the routine work, could be automated. Artificial intelligence algorithms could suggest potential problems based on logs even before inspection take place. Thanks to the use of robots it is also possible to remove people from hazardous area of the aircraft, likes fuel tanks, improving safety conditions. Performing an automated maintenance, the better performance gained account for 35% for the value created, while 65% could potentially come from the labour substitution.

Another example could be related to the implementation of automation in a grocery store. The scenario that is being prepared is that of a highly personalized experience that is faster, more tailored to the customer preferences. What can change is the use of personalized coupons on the mobile device; an automated back-room service sends out the good after the selection, or a drone drops them off at customer's home; no line for payment because there is no physical check put and the payment is automatically. This is a hypothetical future state, but the situation, today, is not far from this description. There is already the use of robots cleaner and automated storerooms already exists, augmented virtual reality product views are just a question of time. Therefore, all these automated solution contribute to improve the customer experience. Moreover, automation in a

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[10] For other examples refers to McKinsey&Company research

grocery could affect workers needed. There could be a shift of workforce from the front-end cashiers' activity, to a higher value added activities, such as customer engagement. An example could be Amazon, which in December 2016 launched a store without cashiers, Amazon Go.

As we can see, automation is a cross-sectoral phenomenon to more industrial sectors. This few example want to highlight that integrating technological capabilities, retraining staff and adjusting processes are fundamental aspect in order to maximize the benefits of automation. In addition, there could be a double benefits, resulting from improved performance, but also from the labour substitution. In fact, these two example confirm the fact that human workforce is still present with a different role.

However, increasing automation does not necessarily mean increasing innovation, evolving, increasing competitiveness, or creating new jobs. To realize this scenario just described, it is necessary to focus on the development of digital culture. This represents the most difficult modification to face since it is not possible to ignore digital innovation both in the workplace and personal field.

The challenges

In this context, business managers, policy makers and workers face considerable challenges in capturing the benefits coming from this revolution. The increase on both digital technologies use and automation will change the organization of companies, the structure, the bases of competition of industries and business model. Moreover, the individual activities are transformed by the use of these technologies and workers will perform activities that are complementary to the work that the machines do and vice versa. It could be claimed that workflow will change and new roles will emerge in this context.

How can you image the employment created by the Fourth industrial revolution pose a major challenge because this phenomenon brings with it also uncertainties about the social and employment repercussion. In fact, in order to take advantage of the opportunity of these new technologies, business leader need to redesign the most of their process organization. This is not a simple and immediate operation: to asses there automation could be most profitability applied to improve performance, business leader has to identify the activities of the organization, where automation potential is high. Then he has to apply the new technology solution that this revolution

provide in order to increase the efficiency. Once he decided how to reorganize the activity, he has to consider how to best redeploy the labour.

In the workplace, workers will need to interact broadly with machines as part of their everyday activities. For this reason, the retraining and skill raising programs will be important to support workers shifting to new roles and taking new activities. The lifelong learning programs allow the less skilled workforce to acquire strategic skills for managing new technologies. These initiatives could reduce the risk of substitution and above all offer the worker new career opportunities. It is therefore possible to say that new jobs created and lifelong learning initiatives mitigate the fear of job losses in favour of machines.

The possible effect of this phenomenon has been the economic actors and policy decision makers in front of a challenge: how can we balance the growth of economic efficiency and the protection of jobs? It is precisely related to this question that the research on these issues becomes fundamental: it is important, from the public decision maker point of view, to have well-founded data and information that can be a solid starting point for making decisions whose effects will be visible in the future.

It is interesting to understand how countries are organizing to seize opportunities created by the Fourth Industrial Revolution and to limit the negative aspects. Analysis of investment in research and development can be a significant factor. According to the Ambrosetti research, in the 2015, the country with the highest spending in research and development is Germany, 87,2 billion€. The lowest spending belongs to Spain, with 13,2 billion€; instead in Italy the spending in research and development was 21,9 billion€.

Another effect attributed to the spread of new technologies is the increase in the number of people in the scientific and technological sectors. These research points out that all the countries analysed growth in employment in this sector, except for Italy.

In addition, the level of digital skills of the population is significant and the graph, taking into consideration the two year-period 2015-2016, shows how the digital skills are spread among some European country. You see how Italy has not experienced any growth in the two-year period, and remains largely distant from the level of digital skills above the baseline level, the last part of the graph at the right side.
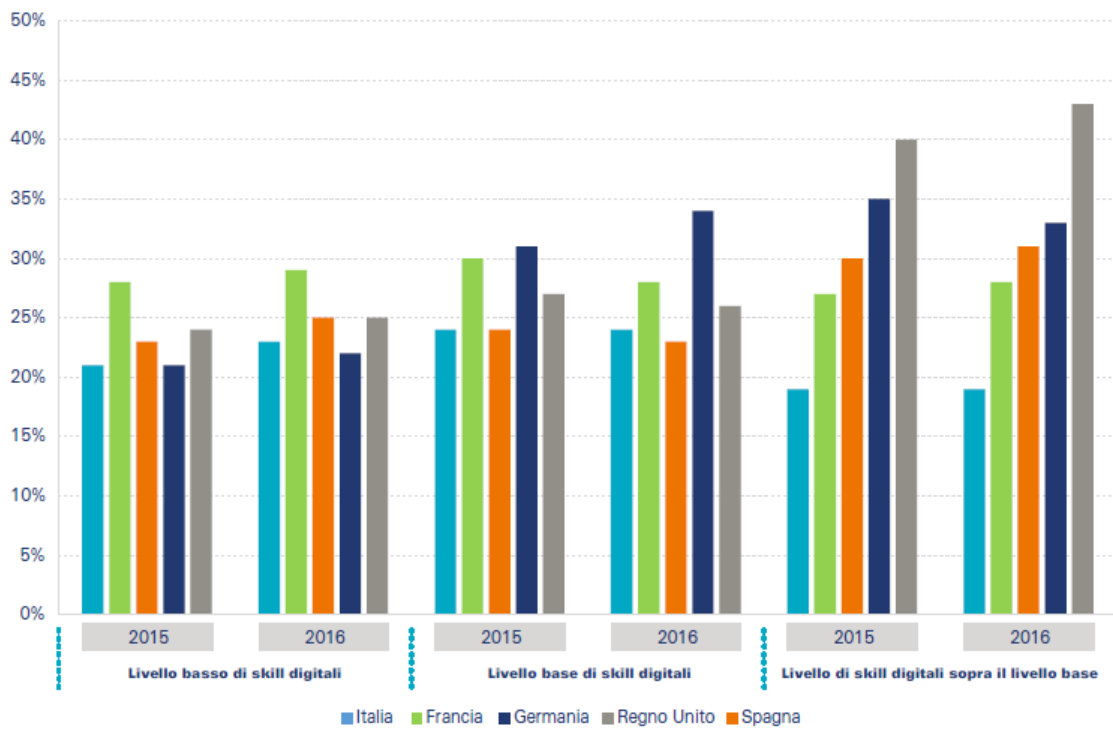

Figure 1- Percentage of population by digital skill level - Ambrosetti research

At the end of the analysis of these three factors, Italy results as a country that in recent years has not invested heavily in innovation and technology. Our country has failed to snap out the potential of the Third Industrial Revolution, but through actions aimed at the common interest, it could recover the gap by collecting the opportunities offered by this Fourth industrial revolution. Moreover, with this revolutionary situation, digital skills become more and more relevant. The diffusion of these skills and the level of preparation of workers are two factors to be carefully studied. Not only, business leader and their organizations will also need to become more aware about the evolution of the technologies themselves, understanding the art of possible and potential for the future in order to best position their enterprise to take advantage of automation.

The main question is how business, government and individuals will react to all these changes. This react has to be aimed to avoid the worst-case scenario not taking advantage from this development and in order to influence the future structure of the labour market. Three major action have been proposed at international level in response to the changes taking place.

- Introduction of the minimum wage: it ensures a basic level of remuneration that must be guaranteed to all workers. However, this action is not an effective way to cope with the risk of technological substitution.
- Introduction of universal income: it guarantees to all citizens a fixed entry regardless of their employment status. This action certainly contributes to ensure money for citizens, but this action do not influence the structure of the labour market and the ability to seize opportunities offered by the digital revolution.
- Robot Taxation: this action means that if a worker lose his work replaced by a robot, he is no longer subject to taxation and taxation has to be shifted to robots. The most dangerous consequence of this action would be to slow down technological adoption by companies.

At the national level, the Italian government has decided to stimulate investment in innovation and industry 4.0 with the formulation of the industry 4.0 plan. Through this plan, the objective is to promote the integration of digital innovations in companies. This plan envisages a public budget of 13 billion euros and a private commitment of 24 billion in the period 2017-2020. Investment incentives in this field are considered fundamental actions to relaunch our country. These investments would place Italy in the geographers of the digital world. It would also allow our country to be among the so-called early adopters countries and become a hub able to attract investment and talents. The main actions are

- Hyper and super depreciation: it supports and incentives companied to invest in tangible, intangible and capital assets to support technological and digital transformation
- Capital goods, or Nuova Sabatini action: it aims to facilitate the access to credit by companies and to increase the competitiveness of our country
- Guarantee Fund: it facilitates access to the financial sources of small and medium enterprises
- R&D tax: the goal is to stimulate research and development private spending to innovate processes and products and ensure business competitiveness
- Start up and Innovative SMEs: It is an action dedicated to new and innovative SMEs that includes tax breaks, administrative simplifications and insolvency law

- Patent Box: it introduces an optional tax regime for income derived from the use of intellectual property, industrial patents, processes or formula legally protected

At the same time, in his research, Ambrosetti also proposes to promote some action to spread the knowledge of new technologies among workers. These initiatives must support workers so they can benefit from this revolution. From this point of view, Italy still has much to do to ensure this opportunity for workers by giving them the opportunity to learn new skills related to automation.
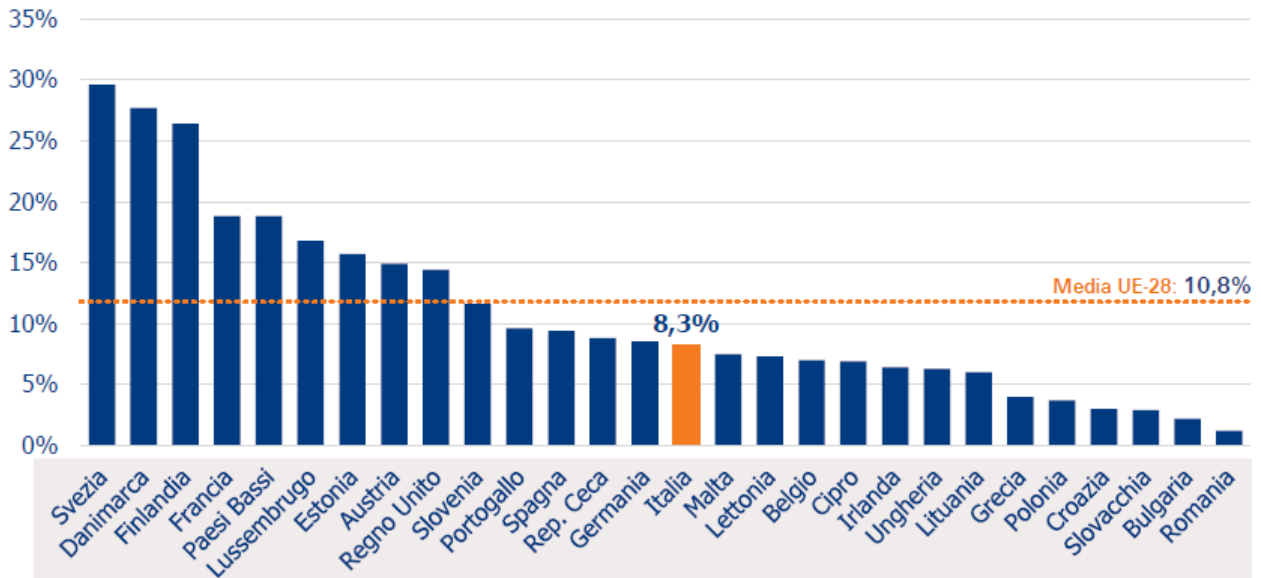

Figure 2- Population involved in a permanent education program – Ambrosetti research

From the graph it is immediately understood that Italy is far from European leaders for the offer of diving courses and below the European average.

Not being prepared to face the challenges of a technological change due to lack of knowledge can spoil unemployment and growing inequality. Therefore, reskilling and upskilling of today's workers will be critical.

Gap definition

One aspect that should be not underestimated is that technological disruption are likely to substitute specific tasks previously carried out as part of these jobs, freeing workers up to focus on new task leading to rapidly changing core skill sets in these occupations. Even those jobs that are less directly affected by technological change and have a stable employment view may require very different skills to define just a few years from now as the ecosystems within which they operate is evolving.

The action that is being undertaken is to reconvert and enhance the knowledge of the human resources already present through reskill initiatives. Differently, people already formed are demanded. In the first case, the main activities taken by companies include training course or job training initiatives; while in the second case the resources are sought in the university world. The trend that has emerged in recent years from the business point of view is an increasing demand for new job profiles linked to process innovation and digital innovation strategy. The table below represents the trend related number of vacancy per job.[11] It is clear, in general, the increase of this job that are related with the main digital technologies trend.

	2013	2014	2015	2016	Trend '13-'16
Developer	13523	18457	21319	26398	▲ 95%
System analyst	5238	6400	6806	8819	▲ 68%
ICT consultant	2571	3303	4052	6046	▲ 135%
Digital media specialist	2268	3240	3655	4343	▲ 91%
System architect	1121	1362	1916	2541	▲ 127%
Database administrator	1351	1557	1593	2377	▲ 76%
Test specialist	783	916	1263	1674	▲ 114%
Business analyst	450	585	695	1363	▲ 203%
Big data	286	470	530	1009	▲ 253%
Service strategy	371	475	572	869	▲ 134%
Network specialist	405	515	538	763	▲ 88%
Mobile	291	566	563	731	▲ 151%
Others	1433	1689	2014	3141	▲ 119%

Table 1 - Number of vacancies per job

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[11] Source: Osservatorio competenze digitali 2017 – scenari, gap, nuovi profili professionali e percorsi formativi

However, this search for new business profiles is not satisfied by the offer. This creates a first gap between those that are the company's needs and the reality of the offer. Furthermore, companies fail to cope with what is needed by the real world, which is evolving very rapidly due to digital innovation. This creates a second gap between the real needs of the context and the proposal coming from the companies.

The main gap is likely to be what exists between the needs perceived by individuals and the educational offer of Italian universities. What is missing is the integration in the university courses of knowledge related to digital innovation. Companies, today, require the students to have a high degree of pervasiveness of digital skill. Nevertheless, in our country, university education does not represent the way to support innovation. The specialization of workers is no longer the solution to recover the skill gap that could penalize the companies' innovation path. The challenge is the transformation of skills; it is therefore necessary to encourage the emergence of a new digital culture and to diffuse new digital skills. In both cases, the university will play a key role in addressing and accompanying changes.

At this historic moment, as we will see from the analysis, digital culture is very heterogeneous and the training courses do not meet the needs of companies.

Research questions

Technologies, automation and digitization lead to a context of deep change and to a series of questions. Universities and companies, along with the government, have to be the main actors of change in our country to take advantage of this digital revolution. The purpose of this study is to provide a vision of what is the state of diffusion and awareness of digital skills and themes that characterize this revolution. In particular, the gap between the demands from companies, regarding digital skills, and the offer that students represent is investigated. At this point, it is necessary to ask whether this gap that companies find in seeking and having resources with the adequate preparation is only the fault of the students or whether the university system that cannot provide the students to those that are the new requests. To answer this question, I have also looked at what is the situation of Italian universities regarding the offer of courses dealing with new digital themes.

Therefore, the research questions that I have approached are:

- Which is the students awareness relate to these digital themes?
- What is the need of companies and their awareness about the change brought by the digital disruption?
- What is the educational offer of universities in digital themes?

The ability to anticipate and prepare the future skill requirement and job content are critical in order to fully seize the opportunity offered by these trends. In the last years, many countries have undertaken significant effort to answer to this need of preparation. However, they focused the initiatives in STEM fields, but improving just this part was not sufficient to absorb the needs coming from the labour market. This means that disruptive changes, coming from this revolution, have and will have a significant impact on skills requirements in all jobs and that they are creating a range of opportunities and challenges in all industries.

Perhaps the most important factor in this fourth revolution, from the company, government and individual side is the hard work in order to be prepare to have success and to adapt workers to these new technologies. So the educational aspect becomes relevant because due to the cross-sectorial characteristic that this revolution express it is important to reskill and upskill talents from varies academic background. From this point of view, it is necessary that education providers, according to government and policy makers, improves the new required skills. This new improvements has to be established rapidly and prioritized in order to fulfil the gap among company needs and the level of preparation of the workers.

This issue is perceived and it is central in the Fourth industrial revolution, anyway there is no a full knowledge for those would be the consequences of these changes, but the revolution is starting and our country must be ready and proactive. In Italy exist some barriers to change management and future workforce planning. The WEF research indicates that there are a high impact due to pressure from shareholders and the desired short term profitability there are some resource constraint, but maybe the most alarming barriers are those caused by an insufficient understanding of disruptive changes, a workforce not aligned to innovation strategy and an insufficient priority related to this issues by top management.

If the opportunities of this new digital revolution does not captured, the negative effect of the spread of automation and new technology could have a negative impact both on the economic and social level. Automation technologies are advancing rapidly and those who are able to manage them effectively and take the lead in their sectors will gain a competitive advantage.

CHAPTER 2 - STATISTICAL STUDY ON ITALIAN UNIVERSITY STUDENTS

In this chapter, we want analyse students' awareness of digital culture, with the aim to have a picture of the skills and the digital mind-set of Italian student. To carry out this study, I joined the University2business, which is part of Digital 360 group[12].

The mission of Unviersity2Business is to disseminate digital culture, and entrepreneurship, to help the Italian university. For this reason, for three years, it is working to produce a research that provides a picture of what is the situation of Italian students facing digital and entrepreneurial issues. The research, which came to the third edition, is called "Il future è oggi : sei pronto? " .

In the scenario of Fourth industrial revolution, it is important to involve all student in this study, due to new digital technologies are no longer focused in a few faculties, but they are transversal among the different sectors. All these elements are the arguments to state that this research is an important cultural project. As already mentioned in the previous chapter, the players of the fourth industrial revolution are not only policy makers and business leaders, but also workers. Furthermore, also the today's students, that will be the future workforce that will contribute to the development of the country, have to be take into consideration along this study. It is therefore important to ask, now, about this issue not merely to understand their awareness of these changes that are taking place in the economy driven mainly by digital innovation; but also to notify them the relevance to know these technologies for their professional future.

To stress again the importance of knowledge the digital technologies in this historic period, the words of Elio Catania[13] reaffirm the concept. He defines necessary to have adequate digital competences to face the digital transformation. He defines the university population as a very interesting target for "fertilizing" this revolution. Again, he claims that in the next 3-4 years it is necessary to have, in the labour market, thousands of graduates ready to face with these competences; otherwise, we will not be able to support these changes. It is important to face this topic now, because digital technologies have created new market and unprecedented business opportunities. The digital transformation is characterised by a rapid pace, and in this context, it is fundamental to understand if the Italian student are aware of this scenario and if they are prepared to face with it once they will be in the work field. Moreover, companies, before engage in a digital

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[12] http://www.digital360.it/
[13] Digital Confindustria president

transformation strategy, need employees who have the right digital skills, who are able to control the key digital technologies in order to exploit their performance.

In addition, the main concept that go with these changes is the preparation. Prepared student are essential to take advantage from this unavoidable revolution. It is already in our everyday life, but how many of our students are aware of and prepared for it?

Digital competences and knowledge

The target of this survey was university Italian students; 2163 students have been sampled. The data were collected between 2/5/2017 and 16/6/2017 about the University-box tour at various university meeting. All university students under the age of 31 form the population of interest for this study. The results are based on a sample that can be considered statistically significant. The percentages shown in the charts are to be considered as referring to the entire population of Italian university students, which according to MIUR data at 31/7/2015 was 1652592.[14]

The survey is divided mainly in two section, one related to the digital competences of the student and the other related to the entrepreneurship knowledge of them. In order to have complete information about these topics look at report "Il future è oggi: sei pronto?" third edition. The focus of my work is only about the digital technologies, for this reason I will study the information coming from those question related to this topics.

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[14] http://statistica.miur.it/

The opportunities to take advantage from this revolution and from deployment of these technologies is a trend recognize by all. In fact, to the question how do you think digital technologies are changing the business strategies of companies on the market , the students answered in this way:
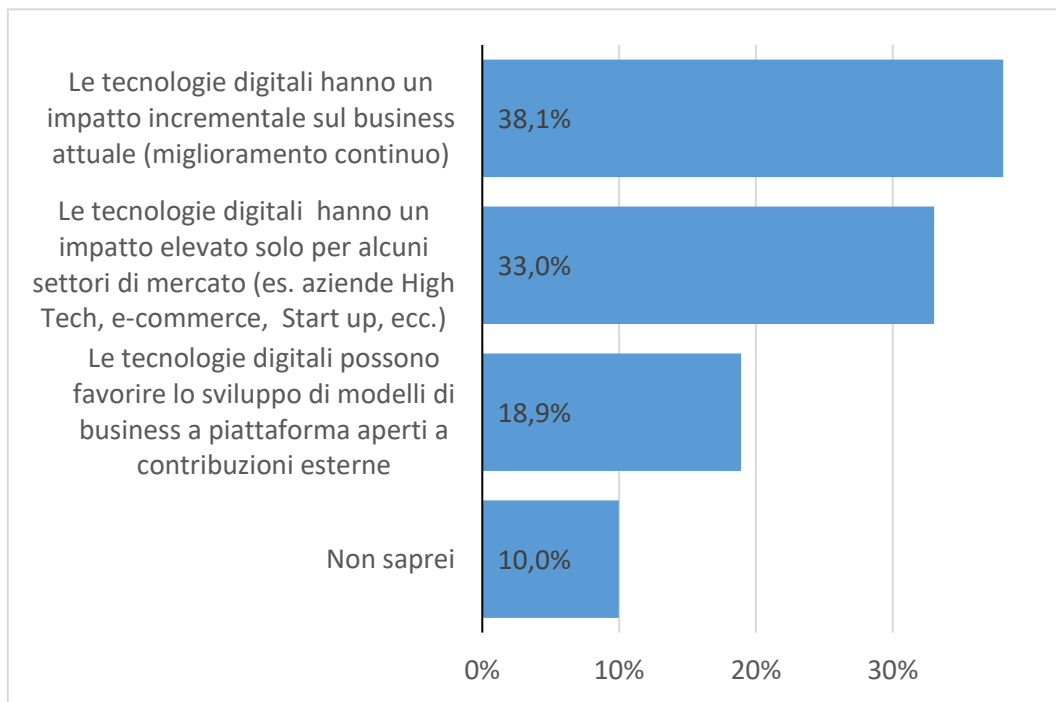

Figure 3-How do you think digital technologies are changing the business strategies of companies on the market? – University2business

The 90% of the sampled people perceive that digital technologies are leading a change in business world. Anyway, one-in-three university student think that this change touch only some sector of the market. Remain a portion of student that are not yet able to realize the direction of this change. This portion is significant in term of change awareness, as mentioned above knowing the consequences of this digital revolution is important not only for the institution and the development of our country but also for the future of the students. Not being aware of the changes implies not being able to take advantage from these changes.

A question in particular can give an idea of what are the student's knowledge related to the most important digital technologies and the main concept that belong to this revolution. They had to indicate for each of these topics their level of knowledge. In the section below, these topics will be discussed, giving a brief definition and showing the results.

E-PAYMENTS & BLOCKCHAIN

E-Payment[15], which means electronic payment, can be defined as paying for the purchase of goods and services on the internet. This type of payment include various method, like card payment, credit transfer or through payment providers, which are intermediary between customer's bank and the retailer. It was developed by the banking industry working together with technology providers, designed to address the requirement of payment via internet. The key aspect of this solution, which distinguish it from other online payment systems are that consumer is authenticated in real time by the institution's online banking. Then the availability of funds is validated in real time and the consumer's financial institution provides guarantee of payment to the merchant

When it comes to Blockchain, the definition is not unique. According to the opinion of some, Blockchain represents the next generation of the Internet. The Blockchain can be used as a platform or as a tool to create digital currency, known as bitcoin; but this technology is not limited to this field of application. Reply Company[16] tries to give a definition, setting it as a secure digital ledger, shared by all parties operating within a distributed network. It records and archives all transactions occurring within the network, ultimately eliminating the need for trusted third parties. Again, the Blockchain is an incorruptible digital ledger[17] of economic transaction that can be programmed to record not just financial transaction but virtually everything of value. This new technology started to establish itself at the end of 2014 and find the financial area the most impacted one.

However, this new technology has several other potentialities. It is valuable and guarantees privacy and trust in property rights and transfer, but also in IoT is important to certify the reliability of information transmitted by object and sensors. Again, Blockchain gives internet users the ability to create and authenticates digital information. The possible business application could be in smart contracts, in sharing economy without the presence of intermediary.

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[15] https://securionpay.com/blog/how-to-define-e-payments/
[16] http://www.reply.com/it/
[17] Blockchain revolution: How technology behind bitcoin is changing money, business and the world, 2016 ; Don Tapscott, Alex Tapscott

An early example, OpenBazaar[18] uses the Blockchain to create a peer-to-peer eBay. You can transact with OpenBazzar vendors, using the app, without paying transaction fees. There is no a real protocol of behaviour, it means that personal reputation will be even more important to business interactions than it currently is on eBay. Blockchain is the technology able to guarantee this lack of security.

It is important to know these two technologies because the future scenario confirms that they will be present in everyday life and not only in business fields. For sure they are quite recent technologies, especially Blockchain, and the sample of student confirm this fact by the 85,5% that never heard on it, on one hand. On the other hand they show themselves not aware that these technologies will be part of their future, in fact just 3,9% of the sample is learning about them and only 0,9% of the student know them.

Never Heard	Something Heard	I am learning	Deep Knowledge
85,5%	9,8%	3,9%	0,7%

DIGITAL MARKETING

Digital marketing is defined as the combination of marketing activities that use web channels to develop their business network, analyse market trends, predict trend and create offers on target customer profiles.

It refers to all those activities of promoting a brand and marketing products and services through one or more digital channels. Digital marketing is able to manage complex customer relationship across a variety of channels, it responds to dynamic customer interaction; it was able to extract value from big data to make better decision faster. Digital marketing is important because it can integrate traditional sales strategies and sometimes it is the only one used. If we think about e-commerce, we understand that the importance of a figure who knows how to attract online customer in the best way is fundamental for corporate profit.

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[18] https://blockgeeks.com/guides/what-is-blockchain-technology/

Digital marketing is a very active sector in recent years, especially for the aim of internet companies as a way to reach their customers by leveraging all the new tools that digital marketing offers, one example could be mobile advertising. About this concept, students were asked to give the right meaning of mobile advertising, and the 51,6% of them gave the right answer, choosing advertise products or services through mobile applications or mobile sites.
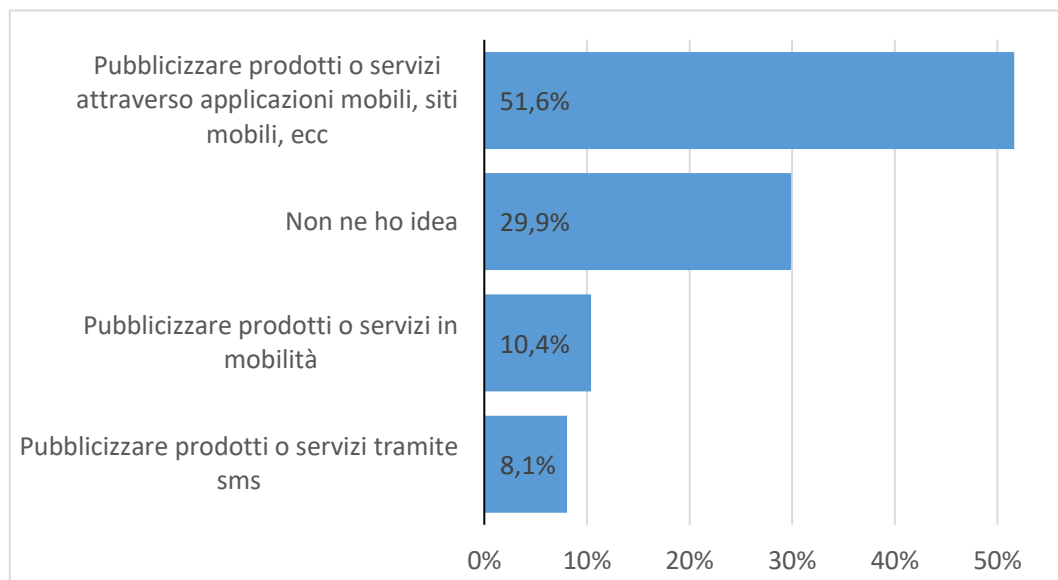

Figure 4- What does mobile advertising mean? – University2business

This result maybe is because the technology, that is increasingly used by companies, comes into play in many fields from computer science to humanities, from marketing to communication. Digital marketing and figures able to handle this business have become more and more popular in recent years. This trend is testified by the fact that 45% of students interviewed has heard of it. Moreover a significant percentage of the students are already study this issue.

Never Heard	Something Heard	I am learning	Deep Knowledge
35,4%	44,3%	17,1%	3,2%

INTERNET OF THINGS

The Internet of Things is a possible evolution of the use of the web, where the "things" become recognizable and acquire intelligence by being able to communicate data about themselves and access aggregated information from others.

All objects can acquire an active role by linking to the web. The things and the parts labelled by Radio Frequency Identification system or QR Codes communicate information through network or mobile devices. The internet of things technologies contributed to the diffusion of sensors, embedded computing systems, and connected using standard technologies. This allows field devices to communicate and interact both with one another and with more centralized controllers. It also decentralizes analytics and decision making enabling real time responses.

The applicability fields are many: smart home, industrial applications, automotive industry, digital payment, health, and logistics, to energy efficiency, remote assistance and environmental protection. As you can see, this technology can be applied in different areas of business; it is a typical example of how the fourth industrial revolution is not focused only in some areas but embraces many sectors.

Even if this technology is already spread among different sector, and the potentialities of it are many and the impact on jobs is relevant, only one in five students hear about it. Moreover, the percentage of students who do not know this technology is very high, nearly 65%.

Never Heard	Something Heard	I am learning	Deep Knowledge
64,8%	21,4%	9,4%	4,4%

CLOUD COMPUTING

NIST[19] defines cloud computing as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristic that are, on demand self-service, broad network access, resource pooling, rapid elasticity, measured service. IBM defines cloud computing as the delivery of on-demand computing resources over the internet.

This technology is one of the most used and spread today, many companies are already using cloud based software or some analytical application. This technology required increased data sharing across sites and company boundaries, but at the same time, the performance of cloud technologies improves, achieving very high reaction times. This improvement leads to increasingly deployed

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[19] National Institute of Standards and Technology

machine data and functionality to the cloud. It has changed the logic function of the technologies by favouring greater flexibility. It needs capability to manage systems with cloud logic and be able to interact with a cloud strategy.

Despite the fact this key technologies is almost diffuse, and it get into the common language, just a small part of student knows cloud computing. Almost 30% of the sample of student claim to have heard about it, but the 55,8% of student never heard this technology.

Never Heard	Something Heard	I am learning	Deep Knowledge
55,8%	27,9%	12,4%	3,8%

If we go further to investigate the knowledge of cloud computing, we see how only a few percentage of students has the concept, only the 5,8% select the right answer defining cloud computing as computational resources distributed and remote accessible. Instead two students on three think that the right definition of cloud computing is online data storage.
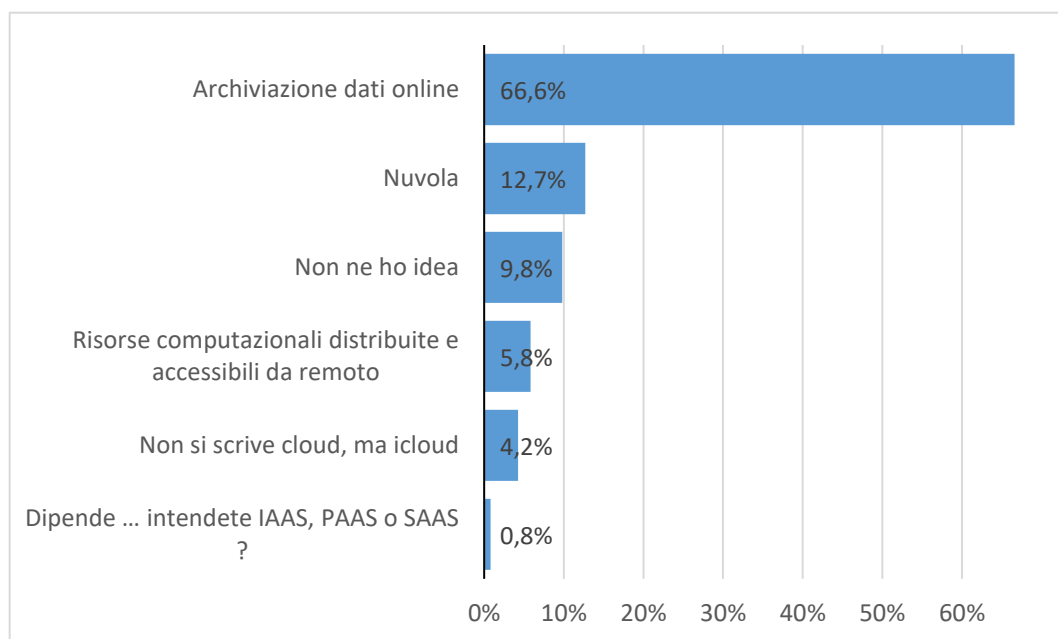

Figure 5- What does cloud computing mean in computer science? – University2business

BIG DATA ANALYTICS

Starting from the concept of Big Data, we mean all the information inside the company, but also from many sources such as social networks, IoT that create such a copiousness of data so that the use of technologies and specific tools will be necessary.

Moreover, big data sources continue to evolve and grow, and new data continue to be generated not only internally but also from public resources such as the web and social media and more and more from the diffusion of sensors. Especially for companies it becomes crucial to be able to identify new sources, incorporate into data management platforms, and develop a knowledge capable of managing this amount of data to exploit it to their advantage. This revolution contributes to the arise of large datasets to be analysed.

The collection and comprehensive evaluation of data from many different sources will become standard to support real time decision making. This trend is evolving very fast and, above all, it grows in terms of volume and variety of data. So having the ability to analyse data to give them a useful purpose for the company is a strategic activity. This rapid development is likely to occur faster than the speed of improving the ability to use this data.

Big data represents a great business opportunity, what is often missing is a clear strategy to exploit them and above all a figure that can handle them. In this regard, we can talk about the new figure of data scientist. The evolution of analysis systems and the strength of big data have highlighted a problem of skills, the purpose is to understand the complexity of the data and exploit them in terms of decision making, this is the challenge according to Paolo Pasini[20].

Italian students are also in this case not well prepared in this subject, with a significant 62% of samples who have never heard of big data analytics. Despite this urgent need for figures able to handle and interpret the large amount of data, only 10.9% of students say that they are studying these subjects and 2.7% is already aware of it.

Never Heard	Something Heard	I am learning	Deep Knowledge
62,0%	24,4%	10,9%	2,7%

When a theoretical definition of what big data are is asked, about 40% of students are able to define this concept in the right way, such as a collection of so extensive data in terms of volume, speed and

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[20] SDA professor of Information system and IT/Digital management at SDA Bocconi school of Management

variety requiring technologies and specific analytical methods for extracting valuable information. However, another 40% of them have no idea what the big data are.
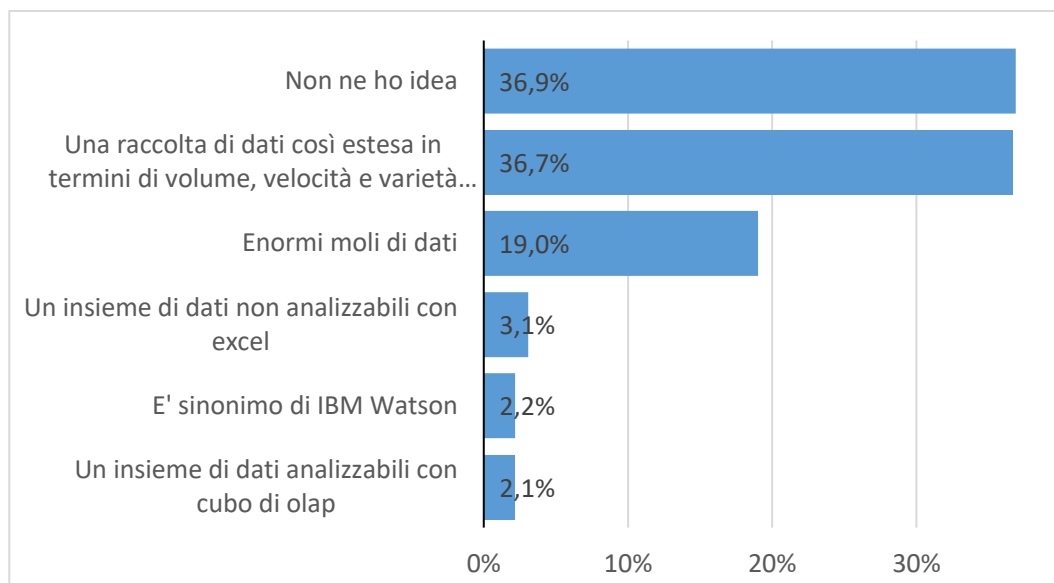

Figure 6 . What does Big data mean? – University2business

COGNITIVE COMPUTING

Cognitive computing[21] describes technologies that are based on the scientific principles behind artificial intelligence and signal processing, encompassing machine learning, human-computer interaction, natural language processing, data mining and more. Its aims is to solve complex problems characterized by uncertainty and ambiguity, problems that until now are only solved by human cognitive thought. Cognitive Computing is the technology that in the future will allow us to interact with computers much more immediately and naturally than today, practically communicating with machines and exploiting their ability to learn from experience. The main advantages will be all those fields where it is necessary to process large amounts of non-homogeneous data that are hard to interpret by traditional IT applications.

The imaginable uses of cognitive computing are many and in the most diverse environments. For example, in the field of medical diagnostics: cognitive-computing-based applications could help doctors in analysing the data of patient laboratory examinations, interpreting them in the light of the most up-to-date research, providing useful answers to accurate diagnosis and effective

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[21] https://www.digital4.biz/executive/approfondimenti/cognitive-computing-una-rivoluzione vicina_43672154787.htm

therapies. This technology can be applied in a variety of industries, from finance, to health, to travel and to the sport entertainment.

In this case, a huge percentage of student never heard about the cognitive computing, just a few heard something and less than 10% is learning something or know cognitive computing.

Never Heard	Something Heard	I am learning	Deep Knowledge
73,0%	17,7%	8,5%	0,8%

AUGMENTED & VIRTUAL REALITY

Virtual reality is an artificial, computer generated simulation or recreation of a real life environment or situation. Instead, Augmented reality is a type of interactive, reality based display environment that takes the capabilities of a computer generated display, sound, text and effect of enhance the user's real world experience; this system can support different services. It is in their initial status, but in the future, companies will make much broader use of augmented reality to provide worker with real time information and to improve decision making and work procedure especially in the industry field. Augmented reality and virtual reality are inverse reflections of one in another. Virtual reality offers a digital recreation of a real life setting, while augmented reality delivers reality elements as an overlay to the real world.[22]

2016 was a breakthrough year for virtual reality and augmented reality and at the beginning of 2017 the industry is looking to capitalize on this scenario. Despite this trend, 63.2% of students have never heard of these concepts. while about 1 out of 4 respondents claim to have heard it and only 2.5% have a thorough knowledge of this, but this can be justified by the young age of these technologies.

Never Heard	Something Heard	I am learning	Deep Knowledge
63,2%	24,1%	10,3%	2,5%

E-INVOICING & DEMATERIALIZATION

Electronic invoicing, also called e-invoicing, is a form of electronic billing. E-invoicing methods are used by trading partners, such as customers and their suppliers, to present and monitor transactional documents between one another and ensure the terms of their trading agreements

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[22] http://www.augment.com/blog/virtual-reality-vs-augmented-reality/

are being met. These documents include invoices, purchase orders, debit notes, credit notes, payment terms and instructions. E-invoicing includes a number of different technologies and entry options and is used as an umbrella term to describe any method by which an invoice is electronically presented to a customer for payment

The dematerialization of a product literally means less, or better yet, no material is used to deliver the same level of functionality to the user. Sharing, borrowing and the organization of group services that facilitate and cater for communities needs could alleviate the requirement of ownership of many products.

This two technologies coming with the fourth industrial revolution, but almost the 50% of students never heard about them. The other part just the 2,8% have a deep knowledge and the 13.4% are learning about these topic.

Never Heard	Something Heard	I am learning	Deep Knowledge
48,9%	34,9%	13,4%	2,8%

Students were also asked to choose among some alternatives the definition about the e-invoicing technology, but only 25,6% of the student was able to give the right answer.
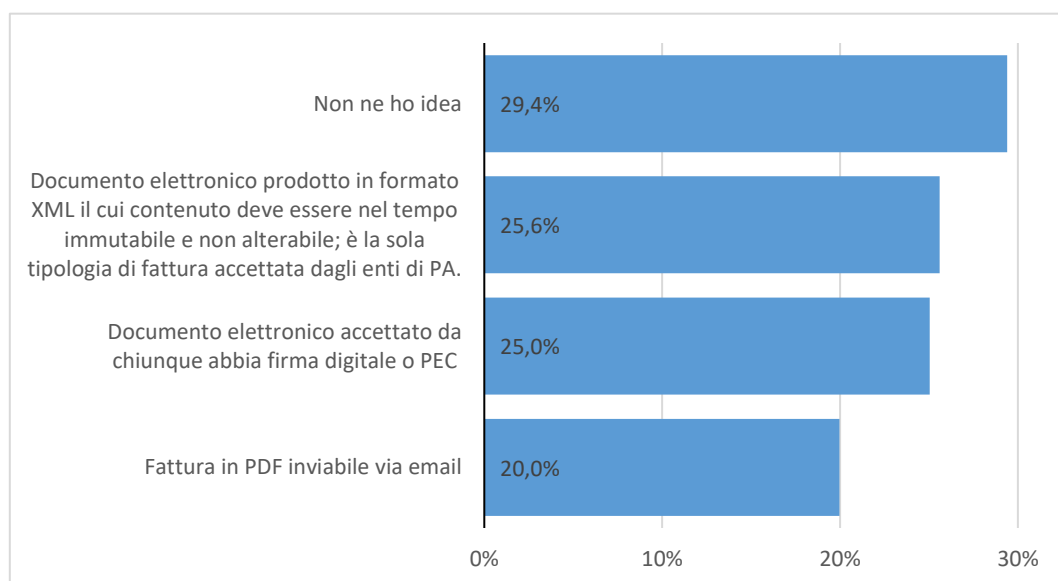

Figure 7 - What does e-invoicing technology mean? - University2business

SOCIAL MEDIA

Social media is the collective of online communications channel dedicated to community based input, interaction, content sharing and collaboration. They are websites and applications dedicated to forums, blogging, social networking, social bookmarking, and social curation. Some example or social media are:

- Facebook : popular free social networking website that allow people to registered users
- Twitter : it is part of the blogging family, in particular it is a microblogging service that allows users to share short post
- LinkedIn : is a social networking site designed for business community
- Instagram : is a social dedicated to a photo sharing

In this regard the most used social networks in our country, from the research We are social[23], are
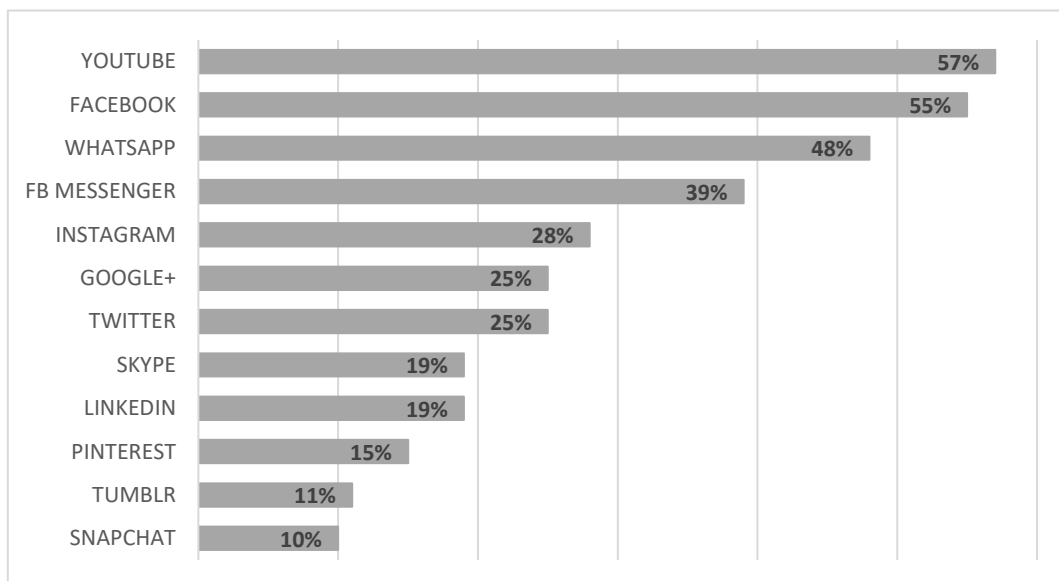

Figure 8- The most used social network

Although not always included among the social, YouTube remains in the head as the most used by the Italians, but immediately followed by Facebook. If we do not consider the messaging applications - WhatsApp and FB messenger - to the third place, we find Instagram, followed by Twitter, LinkedIn and Snapchat.

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[23] https://wearesocial.com/it/

These numbers validate the fact that among the listed technologies and concepts, social media is the best-known by the interviewed students, recording the highest percentage of users who have a deep knowledge, 27,4%. Just the 18,4% of student claim to never hear social media, very low compared with all the other digital technologies analysed. Furthermore, social media are becoming more and more important for the companies as a way to increase visibility and create direct contact, to engage with new potential customer and the presence in the social media can lead to increase revenue. That is why it is fundamental to know how to handle these tools in the workplace and to have a knowledge of all their potentiality.

Never Heard	Something Heard	I am learning	Deep Knowledge
18,6%	27,0%	26,9%	27,4%

UI-UX DESIGN

UX stands for User experience. User experience can be sees as the set of feelings, emotions and memories that the user tries to relate to a site, product or brand. User experience Design is therefore the discipline that studies the user experience, ranging from cultures, feelings, and capabilities to bear in order to put them in the best conditions to be able to experience a positive experience. UX involves an efficient and robust design, because it is based on evidence gained from comparing with real users. It is necessary a strategy that focuses on user needs, taking into account its features and the way it is used; identifying the times a user relies with the site in order to design the initial approach, interaction and results of that fruition, consistent with a positive overall experience.

The User Interface (UI) design discipline deals with creating the interface through which the user can enjoy content or services; some examples are websites and the app. UX and UI design should not be confused as they represent two different moments in the production of an interface. These two areas work together to define the relationship that the user will have with the site, product, or service. A recent research by TAG[24] innovation school declares that 27% of SMEs will want to hire an UX-UI designer in the next 3 years.

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[24] https://innovationschool.talentgarden.org/ux-designer-cosa-fa-quanto-guadagna/

This technology seems to be unknown to students, 84% of them have never heard of it and less than 10% have heard of it.

Never Heard	Something Heard	I am learning	Deep Knowledge
84,0%	9,7%	5,4%	0.9%

DIGITAL BUSINESS STRATEGY

Digital business strategy is most relevant to changes in business models and uses technology to create the capabilities a company needs to become a digital business. It is not an easy and rapid process, but it concerns a digitalization change through a continuous process of transformation. A digital business strategy specifies the direction that an organization has to take to create new competitive advantage. Digital technologies with this revolution becomes more pervasive, companies move in the digital transformation, today digital strategy, and business strategy assume the same meaning. The most critical work to do is to define a precise strategy to ensure that technology is being implemented in a way that supports the business objectives.

Therefore we can say that this concept is very related to the need of create a new business model, but the 56,8% of the student have no idea about this concept, just 2,3% of them know exactly this theme.

Never Heard	Something Heard	I am learning	Deep Knowledge
56,8%	29,3%	11,6%	2,3%

INDUSTRY 4.0

We talk about Industry 4.0 when a variety of technologies, from the automation to the Internet to things, from cloud to big data, from sensor technology to artificial intelligence, are used in production processes, ie factories, to collect real-time data make them immediately available to those who make decisions, which will take them faster and even better. "[25]

Industry 4.0 transform the design, manufacture, operation and service of products and productions systems. Industry 4.0 paradigm refers to the digitization of production and logistic activities.

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[25] Source: http://firstonline.info/News/2017/09/23/industria-4-0-taisch-polimi-la-tecnologia-non-fara-sparire-il-lavoro-/MTFfMjAxNy0wOS0yM19GT0w

It implies new production formats, the introduction of new governance models and business organization. It presents a lot of opportunities for innovative producers, system suppliers. New workforce with innovation abilities and IT related skills are necessary to face this change. Most organisation are still in the early stages of preparations for industry 4.0, but this vision is always more diffused.

It is astonishing how nearly 80% of students are unaware of the change that is closely tied to the Fourth Industrial Revolution

Never Heard	Something Heard	I am learning	Deep Knowledge
73,8%	15,9%	7,9%	2,4%

The different research of University2Business are always investigate also two areas that allow us to understand the degree of preparation of Italian students. We are talking about the use of the major social tools, of which we first emphasized the potentialities, and software development skill. Social media is changing the way it communicates and collaborating with the outside, it is increasingly necessary to know this tool to be able to set up a social strategy in line with the company's business model.

This section aims to highlight how the social media phenomenal took place over time among Italian university students. Anticipating the results, all listed social networks have a growing use, with the exception for the management of blog or a website.

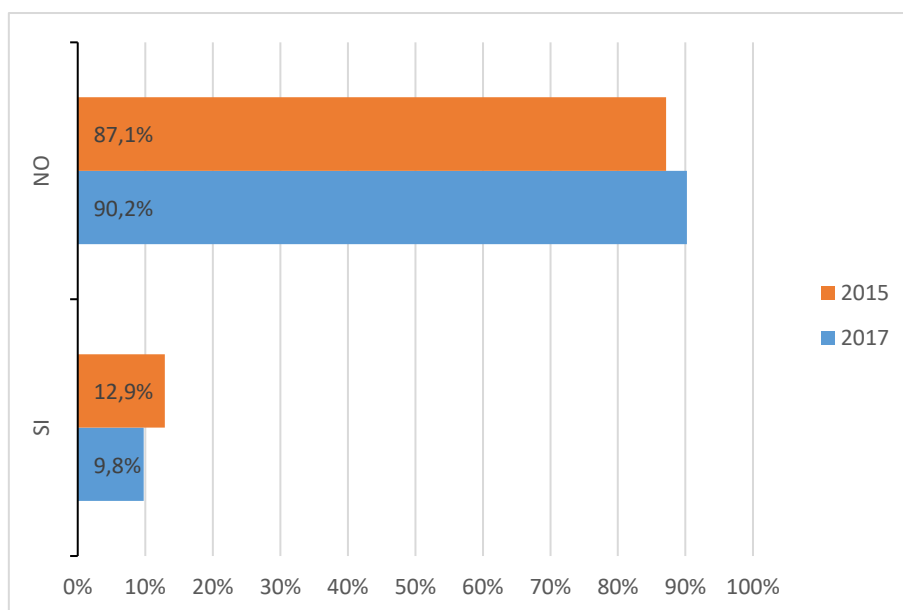➤ Do you have a blog / site or contribute to the management of a blog site?

Figure 9- Do you have a blog/site or contribute to the management of a blog/site? - Unvieisty2business

There is a negative trend in the creation of blog or a website. Moreover, one in five student, who in the 2017 questionnaire said to have a blog, claim to have a blog but that this is inactive.

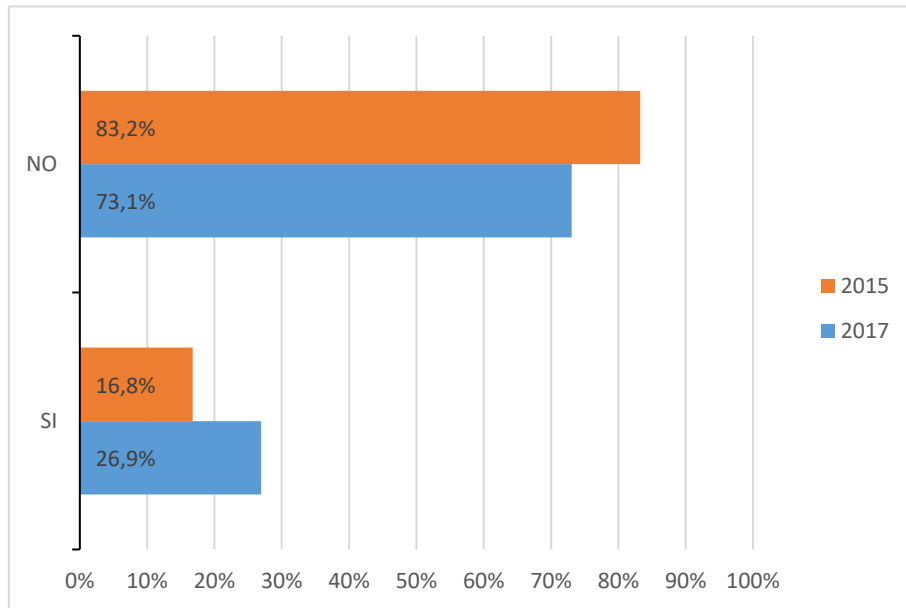➤ Do you manage a Facebook page, in addition to your personal profile page?

Figure 10- DO you manage a Facebook page, in addition to your pesonal profile page? - University2business

Data tells us that Italian students have greatly increased the use of Facebook. Therefore, there is a growing awareness that Facebook is a platform that can be widely used for various purposes, and that it is capable of reaching many people. It is interesting to understand the approach of today's students to this social network. For this reason, we decided to investigate the purpose they have a Facebook page beyond the personal one. Asking also the main content that they share in this page.

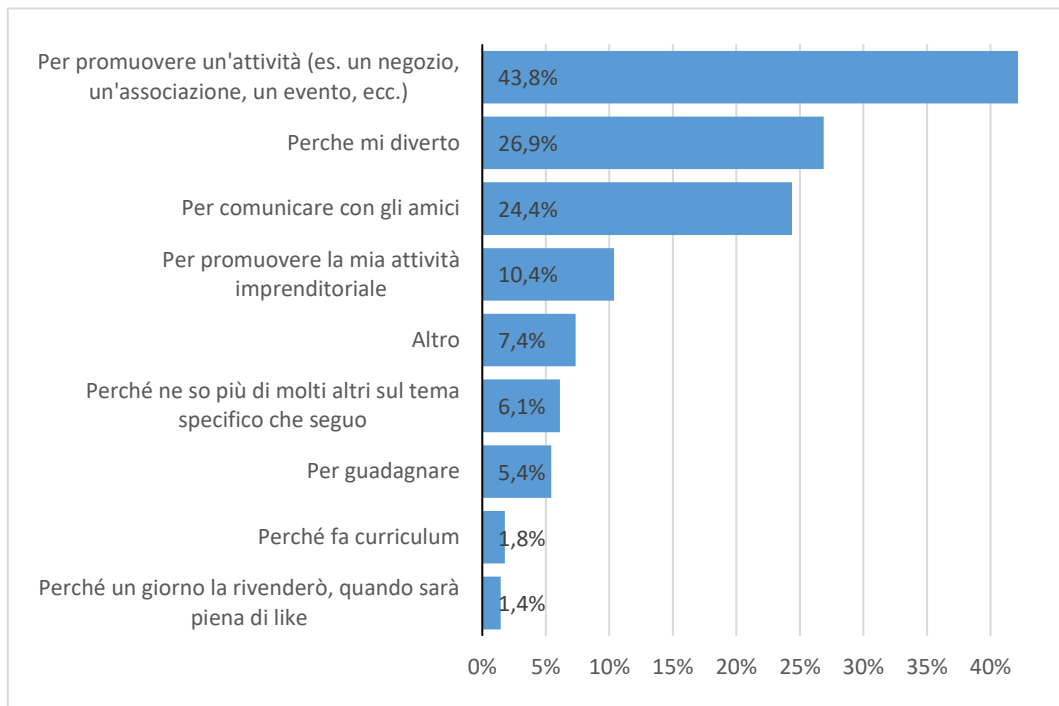- Why do you have a Facebook page beyond your personal page?

Figure 11- Why do you have a Facebook page beyond your personal page? - University2business

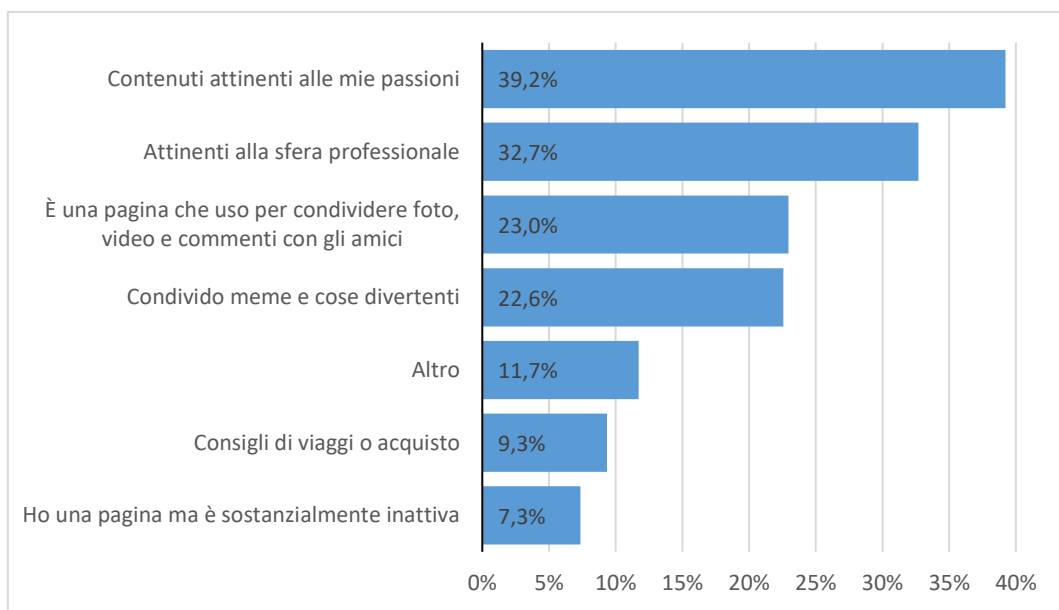- What kind of content do you share on this Facebook page?

Figure 12 - What kind of content do you share on this Facebook page? - University2business

It is very interesting to note that besides the most predictable answer such as sharing passion-related content, or for communicating with friends, there is a relevant business-related answer.

In fact 43,8 % said that they have an additional page to promote an activity. As concern, the contents shared in the additional page, one in three students said to share material related to business. Facebook is a great tool for integrating and strengthen a promotional or communication campaign for a business, with the main advantage of being visible in a virtual square where ordinary people are present in mass.

➢ Do you have a YouTube channel?
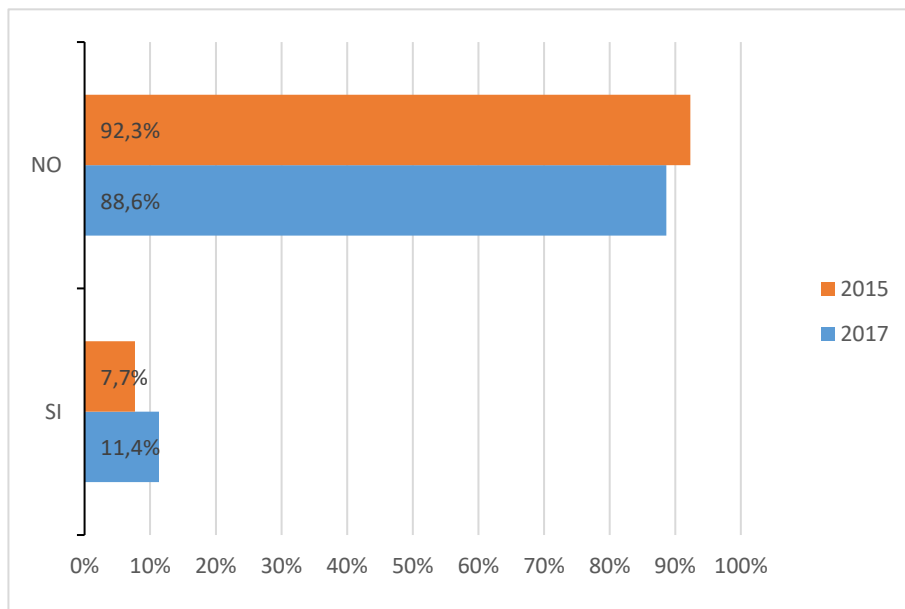

Figure 13- DO you have a YouTube channel? - Univeristy2business

The percentage of students responding to this question is also increasing in this case. However, students who responded to the third edition of the research question only a small one manages the channel assiduously. While 35% claim to make it sporadic, and 66% of respondents respond to have an inactive YouTube channel.
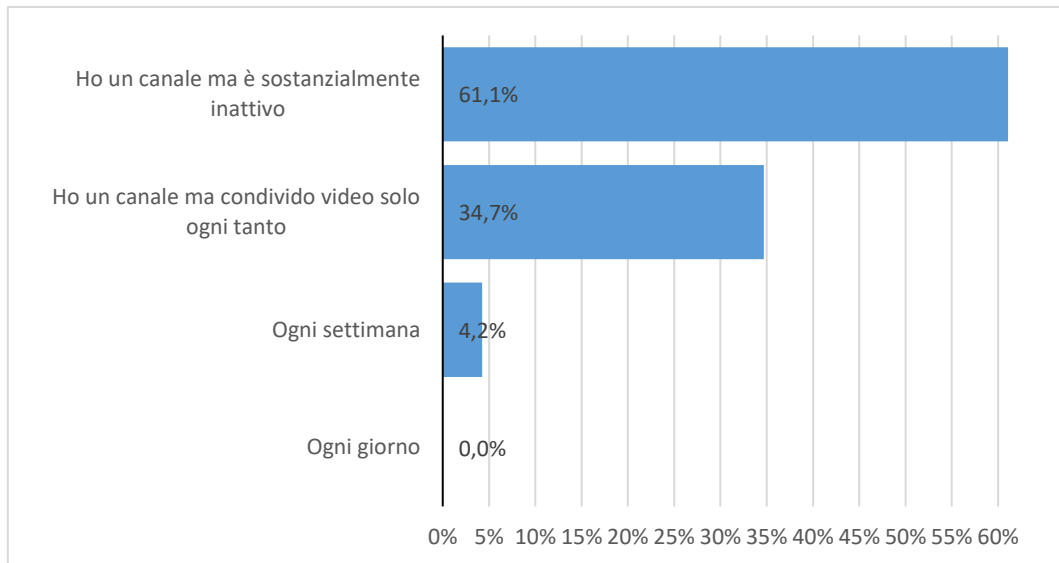
Figure 14- How often do you upload videos to your YouTube channel? - Univeristy2business

> ➤ Do you use Twitter?

Figure 15- DO you use Twitter? - University2business

There is an increase of 5 percentage points on the use of this social. Interestingly, most of the people use this tool to interact with content rather than create a reputation by sharing their content.

Figure 16 - Why do you use Twitter? - Univeristy2business

> Do you have an Instagram account?
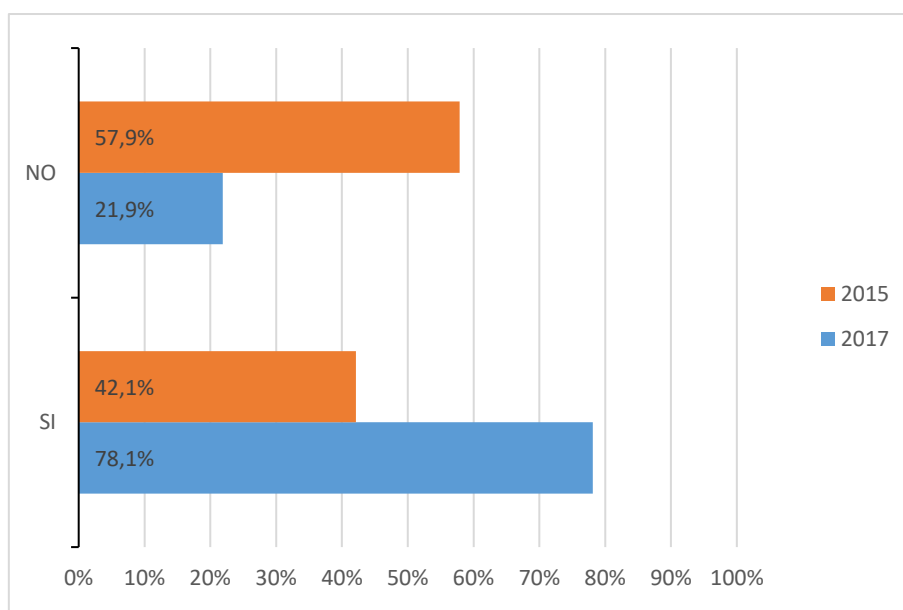
Figure 17 - Do you have an Instagram account? - University2business

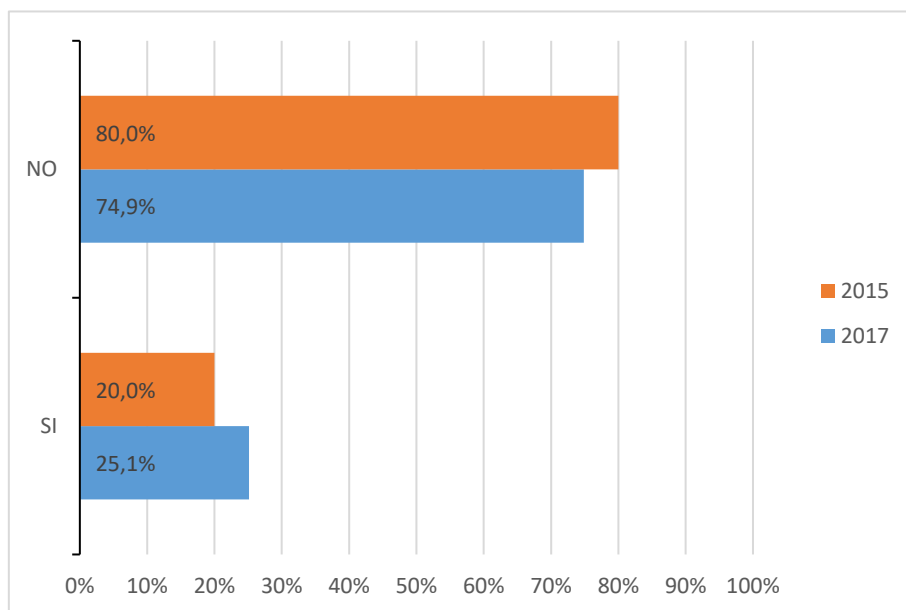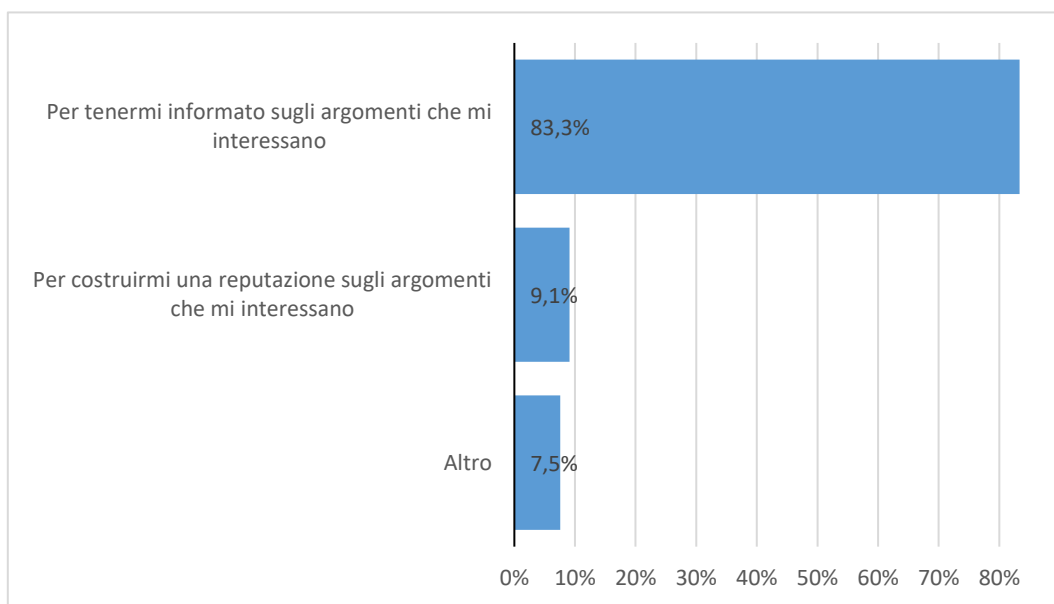Instagram is the social that has recorded the highest increase in use among university students. This can be attributed to the fact that this social has become re-envisioned and a simple platform for posting photos has become a powerful communication tool that provides great visibility to those who use it.
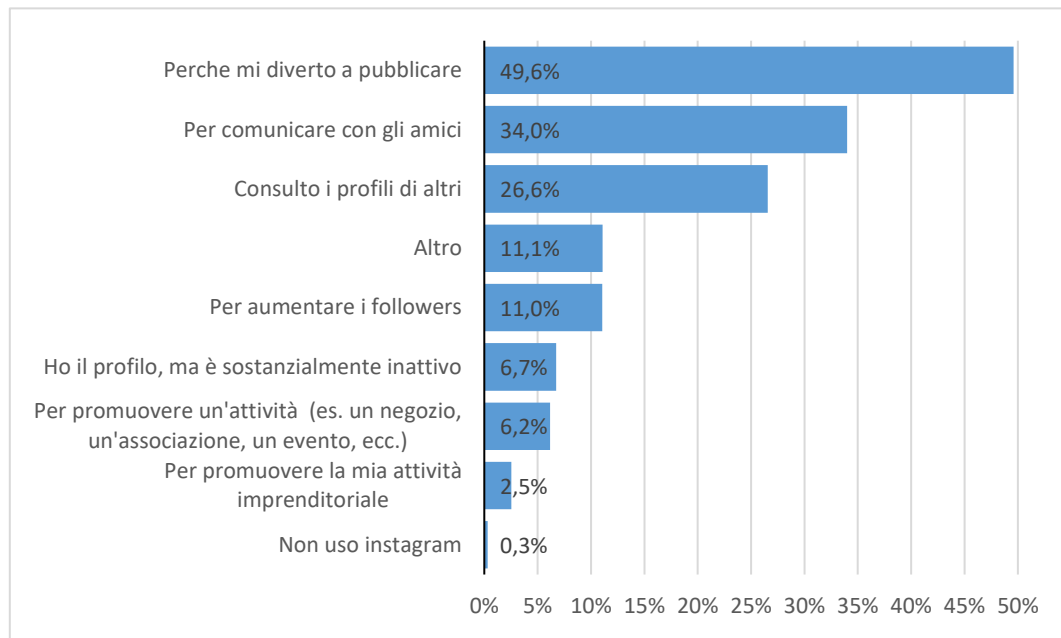
Figure 18- Why you use Instagram? - University2business

This social as opposed to Facebook has an end devoted mainly to the personal sphere. It is a phenomenon very popular now, only 0.3% declare not to use it. Used as a tool to publish and keep in touch with friends, today's students are not seen as an effective tool to promote a business either personal or general, only 13% use it in this way. You can see in this case how this kind of social use is used by most of those who use it only to stay in touch with friends or share photos or videos with a purely "playful" purpose and not aimed at sponsoring a own or another activity.

- Do you use LinkedIn?
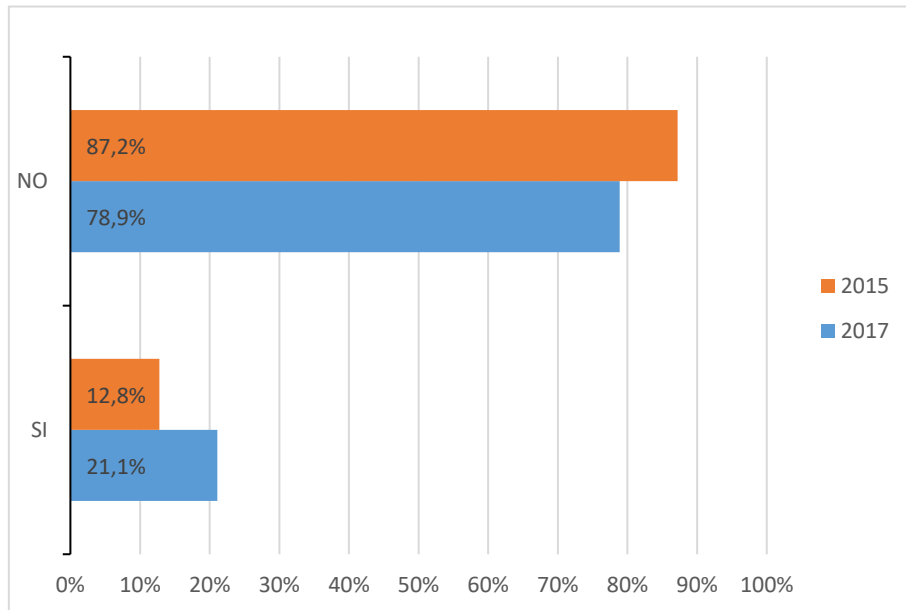
Figure 19- Do you use LinkedIn? - University2business

Among those listed this social is the one most aimed at the professional sphere. This tool allows students to get in touch with the work world. More than 50% use this social only for the request coming from business world, in fact, many companies have started using this social as a recruiting tool. 23.9% of students who answered to use LinkedIn, use proactively this social to create their own business network know that this is the best tool to build their own contact network.
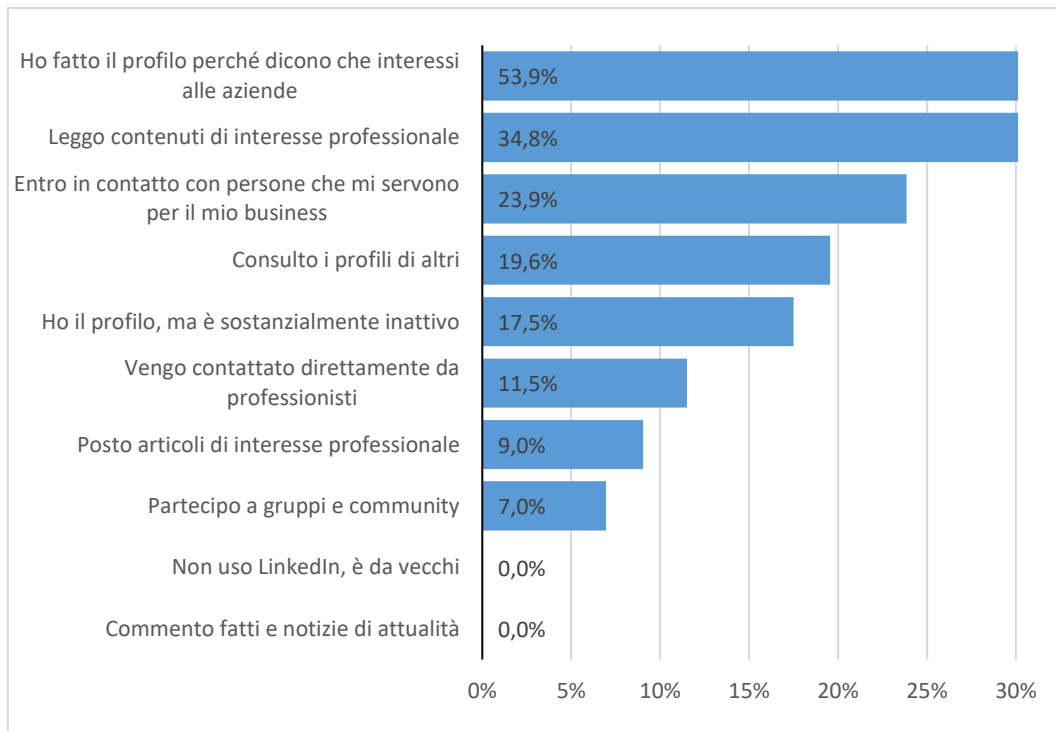
Figure 20- What kind of acitivity do you do on LinkedIn? - University2business

51

➢ Do you use Snapchat?

To complete the social network framework used in 2017, students were asked about the use of Snapchat.
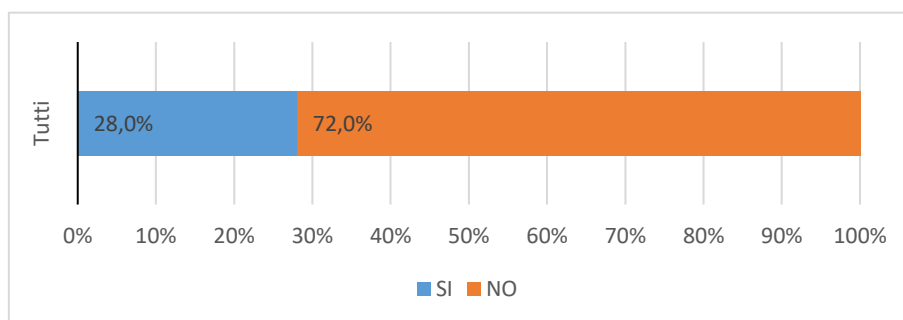
Figure 21- Do you use Snapchat? - University2Business

Less than one on three university student uses this social and it is used only as a pastime without any other purpose.

SOFTWARE DEVELOPMENT

Moving on the software development, student have been asked if they know how to develop a software of if they are learning.
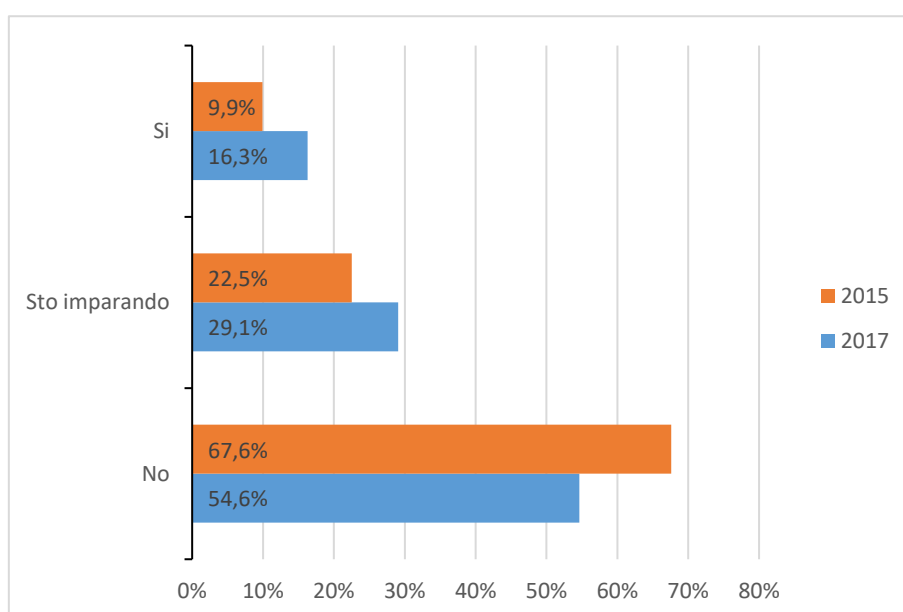
Figure 22 - Trend: Are you able to develop software? - University2business

The percentage of university students who know or are learning to develop software has increased. In particular, those who claimed to be able to develop software, almost 65% developed at least something while 34.2% did not develop anything.
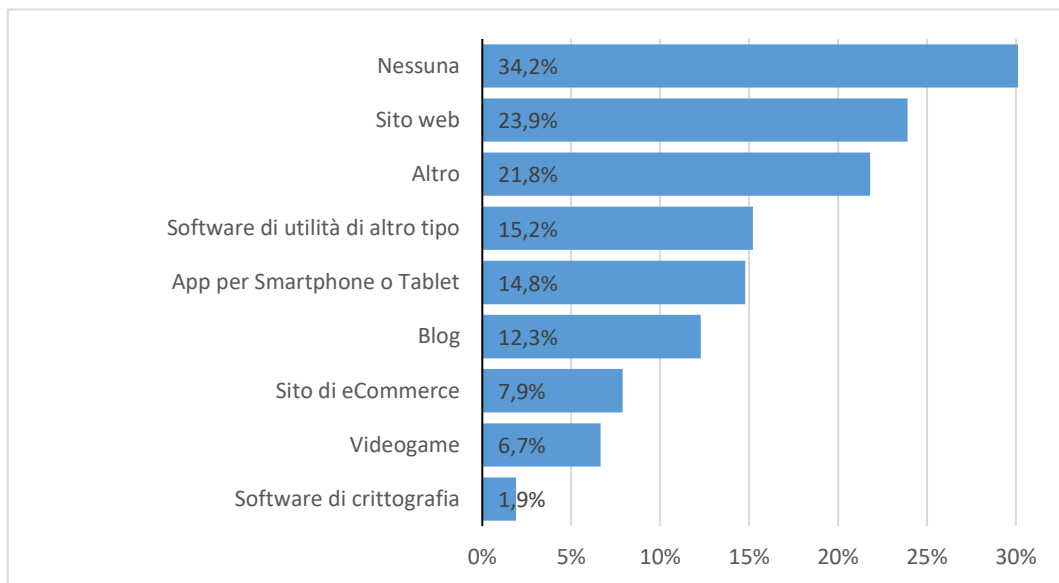
Figure 23- Have you ever develop or are you developing something? - if they know - University2business

The percentage of those who did not develop anything increased in the case of students who said they were learning, reaching 50.9%
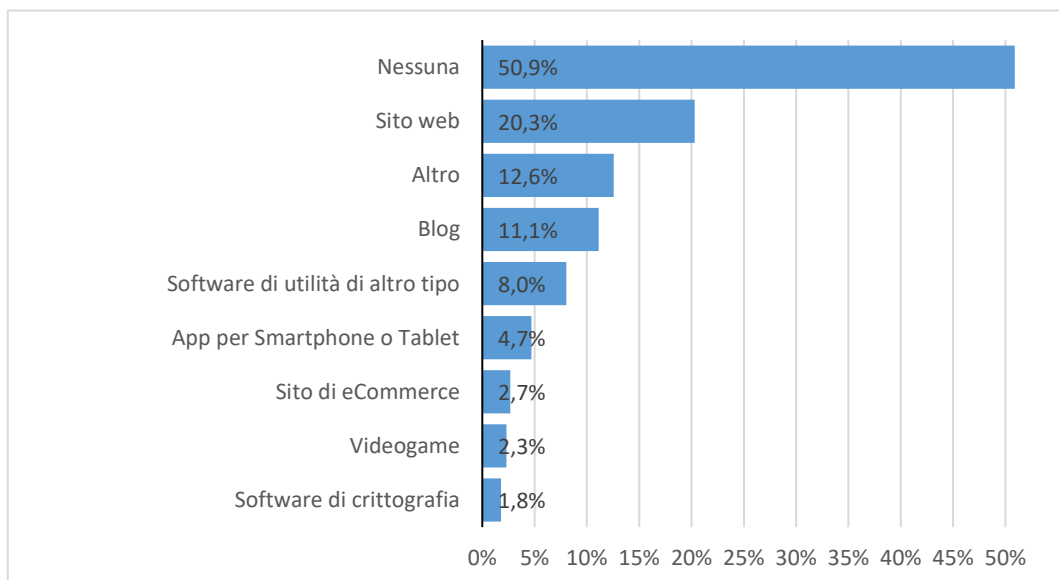
Figure 24- Have you ever develop or are you developing something? - if they are learning -University2business

Some considerations

From this analysis it can be said that the percentage of student who deal with, know, use tools such as social network have increased compared to the 2015 scenario. In addition, even the student who are learning and who are able to develop software have increased compared to the first search. From the graph below it is interesting to notice that the software development is increased among different faculties, from engineering and medicine to humanities faculties, with a great increase in computer science.
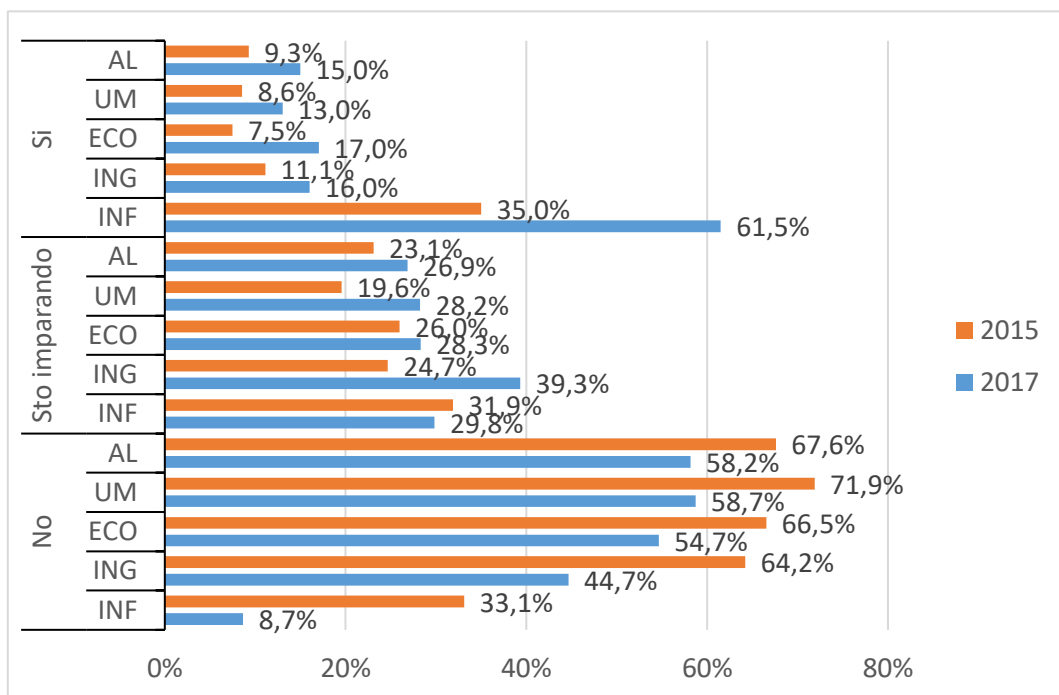
Figure 25 -Trend per faculty: Are you able to develop software? - University2business

So, this data tells us that Italian student are more comfortable in developing and manage social media, and it is fundamental for their career. However, a not entirely positive scenario is represented by students' knowledge of the technologies and the main themes of this digital revolution.

Regarding the theoretical knowledge of some issues related to the digital revolution, today's students have been more prepared than those of 2015 regarding mobile advertising and Big data concept. The percentage of those who gave the correct answer for e-invoicing remains unchanged, while the concept of cloud has been misunderstood by many, resulting in a negative trend.
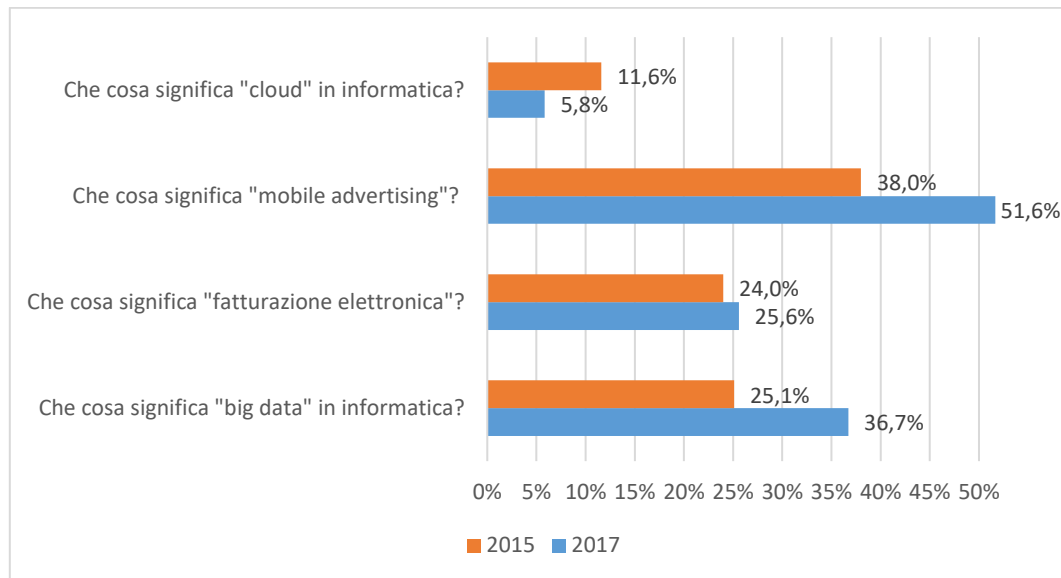
Figure 26 - Trend of theoretical knowledge

While in the knowledge of the major drivers of this digital revolution, it is immediately noticeable that the highest percentage of answers corresponds to having never heard about those concepts. In addition, the percentage of student who have a well-informed knowledge is always the lowest. Social media is the exception of this scenario. In this case, as previously commented, the percentage of students is almost homogeneously distributed, with a predominance of students responding to have a deep knowledge and with only 18% who have never heard of it.

From this table, we can say that among the Italian students social media is the most familiar, followed immediately by those technologies and concepts that have been entering the business world for a few years, confirming the benefits of using them. It is surprising to find industry 4.0 among the most unfamiliar concepts, because exactly with the advent of industry 4.0, the Fourth digital revolution begun.

	Never Heard	Something Heard	I am learning	Deep knowledge
ePayments & Blockchain	85,5%	9,8%	3,9%	0,7%
Digital Marketing	35,4%	44,3%	17,1%	3,2%
Internet of Things	64,8%	21,4%	9,4%	4,4%
Cloud Computing	55,8%	27,9%	12,4%	3,8%
Big Data Analytics	62,0%	24,4%	10,9%	2,7%
Cognitive Computing	73,0%	17,7%	8,5%	0,8%
Augmented & Virtual Reality	63,2%	24,1%	10,3%	2,5%
eInvoicing & Dematerialization	48,9%	34,9%	13,4%	2,8%
Social media	18,6%	27,0%	26,9%	27,4%
UI-UX design	84,0%	9,7%	5,4%	0,9%
Digital Business strategy	56,8%	29,3%	11,6%	2,3%
Industry 4.0	73,8%	15,9%	7,9%	2,4%

Table 2- Knowledge of digital themes – University2business
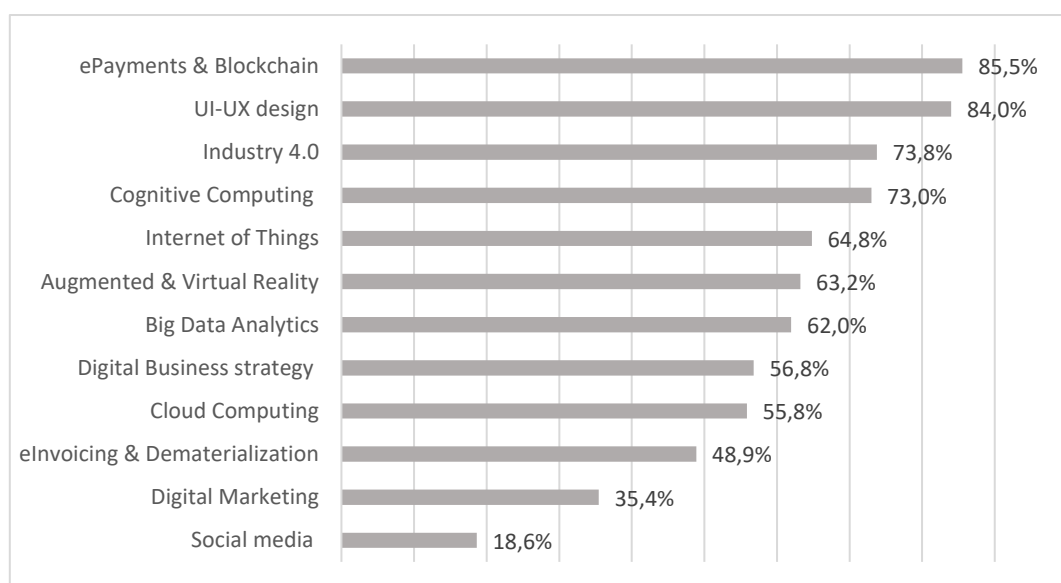
Figure 27- Percentage of "deep knowledge" student
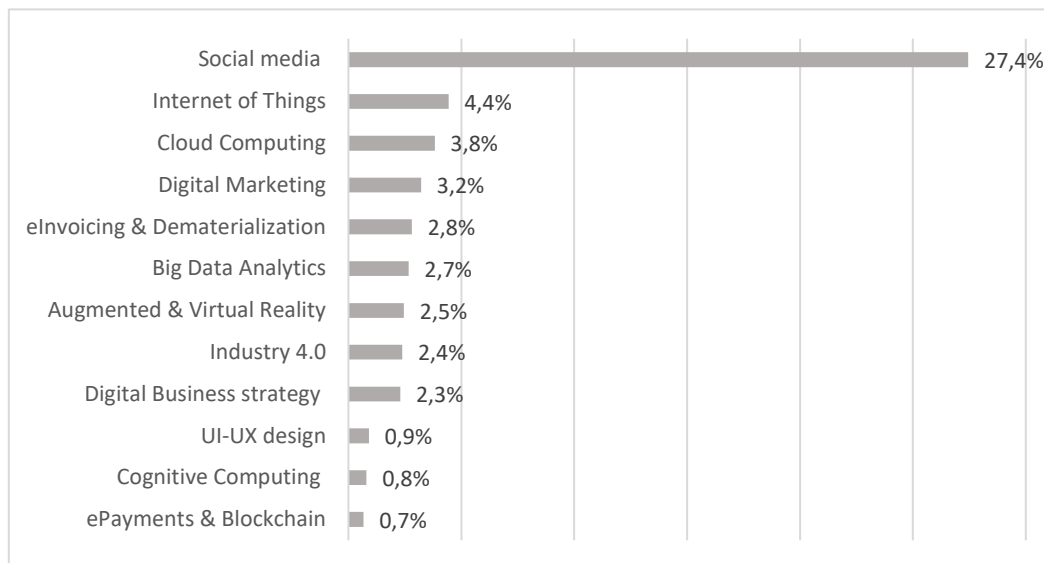
Figure 28- Percentage of "never heard" student

On one hand, the first graph shows more in detail how this basic digital technologies are unknown, recording very high percentage especially related to e-payments and Blockchain and UI-UX desing. On the other hand, the second graph shows the very low percentage of students with a high knowledge. These numbers launch a clear message, students are not ready, but being in the middle of the fourth revolution cannot wait any longer.

Now, it is fair raise a question and understand if this lack of knowledge is only the fault of Italian students or if there is a complicity of the Italian university system that was not able to modernize and keep pace with the current revolution. The next chapter aims to take a snapshot of the Italian universities and their position in relation to this digital revolution.

CHAPTER 3 – STATISTICAL RESEARCH ON HR MANAGER

The change brought by this revolution has also to be considered by business figures point of view. The company itself must therefore overcome the fear of change, embrace it and drive the process of transformation in the best way to have an active role in the market. Disruption has to be seen as an opportunity, leveraging on new technology drivers. This means more than reshaping the organizations; meeting the challenges of this revolution means constantly learning the new technical skills and trying to understand the benefits that this new technical solution could bring to the company.

For sure, this scenario is characterised by a high level of uncertainty. This situation requires an important division of effort. On the one hand, it is important to consolidate the market position of the company and take advantage of opportunities when these arise. On the other hand, at the same time, companies have the task of exploit these disruption technologies to add value to the company. From a research carried out by KMPG among the CEOs, innovation is considered as a strategic priority and at the same time a key initiative to fuel growth[26].

In this context, the principal issue that CEOs face is related to talent shortages and complexity around integrating the new digital capabilities. One of most important initiative to overcome the shortages of talent could be, reinventing the HR function. Business leaders need to manage skill disruption as an urgent concern. It is important understand that the pace of this revolution is faster than the previous ones, for this reason is fundamental that HR function become more strategic, using new analytics tools to identify the best profiles and gaps in digital skills with the goal of helping the company align its business strategy, innovation and talent management to maximize opportunities.

In this chapter, we will investigate the position of companies about this fact through the opinion of HR manager. It will be analysed their demands and expectations, but also what they are doing to adapt to these changes.

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[26] "Disrupt and grow – 2017 Global CEO Outlook" , KPMG international

Company overview

In its research, University2Business has therefore sought to deepen the perception of HR managers on the changes induced by digital transformation. Their considerations were analysed focusing on their point of view based on expectations on the future talents and the concrete actions they have taken or they want to activate to spread a more digital culture within their company.

The words of Isabella Covili Faggioli[27], contribute to value to this study focused on HR managers, who claims that the development of new skills in young people is not just about the course of studies, but also the skills learned at work, and above all the ability to continue to acquire new ones throughout the professional life. Therefore, it is becoming increasingly important for HR managers to develop the skills themselves, both to ensure the best selection resources and to be able to accompany them in the development and growth path that best suits the future.

The research involved 251 HR managers of the major companies operating in our country. The sample of respondents is composed in this way:

SECTOR	Responses	%
Industries	85	33,9%
Others services	41	16,3%
Commerce	34	13,5%
ICT/Digitale/Web/Media service	33	13,1%
Others sectors	26	10,4%
Public institutions	18	7,2%
Banking and insurance	14	5,6%
TOT	251	100%

Table 3 - Company sector - University2business

DIMENSION	Responses	%
Under 50 employees	76	30,3%
From 51 to 250 employees	66	26,3%
Over 1000 employees	61	24,3%
501-1000 employees	25	10,0%
251-500 employees	23	9,2%
TOT	251	100%

Table 4 - Company dimension - Unviersity2business

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[27] National president AIDP -Associazione italiana per la direzione del personale. From "Il futuro è oggi: sei pronto? Second edition, University2business – Digital360 Group

Referring to the question about the knowledge of the drivers of the digital revolution addressed to students, HR managers have been asked which are the most important areas of digital innovation for the development of their company over the next 3 years.
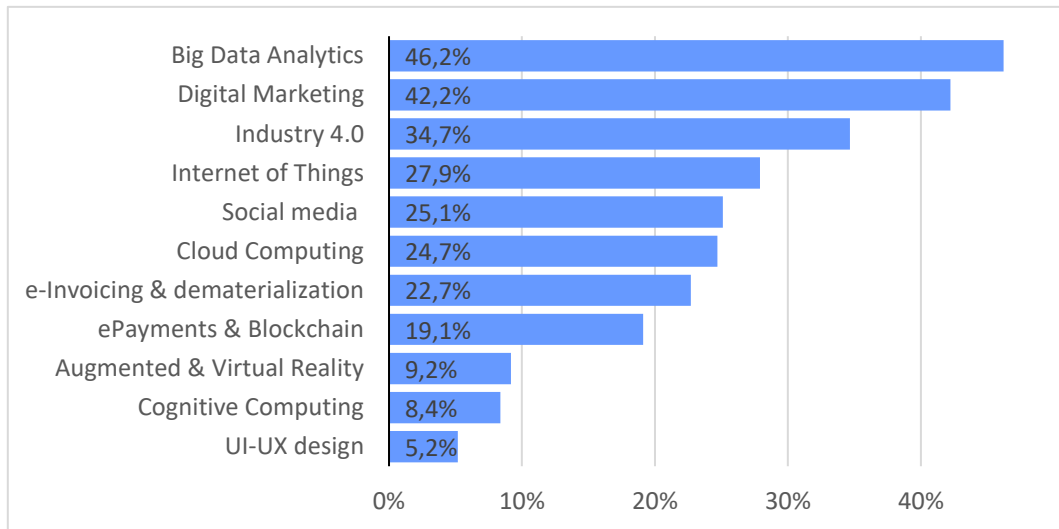
Figure 29- What are the most important areas of digital innovation for the development of the business over the next three years? - Univeristy2business

Big data analytics is recognized by 46.2% of respondents as an important area to be developed, and is consistent with what has been said to date and with the predictions that have been made about this revolution. They are immediately below the Digital marketing area with 42.2% and industry4.0 34.7%.

This fact is also important in function of another question asked by HR managers, namely, how important is the depth of knowledge of one or more areas of innovation in choosing a new graduate profile. More than half of respondents think that the knowledge is very important, 53.4%. Unimportant and fundamental answers have both reached about 20% of responses, while only 2.4% say that knowing these areas of innovation is not important. In addition, 5% of respondents do not know how to answer this question, and since the HR area has gained an increasingly strategic role in this revolution, this figure becomes relevant.
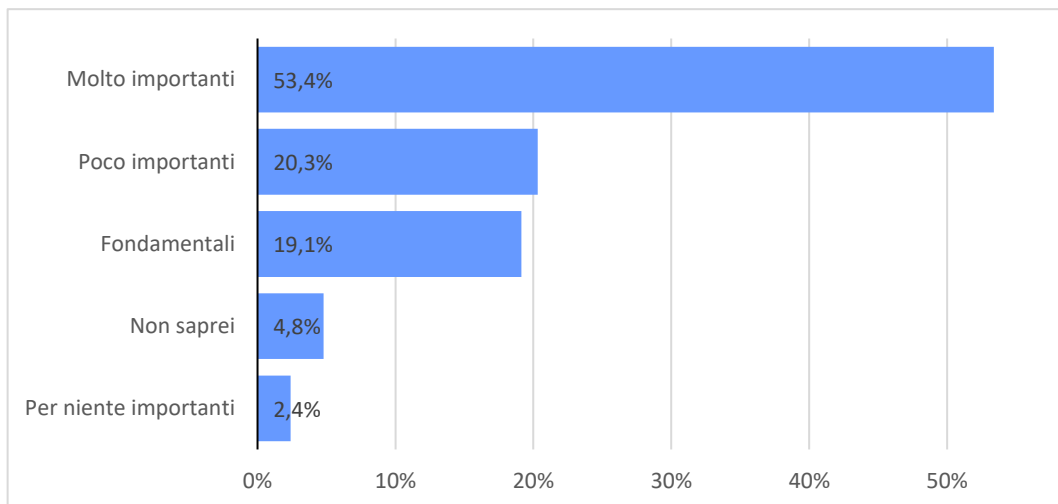
Figure 30- How important is the in-depth knowledge of one or more areas of digital innovation in choosing graduates? - University2business

Moreover, this gives us the opportunity to say that HRs are aware of the ongoing revolution and know that gaining talent with these capabilities becomes fundamental to companies. It was then asked whether it was easy to recruit graduates with the most innovative digital knowledge.
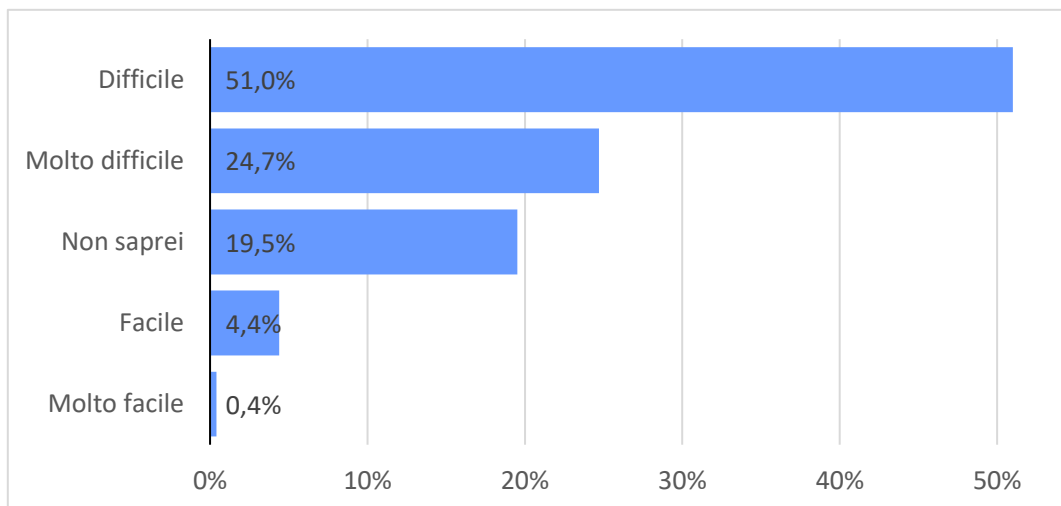
Figure 31 - How easy/difficult is to recruit graduates with innovative digital knowledge? - Univeristy2business

51% of respondents say that graduates with these skills are difficult to find, even about 25% answered that it is very difficult. Only a small percentage responds that it is easy or very easy, while 19.5% do not know how to answer the question.

It is clear that the demand from the companies of candidates with these new digital skills exists and it is current. However, candidates on the labour market do not meet these needs.

Internal company initiatives

Instead, some questions shift the focus of research on the HR managers' initiatives within the company. Data collected says that 36.7% of respondents have not yet checked out new digital skills within the company, but they are thinking about it. While 39% replies, that will consider this possibility in the future.[28].

You also asked for the company's training plan for some actions to develop digital skills, 38% say that the company plans to start some actions; 35.1% say it does not expect it but they are thinking of doing so. Those who have replied that the business plan foresees actions or are planning to implement, they have been asked to indicate the main actions that are either activated or intended to be activated to develop digital skills, among those listed:

- Scouting of Digital Champions / Entrepreneurs within the company to become promoters of digital / business culture
- Enterprise-wide communication and awareness raising initiatives (Intranet, corporate corner points, communication campaigns, corporate events, video pills)
- Short innovation workshop on digital to develop concepts and new ideas
- Business hackathon
- Open contest to employees
- Structured and long training sessions (academy)
- Spot training courses
- On line training

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[28] Source: "Il futuro è oggi: sei pronto? Third edition, University2business – Digital360 Group
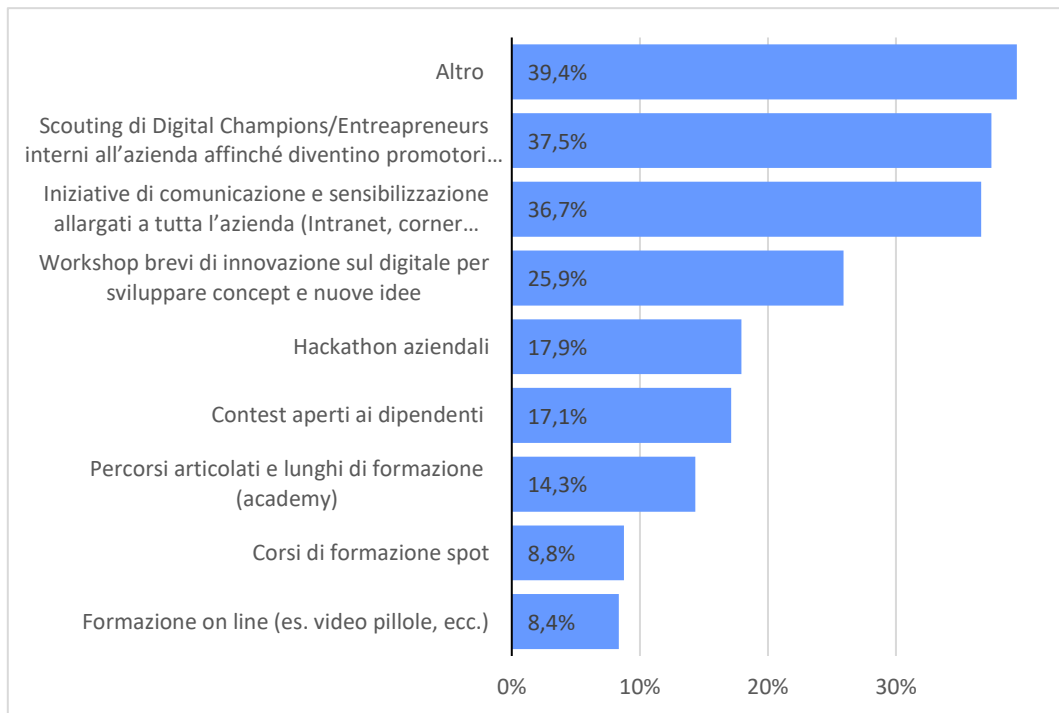
Figure 32 - What are the main initiatives you have started or you are planning to start to develop digital and/or business skills? - University2business

Soft skill overview

A question was then entirely devoted to soft skills. Contrary to what you might think, coping with this digital revolution is not enough to know how to use the computer. Le aziende avranno bisogno di competenze che definiscano strategie da contestualizzare nei nuovi modelli di business che questa rivoluzione ha portato. They are required in addition to technical skills, many soft skills related to digital and innovation. Developing and enhancing the soft skills asset is fundamental to preparing for change, and it is equally important to involve employees in supporting the growth and transformation paths of the company. The HR managers were then asked to choose from the new soft skills as employees need to develop to operate more effectively in the digital era. The new soft skills considered are:

- Virtual communication: effectively communication between individuals and groups using digital technologies

- Knowledge networking: identify, organize and share available information in virtual networks and community

- Digital problem solving: solve complex problems through the conscious use of digital instruments

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- Digital Awareness: willingness to use the potential and the risks associated with digital technologies both in products and services
- Customer Centricity: know how to capture the hidden needs of customers, even by the use of digital tools and transfer them to the organization
- Data Driven Analysis: identify, combine and manage multiple data sources and build advanced analysis models
- Agile Working: work in different places to complete the tasks and projects entrusted
- Creativity: generate, refine and evolve ideas in a multitude of options through the debate
- Agile Innovation/Entrepreneurship: identify, test and refine ideas, through rapid experiments, taking risks
- Digital Change: ability to adapt their behaviours and adapt working methods to new digital technologies
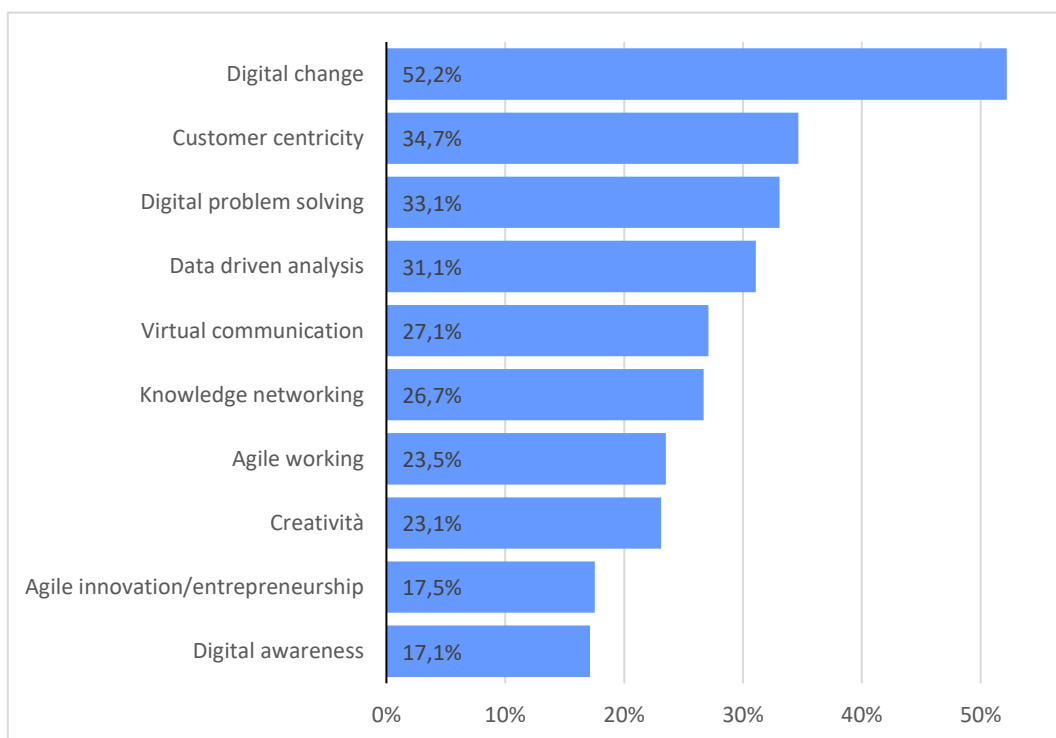
Figure 33 - What are the new soft skills that your compoany employees will need to develop to operate more effectively in the digital age? - Unviersity2business

More than half of respondents said Digital change needed, followed by customer centricity with 34,7% and Digital problem solving by 33,1%. Agile innovation/entrepreneurship and digital awareness are in the last few places. This question places the emphasis on the fact that in the near future digitization will be a mix of articulated skills. Digital change, customer centricity, digital problem solving and data driven analysis are just the examples of soft skills that must accompany the technological skills.

CHAPTER 4 – DESK RESEARCH ON ITALIAN UNIVERSITY

In this chapter, we want to provide a snapshot of the Italian universities about their offer of the main digital themes that are the heart of this revolution. The contribution of Italian universities in this digital revolution is important because poor preparation on these issues is one of the reasons why our country is lagging behind other countries. The great challenge is training, thinking about the establishment of new skills. Besides the aforementioned workplace training initiatives, to improve the employees' knowledge, a proper preparation of student by university is fundamental. This need is expressed in many studies on this subject, which encourage an increasing collaboration between institutions and universities as a key to exploiting all the benefits of this digital revolution and to bridge the gap.

Education system

The awareness of the factors that drive the increase of automation and how new technology are affecting the companies is paramount. It is important for people, as they make education and career choices, identify the skills that could be useful for them to acquire from a labour market perspective and what new activities will be complements of activities that are likely to be automated. Furthermore, as already mentioned, the capability to face the change by the workers and their knowledge of digital skills is crucial. This is the turning point and the education system will need to evolve in order to meet the request coming from the workplace, in fact in the last years we see a large scale shifts in workplace activities. This trend are already under way. For all these reasons, it is necessary that the education providers work to improve basic skill in STEM[29] field, in order to prepare the future workforce to capture the opportunities and to be more attractive for the company. Nevertheless, this is not sufficient because this revolution is characterised by the fact it is involving many sectors; for this reason, it is necessary that these knowledges will be diffuse in all faculties*.

According to Mariano Corso[30], the last 15 years in Italy have been characterized by an industrial and educational policy, which has driven us increasingly far from the advanced countries.

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[29] S.T.E.M. Science Technology Engineering and Mathematics
[30] Professor of Leadership and Innovation course and Scientific manager of the HR innovation practice observatory at the School of management of the Politecnico di Milano. Source : "Il futuro è oggi: sei pronto?" - Unviersity2business, Digital 360 Group

The effects of this misguided policy will be accelerated over the next few years by the effect of the Fourth industrial revolution. In fact, in the traditional sectors, it will be necessary to incorporate new digital skills and countries that will not be able to offer them will face a loss of competitiveness. For the breakout of our country, it is therefore essential to build the basis for a digital transformation, and to do this, it is necessary to act on education system.

Universities mapping

The purpose of this study is to map the educational offer of the Italian universities regarding digital themes and the main driver of this revolution.

Altogether, 73 Italian universities have been analysed[31]. Traditional universities and polytechnics were considered, but telematics universities were excluded. Then, the population of interest was then formed by universities with at least 1000 students enrolled. Universities of all Italian regions have been considered to have a comprehensive coverage of the area. The list of universities is in the table below.

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[31] http://statistica.miur.it/

UNIVERSITY	REGION	UNIVERSITY	REGION
UNIVERSITÀ DEGLI STUDI DI TORINO	Piemonte	UNIVERSITÀ DEGLI STUDI DELLA TUSCIA	Lazio
POLITECNICO DI TORINO	Piemonte	UNIVERSITÀ SAPIENZA	Lazio
UNIVERSITÀ DEL PIEMONTE ORIENTALE	Piemonte	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	Lazio
UNIVERSITÀ DELLA VALLE D'AOSTA	Valle d'Aosta	LIBERA UNIVERSITÀ MARIA SS.ASSUNTA - (LUMSA) DI ROMA	Lazio
UNIVERSITÀ DEGLI STUDI DI GENOVA	Liguria	LIBERA UNIVERSITÀ INTERNAZIONALE DEGLI STUDI SOCIALI GUIDO CARLI - (LUISS) DI ROMA	Lazio
UNIVERSITÀ "CARLO CATTANEO" - LIUC	Lombardia	UNIVERSITÀ DEGLI STUDI DI ROMA "FORO ITALICO"	Lazio
UNIVERSITÀ DEGLI STUDI DELL' INSUBRIA	Lombardia	UNIVERSITÀ DEGLI STUDI ROMA TRE	Lazio
UNIVERSITÀ DEGLI STUDI DI MILANO	Lombardia	UNIVERSITÀ CAMPUS BIOMEDICO DI ROMA	Lazio
POLITECNICO DI MILANO	Lombardia	UNIVERSITÀ DEGLI STUDI INTERNAZIONALI DI ROMA – UNINT	Lazio
UNIVERSITÀ COMMERCIALE LUIGI BOCCONI DI MILANO	Lombardia	LINK CAMPUS UNIVERSITÀ DI ROMA	Lazio
UNIVERSITÀ CATTOLICA DEL SACRO CUORE	Lombardia	UNIVERSITÀ DEGLI STUDI DI CASSINO	Lazio
IULM - LIBERA UNIVERSITÀ DI LINGUE E COMUNICAZIONI	Lombardia	UNIVERSITÀ DEGLI STUDI DEL SANNIO	Campania
UNIVERSITÀ VITA-SALUTE SAN RAFFAELE	Lombardia	UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II	Campania
UNIVERSITÀ DEGLI STUDI DI MILANO - BICOCCA	Lombardia	UNIVERSITÀ DEGLI STUDI DI NAPOLI – PARTHENOPE	Campania
UNIVERSITÀ DEGLI STUDI DI BERGAMO	Lombardia	UNIVERSITÀ DEGLI STUDI L'ORIENTALE DI NAPOLI	Campania
UNIVERSITÀ DEGLI STUDI DI BRESCIA	Lombardia	UNIVERSITÀ DEGLI STUDI SUOR ORSOLA BENINCASA DI NAPOLI	Campania
UNIVERSITÀ DEGLI STUDI DI PAVIA	Lombardia	UNIVERSITÀ DEGLI STUDI DELLA CAMPANIA LUIGI VANVITELLI	Campania
LIBERA UNIVERSITÀ DI BOLZANO	Trentino-Alto Adige	UNIVERSITÀ DEGLI STUDI DI SALERNO	Campania
UNIVERSITÀ DI TRENTO	Trentino-Alto Adige	UNIVERSITÀ DEGLI STUDI DI L'AQUILA	Abruzzo
UNIVERSITÀ DEGLI STUDI DI VERONA	Veneto	UNIVERSITÀ DEGLI STUDI DI TERAMO	Abruzzo
UNIVERSITÀ CA' FOSCARI VENEZIA	Veneto	UNIVERSITÀ DEGLI STUDI GABRIELE D'ANNUNZIO DI CHIETI E PESCARA	Abruzzo
UNIVERSITÀ IUAV DI VENEZIA	Veneto	UNIVERSITÀ DEGLI STUDI DEL MOLISE	Molise

UNIVERSITÀ DEGLI STUDI DI PADOVA	Veneto	UNIVERSITÀ DEGLI STUDI DI FOGGIA	Puglia
UNIVERSITÀ DEGLI STUDI DI UDINE	Friuli-Venezia Giulia	UNIVERSITÀ DEGLI STUDI DI BARI	Puglia
UNIVERSITÀ DEGLI STUDI DI TRIESTE	Friuli-Venezia Giulia	POLITECNICO DI BARI	Puglia
UNIVERSITÀ DEGLI STUDI DI PARMA	Emilia Romagna	UNIVERSITÀ DEL SALENTO	Puglia
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA	Emilia Romagna	UNIVERSITÀ DEGLI STUDI DELLA BASILICATA	Basilicata
UNIVERSITÀ DEGLI STUDI DI BOLOGNA	Emilia Romagna	UNIVERSITÀ DELLA CALABRIA	Calabria
UNIVERSITÀ DEGLI STUDI DI FERRARA	Emilia Romagna	UNIVERSITÀ DEGLI STUDI DI CATANZARO	Calabria
UNIVERSITÀ DEGLI STUDI "CARLO BO" DI URBINO	Marche	UNIVERSITÀ MEDITERRANEA DI REGGIO CALABRIA	Calabria
UNIVERSITÀ POLITECNICA DELLE MARCHE	Marche	UNIVERSITÀ DEGLI STUDI DI PALERMO	Sicilia
UNIVERSITÀ DEGLI STUDI DI MACERATA	Marche	UNIVERSITÀ DEGLI STUDI DI MESSINA	Sicilia
UNIVERSITÀ DI CAMERINO	Marche	LIBERA UNVERSITÀ DELI STUDI DI ENNA "KORE"	Sicilia
UNIVERSITÀ DEGLI STUDI DI FIRENZE	Toscana	UNIVERSITÀ DEGLI STUDI DI CATANIA	Sicilia
UNIVERSITÀ DI PISA	Toscana	UNIVERSITÀ DEGLI STUDI DI SASSARI	Sardegna
UNIVERSITÀ DI SIENA	Toscana	UNIVERSITÀ DI CAGLIARI	Sardegna

Table 5 - List of universities mapped

Once the sample of universities to be mapped has been chosen, the themes to be investigated were defined. The same digital themes and driver used to be map students' knowledge in the survey of research have been consider, to which we added the theme of IT security, legal internet and digital content management. Briefly, as in Chapter 2, a definition of these themes is given.

IT SECURITY

IT security[32] is a set of strategies for managing the processes, tools and policies necessary to prevent, detect, document and counter treats to digital and not digital information. The main aim of IT security is to maintain the confidentiality, integrity and availability of IT systems and business data. Today to the increase of data that a company has to manage, many enterprise employ a dedicated security group responsible for ensure digital security. IT security is critical for business operations, as well as retaining credibility and earning the trust of clients.

LEGAL INTERNET

In this new scenario, with disruptive technologies create a balance to be found between user benefits, user right and corporate responsibility. Furthermore, as more people expand their presence on web, there will almost certainly more grey areas concerning legal internet issues. Old rules regulation no longer sufficient, there is the need to define new rules, trying to avoiding that these new regulation delay or limit the full potential of this technology.

DIGITAL CONTENT MANAGEMENT

Digital content management is the process for collection, delivery, retrieval, governance and overall management of information system in any format. The term is used in reference to administration of the digital content lifecycle, from creation to permanent storage or deletion. There are different types of digital content management like, social media content management, web content management, mobile content management.

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[32] http://searchsecurity.techtarget.com/definition/information-security-infosec

Therefore, the complete list of the themes and drivers is the following:

DIGITAL THEMES & DRIVERS
ePayments & Blockchain
Digital marketing
Internet of Things
Cloud computing
Big data analytics
Cognitive computing
Augmented & virtual reality
eInvoicing & Dematerialization
Social media
UI-UX design
Digital business strategy
Industry 4.0
Software development
IT security
Legal internet
Digital content management

Table 6- List of digital themes and drivers considered

The step further was to conduct a desk research. Each university, course per course, program per program, was analysed to identify the digital themes dealt with in the study programs. The information were collected directly from the official websites of the universities, entering in detail the 2016/2017 training offer.

Mapping methodology

For each university, a list of the learning concerned digital themes and driver was created to keep trace the topics covered by the course. The first collection of data allows us to have a general view of the frequency with these topics are dealt by the Italian university system.
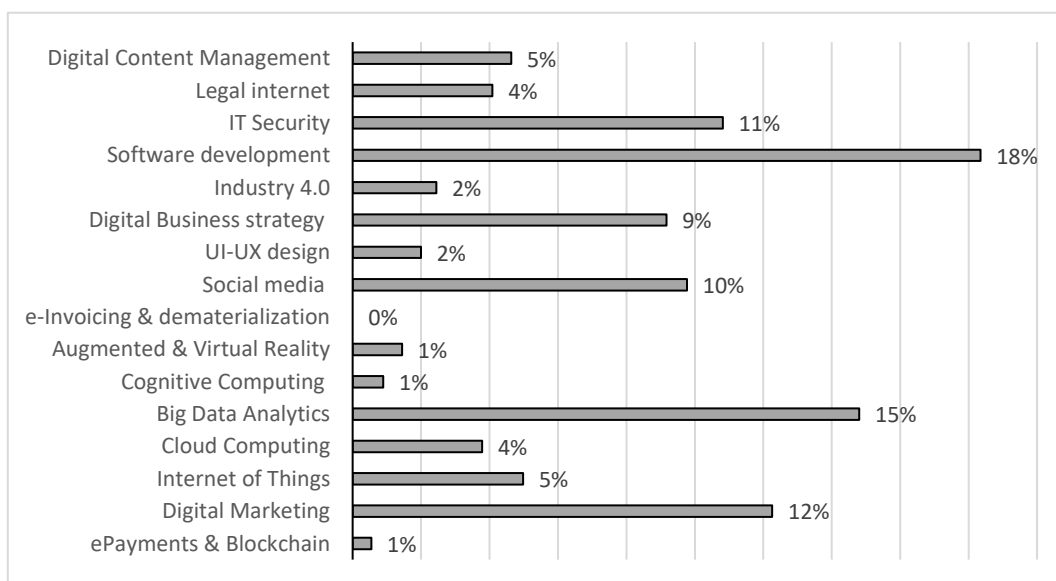
Figure 34- Frequency of digital themes threated

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The aggregated result indicate that the subject most treated is the software development immediately followed by Big data analytics, Digital marketing, IT security, Social media and digital business strategy.

Then all the others with a lower frequency, and there seems to be no course regarding e-Invoicing and dematerialization.

At this point of the analysis, however, it is necessary to make a distinction between those courses that treats comprehensively the digital themes they speak, or those courses that mention just some feature and treats them just partially. This discrimination was made through reading the programs. Hence, when in the course program the digital theme was explicitly mentioned, the topic was named core. While if the program stated that only mention the topics, the theme was considered no-core.

Through this division, always analysing aggregate data, we have other information. It is possible to say that the topics as Software development, industry 4.0 and cognitive computing s are explained partially, in a no core way, when they are treated by a learning. Instead, topics like Social media, IT security, augmented and virtual reality are deeply illustrated by the learning. Interesting to note how big data analytics in most cases is treated in a no-core manner. This result can surprise since all the experts indicate this type of knowledge as necessary in the foreseeable future. The same reasoning can be applied for industry 4.0, only in 33% of the times it has been encountered, it is addressed in detail.
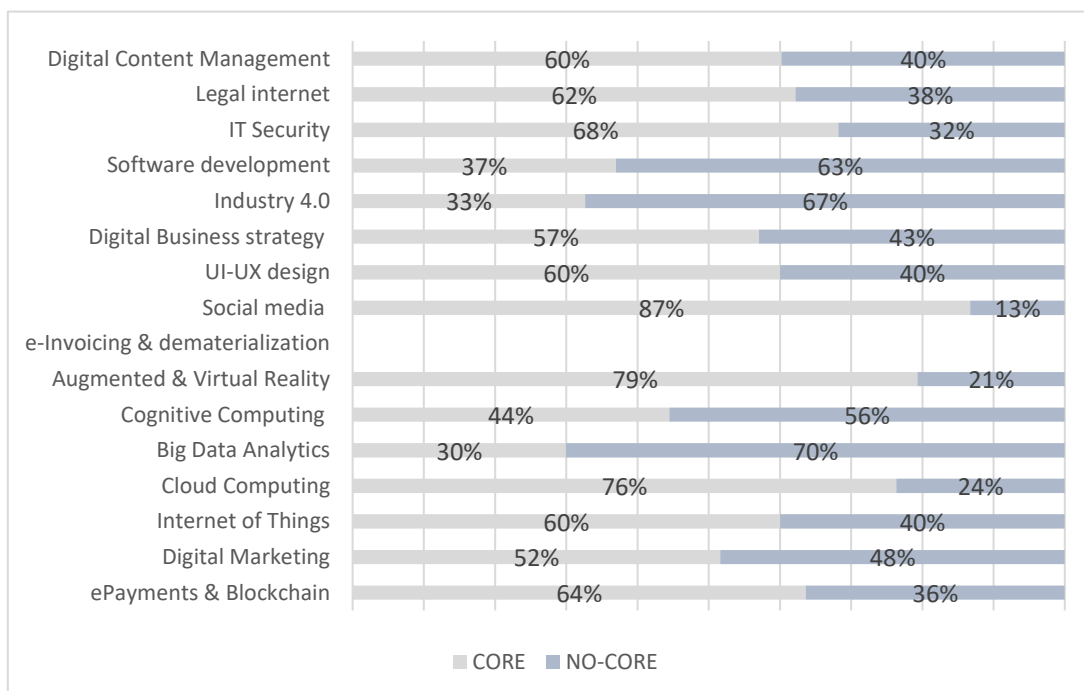
Figure 35 - The way in which digital themes are threated

Segmentation

Afterward, these data were used to analyse in detail the situation of each university. Since the Italian universities are very heterogeneous among them, the comparative analysis has been conducted per faculty group. This division can make comparison more effective. Segmentation by faculty groups was done following the subdivision that can be read in the table[33].

GROUP	FACULTY	GROUP	FACULTY
Humanistic group - HUM	- Law - Psychology and pedagogy - Foreign languages and literatures - Philosophy and letters - Political sciences/ sociology	**Scientific group - SCI**	- Chemical and pharmaceutical faculties - Mathematical, Physical and Statistical sciences - Geo-biological faculty - Agricultural
Other group - OTH	- Medicine and surgery - Healthcare professions - Veterinary - Pharmacy - Architecture and design	**Computer science group – COMP.SC**	- Computer and information engineering - TLC engineering - Computer science faculty
Engineering group - ENG	- Others engineering	**Economic group - ECO**	- Economic, financial and managerial sciences

Table 7 - Group faculty segmentation

Score

Once all the courses talking about digital themes and technological driver was found and it was defined if these courses treats these topics in a core or no-core way, it is possible to create a dataset in which each university is characterised by the number of core digital theme and by the number of no-core digital theme.

With the aim of comparing universities with each other, it is necessary to find a significant measure. One of the immediate ways of comparing courses and universities and to make sense of the

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[33] Regarding the final group division, it has been carried out from MIUR/ISTAT rules. However, for the purpose of research, on the development of work, it has been decided to reorganize it in some parts.

information collected is to use a common measurement unit. In this case, the best unit is the academic credit of the courses, as known as CFU. Academic credit system is a way used by universities to measure the workload required to the student. The purpose of this re-elaboration is to assign a final score to each university that can be interpreted in terms of digital academic credits that the university offers, divided by faculty.

Therefore, the credits of each course are weighted according to the number of digital themes they face and the way they are treated in a core or no-core way.

$$Digital\ CFU\ _{Academic\ course} = CFU_{Academic\ course} * [\#digital\ topics_{CORE} * \alpha + \#digital\ topics_{NO\_CORE} * \beta]$$

In order to obtain the Digital CFU that a specific course produce, the academic credits are weighted by the number of digital topics deal in a core or no-core way that are weighted by two coefficient, that characterised the way in which the topics is treated.

The university ranking in each faculty is given by the sum of the digital CFU of all courses belonging to the specify group of faculty.

$$University\ ranking_{faculty} = \sum_{i=1}^{n} Digital\ CFU_{i_{faculty}}$$

Once this is done, according to the results obtained by this formula it is possible to have a ranking of what could be defined as the most digital university, divide by faculty. In the table below the different value are given. To verify that this method is valid, a sensitivity analysis was performed by varying the Alpha and Beta coefficients, giving them different values. Varying this value did not make any significant changes to the ranking position and to the differenced in scores between universities. For this reason the coefficients were set up

$$\alpha = 1\ if\ the\ themes\ is\ threated\ in\ a\ core\ way$$

$$\beta = 0,25\ if\ the\ themes\ is\ threated\ in\ a\ no\text{-}core\ way$$

The coefficient attribution of β was a matter of consideration. Attributing a weight close to α would imply too much importance to non-core courses. However, this formula aims to highlight the

difference between those courses that have digital theme as the main subject and those courses that only partially deal with them. Further reflection is necessary, yet. In the group of courses that threated digital themes only partially, there is heterogeneity. There may be courses that spend on some digital issue a portion of the study program that is appropriate to provide a certain level of knowledge, without providing a global view on it. While there could be courses that include a digital matter in the program, but not dedicating the number of hours needed to teach the basic concepts. Therefore, the choice of β = 0,25 reflects an average value related to these two possible scenarios.

Through the application of the formula, it was possible to define for each university the university ranking value per faculty. In addition, using a simple algebraic sum it was possible to compute the total of the digital academic credit provide.

Digital academic credit (CFU)							
UNIVERSITY	TOT	SCI	HUM	ECO	ENG	COMP.SC	OTH
UNIVERSITÀ DEGLI STUDI DI TORINO	162	1,5	103,5	17,25	0	39,75	0
POLITECNICO DI TORINO	221,5	0	0	0	204	11,5	6
UNIVERSITÀ DEL PIEMONTE ORIENTALE	55,25	0	15	19,25	0	21	0
UNIVERSITÀ DELLA VALLE D'AOSTA	2,25	0	0	2,25	0	0	0
UNIVERSITÀ DEGLI STUDI DI GENOVA	240	0	22	75	68,25	74,75	0
UNIVERSITÀ "CARLO CATTANEO" - LIUC	121	0	3	88	30	0	0
UNIVERSITÀ DEGLI STUDI DELL' INSUBRIA	137,5	0	34,25	40,5	0	62,75	0
UNIVERSITÀ DEGLI STUDI DI MILANO	219	12	75,75	30	0	101,25	0
POLITECNICO DI MILANO	473,25	0	0	0	287,75	167,5	18
UNIVERSITÀ COMMERCIALE LUIGI BOCCONI DI MILANO	199,5	0	3,75	195,75	0	0	0
UNIVERSITÀ CATTOLICA DEL SACRO CUORE	241,75	0	126,75	115	0	0	0
IULM - LIBERA UNIVERSITÀ DI LINGUE E COMUNICAZIONI	153	0	153	0	0	0	0
UNIVERSITÀ VITA-SALUTE SAN RAFFAELE	12	0	12	0	0	0	0
UNIVERSITÀ DEGLI STUDI DI MILANO - BICOCCA	165,25	29,75	40	46	0	49,5	0
UNIVERSITÀ DEGLI STUDI DI BERGAMO	161	0	56,25	53,25	30	21,5	0
UNIVERSITÀ DEGLI STUDI DI BRESCIA	116,25	0	13,5	60	37,5	5,25	0
UNIVERSITÀ DEGLI STUDI DI PAVIA	234,5	3	60,5	85,5	32,25	51	2,25
LIBERA UNIVERSITÀ DI BOLZANO	101,75	0,75	6	21,75	9,25	64	0
UNIVERSITÀ DI TRENTO	216,5	33,75	12	55,25	0	115,5	0
UNIVERSITÀ DEGLI STUDI DI VERONA	90	1,5	25,5	15	0	48	0
UNIVERSITÀ CA' FOSCARI VENEZIA	205,5	0	0	138	0	67,5	0
UNIVERSITÀ IUAV DI VENEZIA	7,5	0	0	0	0	0	7,5
UNIVERSITÀ DEGLI STUDI DI PADOVA	213,5	0	42	30,75	22,5	118,25	0
UNIVERSITÀ DEGLI STUDI DI UDINE	217,75	55	39,75	1,5	37,5	84	0
UNIVERSITÀ DEGLI STUDI DI TRIESTE	146	6,75	7,5	45,75	31,25	54,75	0

UNIVERSITÀ DEGLI STUDI DI PARMA	**198,25**	0	13,5	33	28,5	107,25	16
UNIVERSITÀ DEGLI STUDI DI MODENA E REGGIO EMILIA	**160**	2,25	37,75	6	24	90	0
UNIVERSITÀ DEGLI STUDI DI BOLOGNA	**355,25**	6,5	121,5	71,75	51	104,5	0
UNIVERSITÀ DEGLI STUDI DI FERRARA	**59**	1,5	12	22	3	20,5	0
UNIVERSITÀ DEGLI STUDI "CARLO BO" DI URBINO	**57,5**	0	20	24	0	13,5	0
UNIVERSITÀ POLITECNICA DELLE MARCHE	**104,25**	15	0	20,25	42	27	0
UNIVERSITÀ DEGLI STUDI DI MACERATA	**21,5**	0	20	1,5	0	0	0
UNIVERSITÀ DI CAMERINO	**113,25**	1,5	5	0	0	90	16,75
UNIVERSITÀ DEGLI STUDI DI FIRENZE	**231**	18	40,5	36,75	18,75	111	6
UNIVERSITÀ DI PISA	**393**	17,25	95,25	71,25	36	170,25	3
UNIVERSITÀ DI SIENA	**193,75**	19,5	48,75	48,25	60	17,25	0
UNIVERSITÀ DEGLI STUDI DI PERUGIA	**114,75**	4,5	9,75	14,25	18,75	67,5	0
UNIVERSITÀ DEGLI STUDI DELLA TUSCIA	**26,75**	1	10	15,75	0	0	0
UNIVERSITÀ SAPIENZA	**358,5**	17,75	38	114	6	162,75	20
UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	**275,75**	11,25	2	120,75	51,75	81	9
LIBERA UNIVERSITÀ MARIA SS.ASSUNTA - (LUMSA) DI ROMA	**47,25**	0	39	8,25	0	0	0
LIBERA UNIVERSITÀ INTERNAZIONALE DEGLI STUDI SOCIALI GUIDO CARLI - (LUISS) DI ROMA	**112,5**	0	0	112,5	0	0	0
UNIVERSITÀ DEGLI STUDI DI ROMA "FORO ITALICO"	**0**	0	0	0	0	0	0
UNIVERSITÀ DEGLI STUDI ROMA TRE	**88,5**	9,5	24,25	4,5	30,75	19,5	0
UNIVERSITÀ CAMPUS BIOMEDICO DI ROMA	**10,5**	0	0	0	10,5	0	0
UNIVERSITÀ DEGLI STUDI INTERNAZIONALI DI ROMA – UNINT	**92,25**	0	0	92,25	0	0	0
LINK CAMPUS UNIVERSITÀ DI ROMA	**45**	0	39	6	0	0	0
UNIVERSITÀ DEGLI STUDI DI CASSINO	**82,5**	0	15	38	9,5	20	0
UNIVERSITÀ DEGLI STUDI DEL SANNIO	**36,75**	0	0	6	3	27,75	0
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II	**199,75**	34	45	36,75	18	63,75	2,25
UNIVERSITÀ DEGLI STUDI DI NAPOLI – PARTHENOPE	**64,5**	1,5	0	21	2,25	39,75	0
UNIVERSITÀ DEGLI STUDI L'ORIENTALE DI NAPOLI	**1**	0	1	0	0	0	0
UNIVERSITÀ DEGLI STUDI SUOR ORSOLA BENINCASA DI NAPOLI	**74,5**	0	74,5	0	0	0	0
UNIVERSITÀ DEGLI STUDI DELLA CAMPANIA LUIGI VANVITELLI	**34,5**	4	0	8	1,5	21	0
UNIVERSITÀ DEGLI STUDI DI SALERNO	**200,25**	1,75	36	30	6,5	126	0
UNIVERSITÀ DEGLI STUDI DI L'AQUILA	**40,5**	1,5	0	2,25	1,5	35,25	0
UNIVERSITÀ DEGLI STUDI DI TERAMO	**42,25**	0	40,75	1,5	0	0	0

UNIVERSITÀ DEGLI STUDI GABRIELE D'ANNUNZIO DI CHIETI E PESCARA	**45**	0	12	31,5	1,5	0	0
UNIVERSITÀ DEGLI STUDI DEL MOLISE	**48,75**	0	19,5	3,75	1,5	24	0
UNIVERSITÀ DEGLI STUDI DI FOGGIA	**15,5**	0	0	2	13,5	0	0
UNIVERSITÀ DEGLI STUDI DI BARI	**89**	6	6	29,5	0	47,5	0
POLITECNICO DI BARI	**91,5**	0	0	0	67,5	24	0
UNIVERSITÀ DEL SALENTO	**90**	0	9,25	59,5	0	21,25	0
UNIVERSITÀ DEGLI STUDI DELLA BASILICATA	**55,5**	1,5	0,75	10,5	7,5	35,25	0
UNIVERSITÀ DELLA CALABRIA	**174,75**	12	45,75	13,5	24,75	78,75	0
UNIVERSITÀ DEGLI STUDI DI CATANZARO	**4,5**	0	0	0	0	4,5	0
UNIVERSITÀ MEDITERRANEA DI REGGIO CALABRIA	**39,25**	0	0	10	1,5	27,75	0
UNIVERSITÀ DEGLI STUDI DI PALERMO	**155,25**	1,5	32,25	37,5	14,25	69,75	0
UNIVERSITÀ DEGLI STUDI DI MESSINA	**87,75**	3,25	41,75	11,25	0	31,5	0
LIBERA UNVERSITÀ DELI STUDI DI ENNA "KORE"	**22,5**	0	7,5	0	1,5	13,5	0
UNIVERSITÀ DEGLI STUDI DI CATANIA	**218,5**	1,5	14,5	26,25	45,75	128,25	2,25
UNIVERSITÀ DEGLI STUDI DI SASSARI	**62,25**	1	12	17,75	0	30	1,5
UNIVERSITÀ DI CAGLIARI	**208,25**	5	28,5	48,75	59	63,75	3,25

Table 8- Unversity score

Ranking

At the end of this methodology, it is possible to have for each faculty group a ranking of the most digitized universities, or better the universities that offer most academic credit in digital themes.

For each group of faculties the rank is done and the number of CFU, computed by the formula, characterizes each universities.

SCIENTIFIC GROUP

		CFU
1-	UNIVERSITÀ DEGLI STUDI DI UDINE	55
2-	UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II	34
3-	UNIVERSITÀ DI TRENTO	33,75
4-	UNIVERSITÀ DEGLI STUDI DI MILANO - BICOCCA	29,75
5-	UNIVERSITÀ DI SIENA	19,5
6-	UNIVERSITÀ DEGLI STUDI DI FIRENZE	18
7-	UNIVERSITÀ SAPIENZA	17,75
8-	UNIVERSITÀ DI PISA	17,25
9-	UNIVERSITÀ POLITECNICA DELLE MARCHE	15
10-	UNIVERSITÀ DEGLI STUDI DI MILANO	12

HUMANISTIC GROUP

		CFU
1-	IULM - LIBERA UNIVERSITÀ DI LINGUE E COMUNICAZIONI	153
2-	UNIVERSITÀ CATTOLICA DEL SACRO CUORE	126,75
3-	UNIVERSITÀ DEGLI STUDI DI BOLOGNA	121,5
4-	UNIVERSITÀ DEGLI STUDI DI TORINO	103,5
5-	UNIVERSITÀ DI PISA	95,25
6-	UNIVERSITÀ DEGLI STUDI DI MILANO	75,75
7-	UNIVERSITÀ DEGLI STUDI SUOR ORSOLA BENINCASA DI NAPOLI	74,5
8-	UNIVERSITÀ DEGLI STUDI DI PAVIA	60,5
9-	UNIVERSITÀ DEGLI STUDI DI BERGAMO	56,25
10-	UNIVERSITÀ DI SIENA	48,75

ENGINEERING GROUP

		CFU
1-	POLITECNICO DI MILANO	287,75
2-	POLITECNICO DI TORINO	204
3-	UNIVERSITÀ DEGLI STUDI DI GENOVA	68,25
4-	POLITECNICO DI BARI	67,5
5-	UNIVERSITÀ DI SIENA	60
6-	UNIVERSITÀ DI CAGLIARI	59
7-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	51,75
8-	UNIVERSITÀ DEGLI STUDI DI BOLOGNA	51
9-	UNIVERSITÀ DEGLI STUDI DI CATANIA	45,75
10-	UNIVERSITÀ POLITECNICA DELLE MARCHE	42

ECONOMIC GROUP

		CFU
1-	UNIVERSITÀ COMMERCIALE LUIGI BOCCONI DI MILANO	195,75
2-	UNIVERSITÀ CA' FOSCARI VENEZIA	138
3-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	120,75
4-	UNIVERSITÀ CATTOLICA DEL SACRO CUORE	115
5-	UNIVERSITÀ SAPIENZA	114
6-	LIBERA UNIVERSITÀ INTERNAZIONALE DEGLI STUDI SOCIALI GUIDO CARLI - (LUISS) DI ROMA	112,5
7-	UNIVERSITÀ DEGLI STUDI INTERNAZIONALI DI ROMA – UNINT	92,25
8-	UNIVERSITÀ "CARLO CATTANEO" - LIUC	88
9-	UNIVERSITÀ DEGLI STUDI DI PAVIA	85,5
10-	UNIVERSITÀ DEGLI STUDI DI GENOVA	75

COMPUTER SCIENCE GROUP

		CFU
1-	UNIVERSITÀ DI PISA	170,25
2-	POLITECNICO DI MILANO	167,5
3-	UNIVERSITÀ SAPIENZA	162,75
4-	UNIVERSITÀ DEGLI STUDI DI CATANIA	128,25
5-	UNIVERSITÀ DEGLI STUDI DI SALERNO	126
6-	UNIVERSITÀ DEGLI STUDI DI PADOVA	118,25
7-	UNIVERSITÀ DI TRENTO	115,5
8-	UNIVERSITÀ DEGLI STUDI DI FIRENZE	111
9-	UNIVERSITÀ DEGLI STUDI DI PARMA	107,25
10-	UNIVERSITÀ DEGLI STUDI DI BOLOGNA	104,5

OTHER GROUP

		CFU
1-	UNIVERSITÀ SAPIENZA	20
2-	POLITECNICO DI MILANO	18
3-	UNIVERSITÀ DI CAMERINO	16,75
4-	UNIVERSITÀ DEGLI STUDI DI PARMA	16
5-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	9
6-	UNIVERSITÀ IUAV DI VENEZIA	7,5
7-	POLITECNICO DI TORINO	6
8-	UNIVERSITÀ DEGLI STUDI DI FIRENZE	6
9-	UNIVERSITÀ DI CAGLIARI	3,25
10-	UNIVERSITÀ DI PISA	3

Digital academic credit percentage

As we said before, Italian university are very heterogeneous among them, not only in function of the different group of faculties, but also in term of the different wide of the faculty's academic offers. Wide academic offer means the number of academic credits offered by the study plans of the courses belonging to the same faculty group. Under the assumption that the bachelor's degree courses offer 180 academic credit in their study plan, a master's degree study plan offers 120 academic credit and a single cycle master degree course offers 300 academic credits, for each faculty group of each university it was calculated the total amount of academic credit offered.

This analysis carried out a value that represent the index of the width of academic offer provide by the university for each faculty

$$
\begin{aligned}
Width\ of\ academic\ offer_{faculty} \\
= \#bachelor's\ degree\ courses_{faculty} * 180cfu + \#master's\ degree\ courses_{faculty} * 120cfu \\
+ \#single\ cycle\ master's\ degree\ courses_{faculty} * 300cfu
\end{aligned}
$$

Adding this dimension to the analysis, every university is defined by a value that indicates the digital credits offered by each faculty and a value that indicate the width of the total offer of credit of each faculty. This two dimension also gives us another possible gateway. In fact, if you calculate the ratio between digital academic credits and the total credit offered for each university, it is possible to obtain a percentage value.

This percentage tells us how many digital credits are present in the offer of each faculty of each university in function of the width of academic offered by each faculty.

$$\frac{University\ ranking_{faculty}[CFU]}{Width\ of\ academic\ offer_{faculty}[CFU]} = \%Digital\ academic\ credit$$

Now it is possible to redefine a ranking according to this percentage of digital academic credit. A comparison is also made with respect to the first methodology used, putting in the last column the position that the university occupied, and indicating with a symbol if the university does not change his position. As you will notice with this new methodology, new universities that in the first case were not present enters in the top 10. In addition to this fact, it will be noted that among universities with a similar value of university ranking per faculty, those who have a wider academic offer will be penalized.

SCIENTIFIC GROUP

		%	RankingCFU
1-	UNIVERSITÀ DI TRENTO	2,56%	3
2-	UNIVERSITÀ DEGLI STUDI DI UDINE	1,80%	1
3-	UNIVERSITÀ POLITECNICA DELLE MARCHE	1,67%	9
4-	UNIVERSITÀ DI SIENA	1,08%	5
5-	UNIVERSITÀ DEGLI STUDI DI MILANO - BICOCCA	0,97%	4
6-	UNIVERSITÀ SAPIENZA	0,76%	7
7-	UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II	0,67%	2
8-	UNIVERSITÀ DELLA CALABRIA	0,44%	
9-	UNIVERSITÀ DEGLI STUDI DI FIRENZE	0,43%	6
10-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	0,43%	

In the scientific group, university of Udine has in the first place with 55 CFU digital, but from the digital academic percentage point of view, the record pass to university of Trento.

HUMANISTIC GROUP

		%	RankingCFU
1-	IULM - LIBERA UNIVERSITÀ DI LINGUE E COMUNICAZIONI	6,22%	-
2-	UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA	3,81%	
3-	UNIVERSITÀ DEGLI STUDI DI TERAMO	3,77%	
4-	LINK CAMPUS UNIVERSITÀ DI ROMA	3,61%	
5-	UNIVERSITÀ DEGLI STUDI SUOR ORSOLA BENINCASA DI NAPOLI	2,96%	7
6-	UNIVERSITÀ DEGLI STUDI DI BRESCIA	2,81%	
7-	UNIVERSITÀ DI PISA	2,30%	5
8-	LIBERA UNIVERSITÀ MARIA SS.ASSUNTA - (LUMSA) DI ROMA	2,17%	
9-	UNIVERSITÀ CATTOLICA DEL SACRO CUORE	2,09%	2
10-	UNIVERSITÀ DEGLI STUDI DI MILANO	1,97%	6

The IULM - Free University of Languages and Communication, prevails among the humanities faculties, both with regard to the CFU digital in absolute way – 153 CFU digital - , and with regard the percentage of digital credit related to the width of academic offer.

ENGINEERING GROUP

		%	RankingCFU
1-	UNIVERSITÀ DI SIENA	11,11%	5
2-	UNIVERSITÀ DEGLI STUDI DI FOGGIA	7,50%	
3-	UNIVERSITÀ "CARLO CATTANEO" - LIUC	4,55%	
4-	POLITECNICO DI TORINO	4,25%	2
5-	POLITECNICO DI MILANO	3,81%	1
6-	UNIVERSITÀ DI CAGLIARI	2,81%	-
7-	UNIVERSITÀ DEGLI STUDI DI BERGAMO	2,78%	
8-	UNIVERSITÀ DEGLI STUDI DI UDINE	2,60%	
9-	UNIVERSITÀ CAMPUS BIOMEDICO DI ROMA	2,50%	
10-	POLITECNICO DI BARI	2,45%	4

The Politecnico of Milano is ranked first among engineering faculties in digital subjects – 287,75 CFU digital - but only fifth in percentage term. From this point of view, the University of Siena is the best.

ECONOMIC GROUP

		%	RankingCFU
1-	UNIVERSITÀ DEGLI STUDI INTERNAZIONALI DI ROMA – UNINT	21,96%	7
2-	UNIVERSITÀ "CARLO CATTANEO" - LIUC	8,63%	8
3-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	7,74%	-
4-	LIBERA UNIVERSITÀ INTERNAZIONALE DEGLI STUDI SOCIALI GUIDO CARLI - (LUISS) DI ROMA	7,50%	6
5-	UNIVERSITÀ DEGLI STUDI DI FERRARA	7,33%	
6-	UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA	6,75%	
7-	UNIVERSITÀ COMMERCIALE LUIGI BOCCONI DI MILANO	6,27%	1
8-	UNIVERSITÀ CA' FOSCARI VENEZIA	6,22%	2
9-	UNIVERSITÀ SAPIENZA	5,94%	5
10-	UNIVERSITÀ DEL SALENTO	5,83%	

In economic group, the digital offer provided by Bocconi university is the higher, with 195,75 CFU digital. However, it is scaled by UNINT university of Rome in the percentage rating.

COMPUTER SCIENCE GROUP

		%	RankingCFU
1-	UNIVERSITÀ DEGLI STUDI DI TRIESTE	45,63%	
2-	POLITECNICO DI MILANO	39,88%	-
3-	UNIVERSITÀ DI TRENTO	27,50%	7
4-	UNIVERSITÀ DI CAMERINO	25,00%	
5-	UNIVERSITÀ MEDITERRANEA DI REGGIO CALABRIA	23,13%	
6-	UNIVERSITÀ CA' FOSCARI VENEZIA	22,50%	
7-	UNIVERSITÀ DEGLI STUDI DI PARMA	22,34%	9
8-	UNIVERSITÀ DEGLI STUDI DI CATANIA	21,38%	4
9-	UNIVERSITÀ DI CAGLIARI	21,25%	
10-	UNIVERSITÀ DEGLI STUDI DI SALERNO	21,00%	5

In the computer science group, the university of Pisa prevails with 170,25 CFU digital in the absolute ranking, followed very close by Politecnico of Milano. However, as a percentage, the University of Trieste has the most digitized offer.

OTHER GROUP

		%	RankingCFU
1-	UNIVERSITÀ DI CAMERINO	1,00%	3
2-	POLITECNICO DI MILANO	0,56%	-
3-	POLITECNICO DI TORINO	0,43%	7
4-	UNIVERSITÀ IUAV DI VENEZIA	0,43%	6
5-	UNIVERSITÀ SAPIENZA	0,40%	1
6-	UNIVERSITÀ DEGLI STUDI DI PARMA	0,37%	4
7-	UNIVERSITÀ DEGLI STUDI DI ROMA - TOR VERGATA	0,22%	5
8-	UNIVERSITÀ DEGLI STUDI DI FIRENZE	0,11%	-
9-	UNIVERSITÀ DI CAGLIARI	0,10%	-
10-	UNIVERSITÀ DEGLI STUDI DI CATANIA	0,06%	-

In the other group, Sapienza university gets the primacy, offering 28,5 CFU digital. While in the percentage ranking university of Camerino has the best digital offer.

Digital change within medicine field

This research has highlighted the heterogeneity of the diffusion of digital credits between the various faculties. In particular, the Other group is far below the average of digital credit offered. This group, in the wat it was created, sees the presence of courses related to architecture and design and courses related to medical faculties. The latter has a very low contribution to digital credits offer. This area was subject to further analysis to investigate how the advent of digital technologies had an influence on it.
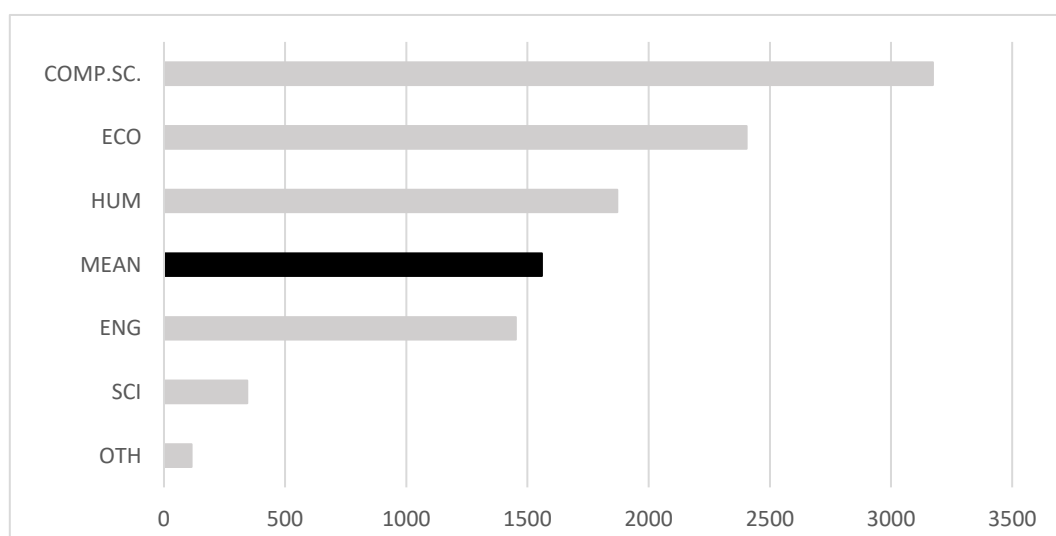

Figure 36- Digital CFU per faculty

Riccardo Maiolino[34] says, "4.0 scenario will also affect unexpected environments such as health and social care, which up to now have had growth limits dictated by contact with the user"[35]. As a high tech activity, healthcare is one of the driving areas for applications that bring together computing, sensors, artificial intelligence, telecommunication and big data, creating a new way of doing tasks. Despite the availability of technologies, the medical community seemed to resist the changes.

The scenario that Eric Topol suggest into his book[36], highlight a change in the approach. The illness is treated in individualized way, and digital technologies are the driving force to draw such transformation. Medicine and the patient of the future will be much different from today, due to the development of these new technologies: constant connectivity, collaboration and mobile device, cloud computing are creating a completely different pattern. Wireless remote sensors enable doctors in remote areas to monitor the condition of patients and to provide timely intervention by gathering information. Electronic health records and health information technology are effective in term of eliminating medical errors created due to not being able to secure complete information on patient condition. Use of intelligent computer for diagnostic, three-dimensional printing capable of rebuilding biological fabrics, cardiac and neurological innovations able to constantly monitor the situation by producing significant data are the possible improvements. In addition, advances in augmented reality technology can make possible to develop systems that can help surgeons to complete their interventions faster and safer by bringing the benefits of organ viewing.

Another purpose of digital technologies is to provide a powerful tool for facing with the community and with other doctors. LinkedIn, the most important professional social network, hosts hundreds of dedicated medical and health groups in all the world's languages. On the field of training, the American Psychological Association has recently created for therapists, virtual patients who are realistically mimicking the symptoms of clinical psychological disorders. The usefulness of this new technology, allows before interacting with real patients, to get a picture of a variety of clinical conditions in a safe and effective environment. Additionally, virtual patients created are available at any time and only computer is necessary.[37]

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[34] Professor at John Cabot University and Italia camp co-founder

[35] http://www.vita.it/it/article/2017/08/23/preparare-i-giovani-al-loro-futuro-ecco-come-deve-cambiare-la-formazio/144291/

[36] "Creative destruction of medicine: How the digital revolution will create a better health care" – Eric Topol – Basic books

[37] https://www.tomshw.it/nuove-tecnologie-medicina-terzo-millennio-81470

Thus, doctors must to evolve. The context describe is plenty of new opportunities and no parts of the healthcare field can avoid to get in touch with these changes. Doctors, hospital and related institutions are the subject of this revolution.

From an AICA research[38], there is a strong awareness of the opportunities that digital tools may have. In this research 1043 professional were interviewed. 79% of respondents consider the digital technologies essential for documentation activities, 71% for training activities and 57% for improving diagnosis and care. Over the 75% of professionals are convinced that these digital tools can have a positive impact on the evaluation of results and foster communication between colleagues. Nearly half of them also considers the need for digital training as essential; the 92% says that the basic digital skills are the priority.

However, this study reveals also that the spread and the updating of digital skills in the healthcare sector has a non-homogenous distribution among universities and healthcare companies.

To make a change possible and solve this discrepancy, medical education must change. There is a need to invest on training, activating new universities paths and defining a clear strategy to address the issues raised by these technologies. AICA president, Giuseppe Mastronardi is convinced about this need: "from the training come the knowledge: planning a training in digital healthcare, means planning a new generation of skills able to guarantee a further progress".

This entire scenario reveals that the medicine faculties are offering the least amount of digital matters than the other groups. This result cannot be underestimate; it provides another evidence of how the digital revolution is transversal.

Some considerations

It is fundamental point out that this research in a way through which it was designed is subject to a certain degree of variability due to the fact the course programs from which information has been deducted may be incomplete, inaccurate or under variation. However, this research highlights the fact that digital issues and drivers linked to the Fourth Industrial Revolution are not so present in our universities, especially for some faculty groups. At national level, there are no researches that are being questioned on this topic by focusing on universities. The most common practice is to

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[38] AICA : Associazione Italiana per l'informatica ed il calcolo automatico -
http://www.sossanita.it/doc/2016_10_rapporto-oss-sanita-digitale.pdf

collect information through students and to understand the situation of our country. Perhaps to cope with all the challenges posed by these new changes, it is necessary to start from a detailed analysis of the courses offered by universities and try to fit them to what is the current and the future scenario.

Anyway, something at university level is moving, understanding that the digital knowledge and new digital skill must be part of the university study plan. The Bocconi University has decided, from the academic year 2017/2018, to make compulsory coding[39] for all the newcomers, because programming is considered crucial. The goal is not to create specialists but to transfer the logic that accompanies the programming to put students aware how to deal with complex problems and be flexible. The urgency of the formation enters in this way in this university.

Another reality is that of the University of Udine that from the current academic year has included in its offer a new bachelor's degree course, called: Internet of things, big data and web[40]. This course was created in response to the rapid evolution of computer and digital disciplines.

At LIUC university[41] will debut the master in planning and managing the intelligent factory with teachings about intelligent factory technology and tools and data analytics for managing the factory.[42]

Some university, probably still few, are therefore feeling the urgency of change caused by this revolution. The words of Professor Mariano Corso are useful to reiterate this concept, he supports the evidence of the immobility of much of the world of formation, whose programs and training methods are often largely stagnant for a long time, being obsolete for today's contest. For this reason, it is important to promote students to make the choices that are better in line with the future labour market, not only in the scientific curriculum but also by forming digital skills in all other faculties[43].

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[39] Source: http://www.ilsole24ore.com/art/tecnologie/2017-09-06/il-coding-arriva-all-universita-obbligatorio-le-matricole-bocconi-113845.shtml?uuid=AEyWJTOC
[40] Source: http://did.dimi.uniud.it/wordpress/wp-content/uploads/2017/02/51_pdfsam_RI_aprile_17_LR_1.pdf
[41] LIUC – Carlo Cattaneo university – Castellanza (VA)
[42] http://www.scuola24.ilsole24ore.com/art/universita-e-ricerca/2017-06-29/piu-innovazione-e-tecnologie-i-tecnici-futuro-172257.php?uuid=AE1xwfoB&refresh_ce=1
[43] Source: "Il futuro è oggi: sei pronto?" – Second edition, University2business – Digital 360 Group

Preparation issue returns to be a fundamental concept for being ready for both university students and country systems. It is also important to prepare students for these skills, as we will see in the next chapter that the world of work is waiting for figures ready to interact with these new drivers.

CHAPTER 5 – KEY CONCLUSION

In this chapter are reported some conclusions regarding the spread of digital themes, especially in the Italian context and at university level. Through the surveys, it was possible to have a clear picture of what the conditions of the students and the expectations of the companies related to the students and their preparation. In addition, a research on Italian universities has been carried out in order to provide a picture of what is now the digital theme offers in our universities, considering all faculties.

The current scenario

Universities and companies, along with the government, must be the main actors of change in our country to take advantage of this fourth industrial revolution. Therefore, the collaboration between these figures is a strategic factor that needs to be developed. These actions are needed because the digital revolution advances, and in the meantime, the mismatching phenomenon advances. Mismatching means the fact that companies offer jobs without finding someone who has the skills to cover them. This is the main reason for what a change in the university system comes into play, and in particular, preparation activities have to be done. Prepared students able to cover new roles and having those soft skills required is the biggest challenge to take. In fact, digital transformation in order to reach the success requires a human capital that is ready and adequate.

Obviously, this challenge is not so easy, the Fourth industrial revolution will bring benefits from the economic point of view, but it will require strong cultural changes and also companies to modify their business model. The other issue to not underestimate, as seen in Chapter 1, is the fear of replacing human activities by the machine. This revolution will surely cause the end of many works, except for those with certain characteristics[44], but will enable the creation of new jobs with new skills.

Here, then, the concept of preparation to this change is fundamental. To avoid an unbalanced situation coming from the risk factors that this revolution involves, it is necessary to promote the emergence of a new digital culture and to prepare the new workforce for these new skills that have so rapidly spread. In both cases, the university system plays a key role.

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[44] The characteristic of these jobs are listed at page 16 of this study

Student and HR manager findings

The current situation shows that on the part of the companies there is awareness of this change and there is therefore a need to find talents that have the necessary skills especially in emerging areas, so it is said to know how to relate to the themes of IoT, Cloud ; big data, software development. On the part of the students, there is awareness about this change. About 40% of students recognize that the digital innovation coming from this revolution will have an incremental impact on current business. However, this awareness is not accompanied by knowledge. As the survey results show, digital culture among students is not disseminated satisfactorily, basic knowledge is limited as can be seen from the table in chapter 2 [45]. The percentage of students, who has a deep knowledge or is studying some digital drivers, results always smaller than the percentage of student who never heard the subject or who hear only something.
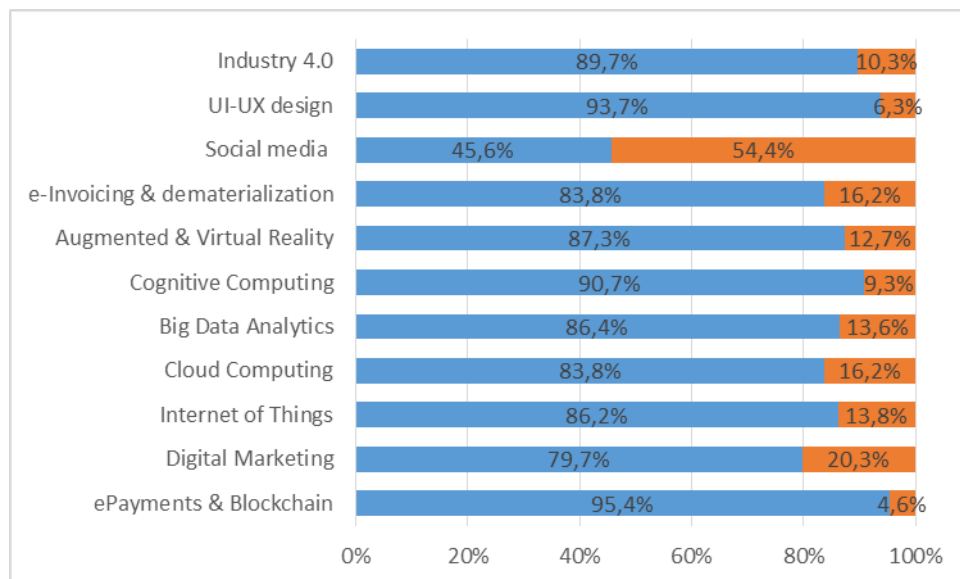
Figure 37- Student knowledge

As mentioned above, social media are exceptions, which have seen a rise in usage compared to data collected in 2015. This data is still a positive note as this digital revolution brings with it the need to know and know how to use these instruments since they have also gained great potential for companies.

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[45] Table - Knowledge of digital themes - Page 56

In addition it was recorded an increase in the software development capabilities among all faculties. It is an important achievement, but has discussed previously this is not sufficient: company requires more than this.

From the point of view of HR managers, the 53,4% of respondent says that the depth knowledge of one or more area of digital innovation in choosing a new graduate profile is very important. Moreover, if we adds up the 19,1% who says that it is crucial, the percentage of the companies that research these skill become relevant. In this case, the phenomenon of the mismatch mentioned earlier appears. This implies the inability of the HR to find candidates with the digital skills needed to make those business transformations to support change.

Nearly 75% of HR managers interviewed admit that it is difficult or even very difficult to find and attract students with the appropriate profile related to the new challenges posed by innovation.

If we compare these results to those indicated by HR managers, as shown in the table, that indicates which are the most important areas of digital innovation for the development of their company over the next three years, students disclose a low level of preparation. In most cases, the higher percentage of the answer is concentrated in the never heard and something heard columns. This means that the most of the student have not the knowledge necessary to satisfy the companies' request. Except for social media that are well known by student, with more that 50% that have a deep knowledge or that are learning about it.

		HR Responses	Never Heard	Something Heard	I am learning	Deep knowledge
1-	Big Data Analytics	46,2%	62,0%	24,4%	10,9%	2,7%
2-	Digital Marketing	42,2%	35,4%	44,3%	17,1%	3,2%
3-	Industry 4.0	34,7%	73,8%	15,9%	7,9%	2,4%
4-	Internet of Things	27,9%	64,8%	21,4%	9,4%	4,4%
5-	Social media	25,1%	18,6%	27,0%	26,9%	27,4%
6-	Cloud Computing	24,7%	55,8%	27,9%	12,4%	3,8%
7-	e-Invoicing & dematerialization	22,7%	48,9%	34,9%	13,4%	2,8%
8-	ePayments & Blockchain	19,1%	85,5%	9,8%	3,9%	0,7%
9-	Augmented & Virtual Reality	9,2%	63,2%	24,1%	10,3%	2,5%
10-	Cognitive Computing	8,4%	73,0%	17,7%	8,5%	0,8%
11-	UI-UX design	5,2%	84,0%	9,7%	5,4%	0,9%

Table 9 - HR expectations and students preparation

Student knowledge is lagging behind, especially with regard to big data, industry 4.0 and IoT, which are the main urgencies that companies want to fill. Digital marketing registers a lower percentage than the other of students who have never heard of it, however, cannot be considered a positive aspect.

Moreover, since data relates to different business sectors, it can be said that demand for emerging digital skills grows on the demand side, while the supply side are not able to fill the gap and generate graduates who are not in possession of that combination of new digital and soft skills. So a reason why this difficulty exists can be identified in the misalignment of the training offer with demand. The main consequence is that the preparation of students regarding these issues does not take the necessary steps to meet the business needs.

Another factor, however, can be seen from company questionnaire data. In fact, in some companies there is little awareness and sensitivity to these new themes. In fact, 26.6% of respondents answered that the company's training plan does not envisage actions to develop digital skills and that perhaps such actions will be taken in the future. 39% did, however, never check out the new digital skills owned by their employees. These data, coupled with difficulties in managing change and the lack of governance to facilitate the diffusion of digital skills, are another possible reasons of the gap.

Universities findings

For the above mentioned training offer, we focus on the contribution of universities. The reason is that the demand for new figures is mainly aimed at graduates. The ability to handle and address the new technologies that have a strategic weight, to handle change, innovation and progressive automation is recognised to the graduate students. However, at university level there is no a strategy that is functional to the development and creation of these new digital figures. In addition,

there is a heterogeneous diffusion of those, which are the basic digital skills that have been considered in the mapping of universities.
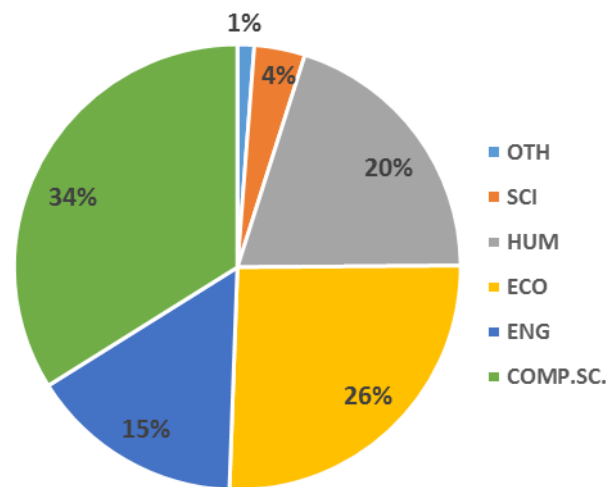

Figure 38 – Percentage of digital CFU per faculty

If we consider the digital credits offered by each university, it can be noticed that computer science faculties, followed by economic and humanistic ones, produce most. If for computer science this result could be expected, perhaps less for the economic and humanistic group. It may be surprising also to find the Humanities faculty group covering engineering. In this group, they find faculties as communication sciences and the ability to communicate externally the corporate values is becoming one of the keys to the success of the companies. This therefore entails knowledge in particular the use of social networks, but also digital marketing techniques or the creation of new digital business strategies that are increasingly characterizing these courses. An example is the IULM University, which offers courses mainly of communication, public relations and advertising.

As for engineering faculties, the position can be explained in a distinction between technologies that favour digitization and technologies that instead refer to automation, although obviously the two concepts are closely linked. As for the former, we talk about Big Data, IoT, cloud computing; while for the latter we talk about Robotics, additive manufacturing, artificial intelligence. The research of the basics knowledge focused mainly on the first class of technologies that mainly focus on management engineer course. While in other engineer courses, we mainly find automation technologies that have been omitted in this study or only partially considered. In this faculty group, the Politecnico di Milano and Politecnico of Turin contribute with to most digital credits.

Scientific and other groups did not seem to have been involved in this digital revolution from the academic point of view, and they are characterised by the low presence of digital themes in their courses. In this study, it has been stated several times that the search for digital profiles extends to all faculties. With the medical industry analysis, it has been shown that digital knowledge is and will be required in this case as well. Therefore, based on these considerations these results are very significant in negative sense.

What is certainly missing in Italy are new metrics for the evaluation of the digital and innovative optics at the universities, as regards the content of digital content and interdisciplinary skills offered in the courses. The goal of mapping universities had this objective, namely to understand how the new themes in the digital world were widespread. These read data alone have little meaning since there is no comparison term, but they make sense if they are alongside the data collected by HRs. Which confirm the general trend that university students who are facing the world of work do not have the required digital skills. So the gap is present, the theme of mismatch is clearly present. Thus, the biggest implication is that university teaching offer is not able to cover the real need that come from the present context.

The main reason why it is created is probably the rhythm of this fourth industrial revolution that will reach its peak much earlier[46] than the others will and finds a country system not adequately prepared. The main shortcoming is that of preparation. It is fundamental the foresight in understanding what will change, and in understanding that companies do not seek more technical people. Above all, the university system has to evolve rapidly to follow the needs of change. "In a time of pushing technology, where everyone is aiming to do, we are saturated to know how to do it. There is nothing paradoxical, indeed it is too logical: hyper specifications are overcome and burned quickly ", and again "know to do without know leads us to do things as we have always been done, because doing in that way has worked. In all working fields we will go to the specialization of knowledge, it is physiological; the problem is that we did not communicate these knowledge between them. Instead, the reality on which we should try to define new professional profiles is

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[46] Ambrosetti club in his research found that the shortening of the time needed to reach the peak has gone from the 30 years of the first revolution to the 20th of the Third Revolution, and he hypothesized that for this revolution the peak will reach 15 years .

complex and cannot be explained by the knowledge that we are exclusively technical or exclusively humanist. Today we can no longer be satisfy to create technicians."[47]

Future implementation

Therefore the main outcomes are:

- University students interviewed show that their preparation on the new digital themes and drivers is slow.
- Social media is an area in which students have a good preparation, recording a higher knowledge related to the average of the other themes mapped, and an increase in their use compared to 2015 data.
- Software development showed an increase among all students in the different faculty groups
- Companies require candidates with the new digital competences, considering Big data analytics, Digital marketing, Industry 4.0 and IoT the fundamental areas over the next three years. The knowledge of soft skills linked to digital is equally important
- 53% of HR respondents claim that digital competences in a graduate student are very important and the 19% consider them fundamental. There is, however, a difficulty in finding adequate candidates, as reported by 75% of respondents. This is a validation of mismatching between companies demand and student offer
- University research has highlighted the lack of digital issues and drivers in study program
- University research has shown a strong heterogeneity of digital teaching among faculty groups

Starting from this, there are some future activities to develop. For example, continuing to map the situation and encourage this collaboration becomes fundamental given the results achieved today. This change cannot be limited to certain faculties, but it has to involve all faculties, by inserting digital study pathways where they lack and making the courses more effective, even because this revolution is transversal to all the sectors. It is fundamental to align basic knowledge with incessant innovation, enhancing interdisciplinary skills, developing soft skills that are needed in today and future work environments. In fact, these soft skills are increasingly intertwined with digital content.

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[47] http://www.vita.it/it/article/2017/08/23/preparare-i-giovani-al-loro-futuro-ecco-come-deve-cambiare-la-formazio/144291/

Candidates, but in particular workers, are now demanding not only specialist skills, but also the soft skills needed to contextualize digital transformation into new business models and support change.

Greater information, awareness and cooperation between university and research companies can bring about and involve demand for digital talent development and attraction. Offer companies closer opportunities for interaction with the faculties to increase the focus of study paths on the priorities and content of digital transformation projects. This not only allows you to target teaching resources and lessons on the most demanding topics, such as Cloud computing, Big Data and IoT, but makes it possible to plan more effectively and correlate with the demand for new digital figures. Therefore, there is a need of intervention for all faculties that can reduce the heterogeneity that is present in the diffusion of digital skills and especially of digital culture. In other words, it is necessary to create initiatives to strengthen or establish digital education in the university education system. Update of study paths are fundamental from the digital point of view, moreover a new metric to define the performance of the Italian universities regarding this aspect is pivotal. In general, this is what the main researches suggest to implement and my study, also, wants to take these activities as a starting point, to be considered them as future implementation.

The final goal is to close the gap that exist today and that if it will remain, it would not allow our country to get a completely positive impact from this digital revolution.

THE ANSWERS TO THE RESEARCH QUESTIONS

The aim of the study is to highlight the weaknesses related to digital issues in the country system, from the point of view of students, companies and universities.

At the end of this investigation, I have tried to answer those that are the research questions that I set at the beginning.

Which is the students awareness relate to these digital themes?

There is awareness of this change among students, but an inadequate preparation to the needs that are required turns out. Through the analysis of a statistically significant sample it was possible to quantify the percentage of students who will be able to meet certain digital requirements. The results confirm the widespread feeling of lack of knowledge among the future workforce.

What is the need of companies and their awareness about the change brought by the digital disruption?

The analysis has confirmed the need of companies to hire people with certain digital skill and to improve the soft skill related to digital context within their boundaries. Furthermore, the lack of these new figures to hire that meet the new requirements was confirmed. Therefore, these evidence in relation to student awareness and preparation are demonstration of the gap between demand and supply of the digital competences. Moreover, the collected data show that there is no total awareness of the changes coming from this digital revolution among the companies.

What is the educational offer of universities in digital themes?
This research has provided interesting insights on the dissemination of digital issues in different faculties, but a more specific metric has to be implemented. It is necessary to eliminate that variability coming from the way in which the search was conducted. Such studies in Italy are not widespread but the contribution that Italian universities might and can give to the changes improving their offer in synergy with government and companies are needed to be mapped precisely.

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