

Digital Revolution in Small and Medium Enterprises’ Human Resources: The Case of Brescia

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Abstract

The measures of intervention introduced by the Italian Piano Industria 4.0 serve as a support for the whole economic tissue uneasy transition toward the fourth industrial revolution paradigm. Considering the structural renewal as the main topic to consider, the plan encourages and offers economic support for the education of human resources, considered as the backbones of a business. This study represents a first attempt of picturing the digital revolution in small and medium enterprises, qualified for limited resources but well known for their dynamic capabilities and great innovation competencies. A framework for the human resources digitalization is offered, considering both selection of new workers and staff education. Accordingly, data on Human Resources (HR) in a time frame of five years are considered, with the support of a local industrial association in a deeply industrialized area, the Brescia province. A direct survey data is also considered, in order to forecast the human resources digital revolution in the next future. As a result, a needed, ongoing digitalization of the Human Resources emerges, through both training activities (the prominent) and new resources selection; also, very next future shows the so called *jobs of the future* will have no room for wide development in small and medium industries.

Keywords: Organization; digital revolution; digital skills, SME

Introduction

The *Piano Industria 4.0*, which had been finally approved by the Italian Senate on 7th December 2016, introduced six well-defined intervention measures (briefly, hyper and super-depreciation, the new Sabatini law, R&D tax credit, Patent box, innovative start-ups and SMEs, Guarantee Fund) aiming at leading and supporting financially businesses (even through the creation of regional Digital Innovation Hubs and Competence Centers) during their structural and conceptual transition towards the paradigm of automated and interconnected business (fourth industrial revolution).

The text of the plan confirms, among other elements, the subsidies and tax reliefs which had been introduced by the Renzi government (an increase of 40% and 150% in the ordinary amortization rate); moreover, it also supports the development of new technologies (30 million euros a year for the period 2019-2021 will be provided to the fund for financial support of Venture Capital; these funds are aimed at businesses which develop new technologies such as Blockchain or artificial intelligence).

The debate on the human-machine interaction and, even more, on the ‘human-machine replacement’, has been developing over the past few years, fostered by the growing concern of the business world for the employability of human resources in increasingly automated and interconnected businesses. After the initial fear for job losses, a new feeling of discovery and creativity showed up. This feeling is related to the upcoming change of the market and to the new jobs which, along with different developments from several authors, will integrate and then replace jobs that have been defined as obsolete. Topics such as ‘jobs of the future’, ‘jobs with the brightest future’, the 12 jobs of the future’ or simply ‘things to know for the jobs of the future’ are becoming popular. They highlight the undisputed relevance of digital skills in rumors, even before than in the reality of the working world.

In 2016, the same year of the launch of Industry Plan 4.0 in Italy, the research “The Future of the Jobs” (displayed at the World Economic Forum 2016) underlined how the impact of technological and demographic factors would be decisive for the adjustment of the job market.

The conclusion of the research showed a global forecast of the job market: 2 million new jobs would be created to replace 7 million ‘obsolete’ jobs (with a negative net balance of more than 5 million jobs), linked in particular to the administrative and production area (more or less 4.8 and 1.6 millions).

On the other hand, there would be an increase in the financial, management, computer science and engineering areas.

In Italy, the 2018 report ‘jobs of the future’ by Hays group shows a forecast up to 2025 and highlights the most sought-after IT profiles by 2025, listed as follows:

- Big Data Expert holds 54.62% of the preferences;
- IT Security Specialist (44.58%);
- App Developer (26.10%);
- Multichannel Architect (24.90%);
- Interactive Developer (23.29%).

However, there isn’t any statement about the kind of placement these figures will have in terms of types of businesses. Also, there is no specific reference to small and medium-sized enterprises.

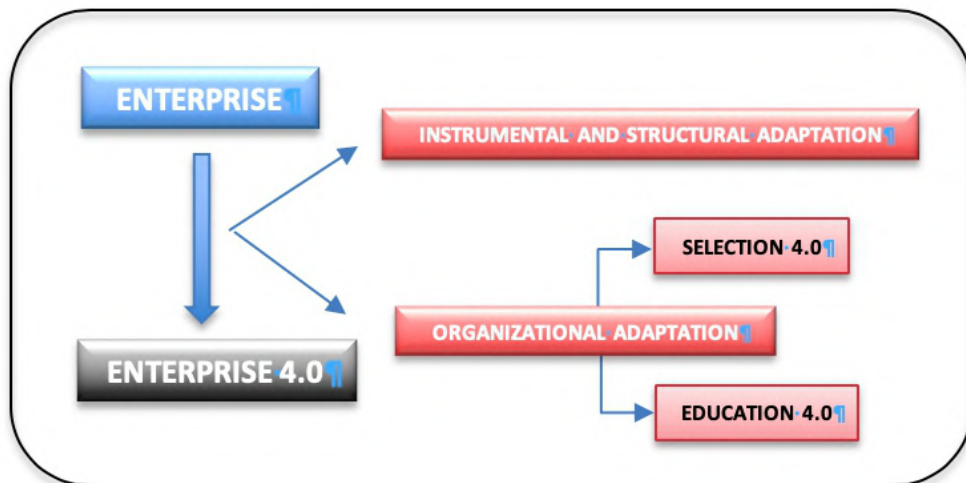
The Government, which is aware of the educational gap between the requests of a transforming enterprise system and the supply of human resources provided by a not yet ready school system, inserted an incentive system for digital education in the Industry plan 4.0.

The job market revolution, which is linked to the fourth industrial revolution, will actually give place to a significant organizational change for the business: during its evolutionary process towards the Industry 4.0 paradigm, the business will renew its own instrumental structure, but at the same time an often quiet, although continuous, revolution of the human resources dedicated to the business activity will take place.

This organizational adaptation results in a dual path, which is somehow linked to the dichotomy ‘make or buy’. In the case of human resources, the organizational adjustment excludes a unique field choice and, in a perspective of development, it includes instead both paths, in a way that is functional to the business and market changes. In this study the topic is described as follows:

- **“Buy”: selection 4.0** - the process of finding new human resources in the job market, with digital skills suited to the needs of the company;
- **“Make”: education 4.0** - the integration of digital skills into the human resources of the company through ad hoc training activities.

Figure 1: The transformation of the company towards the 4.0 paradigm



In order to understand the digitalization of human resources in small and medium-sized industries, the present study focuses on a specific area of investigation: the province of Brescia. This territory stands out for the presence of large industries and industrial groups, but it is also rich of small and medium industrial realities, deeply rooted and linked to the resources of

the territory. The research displayed in the present work, is structured in two consecutive phases.

Theoretical foundations

Information and Communication Technologies (ICTs) have changed drastically over time, as a result of the extraordinary technological evolution we are witnessing. Technology, defined as a support system for data management - data and information processing, storage, transmission and Internet communication, (Brown et al., 2010; Yu et al., 2017), makes everyday forms of sharing and collaboration easier, both at work and in private life (Brown et al., 2010; Di Gregorio et al., 2019). Some literature highlights how the use of ICTs and the consequent development of digital technologies actually implements the so-called digital inequality (i.e. the 'distance' between countries or between cities and rural areas, determined by the impossibility for some people to have an easy and widespread access to these technologies; see among others: Van Dijk and Hacker, 2003; Van Deursen and Van Dijk, 2009; Gui and Argentin, 2011; Van Deursen and Van Dijk 2015; Yu et al., 2017). It is therefore unavoidable to consider how the introduction of (and changes in) information and communication technologies (ICT) has deeply modified the very concept of work (Rainie, H., & Wellman, 2012), sometimes even releasing it from the physical place where work is done, alongside with the emergence of the so-called digital nomads, evolved forms of flexible and delocalized work, in which technology takes on an unquestioned importance (Rainie and Wellman, 2012; Ericsson et al. 2014; Ales et al., 2018).

Some literature directly connects the field of digital skills to the so-called 'internet skills' (see van Deursen et al., 2014 for an in-depth bibliographic examination). Ferrari (2012) considers that digital competences cover “information management, collaboration, communication and sharing, creation of content and knowledge, ethics and responsibility, evaluation and problem solving, and technical operations”. A more general definition of digital skills considers 'skills or literacies needed in the use of digital media, primarily computers and the Internet' (Van Dijk, JA, & Van Deursen, AJ, 2014), but later on in 2017 the same authors refocused the definition, taking into account the basic skills needed to interact with computers and internet technology ¹ (van Laar and Van Dijk, 2017).

Tackling of digital skills features, Ferrari (2012) lists some main characteristics, among which stand out 'Information skills, Communication skills, Content Creation skills, Safety skills, and Problem-Solving skills'. On the other hand, Helsper and Eynon (2013) identify four macro-areas of

¹ According to the Authors, digital skills can be grouped into
'A basic set of skills in using computers or Internet technology', van Laar et al., 2017.

reference (Technical, Social, Critical, and Creative skills) and van Deursen et al. (2014) classify them in Operational, Information Navigation, Social, Creative and Mobile skills.

Among the most recent works, van Deursen and Van Dijk (2014)², who analyse the digital skills of a target population and identify operational skills (the skills to operate digital media); formal skills (the skills to handle the special structures of digital media, such as menus and hyperlinks); information skills (the skills to search, select and evaluate information in digital media); and strategic skills (the skills to employ the information contained in digital media as a means to reach a particular personal or professional goal). In their later work, the Authors add two skills: communication and content creation (Van Deursen et al.2015). The analyzed material highlights a positive correlation between the skill development and two factors:

- The education, which plays a significant role: the higher the level of education is, the better the digital skills will be;
- The real age, which confirms the assumption whereby the so-called ‘digital natives’ have better interaction and digital learning skills compared to previous generations, which can however rely on their strategic skills (van Deursen et al.2014).

This confirms that digital skills are relevant: nowadays they are the set of knowledge needed in order to enter the job market (Gui e Argentin, 2011; van Laar et al., 2017). Very recently, van Laar et al. (2018) lists the main areas for digital skills as technical; information management; collaboration; communication; creativity; critical thinking; problem solving.

Several studies focus on the age as a determinant for digital skills, but they consider education as the determining factor for the development of one’s digital skills (Gui et al. 2011). The education becomes a rewarding factor for the hiring of management roles (Mauri et al., 2017) in Di Gregorio et al.’s work (2019). Through a cross-country analysis, he identified in detail the required skills to be hired (basic soft; digital and technical; core marketing analytical; customer insights). According to the Authors, soft skills and marketing knowledge are considered as essential pre-requisites for the recruitment, while digital skills appear to have a secondary role (even with differences among countries that can’t be ignored). This seems to suggest the creation of an education stage for digital skills which takes place after being hired.³

² Van Deursen and Van Dijk, 2014, p.4

³ ‘Although the professions of the future will gravitate toward the digital world, digital and technical skills rank within the top three most important skills for marketing graduates only in Italy and Spain. It thus might be expected that digital-related knowledge could be learned on the job’, p. 255.

We consider the main common features of business digital skills as following:

- They qualify the person/worker, however
- They develop thanks to the interaction with digital technologies;
- They can be supported by different devices (computer, tablet, smartphones, but also numerical control machines, labellers, etc).
- They accumulate – growing as time goes by;
- They are dynamic – they require constant updates and integration;
- They can be transferred
- They are aimed at problem solving

Even if the pervasiveness of ICTS appears as an essential condition thanks to the digital competence, the possibility of a widespread access to these technologies and to a digital connection cannot guarantee its development (van Dijk and Hacker, 2003; van Dijk et al., 2013; van Deursen et al., 2014; Yu et al, 2017).⁴ On the other hand, a distinguish is due as describing digital skills and the level of digitalisation of a population - which appears to increase when approaching the digital natives' generation (Brown, 2000; van Dijk and Hacker, 2003), differs to describing job digital skills, needed to relate with devices, programs and procedures used in different business processes.

This turns out to be true when the typical features of small and medium-sized enterprises human resources are on exam.

Methodology

The research was aimed at detecting small and medium-sized enterprises changes regarding jobs and skills in connection with ICTs and the fourth industrial revolution.

For this purpose, following the framework for digital revolution in figure 1, some research question drove the work:

- *RQ1: which kind of digital revolution is moving SME?*
 - *RQ1a: selection of new HR is higher for digital roles or old working position renewed with digital skills?*
 - *RQ1b: do digital positions rise in SME?*
 - *RQ1c: do the digital skills rise in SME?*
- *RQ2: is staff digitalization supported by educating programmes?*
- *RQ3: which are the roles the digital skills appear to be the most pervasive?*
- *RQ4: which will be the next future scenario for HR?*

⁴ Even when people have equal access to computers and the Internet, they may not have the skills to engage in a wide variety of use', Van Deursen and Van Dijk, 2014, p.2

- *RQ4a: are the so called ‘jobs of the future’ taken on account in SME?*

In order to identify the ongoing HR dynamics of the businesses and to provide a prospect on business organization in the near future, this research examines the data of the enterprises associated with Apindustria Brescia – a local small and Medium industries association, which granted us the use of data related to the selection and education managed internally by the association, and allowed us to administer a qualitative questionnaire to the members – in order to identify the staff prospects for digital development and to profile new positions in a sample of small and medium-sized industries.

In the first phase of this research, data on human resources selections are under examination, along with training programs’ main topics and attending students. Data collected by a local SME Association of data directly collected by the Association relating to Human Resources for the last five years (2013-2018)

Some clarifications about the methodology in use are due:

- Data on HR are provided by the human resources department of Apindustria Brescia. Human resources data are categorised into two macro areas matching two offices within the Association specifically dedicated to the reference area:
 - Human resources selection office
 - Training area
- The collection period used in the present survey and considered in data analysis includes the last five years.
- The last year for data collection and analysis is 2018. This because of limited availability of data for the 2019, still ongoing .
- For the specific purposes of this work, we analysed only the data referring to the selection of personnel with digital and technological skills and to the digital and technological training.

It must be noted that the described data obviously does not exclude alternative recruitment and education courses for the same small and medium-sized enterprises in exam. Therefore, the intention is to detect dynamics currently underway, while in no way claiming to be exhaustive on the theme in the territory of Brescia.

We assume HR digital revolution in SME can be measured considering the digital skills required while acquiring new force. Based on the pervasiveness of ICTs in managing the tasks on duty, we can distinguish:

- working position for fully digitalized tasks – we will call them ‘digital positions;
- working position encompassing clearly stating digital skills;

- working position encompassing tacitly digital.

The latter are not easy to select.

- *RQ1: which kind of digital revolution is moving SME?*
 - *RQ1a: selection of new HR is higher for digital roles or old working position renewed with digital skills?*
 - *RQ1b: do digital positions rise in SME?*
 - *RQ1c: do the digital skills rise in SME?*

To answer the first research question, data on new staff selection are considered. We refer to the demand for techno-digital human resources (abbreviated T-D) as the set of:

- people required to cover specific positions in the technology and digital field T-D (sub 1),
- people who are selected for different positions, which however require specific digital and technological skills (sub 2).

In order to identify the recruitment of staff with technological and digital skills, we analysed the demand for human resources received by the selection office of Apindustria Brescia in the five years taken under consideration.

Since 2013, staff requests have increased by 108% (with a decrease of 11% in the last year, extended to all the examined categories).

In the same period the 'techno-digital' staff increased by +85% (a considerable but less than proportional increase compared to the overall requests of human resources), while the sub-categories show separate dynamics.

In fact, the subdivision of the skills category into sub-categories highlights the significant demand for sub 2 personnel (different positions, but with digital skills), especially in 2017. From 2016 onwards, the Sub 2 component exceeds percentage of Sub 1 in the area of Techno-digital positions.

- Sub 1 - techno-digital roles (T-D)

The demand for technological and digital positions increased by 62% c. over the last the five years, but it is subject to a substantial variability on an annual basis. The final year survey is stable in numbers, lacking the changes of the previous year (the other examined categories show, on the other hand, sensitive contractions).

- Sub 2 - Roles that include techno-digital skills

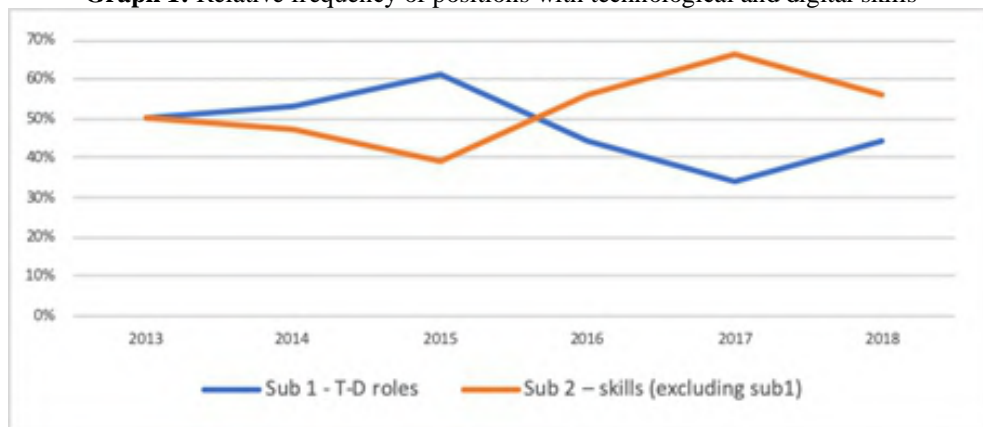
The demand for traditional roles with digital and technological skills is growing steadily, closing with a 108% increase if compared to 2013, in line with the dynamics detected by the overall demand for personnel.

2018 is in contrast with the trends of the last two years, when the Sub 2 category grew exponentially.

Table 1: Relative frequency of positions with technological and digital skills

	Selections T-D (out of the total number of selections)	Sub 1 - T-D roles	Sub 2 – skills (excluding sub1)
2013	51%	50%	50%
2014	41%	53%	47%
2015	46%	61%	39%
2016	41%	44%	56%
2017	51%	34%	66%
2018	45%	44%	56%

Graph 1: Relative frequency of positions with technological and digital skills



In table 1, digital selections are compared to the total selections by year. Sub1 and sub 2 are compared to the total techno-digital category.

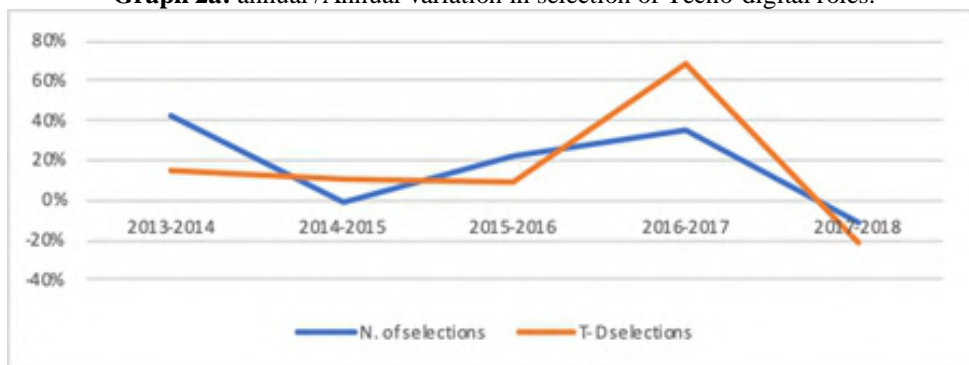
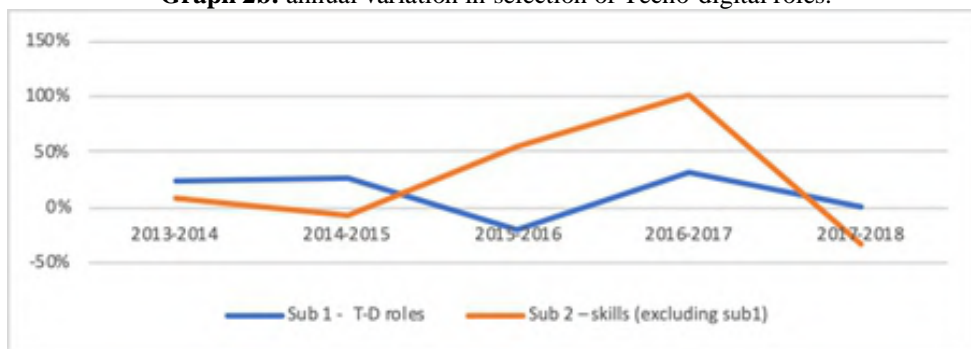
RQ1a: selection of new HR is higher for digital roles or old working position renewed with digital skills?

While the T-D selection appear to be quite steady, changes occur in sub 1 and sub 2, as easy visible in the graph: the fewer digital roles are requested, the more digital skills enrich and change traditional roles.

This is confirmed while analysing the variation per years in table 2. The political and economic instability in 2018 appears to have slowed down the demand for employees; a fall in Apindustria HR selection office activities witness the effects of this slowdown.

Table 2: annual / Annual variation in selection of Tecno-digital roles.

	Variations vs previous year			
	N. of selections	T-D selections	Sub 1 - T-D roles	Sub 2 – skills (excluding sub1)
2013-2014	43%	15%	23%	8%
2014-2015	-1%	10%	25%	-7%
2015-2016	22%	9%	-20%	54%
2016-2017	35%	69%	31%	100%
2017-2018	-11%	-21%	0%	-33%
Var. 2013-2018	+108%	+85%	+62%	+108%

Graph 2a: annual /Annual variation in selection of Tecno-digital roles.**Graph 2b:** annual variation in selection of Tecno-digital roles.

RQ1b: do digital positions rise in SME?

RQ1c: do the digital skills rise in SME?

To answer RQ1b and RQ1c, graph n. 2a and 2b can help. The last year on analysis confirm the political and economic instability in 2018 have slowed down the demand for employees, but the total variation 2013-2018 reveal a rise up to 108% in HR selection along with an identical rise in roles with digital skills. Digital roles rise is less than proportional as its increase is just for 62%.

To answer RQ3 (which are the positions where digital skills appear to be the most pervasive?) the working positions requested in SME are analysed, so three roles in particular stand out:

- Administration
- Engineers and computer technicians
- C.n.c. operators (referred to as 'CNC')

During the last five years some significant changes occur. Designers and programmers seemed to be more requested in the past, but in the last two years their demand has decreased.

In 2018, the three most-requested categories (in the table: administration, engineer, CNC) account for 69% of the requested roles with technological and digital skills.

Table 3: digital skills in selected roles by year

	ADMINISTRATION	ENGINEER	CNC	DESIGNERS	PROGRAMMER	% OF THE TOTAL NUMBER OF TECH-DGT SKILLS
2013	12%	8%	0%	23%	8%	50%
2014	23%	30%	7%	13%	3%	77%
2015	15%	39%	6%	12%	9%	82%
2016	33%	14%	11%	6%	17%	81%
2017	21%	23%	13%	8%	5%	70%
2018	29%	23%	17%	2%	2%	73%

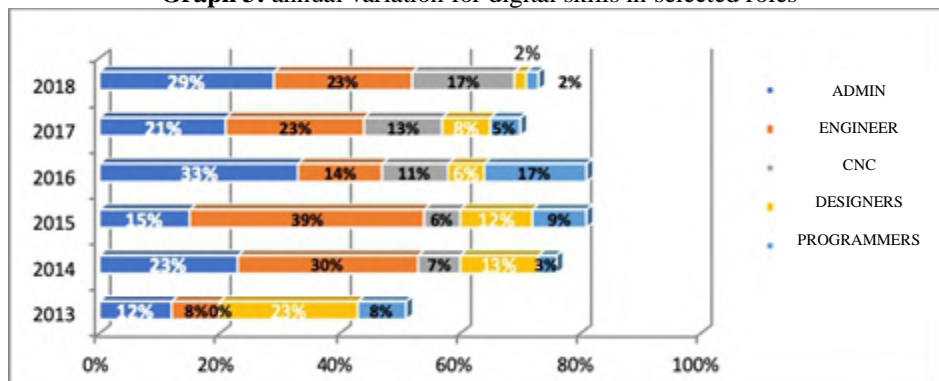
By analysing the variation in different roles selections (as already been said, the described roles are the most representative on a numerical point of view) over the previous year, we can highlight the annual variability and the variability during the examined period. In general, we have already highlighted in the previous paragraph how digital skills are a growing selection parameter; in the last five years they have grown with a trend of +85%, but in the last year they have decreased by -21% compared to 2017.

The roles with digital and technological skills showing the highest growth trend are engineers (+198% since 2013, but with some noteworthy decrease) and administrators (an increase of +153% over the last five years).

C.n.c. operators have been growing significantly: even with a non-noticeable variation during 2013, they have increased by 300% from 2014 to 2018. However, the significant annual variability registered on the different roles does not allow to draw an exact comparison of the results with the previously detected data over the last five years.

Table 4: annual variation for digital skills in selected roles

Annual Variations	TECH-DGT skills	ADMINISTRATION	ENGINEER	CNC	DESIGNERS	PROGRAMMERS
2014	15%	133%	350%	-	-33%	-50%
2015	10%	-29%	44%	0%	0%	200%
2016	9%	140%	-62%	100%	-50%	100%
2017	69%	8%	180%	100%	150%	-50%
2018	-21%	8%	-21%	0%	-80%	-67%
<i>Variation 2013-18</i>	85%	153%	198%	-	-91%	-73%

Graph 3: annual variation for digital skills in selected roles

To answer the RQ2 (is staff digitalization supported by educating programmes?) data on education programs (topics and attending students) are considered, for the timeframe 2013-2018.

A first analysis considers the number of courses with digital skills.

At a first glance, numbers reveal that between 2014 and 2016 the number of courses with digital contents decreased, but they increased steadily again in the two-year period 2017-2018.

An in-depth analysis was due, revealing significant information. The average duration of courses shows a slight decrease during the 2014, but over time it eventually regains a high average level compared to the average of the provided courses. A real change can only be outlined in the last year (2018), as the average duration of the courses decreases by 37% c. compared to the previous year of examination. As in table 5, the average number of participants undergoes an isolated inflection in 2014, followed by a constant increase until 2018, when it increases by 49% compared to the previous year (+ 32% compared to 2013).

Table 5: courses with digital competences by year

Digital courses					
	Variations over previous year			Average hours (total)	Average number of participants
	n. of courses	HOURS (total)	PEOPLE ATTENDING		
2013	-	-	-	34,25	4,71
2014	-32%	-35%	-48%	32,89	3,63
2015	-21%	-9%	-6%	38,07	4,33
2016	-13%	-15%	-11%	37,42	4,46
2017	92%	84%	81%	35,84	4,2
2018	32%	-16%	96%	22,73	6,24

However, the variation in the number of participants becomes even more significant if we analyse the aggregate numbers: a sharp increase of 56% between 2013 and 2018 and of 96% between 2018 and 2017 (table 5 and 6).

Table 6: data on participants to digital courses. Comparing 2013 and 2018 annual data.

n. of participants 2018	
Variation since 2013	Variation over previous year
56%	96%
Average n. of participants	
Variation since 2013	Variation over previous year
32%	49%
Av. training hours	
Variation since 2013	Variation over previous year
-34%	-37%

The ‘under 25’ age group is the one that attends the least: they represent on average 8% of the total number of participants.

It is interesting to cross reference the data on the attendees with their level of education and professional qualification.

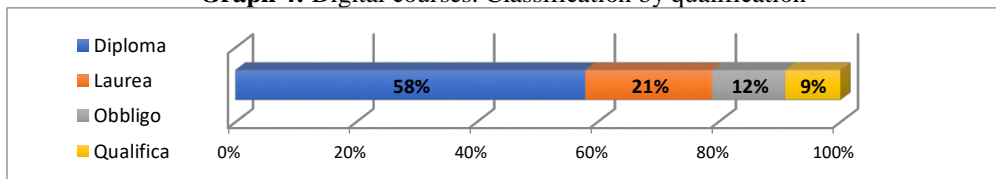
Most of the participants in training courses with digital and technological contents own a middle or secondary school diploma (79% of the cases on average); they are predominantly secondary school graduates (more than 60%), while university graduates represent on average 21% of the total number of attendees.

On the other hand, employees with a compulsory education or vocational training qualification are confined in very small numbers: respectively, 12% and 9% of the total number.

The only interesting variation happened in 2014, when 20% of the attendees owned a compulsory education qualification (table 7).

Table 7: Digital courses. Classification by qualification

	Compulsory education	Qualification	Secondary school diploma	University degree	Total
Average attendees	12%	9%	58%	21%	100%
Variation	5%	3%	6%	4%	

Graph 4: Digital courses. Classification by qualification

Therefore, the courses are generally designed for people with a secondary school diploma or a university degree, implying that the positions held by these people require education or updates regarding digital and technological skills. On the other hand, those who hold operational positions thanks to their qualifications require less education on this matter.

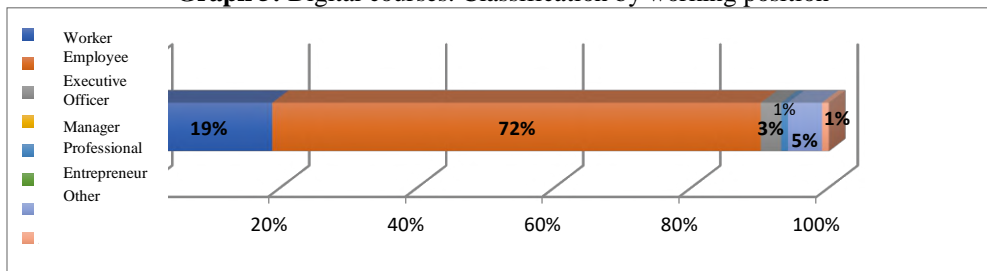
By focusing the analysis on the attendees' qualifications, we can easily divide the participants in two categories of employees.

The employees' category stands out (table 8): it represents on average 72% of the attendees (the workers are 19%), while the other positions are scarcely present or not included at all in the examined courses. Together, employees and workers account for 91% of the total number of attendees of digital and technological training courses.

It should be noticed how the data regarding 2014 differs a lot from the average of the last five years: the workers who took part in courses raised to 41% (compared to 58% of employees).

Table 8: Digital courses. Classification by working position

	Worker	Employee	Executive	Officer	Manager	Professional	Entrepreneur	Other	Total
Average attendees	19%	72%	3%	0%	1%	0%	5%	1%	100%
Variation	11%	9%	2%	0%	1%	0%	7%	1%	0%

Graph 5: Digital courses. Classification by working position

To answer the RQ4: which will be the next future scenario for HR?, a direct survey to a sample was submitted.

In order to build a congruous sample, we have selected 100 enterprises which represent the associations and the economic tissue of small and medium sized enterprises in Brescia, with a strong industrial vocation linked to the engineering sector and to metal working. A direct survey was generated and submitted digitally through Limesurvey platform, during the month of January 2019. Results are anonymised.

The most represented type of business in the sample is the medium-sized engineering enterprise with 10 up to 49 employees (more than 70% of respondents) and with a revenue of 1-2 million euros (45% of respondents; the percentage increases to 73% if we aggregate the two subsequent categories – “500,000-1 million euros”, and “2-5 million euros”). The engineering sector is the most represented one, followed by mechanical productions: together they account for 70% of the respondents.

Table 9 a, b, c: companies profile

NUMBER OF EMPLOYEES	Rate %
1-5	4,26%
6 - 9	6,38%
10-15	25,53%
16-19	6,38%
20-49	38,30%
50-99	14,89%
100-249	4,26%

SECTOR	Rate %
Agri-food	2%
Other	2%
Chemical	4%
Construction and Stone Industry	2%
Electromechanical	4%
Electromechanical	2%
Computer science and telecommunications	2%
Wood	2%
Machines	6%
Engineering	55%
Mechanical Productions	15%
Textile-clothing	2%

REVENUE	Rate %
Less than 500.000€	9%
More than 500.000€, less than 1Mil€	13%
More than 1Mil, less than 2Mil€	45%
More than 2Mil, less than 5Mil€	15%
More than 5Mil, less than 10Mil€	13%
More than 10Mil, less than 20Mil€	6%
More than 20Mil, less than 50Mil€	9%
More than 50Mil€	0

In order to create the best outline, the surveyed companies were asked about their propensity for the digital and instrumental sector - and how much it depended on a system of protection and tax relief provided at national level.

The interviewed are almost equally divided: around 42% of them invested in Industry 4.0; the remaining (58%) did not invest in it. However, in order to better understand the digital propensity of SMEs (intended as the natural evolution of the business towards a 4.0 model), we asked whether the investments depended on the benefits promised by the measure or not. The response rates get reversed and it emerges that the propensity towards the digital renewal of corporate structure depends less than expected on benefits linked to the Industry Plan 4.0: 57% of the respondents started the digital transformation regardless of national regulations (this percentage includes, of

course, those who made investments that can be traced back to the national Industry 4.0 plan, and those who have been excluded from it).

More than 50% confirms that they will maintain this propensity even in the future (estimated as a precautionary measure in the next 2-3 years); the remaining respondents are strongly undecided (37% of respondents).

Table 10: propensity toward digitalization

	YES	NO	I DON'T KNOW
I invested in Industry 4.0	42%	58%	0%
I have already started the digital transformation of my business, regardless of national rules.	57%	42%	1%
I'm willing to invest in the digital instrumental transformation in the next 2-3 years.	51%	12%	37%
I have already started processes aimed at digitalizing the employees.	42%	56%	1%
I am willing to start processes aimed at digitalizing the employees in the next 2-3 years.	52%	14%	35%
I have gathered/am gathering information on the voucher for innovation manager (2019 measure)	13%	72%	15%
I have gathered/am gathering information on Education 4.0	44%	46%	10%

Data on human resources reflect what has been indicated in terms of instrumental renewal: around 42% of the interviewed businesses has already started a process of digitalisation of the staff, and more than half of the respondents will continue to do so in the near future, highlighting the importance of human resources in businesses which are already digitalized or intend to continue with the digitization of their processes (table 10).

In table 11, the digitalization of the staff is under consideration, with a correlation between the state of the art and the next future. When analysing the two questions related to the digital education of the employees, we can notice how 43% of the businesses which haven't started projects aimed at digitalizing the human resources will fix the situation in the next three years (38% of them remains undecided and 20% think it's not needed, especially considering how their business is structured). On the other hand, the data confirms the strong tendency to digital education in businesses that have already started this kind of processes in the past: 64% of them will keep on investing in digitalization in the next three years, while only 4% will abandon this field (32% hasn't yet decided what to do on the matter).

Table 11: employees digitalization - correlation between the state of the art and the next future

[I have already started a process aimed at digitalizing the employees.]	[I am willing to start processes aimed at digitalizing the employees in the next 2-3 years.]		
	NO	I DON'T KNOW	YES
NO	20%	38%	43%
YES	4%	32%	64%
Total	11%	28%	42%

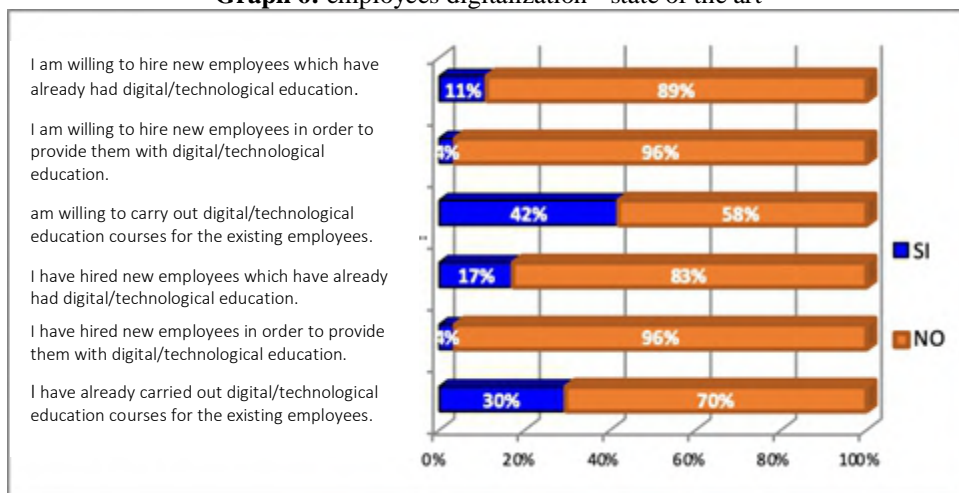
The interventions provided by the new Government Measures seem to be little-known to the interviewed people:

- Only 13% of them is gathering information on the voucher for innovation manager,
- 44% is gathering information on the interventions for Education 4.0.

When analysing in detail the relationship between human resources and digital skills, we can notice how education is a focal point for the interviewed enterprises, even more than hiring fully trained employees.

Table 12: employees digitalization - state of the art

	YES	NO
I have already carried out digital/technological education courses for the existing employees.	30%	70%
I have hired new employees in order to provide them with digital/technological education.	4%	96%
I have hired new employees which have already had digital/technological education.	17%	83%
I am willing to carry out digital/technological education courses for the existing employees.	42%	58%
I am willing to hire new employees in order to provide them with digital/technological education.	4%	96%
I am willing to hire new employees which have already had digital/technological education.	11%	89%

Graph 6: employees digitalization - state of the art

In table 12, data of digitalization processes for human resources are summarized: 30% of the sample companies asserts that they have already carried out education courses on the business employees and that they will continue doing so even in the next three years (42%). Almost none is interested in hiring employees which already have digital skills (11%) or which have to be educated in this direction (4%), maybe just because they have already been hired (17% of the interviewed people).

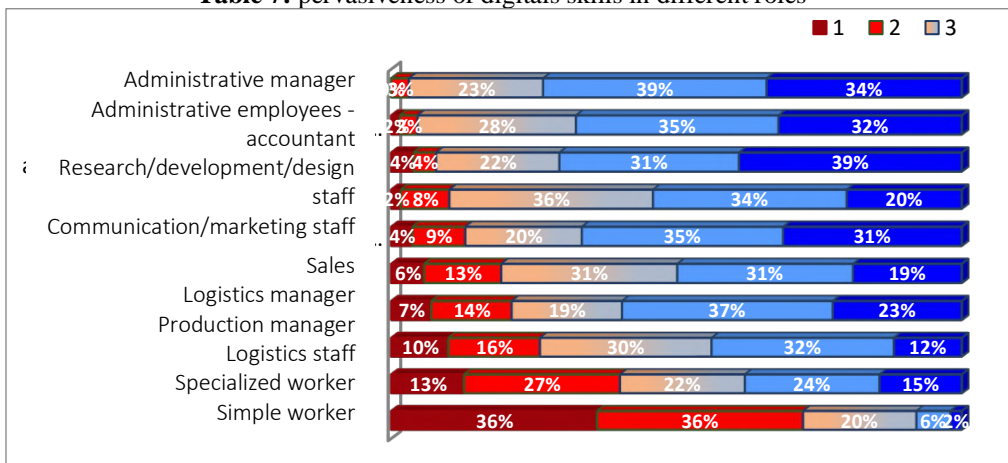
The research then inspects how pervasive digital skills are in the different roles by using a Liker scale in 5 points (table 13). As highlighted in the first phase, the roles where digital skills are more relevant belong to the following areas: administrative area (including both employees and managers), research and development (which includes also the design) and the communication/marketing area. The role of simple worker does not require basic digital knowledge (in 72% of the cases minimum skills or no skills at all are required), while specialized people find themselves in a situation where digital/technological skills are much more significant.

In the table 13, the first level (level 1) corresponds to non-existent digital skills in the role, level 5 corresponds to digital skills at the highest level.

Table 13: pervasiveness of digital skills in different roles

Significance of digital skills in the examined roles	1	2	3	4	5
Simple worker	36%	36%	20%	6%	2%
Specialized worker	13%	27%	22%	24%	15%
Logistics staff	10%	16%	30%	32%	12%
Production manager	7%	14%	19%	37%	23%
Logistics manager	6%	13%	31%	31%	19%
Communication/marketing staff	4%	9%	20%	35%	31%
Research/development/design staff	4%	4%	22%	31%	39%
Sales	2%	8%	36%	34%	20%
Administrative employees - accountant	2%	3%	28%	35%	32%
Administrative manager	0%	3%	23%	39%	34%

In terms of graphics, the following ‘barometer’ features two colour variations: The colour blue stands for digital, while red represents the absence of digital skills. The two extremities are characterized by brighter colours; the more a role turns to blue, the more digital skills will be significant for that role; the more a role turns to red, the less digital-technological skills will be found.

Table 7: pervasiveness of digital skills in different roles

Last research question RQ4a (are the so called ‘jobs of the future’ taken on account in SME?) intend to state if the new digital roles have any development possibility in SME. Associated companies have been urged to state their position on new roles widely acclaimed by research and press articles. A short list was provided, as in table 14’ first column.

It appears that none of the so-called "new professions" qualifies the digital transformation path for the next three years.

Table 14: new digital jobs in SME

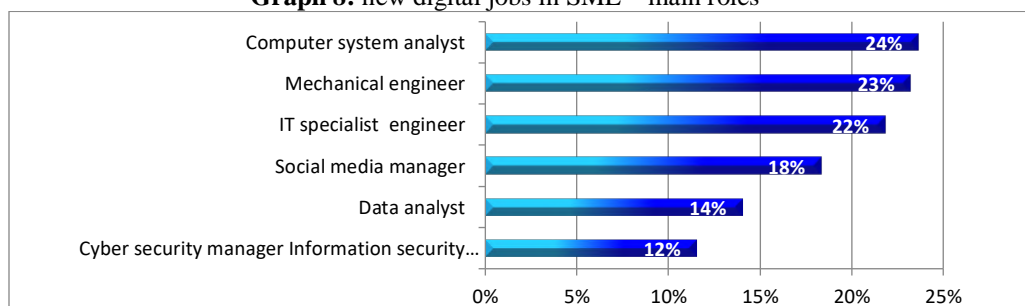
	Already part of the staff, I have no future forecasts	Already part of the staff, further development in the next 2-3 years	Not part of the staff, but I've planned a selection in the next 2-3 years	Not part of the staff, not in forecast
Data analyst	11%	4%	9%	77%
Social media manager	8%	10%	10%	72%
Cyber security manager Inform. security analyst	12%	0%	13%	75%
Computer system analyst	20%	4%	4%	73%
Mechanical engineer	7%	16%	14%	63%
IT specialist engineer	13%	9%	9%	69%

In the past the interest and the recruitment of appropriate staff was mainly focused on four different positions (table 14a):

- Computer system analyst (24%)
- Mechanical engineers (23%) - 16% of which developing over the next three years
- IT specialist / engineer (22%) - 9% of which expecting further development over the next three years
- Social Media Manager (18%, 10% of which is aiming at further development).

Table 14a: new digital jobs in SME – main roles

	Already part of the staff, no future development forecasts	Already part of the staff, further development in the next 2-3 years	Total
Cyber security manager Information security analyst	12%	0%	12%
Data analyst	11%	4%	14%
Social media manager	8%	10%	18%
IT specialist engineer	13%	9%	22%
Mechanical engineer	7%	16%	23%
Computer system analyst	20%	4%	24%

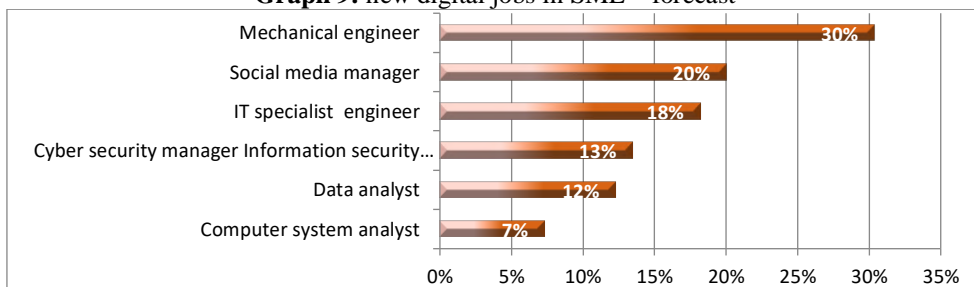
Graph 8: new digital jobs in SME – main roles

Future prospects are different (table 14b): companies are interested, above all, in the technological position of Mechanical engineer. Overall, in the next three years it will be sought-after by more or less 30% of SMEs, followed by the position of Social Media Manager (20%).

Table 14b: new digital jobs in SME – forecast

	Already part of the staff, further development in the next 2-3 years	Not part of the staff, but I've planned a selection in the next 2-3 years	Total
Computer system analyst	4%	4%	7%
Data analyst	4%	8%	12%
Cyber security manager Information security analyst	0%	13%	13%
<i>IT specialist engineer</i>	9%	9%	18%
<i>Social media manager</i>	10%	10%	20%
<i>Mechanical engineer</i>	16%	14%	30%

Graph 9: new digital jobs in SME – forecast



In fact, even if more or less 70% of the interviewed people confirms that the typical features of SMEs don't support the recruitment of people so specialized on a digital-technological point of view – and their permanent addition in the workforce – it is still true that the remaining 30% shows interest in the so called 'new roles': in some cases this interest will develop steadily over the next three years. This is the case of positions such as engineers who were also IT management (22%) and Computer System Analyst (24%) experts.

The next three years will be characterized by the predominance of a role which has already been of great interest to a lot of businesses until today (it has already been hired by 23% of the interviewed businesses): the *mechanical engineer*. Mechanical engineers will be sought-after by 30% of the interviewed enterprises (16% of them have already added them to their staff, but they will further develop this role in the next three years).

The development of social network is reflected in the huge numbers of users and in the increasing global trend: in a world with 4 billion internet users⁵ and in a market dominated by conversations where real public squares have been replaced by virtual communities, online advertising plays a key role in increasing the visibility and influencing the market perception.

It seems that even small and medium-sized enterprises are aware of this, especially the ones which plan to add the position of Social Media Manager in their staff in the next three years (20% of the interviewed businesses, however 10% of them have already inserted this position in their staff and have planned an expansion in the near future).

Future research

Human resources in enterprises are the more and more facing the fourth industrial revolution effects, requiring new competencies, dynamic capabilities and digital skills in SMEs. This work collected data on selection of new resources and on education of the existing ones, concluding a concurrent upgrade of the whole organization, in line with the structural adaptation of the enterprise, is driving human resources in SMEs.

As a first suggestion for further development, it could be of interest to widen the sample in use in this work, coming from a well-defined geographical area, in order to validate data on a broader scale.

Also, at this stage of the work, the paper underlies that during the organizational adaptation toward the new enterprise paradigm, the ordinary management is ongoing: this situation refers to a concept widely considered in literature: organizational ambidexterity (He and Wong, 2004; Gibson and Birkinshaw, 2004; Raisch and Birkinshaw, 2008) in incumbents.

Ambidexterity refers to the uneasy situation of transition, when two different systems coexist in the same organization: the one referring to old paradigms and the second aiming at exploring by adapting dynamically: this is the typical situation of a SME moving to the digitalized enterprise 4.0 paradigm (an interconnected reality based on the overall integration of IT technologies to manage big data, internet of things and additive manufacturing)

The concept of ambidexterity has been largely developed in organizational studies, as it foster the idea of dynamic capabilities (O'Reilly III et al, 2008) with a focus on its relationship with innovation (Andriopoulos and Lewis, 2009) and performance (Raisch et al., 2009; Junni et al. 2013). It also shows a strong connection with the sustainability of the competitive advantage of firms (Jurksiene et al, 2016).

⁵ Cfr: WeAreSocial Hootsuite - Digital in 2018 Report – 2018On

For its relevance, and following the work of Konlechner et al (2018) - stating a relationship between the three concepts of dynamic capabilities, technological change and ambidexterity - it could be of interest in future research to prove the coexistence of both exploitation and exploration of new capabilities in incumbents moving to the industry 4.0 paradigm (Müller et al. 2018) through the technological change of human resources skills.

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