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Industry 5.0 beyond borders: A comparative survey on the expectations of Italian and Austrian master students

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Abstract

The Industry 5.0 paradigm emphasizes the three pillars of sustainability, resilience, and social fairness and aims to bring back the human factor to the center of the production processes. This concept represents a significant step forward from the previous Industry 4.0, which prioritized digitization and artificial intelligence. The objective of this study is to examine the expectations about the Industry 5.0 paradigm in a sample of Austrian and Italian students. After carrying out a review of the scientific literature on the topic of Industry 5.0, this study explores the perspectives of students about entering the workforce, their expectations of human-machine interaction, and the assessment of their readiness for this new approach to technology. A survey conducted among Austrian and Italian students reveals insights into their preparedness, giving a particular accent on cross-cultural differences. This comparative analysis offers a valuable contribution to understanding student readiness for the next industrial revolution.

JEL Classification: O33, J24, Q01, L60

Keywords: *human factor, perspective of students, Industry 5.0, sustainability, resilience*

1. Introduction

The term " Industry 5.0" represents a step forward from the previous Industry 4.0. The aim of this 'new' revolution is to refocus on the concepts of sustainability, resilience, and social fairness, which were already considered in the fourth industrial revolution but had gradually lost importance. Digitalization and technologies based on artificial intelligence have gained the upper hand and have in fact become the main focus of Industry 4.0, which over the years has aimed to improve the scalability and efficiency of production. The rapid pace of technological development is a cause for concern, particularly in terms of the impact on younger workers, who are about to enter the labour market. They may be faced with new challenges, such as the need to acquire specific skills to adapt to an increasingly automated work environment, with the risk of partial or total exclusion from certain professional sectors.

Industry 5.0 has only recently been discussed in the scientific community: the fifth industrial revolution has officially been under discussion since 2020, although the first scientific studies driving its development have only been available since 2017. The term "Industry 4.0" only became publicly known in 2011, when an initiative of representatives from business and politics propagated the idea as an approach to strengthen the competitiveness of the German manufacturing industry (Kagermann, Lukas, & Wahlster, 2011).

This rapid change highlights the speed at which digital technologies are evolving and makes it urgent to rethink fundamental aspects such as resilience, the human factor and sustainability. Furthermore, the COVID-19 pandemic has further accelerated these considerations, demonstrating how global crises can put pressure on industrial systems and emphasizing the importance of a more holistic and sustainable approach to resource and technology management.

This article takes a closer look at one of the three pillars, namely the central importance of the human factor. Despite the recent introduction of the concept of Industry 5.0, many efforts have been made to investigate its crucial aspects. However, one topic that has remained unexplored and deserves more attention and analysis in the literature is the perspective of students about to enter the workforce. The aim of this study is to identify students' expectations, opinions and readiness to face Industry 5.0 with enthusiasm.

This paper addresses this issue relying on data collected using the survey method. The main aim is to gain a clearer understanding of students' views by analysing the data sets collected in interviews to Austrian and Italian students in 2023.

In order to provide a deeper and more comprehensive analysis, another interesting aspect is examined, which has to do with the possible discrepancies resulting from studying in different regions - Italy and Austria.

In order to verify whether there are significant differences between their expectations, the survey is based on a sample of Austrian and Italian students, thus providing a relevant cross-cultural contribution.

The analysis of the responses revealed some similarities, such as that the majority of students in Austria and Italy are prepared by their studies but do not feel sufficiently prepared, or that the majority of students are interested in acquiring hard skills rather than soft skills and prefer on-the-job training, workshops and seminars as a learning method.

Regarding the question of students' perceived preparation for Industry 5.0, it can be seen that in both countries, the majority of students who answered "yes" came from the IT/computer science sector; again, in both countries, those who answered "no" were predominantly from the humanities. However, differences can also be seen between the two countries. A lower percentage of students in Austria chose

customer/supplier interaction as the activity where the human element is considered most important, recognising the human element that is also prominent in other activities such as data analysis or project planning. In addition, the Austrian students placed more emphasis on soft skills compared to the Italian students. The last open question showed that the focus of Italian students is on the "future" and "technology and innovation" clusters, while Austrian students tend to focus more on "technology and innovation", but also on "human-robot cooperation", also indicating higher percentages for the "sustainability" and "humanity" clusters.

The fact that can be emphasized is that although there are some differences, they are not substantial. Moreover, the comparative analysis has shown that the existing differences relate to the different courses of study. It also shows that awareness and knowledge of Industry 5.0 is less pronounced in Italy than in Austria.

2. Theoretical background

Although Industry 5.0 is a very recent concept, there are numerous works in the literature that deal with its dynamics. The first scientific studies driving its development have been appearing since 2017, while an official mention only came later, in 2020.

If we look at various definitions of Industry 5.0 on the following pages, it becomes clear that its basic ideas and principles are closely related to those of its predecessor Industry 4.0. Industry 5.0 can be seen as an evolving concept that has its foundations in Industry 4.0, but it is still worth looking at some of the specifics of these industrial paradigms to gain a deeper understanding of some key considerations. According to Julian Müller's "Enabling Technologies for Industry 5.0 - results of a workshop with Europe's technology leaders (2020)", these considerations relate to terminology, guiding principles, the overlap of ideas and the state of technology adoption.

First of all, there can be misunderstandings when talking about a development or result in connection with the fourth industrial revolution, because Industry 5.0 encompasses the technology relevant to Industry 4.0. While the innovations of other industrial revolutions took decades to materialize, Industry 4.0 appeared only in 2011. Given the short time span between its ideas, Industry 5.0 could come across as rather marketing-driven and confusing if it is perceived as a mere extension of Industry 4.0. Furthermore, if Industry 5.0 focuses on societal and environmental ideals rather than technology, there is a risk that the focus will shift from scientific capabilities to policy issues. The overlap of ideas is related to the fact that, as mentioned above, Industry 4.0 already contains some of the principles of Industry 5.0 in several respects. Initially, Industry 4.0 focused on environmental, social and human values and emphasized customized goods, but later this broader goal was often no longer considered. Another aspect to consider is that Industry 4.0 is still being implemented, especially in traditional sectors and smaller companies.

Taking all these assumptions into account, it is now possible to better address the specifics of this new era. Industry 5.0 goes beyond Industry 4.0 and complements the digital technology, automation and data-driven processes of the Industry 4.0 paradigm, offering new elements and an innovative perspective and focusing on the three core pillars of human factors, industrial resilience and sustainability. Among the many definitions in the published literature, the European Union's stands out.

On a topic as important as Industry 5.0, the European Union's intervention is fundamental in supporting the project towards its successful goals; by proposing an essential framework for the future development of the sector, the EU familiarized people with its position and objectives in order to provide a clear perspective on the direction it intends to take. The definition provides a first insight into the guidelines and priorities that will be set at institutional level. In particular, the NDICI Global Europe Initiative 'Global Challenges' addresses the global and multilateral dimensions of EU activities for the implementation of its

policy objectives for the period 2021-2027.
It is the EU's main instrument for international partnerships in the areas of sustainable development, climate change, democracy, governance, human rights, peace and security in the EU's neighbouring countries and beyond. It aims to strengthen the EU's role as a global actor in the implementation of the United Nations 2030 Agenda and the Paris Agreement, leading to activities that address global challenges, promote global goals, preserve global public goods, support international cooperation and foster transformative and fundamental change. The program's framework reflects the interconnected pillars of the 2030 Agenda that led to the SDGs (Sustainable Development Goals): People, Planet, Prosperity, Peace and Partnership. The concept of Industry 5.0 was discussed by participants from research and technology organizations in two virtual workshops held on 2 and 9 July 2020 and organized by the Directorate for Prosperity, a department of the European Commission (EC) responsible for EU policy in the field of research and innovation.

There was a consensus that Europe's social and environmental concerns need to be better integrated into technological progress and that the focus needs to shift from individual innovations to a systemic approach. According to the European Commission's definition, Industry 5.0 should recognize the ability of industry to achieve societal goals beyond jobs and growth and become a resilient wealth creator by making production respectful of our planet's limits and putting the well-being of industrial workers at the heart of the production process. The urgent need to focus on human and sustainable values is undeniable and is also evident when looking at other relevant definitions. Industry 5.0 is seen as the answer to the question of a new human-centric industrial paradigm that starts from the structural, organizational, managerial, knowledge-based, philosophical and cultural transformation of production processes in industry (Carayannis E.G. et al., 2020).
Another strand of literature recognizes Industry 5.0 as a first industrial revolution led by people and based on the 6R principles (Recognize, Reconsider, Realize, Reduce, Reuse and Recycle) of industrial upcycling, a systematic technique to avoid waste and an efficient logistics design to evaluate living standards, create innovative creations and produce high-quality customized products (Rada M., 2020); other literary works agree that Industry 5.0 now characterizes an ecosystem with a harmonious human-machine collaboration that brings the human workforce back to the factory, where humans and machines are paired to increase process efficiency by harnessing human intelligence and creativity through the integration of workflows with smart systems (Nahavandi S., 2019); in the same vein, another definition of Industry 5.0 as a human-centric design solution where the ideal human companion and cobots collaborate with human resources to enable personalizable autonomous manufacturing through enterprise social networks (Maddikunta P. K. R. et al., 2022). In Industry 5.0, the pursuit of expansion, profit and technological advancement, while still critical, must necessarily be balanced with other factors that can be summarized in the three key elements of Industry 5.0: People-centricity, sustainability and resilience.
The enabling technologies of Industry 5.0 are a set of complex systems that combine technologies, such as smart materials, with embedded, bio-inspired sensors (Müller J., 2020). These technologies are fundamental since the concept of Industry 5.0 seeks to improve collaboration and cooperation across automated systems and promote even deeper integration between humans and machines.
To cite some of the most important enablers of Industry 5.0: edge computing, blockchain, digital twins, cobots, the IoE, big data analytics, and 6G.

Edge computing refers to the enabling technologies allowing computation to be performed at the edge of the network (Shi J. et al., 2016)**.** In this way, with edge computing, computing is put in the proximity of data sources granting more efficiency if compared to the cloud computing paradigm, introduced around

2005. For Industry 5.0 applications, Edge Computing ensures low latency, data security and privacy, and delivers efficient services to the end users (Pham Q.V. et al., 2020).

Digital twins allow, physical systems to be analysed and monitored digitally so that possible problems can be foreseen and solved in the real world. A Digital Twin is a high-fidelity representation of the operational dynamics of its physical counterpart, enabled by near real-time synchronization between cyberspace and physical space (Schleich B. et al, 2017).
Cobots, also known as collaborative robots, are robots intended to interact with humans in a shared space (Veloso M. et al, 2015). Since 1996, when the first cobots were developed, they have evolved significantly becoming more responsive and safer in human-centric environments, and holding great promise in Industry 5.0.
The Internet of Everything (IoE) is an interconnected link between people, processes, information and things (Li X. & Da Xu L., 2020), which, in the context of Industry 5.0 has the potential to create new opportunities and functionalities, for instance enhancing customer satisfaction by offering personalized experiences based on IoE-generated data.
Big data analytics in the context of Industry 5.0, play a decisive role, for example, they make it possible to frame real-time decisions. They encompass a vast and diverse range of data from various sources; many data analysis techniques include Big Data technologies such as Machine Learning, AI, social networking, data mining, data fusion and so on (Hämäläinen E. & Inkinen T., 2019).
Blockchain is a collection of interconnected blocks that store data in a distributed, transparent, and tamper-proof manner (Verma A., at al 2022). One of the key benefits of blockchain is its ability to support secure peer-to-peer communication, underpinned by an immutable ledger for record-keeping, that fosters operational transparency and accountability, and therefore it can be used to design decentralized and distributed management platforms by enabling distributed trust (Viriyasitavat W. & Hoonsopon D., 2019).
6G The use of 6G in the industry 5.0 environment makes it possible to deliver better latency, support high-quality services, as well as IoT infrastructure and integrated AI capabilities (Chowdhury M. Z. et al, 2020). In Industry 5.0, 6G networks are crucial for boosting performance with smart spectrum management, AI-driven edge computing, and intelligent mobility (Tariq F. et al, 2020), they deliver ultra-fast data providing low latency, reliability, and energy efficiency.

3. Empirical analysis

These advanced technologies require a collaborative and inclusive approach to maximise the benefits and promote the transition to a more advanced but harmonious industrial model that respects the well-being of workers. It is necessary to develop the competencies and skills of workers at all levels, who must therefore be informed and trained to understand the complexity and use the new tools and methods. In this sense, Industry 5.0 would bring significant challenges and require new learning approaches for the retraining of the existing workforce and the ability to scale and meet the needs of new entrants.
The present work, which deals with one of the three pillars, the central importance of the human factor, aims to contribute to research in this area by examining aspects that haven't yet been researched. Specifically, it aims to analyse the expectations of students in Italy and Austria in this complex and rapidly evolving context.
The transition to the era of Industry 5.0 means being aware that there are many opportunities but also complicated issues that need to be considered by institutions, companies and workers, such as costs and finances, but also security, privacy, scalability, regulatory compliance, acceptance and adaptation, and the need for a trained workforce.

The hypothesis aimed to investigate whether there are potential differences between Italians and Austrians in order to gain a better understanding of the cultural variations and educational influences in the two realities.

3.1 Survey data

The empirical analysis was conducted using a questionnaire as a method of data collection. The questionnaire reached 126 respondents who formed the sample for the study. Among the multiple-choice questions (with only one choice), only one question was intended as an open question: "What does Industry 5.0 mean to you?". The first questions in the questionnaire relate to gender, country of residence, academic discipline and educational qualification. The following questions, ranging from the fifth to the tenth question, refer to various aspects related to students' skills, readiness for the work environment, training and roles: "Are you interested in acquiring new skills?", "Do you think your current degree programme has prepared you sufficiently for jobs in Industry 5.0 jobs?", "What type of training are you most interested in?", "In which of the following roles is the human component more important than the technological component?", "Which skills do you consider most important in this context?" and the open question "What does Industry 5.0 mean to you?". A fundamental step was to extract the data from the Google forms, resulting in a clear and detailed database structured by rows and columns, the very first version, which was subsequently revised. The total 126 respondents are composed as follows: 53 Austrian students and 73 Italian students identified with the second question that helped to divide the sample into the two groups Italy and Austria. For each group, questions were scored from 5 to 10 according to gender, field of study and degree.

3.2 Results

Students were asked to express their interest in acquiring or not acquiring new skills and to choose between hard and soft skills if they were interested. In both countries, the majority of respondents agreed with the choice between hard skills and soft skills (Italy 75%, Austria 72%). As already explained in the last question "What does Industry 5.0 mean to you?", the analysis takes into account the differences in the students' choices based on the participants' gender, level of study and field of study. This means that responses are analysed by gender (female or male), by level of study (from Bachelor's to Master's), with the exception of PhD, as no relevant information is available, and by academic discipline (5 clusters): Business and Finance, Engineering and Architecture, IT/Computer Science, Humanities, Healthcare and Science.

When it comes to the question of interest in acquiring new skills, the only notable difference between the two groups is in relation to female gender; in fact, 68% of Austrian female students chose the "soft skills" option, while 75% of Italian female students, and thus the majority, chose the "hard skills" option.
There are no differences in the male population. Most participants prefer to acquire hard skills anyway, especially in Italy among Master's students. Based on the same survey and using the field of study as a distinguishing feature, it is possible to state that in Austria 35% of IT/computer science students are interested in acquiring hard skills, while in Italy the 35% of respondents who are interested in acquiring hard skills are studying humanities. The percentages of soft skills underline a similar interest between Italy and Austria, with interest in these skills being more prevalent among people from the humanities.
The survey also focused on the level of readiness of students for jobs in Industry 5.0; universities in particular play a central role, as the work environment requires new and very specific skills. Overall, the majority of respondents (56% in Italy, 60% in Austria) believe that their preparation is insufficient due to their current course of study. Furthermore, a significant proportion of respondents in both countries believe that they are not sufficiently prepared at all for jobs in Industry 5.0.

Looking at the differences between genders, the majority of students who answered "yes, but not enough" are female in Italy, while they are male in Austria. Furthermore, in both regions, the majority of those who feel prepared are male.
The analysis on this topic of the survey then continues considering the level of study. A large percentage (73%) of Italians who answered "yes" and thus feel prepared are Bachelor's students; in Austria, on the other hand, most people who answered "yes" are studying at Master's level (63%). Due to the different fields of study, it appears that in both countries those who do not feel prepared are mainly studying humanities subjects (Italy 55%, Austria 45%). The majority of students who feel prepared are IT/computer science students (Italy 42%, Austria 40%).
The preferred type of training is on-the-job training, followed by workshops and seminars, online courses and traditional classroom courses, which are the least frequently chosen by students. Adding up the percentages for the two countries, 87 are accounted for by on-the-job training, 48 by workshops and seminars, 44% by online courses and 23% by traditional classroom courses. In both Italy and Austria, students are more interested in acquiring their skills directly in practise. In Austria, female students are more interested in workshops and seminars (37%), while in Italy they prefer on-the-job training (48%). If we continue the analysis taking gender into account, we see that the majority of male students in both countries prefer on-the-job training (Italy 42%, Austria 50%). In terms of study level, the majority of Bachelor students in both Italy and Austria are considering on-the-job training to acquire new skills (Italy 36%, Austria 39%).

The majority of Master's students also expressed this view (Italy 61%, Austria 43%). Interest in traditional face-to-face courses is lower among Master's students and especially among Italian students (additional share of Italian and Austrian Bachelor's students 27%, additional share of Italian and Austrian Master's students 15%). In terms of field of study, the majority of IT/computer science students in Italy prefer workshops and seminars (50%), while the majority of students of the same subjects in Austria prefer on-the-job training (56%). In the humanities, more Austrian respondents prefer online courses compared to Italian students (Italy 11%, Austria 27%). In addition, the majority of economics and finance students would prefer on-the-job training (Italy 65%, Austria 43%). In the field of engineering and architecture, no one in Italy is interested in traditional face-to-face courses, the majority of Italian students prefer online courses (50%), while the majority of Austrian students opt for on-the-job training (43%).
In the following question of the survey, the participants were asked to decide in which activity the human component is considered more important than the technological component. The first role students voted for is customer and supplier interaction (overall percentage 119%), followed by data analysis (overall percentage 33%), project planning (overall percentage 31%) and then technical design (11%) and supply chain management (6%), which were less frequently chosen. As with the previous questions, the analysis focuses on possible differences in responses according to gender, level of study and academic discipline. Interaction with customers and suppliers was chosen more frequently by women in both Italy and Austria (Italy 73%, Austria 63%). In addition, more male students in Austria (Italy 0%, Austria 12%) believe that the human element is more important in engineering design, recognizing that it is not only relevant in roles such as "interaction with customers and suppliers", where the human element is typical.
At Bachelor level, the majority of respondents, Italians and Austrians, voted for "interaction with customers and suppliers" (Italy 67%, Austria 65%), then more Italian students chose "data analysis" (Italy 19%, Austria 9%); at the same time, more Austrians voted for "project planning" (Italy 10%, Austria 26%). At Master's level, the majority of Italian and Austrian respondents again chose "Interaction with customers and suppliers" (Italy 64%, Austria 50%). In each academic discipline, "interaction with customers and suppliers" remains the most frequently chosen role (total IT/computer science 106%, total humanities

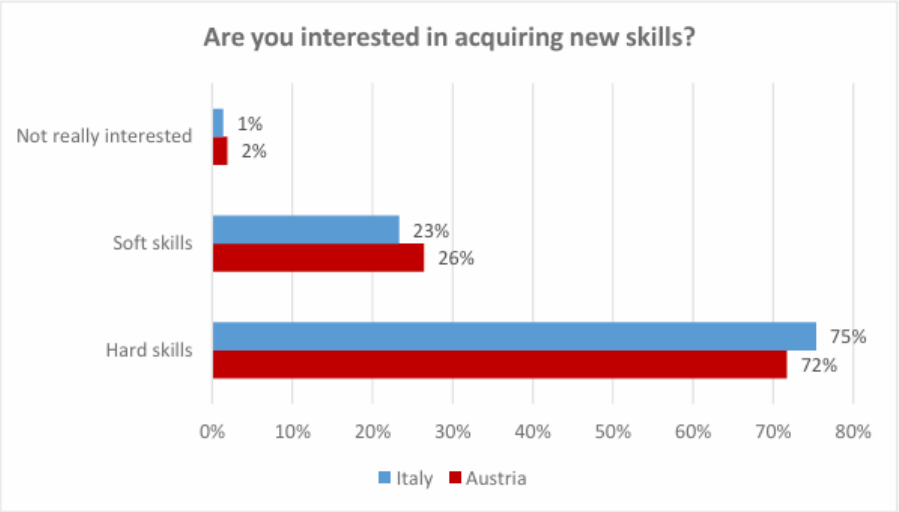
134%, total business & finance 117%, total engineering & architecture 93%), although the study area "healthcare & natural sciences" is not included here due to the inconsistent number of respondents. Another interesting finding is the assessment of skills according to their perceived relevance. In this context, the most important skill for Italian respondents is flexibility (34%), followed by creative thinking (28%), analytical thinking (14%), AI and big data (12%), programming (8%) and technological competence (4%). In Austria, Analytical Thinking (26%) ranks first, followed by Creative Thinking, AI and Big Data and Flexibility with a share of 23%, followed by Programming (5%).

This shows that despite the strong interest in acquiring hard skills, the importance of cognitive skills in Industry 5.0 is recognized. The majority of Italian female students chose flexibility (38%), followed by creative thinking (35%).
The majority of Austrian female students chose analytical thinking (53%). In contrast to women, AI and big data received a higher percentage of votes among men in both regions (Italy 24%, Austria 29%).
At Bachelor's level, the majority of Italian students responded with flexibility (38%) and creative thinking (36%), while the majority of Austrian students voted for flexibility (30%), but also considered creative thinking, analytical thinking, AI and big data to be relevant (22% each).
The majority of Italian Master's students also voted in favor of flexibility (32%), albeit with a lower percentage (32%); in fact, the percentages for analytical thinking (18%) and AI and big data (18%) increased significantly. The final open question excluded 7 responses, bringing the total number of responses considered to 119. The students express a variety of perspectives on how Industry 5.0 is perceived, which illustrates the complex nature of this revolutionary phase in the development of industry. Innovation, collaboration with machines, sustainability and the use of cutting-edge technology are some of the themes that stand out. The answers can be summarized in 5 main groups: Sustainability, Technology and Innovation, Human-Robot Collaboration, Future and People at the Center. The answers are analyzed by gender (female/male), level of study and academic discipline. The analysis, which takes into account the different academic disciplines, shows that in Austria, IT/Computer Science and Engineering & Architecture students think about sustainability issues (IT/Computer Science 67%, Engineering & Architecture 33%). In Italy, those studying IT/computer science think more about technology and innovation (32%).

4. Discussion

The questionnaire shows that the majority of students in both Italy and Austria are interested in acquiring hard skills, in particular 75% in Italy and 72% in Austria (Figure 1).

Figure 1 - *Hard or soft skills*



Moreover, in both countries it is male students who tend to prefer this. At degree level, the percentage of students interested in hard skills is higher in Italy than in Austria, especially for Master's degrees (Figure 2, Figure 3).

Figure 2 - *Hard or soft skills: Bachelor*

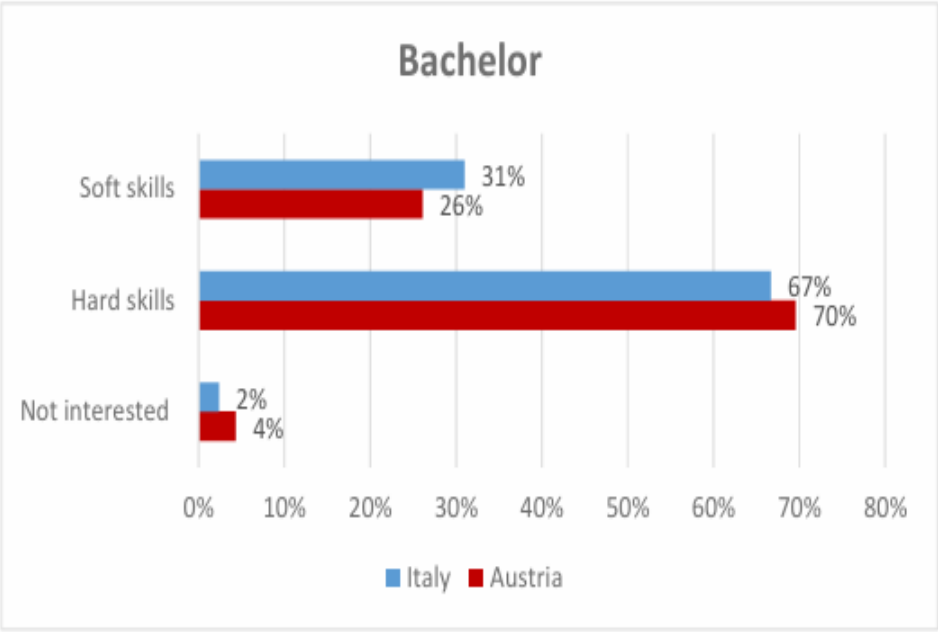
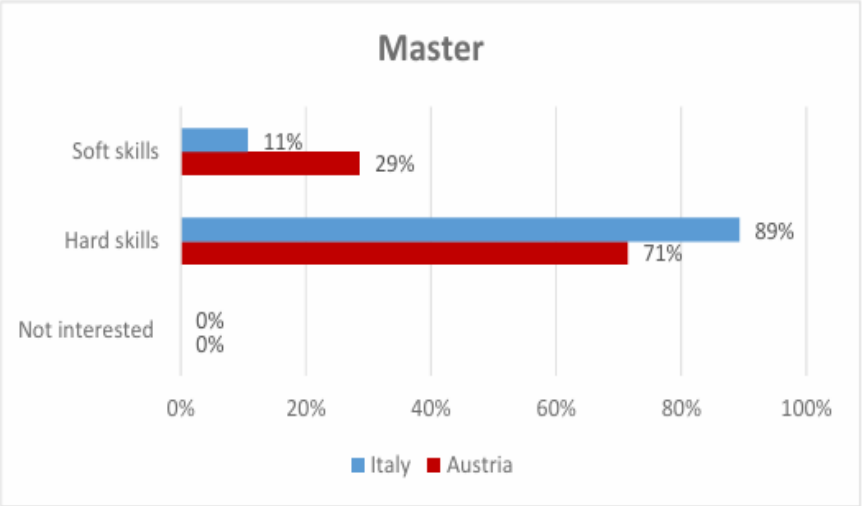


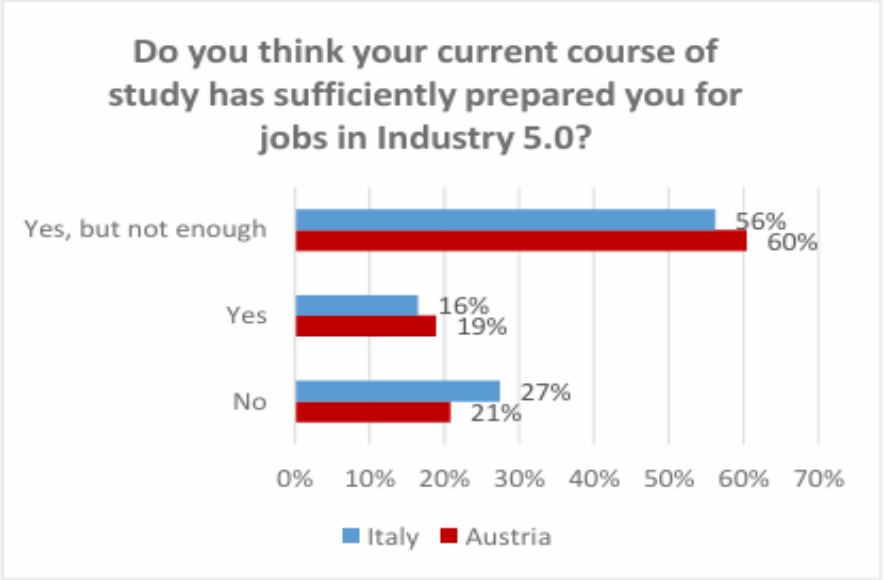
Figure 3 *- Hard or soft skills: Bachelor*



In Austria, it is mainly IT/computer science students who are interested in hard skills, while in Italy the highest percentage is found among humanities students. In this context, however, it should be noted that most respondents in Austria study IT/computer science, and the same applies to humanities students in the Italian region.

A large proportion of economics and finance students are also interested in acquiring hard skills, in particular 24% in Austria and 25% in Italy. Despite this interest in acquiring hard skills, the majority of students in both countries do not feel ready to face the world of work in the context of Industry 5.0 (56% in Italy and 60% in Austria – Figure 4).

Figure 4 *- Students' readiness for jobs in Industry 5.0*



Moreover, only 16% in Italy and 19% in Austria feel ready, with the remaining percentages answering that they are not. Of the students who feel ready but not sufficiently prepared, 69% are male in Austria, while in Italy female students feel that they have not fully acquired the necessary skills (61%). In this question on student preparation, it is also noticeable that the proportion of students answering "no" is decreasing among Master's students in both Italy and Austria. It is noteworthy that the majority of those who responded that they were not prepared at all come from humanities degree programmes (45% in Austria

and 55% in Italy – Tables 4.5, 4.6). In both Italy and Austria, the majority of students who consider themselves prepared are studying IT/computer science (Figure 5, Figure 6).

Figure 5 - *Students' readiness for jobs in Industry 5.0: Austria (academic discipline)*

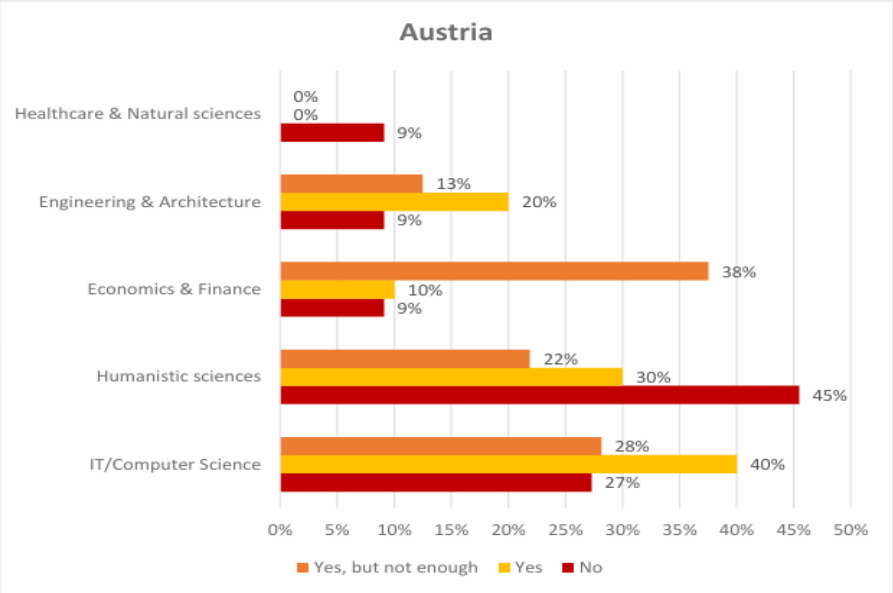
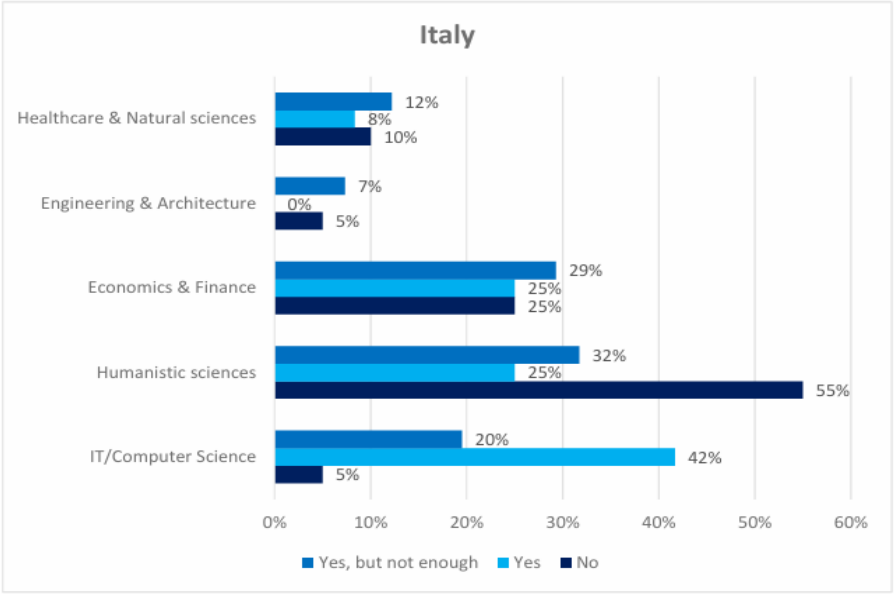
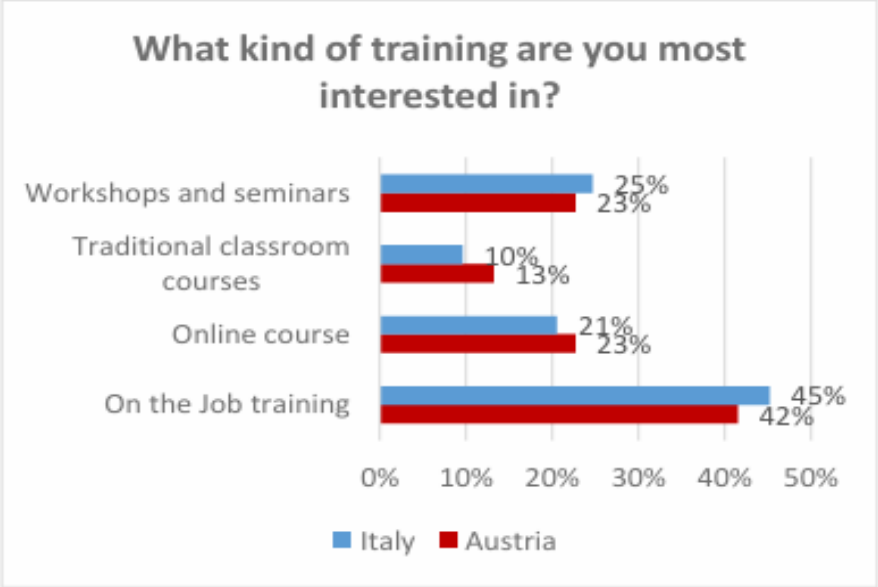


Figure 6 - *Students' readiness for jobs in Industry 5.0: Italy (academic discipline)*



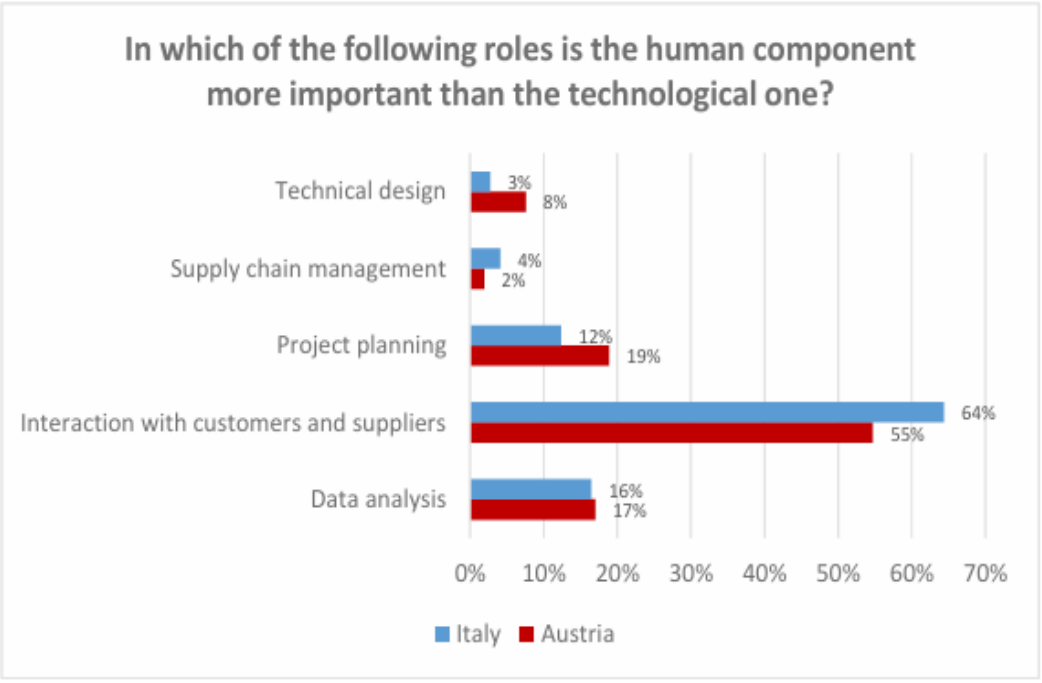
Also in terms of the type of skills acquisition, the majority of students in both countries prefer "on-the-job training" (45% in Italy and 42% in Austria – Figure 7).

Figure 7 *- Interests in different kinds of training*



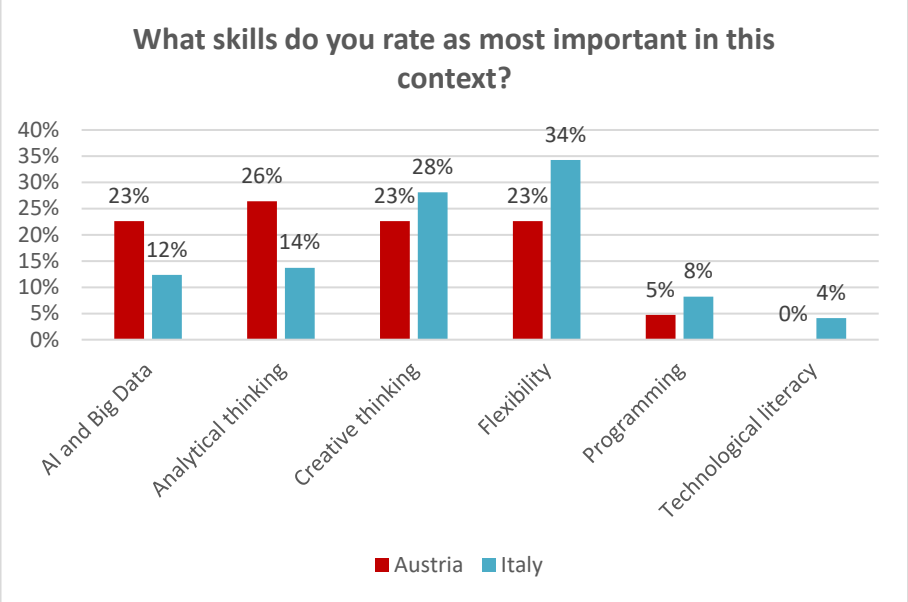
The second most popular type are workshops and seminars, the third most popular, albeit to a slightly lesser extent than the previous ones, are online courses and the last are traditional face-to-face courses. Of economics and finance students, 65% in Italy prefer on-the-job training, a percentage that is higher than the Austrian percentage of 43%. Students were then asked to choose from the various activities proposed (technical design, supply chain management, project planning, interaction with customers and suppliers and data analysis) the one in which they consider the human component to be more important than the technical one. The majority of students responded to the question about interaction with customers and suppliers, 64 in Italy and 55% in Austria (Figure 8).

Figure 8 *- Human and technological components*



At this point, it is perhaps necessary to make it clear to students that human presence is also essential in areas such as technical design, supply chain management, project planning and data analysis. Even though customer interaction seems to be the most human-centred activity, understanding customer needs is important in activities such as technical design and project planning. Data analysis also requires the human element to interpret the results and make decisions based on this data. A high percentage of students also chose data analysis, which ranks second in Italy, followed by project planning and third in Austria. It can also be noted that 'Interaction with customers and suppliers' was chosen more by female students in both countries. The male population also rated the other activities more highly. In terms of the skills considered most important, the ranking for each country is as follows. Italy: 1. Flexibility; 2. Creative thinking; 3. Analytical thinking; 4. AI and Big Data; 5. Programming; 6. Technological literacy. Austria: 1. Analytical thinking; 2. AI and Big Data, Creative thinking and flexibility; 3. Programming; 4. Technological literacy: no votes (Figure 9).

Figure 9 - *Perception on the importance of skills*



The majority of Austrian female students voted for Analytical thinking, while the Italians voted for flexibility and creative thinking. The male population in Italy also voted for Flexibility, while in Austria it was mainly AI and Big Data and Flexibility with the same percentage of 29%. In both countries, those who chose AI and big data were mainly computer science/computer engineering students.

The last open question allowed students to freely express their opinions on the topic of Industry 5.0. Clusters were formed for the answers, and most answers fell under the technology and innovation category. However, opinions varied, with some expressing uncertainty or a lack of familiarity with the concept. While many foresee a future of increasing automation and technology integration, others emphasise the importance of maintaining a balance between technological advancement and human integration. The recurring emphasis on sustainability and human-centred approaches underscores a shared vision of industrial development that takes into account environmental and social impacts. In this regard, the analysis of Master's students revealed that in Italy most associate Industry 5.0 with technology and innovation and the future, while in Austria it is more associated with human-machine collaboration and the fact that it places human inclusion at the heart of technological development (Figure 10, Figure 11).

Figure 10 *- Perception on the importance of skills: Austria*

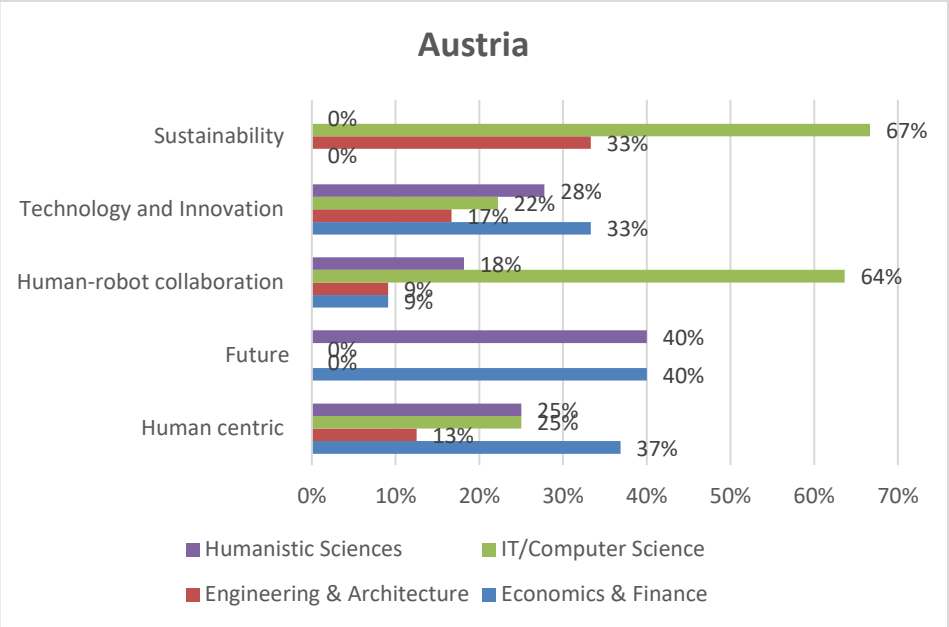
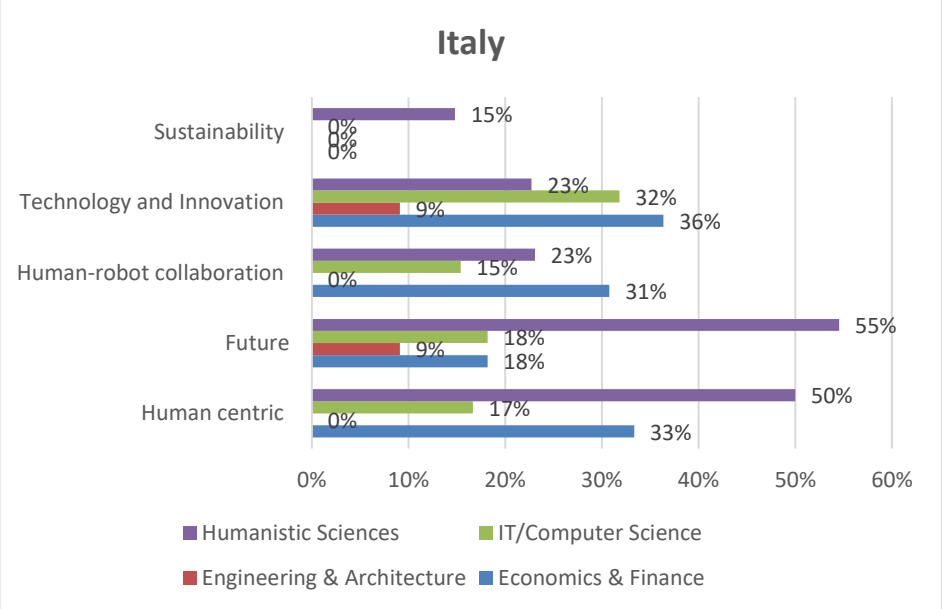


Figure 11 *- Perception on the importance of skills: Italy*



Considering the comparative analysis and taking into account the limitations due to the small sample, these results could reveal a discrepancy in terms of curricula that affects the sensitivity and awareness of these Industry 5.0 topics, which seems to be more lacking in Italy.

5. Conclusions

This study explored the theoretical structure and conceptual framework of Industry 5.0. As a logical progression from Industry 4.0 to Industry 5.0, the three key components of resilience, sustainability and human-centricity are brought to the fore. These principles serve as the basis for an industrial paradigm shift.

The main objective of this research was to shed light on the revolutionary potential of Industry 5.0, driven by the conviction that the combination of technological innovation, sustainability and human-centricity can improve the situation in the face of all the associated challenges. Mainly thanks to the questionnaire, it was possible to learn and add reflections on the topic, in particular focusing attention on the human-centered aspect by collecting the expectations of Italian and Austrian students. The most important part of this research was the use of the data obtained through the survey, which made it possible to understand the students' extremely valuable answers.

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Figures

Figure 1 *- Hard or soft skills*

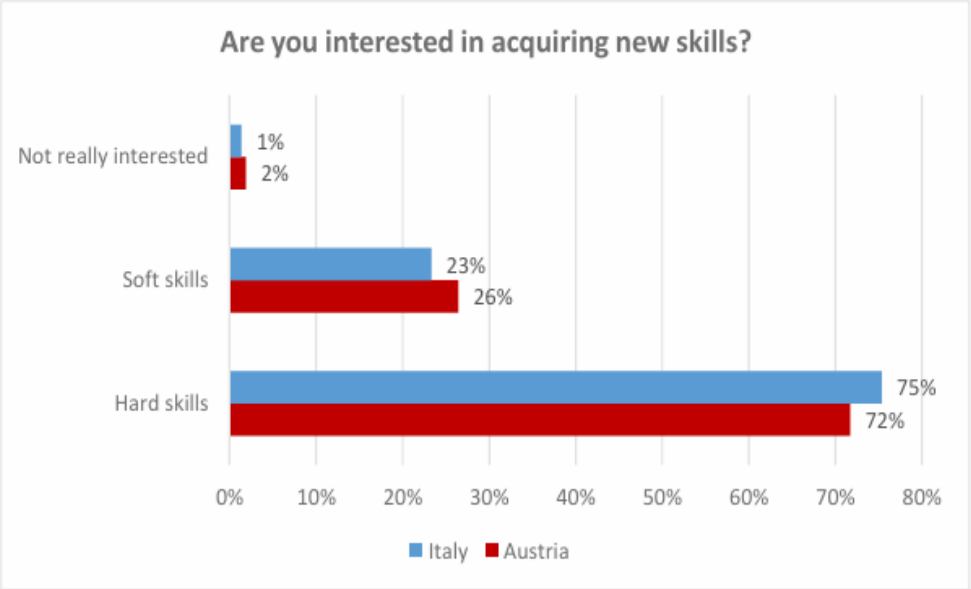

Figure 2 *- Hard or soft skills: Bachelor*

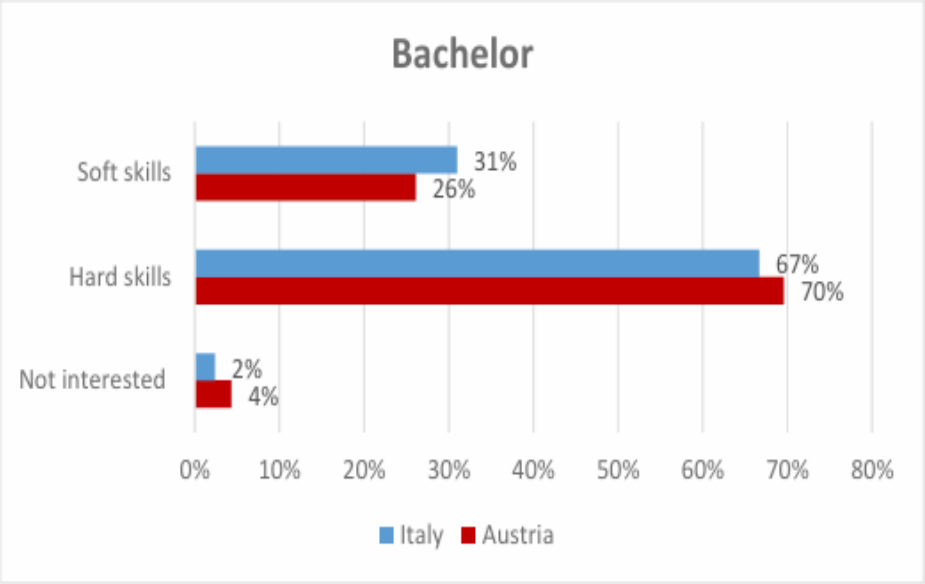

Figure 3 - *Hard or soft skills: Master*

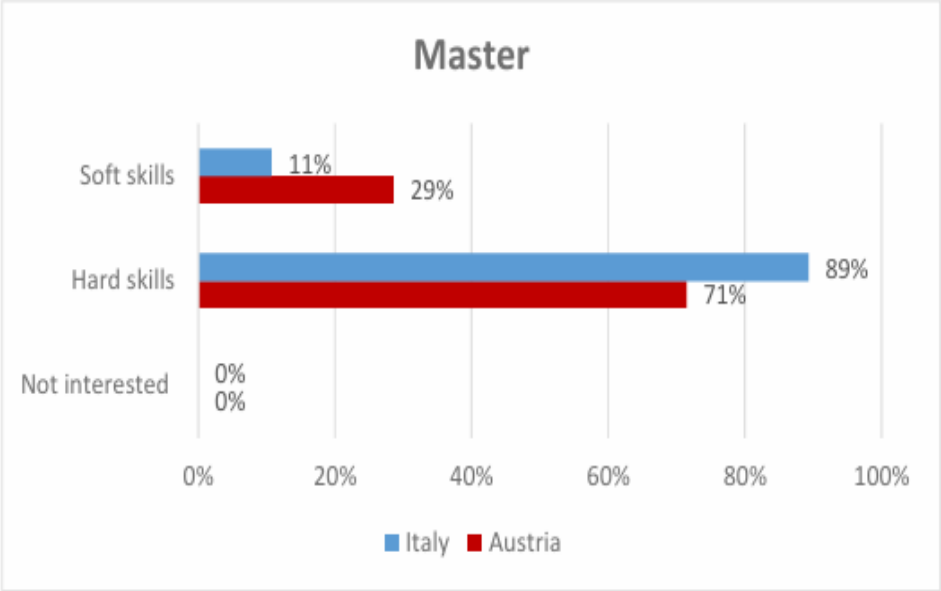

Figure 4 - *Students' readiness for jobs in Industry 5.0*

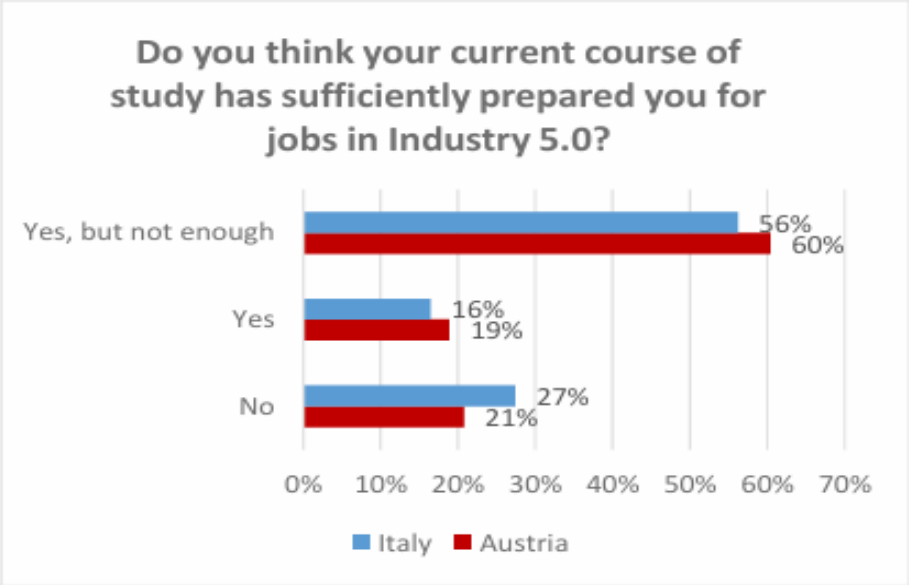

Figure 5 *- Students' readiness for Jobs in Industry 5.0: Austria (academic discipline)*

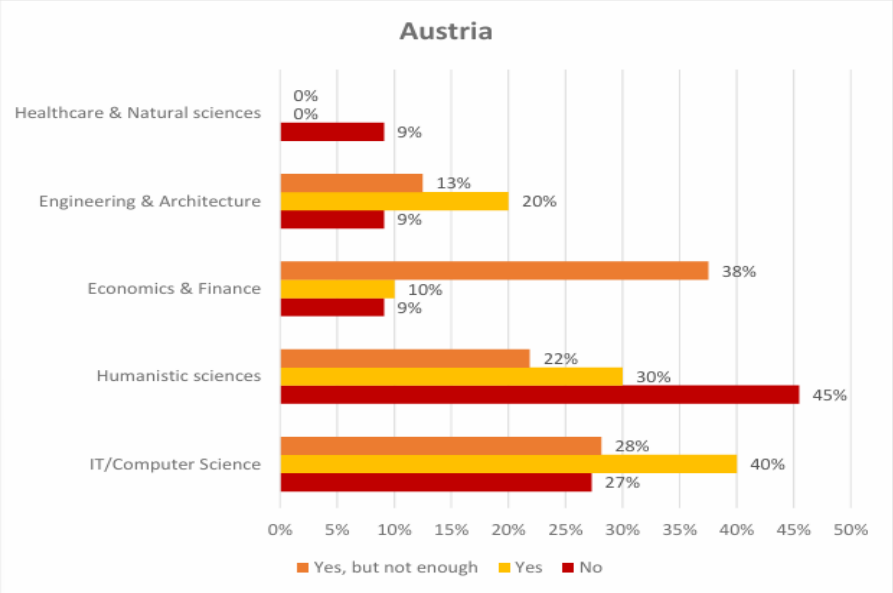

Figure 6 *- Students' readiness for Jobs in Industry 5.0: Italy (academic discipline)*

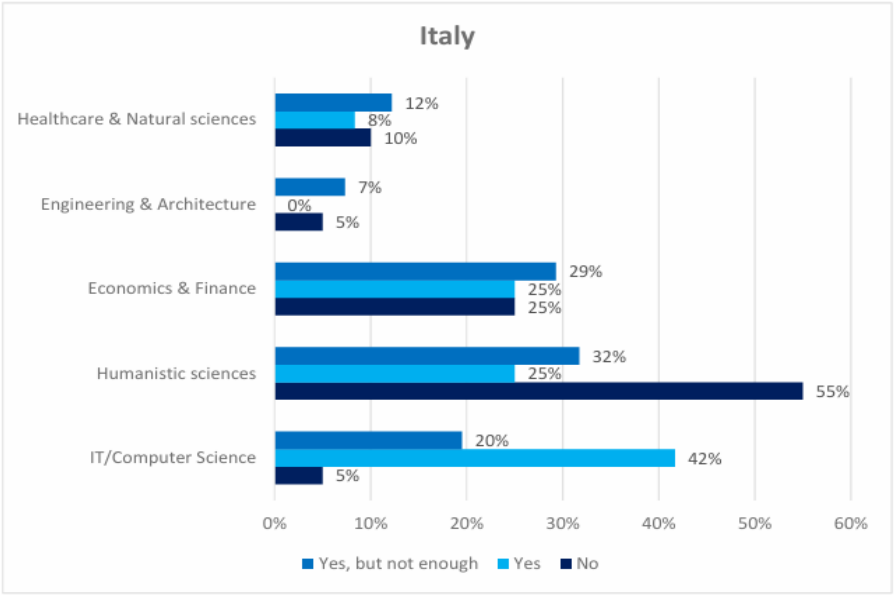

Figure 7 *- Interests in different kinds of training*

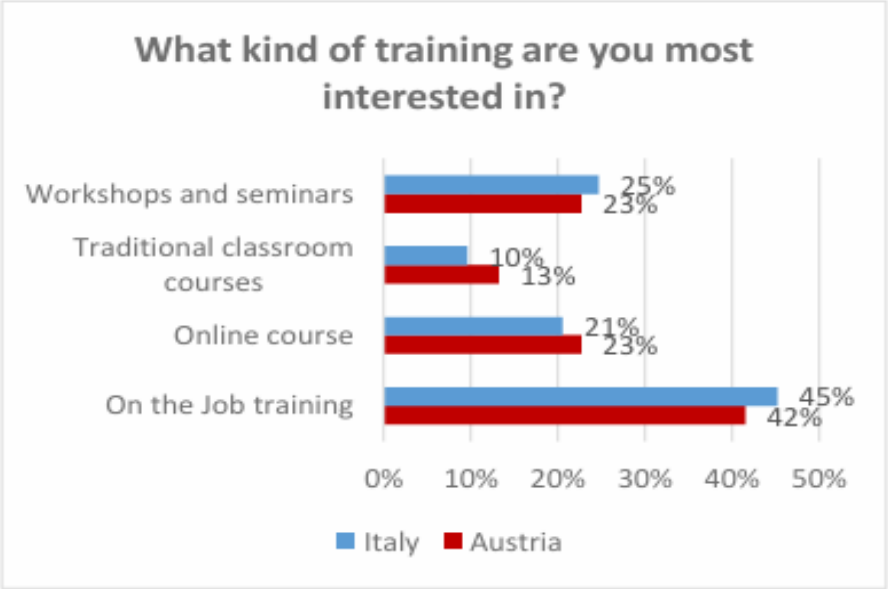

Figure 8 *- Human and technological components*

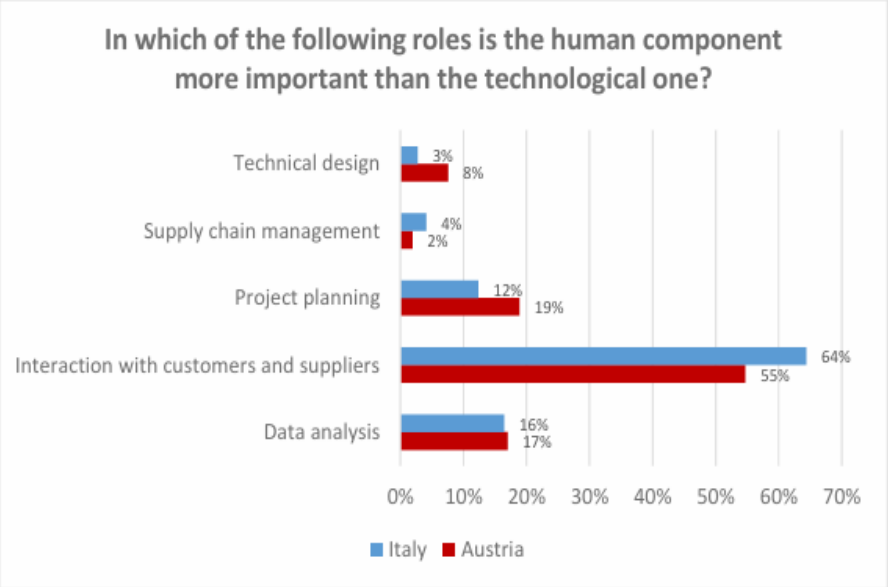

Figure 9 - *Perception on the importance of skills*

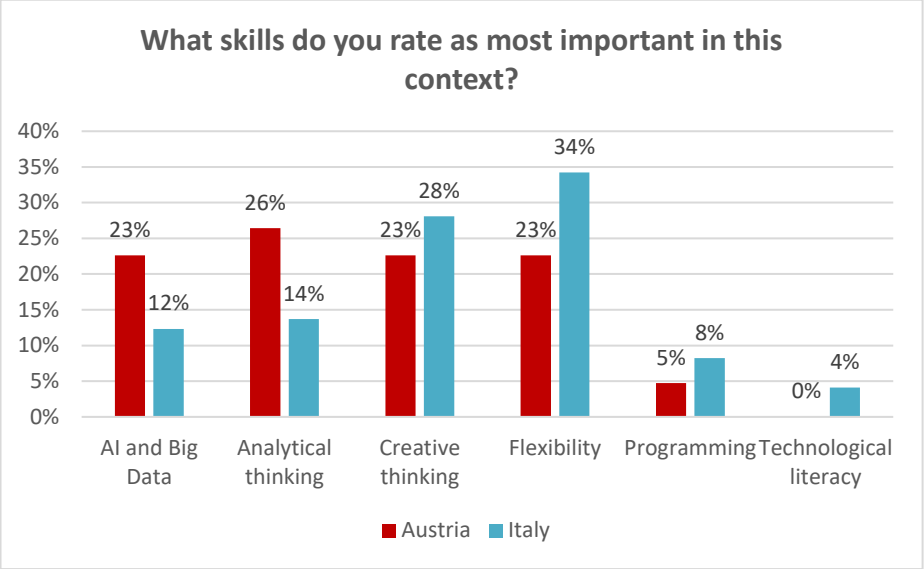

Figure 10 - *Perception on the importance of skills: Austria*

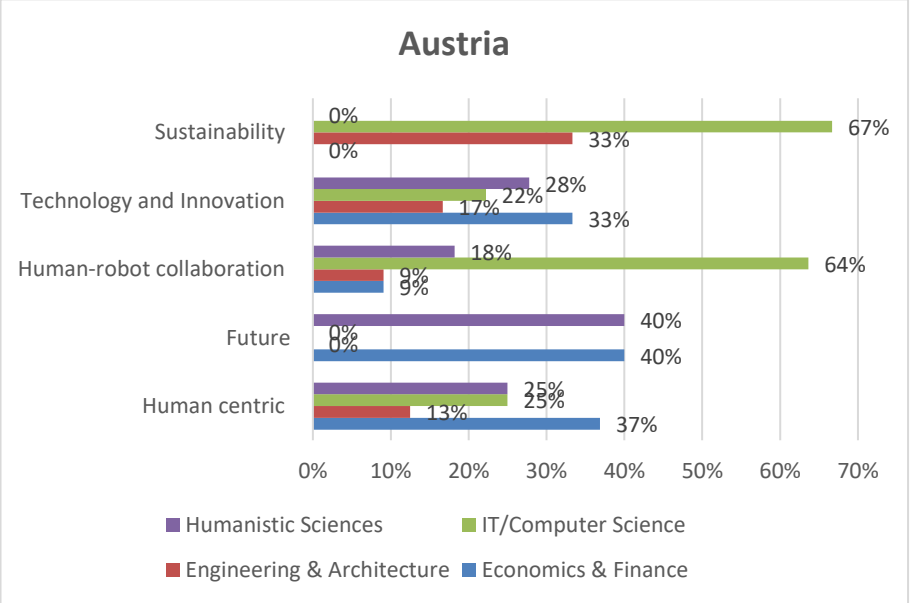

Figure 11 *- Perception on the importance of skills: Italy*