

# D3.2 - M24 - Analysis of the Impacts and Evolution of jobs in Advanced Manufacturing

D3.2 - M24 - I Italy sub-report



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# ACRONYMS

#### AI - Artificial Intelligence

**ANPAL -** Agenzia Nazionale Politiche Attive del Lavoro (*National Agency for Active Labour Policies*)

**EQF -** European Qualification Framework

ESCO - European Skills, Competences, Qualifications and Occupations

IoT - Internet of Things

LCAMP - Learner-Centric Advanced Manufacturing Platform

VET- Vocational Education and Training

# **CONTENT TABLE**

EXECUTIVE	E SUMMARY	6
1. ITALY: J	OB'S IMPACT ANALYSIS	7
1.1. Lis	t of selected jobs	
1.2. Da	ta analyst	
1.2.1.	Job description and scope	
1.2.2.	Context and limitations	
1.2.3.	From current situation to ongoing situation	
1.3. Au	tomation engineer	15
1.3.1.	Job description and scope	15
1.3.2.	Context and limitations	16
1.3.3.	From current situation to ongoing situation	17
1.4. Cy	bersecurity specialist	19
1.4.1.	Job description and scope	19
1.4.2.	Context and limitations	20
1.4.3.	From current situation to on-going situation	21
1.5. Exp	perts' comments	23
1.6. Co	nclusions	24
2. REFERE	NCES	25
3. INDEX O	F TABLES	27



The Italy sub-report, part of the D3.2 - M24 Analysis, focuses on the impacts and evolution of jobs in Advanced Manufacturing within the context of Italy. This study examines three critical job roles: Data Analyst, Automation Engineer, and Cybersecurity Specialist. These roles were selected based on insights from the report "*Previsioni dei fabbisogni occupazionale professionali in Italia a medio termine* (2023-2027)" (Forecasts of occupational and professional needs in Italy for the medium term, 2023-2027), drafted by Unioncamere and ANPAL, which forecasts occupational needs in Italy.

In particular, the report highlights the importance of continuous skills development and adaptation to emerging technologies. It is important to equip professionals in the three analysed roles with the necessary skills to navigate the on-going challenges of digital and green transitions. Data Analysts, Automation Engineers, and Cybersecurity Specialists play, in fact, integral roles not only within their respective companies but also across the value chains. Their ability to adapt to new technologies and trends is going to be essential for maintaining efficiency, reliability, and security in interconnected business environments, especially if considering their roles:

- Data Analysts extract value and perform exploratory analysis on vast amounts of data and implement complex statistical models or machine learning algorithms, for which individuals typically need to meet certain educational qualifications.
- Automation Engineers are characterised by interdisciplinary knowledge in the fields of control systems, mechanics, computer science, electronics, and electrical engineering. They need to possess specific skills and to update those skills to be able to readily integrate into various work environments.
- Cybersecurity Specialists play a pivotal role in protecting sensitive data, ensuring the integrity of digital operations, and bolstering resilience against cyber-attacks. As reliance on digital infrastructure grows, so too does the need for professionals who can safeguard these systems from cyber threats.

# 1. ITALY: JOB'S IMPACT ANALYSIS

This section examines the analysis of three specific job roles selected for this study: Data Analyst, Automation Engineer, and Cybersecurity Specialist. As outlined in our methodology, the analysis first explored the changes occurring within companies and identified the **drivers behind these changes** as they relate to the specified jobs. Subsequently, it detailed the observed shifts in required **skills and knowledge**.

The report focuses on three specific job roles:

- Data Analyst
- Automation Engineer
- Cybersecurity Specialist

The job roles were selected based on insights from the "*Previsioni dei fabbisogni occupazionale professionali in Italia a medio termine* (2023-2027)" (Forecasts of occupational and professional needs in Italy for the medium term, 2023-2027). This report, developed within the Excelsior Information System by Unioncamere and ANPAL, provides the latest predictive scenarios on occupational needs. It has been continuously updated and the current edition extends its forecast to cover the period from 2023 to 2027 (Unioncamere, 2022).

### **1.1. LIST OF SELECTED JOBS**

Here is the short list selected by Italy:

Table 1: List of selected jobs

ESCO CODE	ESCO OCCUPATION	ESCO DESCRIPTION	1- INDUSTRY SECTORS	2 - DIGITAL AND GREEN TRANSITIONS NEW TRENDS IMPACTING	3 - EMPLOYABILITY	4 - RELEVANCE FOR THE SMART SPECIALISATION STRATEGY AT	5 - EDUCATION LEVEL
2511.3	Data Analyst	Data analysts import, inspect, clean, transform, validate, model, or interpret collections of data with regard to the business goals of the company. They ensure that the data sources and repositories provide consistent and reliable data. Data analysts use different algorithms and IT tools as demanded by the situation and the current data. They might prepare reports in the form of visualisations such as graphs, charts, and dashboards.	Machine tools (Mechanical Engineering), Automotive, Aerospace, Electric and electronic Industries, Transport, Maritime	<ul> <li>1-1 Internet of Things (loT) / Smart Sensors / 5G technology,</li> <li>1-2 Artificial Intelligence (AI) / Machine learning / Big Data Analytics,</li> <li>5-5 Green Logistics and Supply Chain,</li> <li>5-3 Energy Efficiency,</li> <li>2-1 Virtual and Augmented Reality,</li> <li>3-1 Cybersecurity</li> </ul>	High difficulty in finding	Lombardy Region and Piedmont Region consider Advanced Manufacturing as one of the priorities in their 53	In Italy, courses and programs for Data Engineers often fall within EQF (European Qualifications Framework) levels 6 to 8, which correspond to undergraduate and postgraduate levels 6, such as bachelor courses in Data Science or Statistics



2141.4.2.1	Automation Engineer	Automation engineers research, design, and develop applications and systems for the automation of the production process. They implement technology and reduce, whenever applicable, human input to reach the full potential of industrial robotics. Automation engineers oversee the process and ensure all systems run safely and smoothly.	Automotive, Machine tools (Mechanical Engineering)	<ul> <li>1-2 Artificial Intelligence (AI) / Machine learning / Big Data Analytics,</li> <li>1-1 Internet of Things (IoT) / Smart Sensors / 5G technology,</li> <li>2-1 Virtual and Augmented Reality,</li> <li>5-3 Energy Efficiency</li> </ul>	Average difficulty in finding: 61%	Lombardy Region and Piedmont Region consider Advanced Manufacturing as one of the priorities in their \$3	In Italy, courses and programs for Automation Engineer often fall within EQF (European Qualifications Framework) levels 6 to 8, which correspond to undergraduate and postgraduate levels.6, such as bachelor's degree in Automation Engineering or Robotics
2529.4	Ethical Hackers (main title of ESCO occupation)/Cybersecurity specialist (Alternative label put on the ESCO occupation)	Ethical hackers perform security vulnerability assessments and penetration tests in accordance with industry-accepted methods and protocols. They analyse systems for potential vulnerabilities that may result from improper system configuration, hardware or software flaws, or operational weaknesses.	Electric and electronic Industries, Transport, Maritime	<ul> <li>1-1 Internet of Things (IoT) / Smart Sensors / 5G technology,</li> <li>3-2 Edge Computing vs Cloud Computing / Blockchain for Supply Chain / Quantum Computing,</li> <li>4-4 Digital Twins,</li> <li>5-2 Circular Economy,</li> <li>5-4 Waste Reduction</li> </ul>	Average difficulty in finding: 50%	Lombardy Region and Piedmont Region consider Advanced Manufacturing as one of the priorities in their \$3	In Italy, courses and programs for Cybersecurity Specialist often fall within EQF (European Qualifications Framework) levels 6 to 8, which correspond to undergraduate and postgraduate levels.6, such as bachelor's degree in Computer Science.



**1.2. DATA ANALYST** 

### **1.2.1. JOB DESCRIPTION AND SCOPE**

#### Job Description

**Data Analyst** (ESCO 2511.3) ESCO description: "import, inspect, clean, transform, validate, model, or interpret collections of data regarding the business goals of the company. They ensure that the data sources and repositories provide consistent and reliable data. Data analysts use different algorithms and IT tools as demanded by the situation and the current data. They might prepare reports in the form of visualisations such as graphs, charts, and dashboards" (ESCO, n.d.).

This figure, therefore, revolves around the extraction of value from data to enable companies to improve their decisions in any field: optimisation of commercial policies, production scheduling, predictive maintenance, just to name a few examples (Fantini & Pinzone, 2019).

In particular, Data Analysts are the ones who perform exploratory analysis on vast amounts of data and implement complex statistical models or machine learning algorithms. In seeking to identify common traits, a good Data Analyst is required to have a basic knowledge of statistics and databases, both relational and non-relational (Osservatori Digital Innovation, 2019).

To embark on such a career, individuals typically need to meet certain educational qualifications. One common pathway is obtaining a bachelor's degree or a postgraduate qualification in fields such as Statistics, Economics, or Mathematics. These disciplines provide a solid foundation in quantitative analysis and data interpretation, which are essential skills for data analysis roles. Additionally, subjects like Psychology and Operations Research can also be relevant, especially if they include coursework in statistics. Moreover, pursuing postgraduate specialisation can further enhance one's qualifications. Many professionals opt to enrol in master's programs, often offered by faculties of Computer Engineering and Information Sciences. These specialised programs are designed to equip participants with advanced skills in managing and analysing complex datasets. Through coursework and hands-on experience, participants gain expertise in utilizing various analytical tools and techniques, preparing them for the demands of the data analysis profession (Randstad, n.d.).

#### Business Area

In the modern **industrial sector**, data and their analysis play a more prominent role than ever before. This is why all processes are monitored in real-time, with the dual objective of increasing safety standards on one hand and maximising efficiency levels on the other. But that's not all, because data are also fundamental from a risk management perspective, i.e., to prevent failures. Data analysis processes have positively benefited from the innovations brought about by Industry 4.0 in terms of automation: this has resulted in the so-called automated analysis, which considers predictive and descriptive analyses to identify rules from which specific actions can automatically take place. A concrete example in this regard could be represented by analysing the behaviours of a certain machinery under specific conditions (Bergamo News, 2022).

### **1.2.2. CONTEXT AND LIMITATIONS**

In the future, the manufacturing sector will witness a surge in data generation. This presents a dual prospect: it offers avenues for enhancing efficiency and predictive capabilities, yet it also poses a challenge as the volume of data surpasses human capacity for comprehension without advanced tools. These tools, predominantly rooted in machine learning and AI, aim to extract insights from vast datasets, including big data. While AI and machine learning have advanced considerably, many algorithms were initially designed for domains other than manufacturing, presenting a hurdle as they may not fully address manufacturing-specific data challenges like small sample sizes and unbalanced datasets. Moreover, some newer tools operate as opaque "black boxes," lacking transparency regarding causality - a critical aspect for many manufacturing applications. Consequently, future manufacturing professionals will need skills to engage with and critically evaluate outputs from big data solutions tailored to manufacturing.

An increasing number also requires expertise in data preprocessing to enable analysis using machine learning and AI algorithms, facilitating the development of bespoke data analytics applications for their manufacturing context. This emerging need intertwines with ethical considerations, albeit more prominently in areas like biometrics than in core manufacturing functions. However, as AI solutions start influencing human resource metrics or undertake safety and privacy roles within companies, ethical implications will become increasingly pertinent (World Manufacturing Forum, 2019).

### **1.2.3. FROM CURRENT SITUATION TO ONGOING SITUATION**

Here after the description of the main tasks impacted by **Digital Technology** and/or **Green transition**, modifications and evolutions of the related needed skills.

Table 2: Tasks and skills impacted related to Data Analyst occupation.

OCCUPATION CODE	OCCUPATION TITLE	TASK	IMPACTING DIGITAL TECHNOLOGY AND/OR GREEN TRANSITION	IMPACTS DESCRIPTION	RELATED NEEDED SKILLS/ KNOWLEDGE IMPACTED	EXPECTED TENDENCY FOR SKILL EVOLUTION	SKILL TYPE	MATURITY LEVEL TO REACH (IMPLEMENT AND COMBINE MATURITY LEVELS WITH BLOOM'S TAXONOMY)	SKILL ESCO URL	SKILL DESCRIPTION
2511.3	Data Analyst	Data Collection: Gather data from various sources, including databases, spreadsheets, and external APIs	1-1 Internet of Things (IoT) / Smart Sensors / 5G technology	Increased volume and variety of data from IoT devices and sensors. Analyzing real-time data streams and ensuring data security.	Internet of Things	+	knowle dge	L4	http://data.europ a.eu/esco/skill/f0 49d050-12da- 4e40-813a- 2b5eb6df6b51	The general principles, categories, requirements, limitations and vulnerabilities of smart connected devices (most of them with intended internet connectivity).
2511.3	Data Analyst	Predictive Analytics: Use statistical models and machine learning algorithms to make predictions about future trends or outcomes.	1-2 Artificial Intelligence (AI) / Machine learning / Big Data Analytics	Utilizing advanced machine learning algorithms for predictive analysis. Dealing with larger datasets and more complex analytical models.	Utilise machine learning	+	Skill	L4	http://data.europ a.eu/esco/skill/8 369c2d6-c100- 4cf6-bd83- 9668d8678433	Use techniques and algorithms that are able to extract mastery out of data, learn from it and make predictions, to be used for program optimisation, application



		Evaluate model performance and refine models as needed.								adaptation, pattern recognition, filtering, search engines and computer vision.
2511.3	Data Analyst	Analysing data related to supply chain operations, including inventory levels, demand forecasting, and supplier performance. This can help optimize inventory management and ensure a smooth flow of materials.	5-5 Green Logistics and Supply Chain	Enhances efficiency and reduces costs by optimizing inventory management, streamlining logistics, and improving overall supply chain visibility.	analyse supply chain trends	+	skill	L4	http://data.europ a.eu/esco/skill/b 7e57889-a84f- 440c-9e60- 459aa69979e9	Analyse and make predictions about trends and evolutions in supply chain operations in relation to technology, efficiency systems, types of products shipped, and logistical requirements for shipments, to remain at the forefront of supply chain methodologies.
2511.3	Data Analyst	Monitoring and analysing energy consumption data to identify opportunities for energy efficiency improvements. This can contribute to cost savings and sustainability goals.	5-3 Energy Efficiency	Increases overall efficiency by identifying and eliminating inefficiencies in manufacturing processes, leading to improved production output and reduced waste	lead process optimisation	+	skill	L4	http://data.europ a.eu/esco/skill/1 0026df1-670d- 4c75-b3d5- ee0037f9d59b	Lead process optimisation using statistical data. Design experiments on the production line and functional process control models.

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2511.3	Data Analyst	Data Interpretation and Reporting: Interpret analytical results and derive actionable insights. Generate reports and presentations to communicate findings to non- technical stakeholders.	2-1 Virtual and Augmented Reality	Analysing data generated by virtual and augmented reality applications.	virtual reality	÷	knowle dge	L3	http://data.europ a.eu/esco/skill/5 da42cfd-1da8- 4e4f-b68e- 4f821d005fc5	The process of simulating real- life experiences in a completely immersive digital environment. The user interacts with the virtual reality system via devices such as specifically designed headsets.
2511.3	Data Analyst	Improve data securisation	3-1 Cybersecurity	Protect sensitive maintenance data	Cybersecurity principles - Vulnerability assessment & penetration testing skills - Network security protocols & best practices	+	Knowle dge	L4	http://data.europ a.eu/esco/skill/8 088750d-8388- 4170-a76f- 48354c469c44	The methods that protect ICT systems, networks, computers, devices, services, digital information and people against illegal or unauthorised use.

## **1.3. AUTOMATION ENGINEER**

### **1.3.1. JOB DESCRIPTION AND SCOPE**

#### Job Description

**Automation Engineer** (ESCO 2141.4.2.1) ESCO description: "*automation engineers research,* design, and develop applications and systems for the automation of the production process. They implement technology and reduce, whenever applicable, human input to reach the full potential of industrial robotics. Automation engineers oversee the process and ensure all systems run safely and smoothly" (ESCO, n.d.).

Therefore, their role is characterised by interdisciplinary knowledge in the fields of control systems, mechanics, computer science, electronics, and electrical engineering. They are capable of conceiving, designing, implementing, and commissioning automation systems for machines, processes, plants, products, and services. Automation engineers possess specific skills that enable them to readily integrate into various work environments, operating as system integrators, designers, and/or technicians in any application context where automation technologies and principles play a significant role. In this context, one function of the automation engineer's professional role is that of an expert in processing and control systems.

The automation engineer is involved in the design, management, and implementation of acquisition, processing, and real-time control systems typical of computer-based automation systems. This role is distinguished by the ability to understand and model the dynamics of complex systems and develop algorithms and real-time software for their supervision and automation. Additionally, the automation engineer's function is strongly oriented towards integrating different computer and electronic technologies functional to the automation of industrial plants of varying scales (University of Bologna, n.d.).

#### Business Area

The automation engineer can find employment not only in industries producing tools and systems for automation but also in all companies and organisations where automation systems play technically and economically significant roles. The automation market now encompasses all sectors of industrial production and services: the industry manufacturing automatic machines, robots, and mechatronic systems; the process industry; the transportation industry; the consumer goods manufacturing industry; public utility networks; systems and facilities for the production and distribution of energy from renewable sources; home automation (Politecnico di Milano, n.d.).

### **1.3.2. CONTEXT AND LIMITATIONS**

In the pursuit of sustainability, automation extends beyond its intrinsic benefits of increased productivity and improved quality. It provides a foundation for businesses to effectively achieve their sustainability goals. The growing demand for sustainability, among the major trends reshaping markets, makes it crucial for business leaders to ensure that their operations are aligned with these important objectives. This transformation is no longer a choice but a necessity. Organisations must therefore adapt.

Automation offers companies of all types and sizes a wide range of advantages in the pursuit of sustainability. Robots excel in performing tedious, dirty, dangerous, or delicate tasks. They allow companies to optimize repetitive tasks, increase efficiency, and reduce errors, freeing up time and resources to focus on other initiatives, such as enhancing sustainability efforts.

Through automation, companies can reduce or even eliminate the need for manual labour in tasks, thereby reducing the risk of human errors and enabling better resource allocation across company departments. This also helps in reducing waste, as robots can precisely control and measure throughout the production process, with minimal energy consumption, thus promoting more sustainable practices (Spainer, 2023).

### **1.3.3. FROM CURRENT SITUATION TO ONGOING SITUATION**

Here after the description of the main tasks impacted by **Digital Technology** and/or **Green transition**, modifications and evolutions of the related needed skills.

Table 3: Tasks and skills impacted related to automation engineer occupation.

OCCUPATION CODE	OCCUPATION TITLE	TASK	IMPACTING DIGITAL TECHNOLOGY AND/OR GREEN TRANSITION	IMPACTS DESCRIPTION	RELATED NEEDED SKILLS/ KNOWLEDGE IMPACTED	EXPECTED TENDENCY FOR SKILL EVOLUTION	SKILL TYPE	MATURITY LEVEL TO REACH (IMPLEMENT AND COMBINE MATURITY LEVELS WITH BLOOM'S TAXONOMY)	SKILL ESCO URL	SKILL DESCRIPTION
2141.4.2.1	Automation Engineer	System Design and Integration: Designing and integrating automation systems based on project requirements. Collaborating with cross-functional teams to ensure compatibility and seamless integration.	1-1 Internet of Things (IoT) / Smart Sensors / 5G technology	Integration of IoT devices and sensors into control systems to enhance process monitoring and decision-making like monitoring energy consumption in various processes (real-time adjustments to optimize energy efficiency).	Knowledge of IoT device communication	+	knowled ge	L4	http://dat a.europa .eu/esco /skill/f04 9d050- 12da- 4e40- 813a- 2b5eb6d f6b51	The general principles, categories, requirements, limitations and vulnerabilities of smart connected devices (most of them with intended internet connectivity).
2141.4.2.1	Automation Engineer	"oversee the process and ensure all systems run safely and smoothly: Enhance prediction of "industrial robots" troubleshoots.	1-2 Artificial Intelligence (AI) / Machine learning / Big Data Analytics	Based on IoT device and sensors integration data Implement AI algorithms for advanced decision- making. Integrate machine learning for predictive maintenance. Utilize big data analytics to optimize robotic processes."	Programming skills - machine learning concepts	÷	skill	L4	http://dat a.europa .eu/esco /skill/f4a 6e9f7- 5cff- 46c0- 894c- 59c20bb 78694	Set of technologies that make a process, system, or apparatus operate automatically by control systems.



2141.4.2.1	Automation Engineer	Training and Knowledge Transfer: Providing training to operators and maintenance personnel on using and maintaining automated systems. Transferring knowledge to relevant stakeholders for effective system operation.	2-1 Virtual and Augmented Reality	Integrating VR/AR technologies for operator training. Using AR for real-time visualisation of system performance.	virtual reality	+	knowled ge	L3	http://dat a.europa .eu/esco /skill/5da 42cfd- 1da8- 4e4f- b68e- 4f821d0 05fc5	The process of simulating real-life experiences in a completely immersive digital environment. The user interacts with the virtual reality system via devices such as specifically designed headsets.
2141.4.2.1	Automation Engineer	Integrating robotic systems into manufacturing processes for tasks such as material handling, assembly, welding, and packaging. Programming and configuring robotic arms and ensuring their seamless collaboration with other automation components.	1-2 Artificial Intelligence (AI) / Machine learning / Big Data Analytics	Implementation of AI algorithms for advanced decision-making. Integration of machine learning for adaptive behaviour. Use of big data analytics to optimize robotic processes.	Utilise machine learning	+	Skill	L4	http://dat a.europa .eu/esco /skill/836 9c2d6- c100- 4cf6- bd83- 9668d86 78433	Use techniques and algorithms that can extract mastery out of data, learn from it and make predictions, to be used for program optimisation, application adaptation, pattern recognition, filtering, search engines and computer vision.
2141.4.2.1	Automation Engineer	Selecting, installing, and configuring sensors (e.g., proximity sensors, vision systems) for data acquisition and feedback control. Integrating sensor data into control systems to enhance process monitoring and decision- making.	5-3 Energy Efficiency	Sensors are critical for monitoring energy consumption in various processes. Integration of sensor data allows for real-time adjustments to optimize energy efficiency.	sensors	+	knowled ge	L4	http://dat a.europa .eu/esco /skill/70a 7b3b3- 31ef- 4b29- a30f- bb7299d ff39b	Sensors are transducers that can detect or sense characteristics in their environment. They detect changes in the apparatus or environment and provide a corresponding optical or electrical signal. Sensors are commonly divided in six classes: mechanical, electronic, thermal, magnetic, electrochemical, and optical sensors.

### 1.4. CYBERSECURITY SPECIALIST

### **1.4.1. JOB DESCRIPTION AND SCOPE**

#### Job Description

**Cybersecurity Specialist** (ESCO 2529.4) ESCO description: "*perform security vulnerability* assessments and penetration tests in accordance with industry-accepted methods and protocols. They analyse systems for potential vulnerabilities that may result from improper system configuration, hardware or software flaws, or operational weaknesses" (ESCO, n.d.).

According to Article 2, point 1) of Regulation (EU) 2019/881 concerning ENISA, cybersecurity is understood as "the set of activities necessary to protect the network and information systems, the users of such systems, and other persons affected by cyber threats." Therefore, cybersecurity actions have the mission of protecting against cyber threats, understood as "any circumstance, event, or action that could damage, disrupt, or otherwise have a negative impact on the network and information systems, their users, and other persons."

#### Business Area

Given the significant technological advancements and widespread adoption of information systems across all economic sectors, the role of a cyber-security expert is increasingly indispensable. Their expertise is sought after not only by companies, both public and private, but also by associations, organisations, and governmental entities. As reliance on digital infrastructure grows, so too does the need for professionals who can safeguard these systems from cyber threats.

Cyber security experts play a pivotal role in protecting sensitive data, ensuring the integrity of digital operations, and bolstering resilience against cyber-attacks. Their work encompasses a broad range of responsibilities, including risk assessment, threat detection and mitigation, incident response, and compliance with regulatory standards. In essence, the demand for cyber security experts reflects the critical importance of securing digital assets and maintaining trust in the digital age (Randstad, n.d.).



#### **1.4.2. CONTEXT AND LIMITATIONS**

Cybersecurity refers to a series of actions designed to defend electronic systems, networks, servers, and devices from hacker attacks (Kasa, 2020). Essentially, it consists of a series of actions and measures intended for information security. Hackers are those who threaten information, systems, and networks, so it's necessary to take precautions, making cybersecurity fundamental (Cyber Security 360, n.d.). Neglecting it exposes one to a series of risks because threats multiply at an alarming rate, almost doubling year after year. When thinking about the industrial sector, it's important to implement the right procedures to safeguard information and all the most sensitive data. Cyberattacks orchestrated by one or more hackers with the aim of economic gain could cause disruptions in a company's production continuity.

It is also useful to define the figure of the cybercriminal, also known as a hacker: they are individuals driven by criminal intent to carry out cyberattacks via the internet. The network, therefore, becomes the access point for these criminals whose goal is to gain profit or as mentioned, disrupt the operations of a company, organisation, or other entity. Often, political motivations underlie all this, driving hackers to action. Cyberattacks are devised to endanger cybersecurity, which is why they are very dangerous and must be prevented absolutely. When prevention is not possible, they must be minimised as quickly as possible to try to limit the damage (Alteredu, n.d.). For this reason, it is important to implement proper procedures to protect information and all sensitive data.

### **1.4.3. FROM CURRENT SITUATION TO ON-GOING SITUATION**

Here after the description of the main tasks impacted by **Digital Technology** and/or **Green transition**, modifications and evolutions of the related needed skills.

Table 4: Tasks and skills impacted related to cybersecurity specialist occupation.

OCCUP ATION CODE	OCCUP ATION TITLE	TASK	IMPACT IN DIGITAL TECHNOLOGY AND/OR GREEN TRANSITION	IMPACTS DESCRIPTION	RELATED NEEDED SKILLS/KNO WLEDGE IMPACTED	EXPECTED TENDENCY FOR SKILL EVOLUTION	SKILL TYPE	MATURITY LEVEL TO REACH (IMPLEMENT AND COMBINE MATURITY LEVELS WITH BLOOM'S TAXONOMY)	SKILL ESCO URL	SKILL DESCRIPTION
2529.4	Cyberse curity Speciali st	Identifying and assessing vulnerabilities in the manufacturing network and systems, followed by developing and implementing risk mitigation strategies.	1-1 Internet of Things (IoT) / Smart Sensors / 5G technology	Increased complexity due to a larger attack surface with the proliferation of IoT devices. Need for securing communication protocols and data transmitted by smart sensors.	Internet of things	+	knowl edge	L4	http://data.e uropa.eu/es co/skill/f049 d050-12da- 4e40-813a- 2b5eb6df6b 51	The general principles, categories, requirements, limitations and vulnerabilities of smart connected devices (most of them with intended internet connectivity).
2529.4	Cyberse curity Speciali st	Creating and implementing security policies tailored to the manufacturing environment, covering aspects like access controls, data protection, and incident reporting.	3-2 Edge Computing vs Cloud Computing / Blockchain for Supply Chain / Quantum Computing	Securing edge computin environments an decentralized processing Addressing cybersecurit implications of clou computing and securing dat in the cloud Ensuring the security of blockchain technology i supply chain applications Preparing for potentia cybersecurity challenge posed by quantur computing.	establish an ICT security prevention plan	+	skill	L4	http://data.e uropa.eu/es co/skill/114c 9698-c999- 4369-8498- 81bf641fe87 1	Define a set of measures and responsibilities to ensure the confidentiality, integrity and availability of information. Implement policies to prevent data breaches, detect and respond to unauthorised access to systems and resources, including up-to- date security applications and employee education.

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21

2529.4	Cyberse curity Speciali st	Identifying and assessing potential security risks and vulnerabilities within an organisation's systems, networks, and applications	4-4 Digital Twins	Digital twins create an extended attack surface as they mirror physical systems. Cybersecurity specialists must secure both the physical and virtual components to prevent compromise.	establish an ICT security prevention plan	+	skill	L4	http://data.e uropa.eu/es co/skill/114c 9698-c999- 4369-8498- 81bf641fe87 1	Define a set of measures and responsibilities to ensure the confidentiality, integrity and availability of information. Implement policies to prevent data breaches, detect and respond to unauthorised access to systems and resources, including up-to- date security applications and employee education.
2529.4	Cyberse curity Speciali st	Assessing and analysing security risks and threats, evaluating their potential impact, and developing risk mitigation strategies.	5-2 Circular Economy	cybersecurity experts may be involved in securing the data and systems related to recycling processes, produc lifecycle management, and reverse logistics to ensure the integrity and confidentiality of sensitive information.	Skills in risk management and compliance	+	knowl edge		http://data.e uropa.eu/es co/skill/6eff1 34b-e34f- 4d6e-a6e8- 5e47cf2228 d0	The process of identifying, assessing, and prioritising of all types of risks and where they could come from, such as natural causes, legal changes, or uncertainty in any given context, and the methods for dealing with risks effectively.
2529.4	Cyberse curity Speciali st	Creating and implementing security policies tailored to the manufacturing environment, covering aspects like access controls, data protection, and incident reporting.	5-4 Waste Reduction	cybersecurity professional would need to safeguard the data collected from lo devices, sensors, and waste management software to prevent data breaches of tampering that could compromise waste reduction efforts or violate privace regulations.	Understanding of waste management processes	+	knowl edge	L3	http://data.e uropa.eu/es co/skill/f049 d050-12da- 4e40-813a- 2b5eb6df6b 51	The general principles, categories, requirements, limitations and vulnerabilities of smart connected devices (most of them with intended internet connectivity).

## **1.5. EXPERTS' COMMENTS**

The five Italian experts, representing Research Centres, Business Organisations, and Industry, were engaged to evaluate three specific job profiles: Data Analyst, Automation Engineer, and Cybersecurity Specialist.

- Data Analyst: The experts largely concurred with the identified trends and skill impacts for Data Analysts. However, they highlighted the evolving importance of this role due to the increase in data generated by Industry 4.0 initiatives and the need to monitor business process variables. They emphasised that Data Analysts must ensure data reliability and security, analyse significant content, and possess extensive knowledge of IoT technologies, which are fundamental in data collection for Industry 4.0. They also noted the expanding scope of the Data Analyst's role beyond individual companies to encompass the entire supply chain, underscoring the need for efficiency analysis extending to subcontractors.
- Automation Engineer: The feedback on the Automation Engineer profile also supported the pre-identified trends, with additional insights emphasising the need for integration between IoT devices / smart sensors and automation systems. Experts pointed out that Automation Engineers must understand IoT communication technologies and protocols to design systems that meet operational expectations and align with technical requirements.
- **Cybersecurity Specialist:** This profile garnered the most interest and detailed feedback. Experts validated the identified trends and skills, adding that securing IoT devices demands a comprehensive approach involving data encryption, strong authentication, network segmentation, and proactive monitoring. Cybersecurity Specialists need robust knowledge of IoT-related issues, including device isolation, anomaly detection, and security update mechanisms. They should also be adept at managing the complexities of new data-sharing technologies and the associated cyber risks within manufacturing environments.

The experts positively evaluated the overall analysis of these job profiles at the Italian level, noting the crucial role these professionals play in digital transformation. They emphasised the necessity for all three profiles to continuously adapt and acquire new skills to meet the demands of evolving data collection, analysis, and sharing processes. Moreover, the responsibilities of Data Analysts, Automation Engineers, and Cybersecurity Specialists extend beyond individual companies, integrating into broader supply and value chain mechanisms. This interconnected approach underscores the need for comprehensive skills in handling digital transformation challenges effectively.

## **1.6. CONCLUSIONS**

In conclusion, the experts have affirmed the importance of equipping Data Analysts, Automation Engineers, and Cybersecurity Specialists with the necessary skills to navigate the ongoing challenges of Digital Transformation. The tasks performed by these professional figures are crucial not only within their respective companies but also across broader supply and value chains, highlighting their integral role in the modern industrial landscape.

Their roles extend beyond traditional boundaries, emphasising the need for a comprehensive understanding of new Technologies, trends and skills that are needed to ensure efficiency, reliability, and security in increasingly interconnected business environments.





- Alteredu. *Cybersecurity: Definizione, Significato e Perché Serve* (Cybersecurity: Definition, Meaning, and Why It Matters). Retrieved from https://www.alteredu.it/cybersecuritydefinizione-e-significato/
- Bergamo News. (n.d.). *L'importanza dell'analisi dei dati nell'industria 4.0* (The Importance of Data Analysis in Industry 4.0). Retrieved from https://www.bergamonews.it/dal-territorio/limportanza-dellanalisi-dei-dati-nellindustria-4-0/
- Cyber Security 360. *Nuove minacce alla sicurezza informatica tra malware e attacchi hacker* (New Threats to Cybersecurity Between Malware and Hacker Attacks). Retrieved from https://www.cybersecurity360.it/nuove-minacce/
- ESCO. (n.d.). Occupation: Automation Engineer. Retrieved from http://data.europa.eu/esco/occupation/bb609566-3ab6-44dd-8f48-cf0b15b96827
- ESCO. (n.d.). Occupation: Cyber Security Expert. Retrieved from http://data.europa.eu/esco/occupation/76ef0a87-6afe-4560-b5d0-9a086abe45c5
- ESCO. (n.d.). Occupation: Software Developer. Retrieved from http://data.europa.eu/esco/occupation/d3edb8f8-3a06-47a0-8fb9-9b212c006aa2
- Fantini, P. M., & Pinzone, M. (2019). "Sviluppo di nuove competenze" (Development of New<br/>Skills).Skills).Retrievedhttps://re.public.polimi.it/bitstream/11311/118135/2/007\_Fantini\_Pinzone.pdf
- Kasa, N. (2020, September 15). *Che cos'è un server? La spiegazione semplice* (What is a Server? The Simple Explanation). Retrieved from https://www.kasadellacomunicazione.it/server/
- Osservatori Digital Innovation. (2019). "*Data Analyst: Cosa fa, stipendio*" (Data Analyst: what does he do, salary). Retrieved from https://blog.osservatori.net/it\_it/data-analyst-cosa-fa-stipendio
- Politecnico di Milano. (n.d.). Ingegneria dell'automazione (Automation Engineering). Retrieved from https://www.polimi.it/futuri-studenti/corsi-di-laurea/ingegneriadellautomazione
- Randstad. *I lavori più richiesti: Cyber Security Expert* (Most Requested Jobs: Cyber Security Expert). Retrieved from https://www.randstad.it/candidato/lavori-piu-richiesti/cyber-securitysecurityexpert/#:~:text=Per%20il%20grande%20sviluppo%20tecnologico,organizzazioni%2
- Randstad. (n.d.). "*I lavori più richiesti: Data Analyst*" (Most Requested Jobs: Data Analyst). Retrieved from https://www.randstad.it/candidato/lavori-piu-richiesti/data-analyst/

0e%20dalla%20Pubblica%20Amministrazione

- Spainer V. (2023). "Come promuovere la sostenibilità grazie all'automazione" (How to Promote Sustainability Through Automation), The Innovation Post. Retrieved from https://www.innovationpost.it/tecnologie/robotica/come-promuovere-la-sostenibilita-grazie-allautomazione-la-guida-di-epson/
- Unioncamere. (2022). "Previsioni dei fabbisogni occupazionali e professionali in Italia a medio termine" (Forecasts of Occupational and Professional Needs in Italy in the

Medium Term, 2023-2027). Retrieved from https://excelsior.unioncamere.net/pubblicazioni/2023/previsioni-dei-fabbisogni-occupazionali-e-professionali-italia-medio-termine

- University of Bologna. (n.d.). Prospettive: Ingegneria dell'automazione (Perspectives: Automation Engineering). Retrieved from https://corsi.unibo.it/laurea/IngegneriaAutomazione/prospettive
- World Manufacturing Forum (2019), "Skills for the Future of Manufacturing", retrieved from https://worldmanufacturing.org/wp-content/uploads/2019-WMF-Report-Presentation.pdf

# **3. INDEX OF TABLES**

Table 1: List of selected jobs         Table 2: Tasks and skills impacted related to Data Analyst occupation.	8	
	12	
Table 3: Tasks and skills impacted related to automation engineer occupation		
Table 4: Tasks and skills impacted related to cybersecurity specialist occupation.		







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