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INDUSTRY 4.0 WORKFORCE: ENCYCLOPEDIA OF THE DIGITAL PROFESSIONS BY GROUPS OF TECHNOLOGICAL INNOVATION

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Purpose: The purpose of the paper was the need to systematise the digital professions of Industry 4.0. With the development of new technologies, the demand for new employees is increasing. Companies need more and more employees with digital skills. The question arises: who do companies need for their Industry 4.0 strategy.
Design/methodology/approach: The paper consists of two parts: an overview of the competences of the Industry 4.0 workforce and a list of IT professions. The list of occupations is based on a review of government websites: www.praca.gov.pl; www.prace.cz. The paper presents occupations according to the innovative technologies of Industry 4.0.
Findings: Demand for employees is driven by the key technologies of Industry 4.0. The analysis of IT professions is presented by the following technologies: ITC systems and networks, automation and robots online, AI, Big Data, Big Data Analytics, IoT, Cloud Computing, Cybersecurity.
Research limitations/implications: The list of professions included in the paper is not complete, but exemplary (it was made on the basis of job offers posted on the websites in December 2022). The list was created during a review of Polish and Czech government websites, which are both job listings and encyclopedias of occupations.
Practical implications: This paper is an overview of IT professions that are particularly needed in Industry 4.0. The prepared description of professions according to the innovative technologies of Industry 4.0 can help companies plan the development of human resources.
Originality/value: The topic of the human factor in Industry 4.0 is important and topical. Technologies are constantly changing and industrial concepts are evolving (currently Industry 4.0 is changing into Industry 5.0). In the technological and industrial innovations taking place, the question of the competence of the modern company's employee is still relevant.

Keywords: Industry 4.0, workforce, digital skills, digital professions.

Category of the paper: general analysis.

1. Introduction

The current period of economic development is characterised by major technological, legal, business and social changes that are driving traditional industry towards Industry 4.0 (also known as the fourth industrial revolution). Automation and robotization are at the heart of Industry 4.0. Nine technologies are transforming current industrial production. These are: simulation, augmented reality, autonomous robots, the industrial 'Internet of Things', the cloud, cyber security, incremental manufacturing, horizontal and vertical systems integration, and Big Data and analytics (Booth Welsh, Erboz, 2017; Senn, 2019). New technologies are strongly influencing the labour market. Working in the new production environment and in a dynamic technological environment (artificial intelligence, internet of things, big data, cloud computing, quantum computers, etc.) will require adapted competences beyond - hitherto considered key and traditionally understood - technical and digital competences. Given the breadth of applied technologies of the fourth industrial revolution, a worker may be a database designer, a data scientist, a robot teacher, a robot controller, a robot assistant, a manager for robots, an online robot programmer, a machine learning programmer, a CPSs architect, a machine-to-machine liaison, an artificial intelligence operator, a CAD operator, a computer applications operator, a cloud computing architect, a 3D printer operator, etc. The list of professions that are emerging with the development of Industry 4.0 technology is getting longer every year (Astor, 2017; Gajdzik, Wolniak, 2022; Cedefop, 2019; Gajdzik, Grebski, 2022). Companies that have announced plans to invest in the technologies of the fourth industrial revolution need new employees to help them realise their Industry 4.0 strategies.

According to the latest DESI2022 report, in 2021 there were around 9 million people working as ICT professionals in the EU. The highest number was in Germany, where 2 million ICT professionals were working (22.5% of the EU total). The EU's goal is to have 20 million ICT professionals by 2030, which is about 10% of total employment (DESI Report, 2022). Human beings will be influenced by strong synergy technologies (mechanics, robots and cobots, computing and electronic control, mobile devices, IoT, computing/software, artificial intelligence, etc.) (Rotman, 2013).

New technical and digital skills must find an important place in vocational education. The place for acquiring new competences and raising their level are educational organisations and production companies that implement their Industry 4.0 strategies. On the basis of the companies' job offers, a list of occupations related to the key technologies of Industry 4.0 has been drawn up. The descriptions of each type of occupation are preceded by an overview of the characteristics of the Industry 4.0 workforce based on scientific publications and reports. The aim of this article is to analyse the digital professions by government websites: www.praca.gov.pl; www.prace.cz.

2. Who Industry 4.0 needs

Surrounded by new technologies of Industry 4.0 - artificial intelligence, big data, cloud computing, virtual reality and others - employees' skills and proactive attitudes are coming to the fore, becoming a major driver of business development. Businesses need IT and digital-skilled employees with knowledge of engineering and industrial informatics. The digital skills required in the workplace are more advanced than they used to be, and companies expect most employees to have them (Berger, 2016; World Econ. Forum, 2018).

The labour market is still lacking employees with digital competences. According to reports by the European Commission, which assesses the digital society every year (the DESI index), at least 80% of people with at least basic digital skills and increase the number of ICT specialists to 20 million (around 10% of total employment), with convergence between men and women by 2030. In 2021, 54% of Europeans had at least basic digital skills (DESI Report, 2022). In practically every EU country, there is a problem of insufficient competencies of the industrial workforce in relation to the needs for effective technological transformation. The only differences lie in the scale of the problem and the countries' ability to address the skills deficit.

The problem of the lack of digital competences was already highlighted in the third industrial revolution. Nowadays, in the fourth industrial revolution, industry is still reporting a need for digital competences but the scope of digital competences has changed significantly compared to the third industrial revolution. An important change concerns the superstructure of digital competences with soft competences and the diversification of the scope of digital competences. The digital competence of employees can be divided into low, medium and specialised (highly advanced). The first level of competence enables the use of technology in daily work for accessing online information or using software. The second level includes specific competences enabling work in the creation of digital products and services, websites, e-commerce applications, using big data and the cloud, and including knowledge of programming, application development and/or network management. The third level includes complementary competences - enabling IT problem solving, processing complex data sets, building cloud architecture, robotic programming (online), etc. (DESI Report, 2022; OECD, 2016).

Information and computer technologies (ICTs), starting in the 1990s (and earlier) is changing businesses worldwide. With the technological advances of the third and fourth industrial revolutions taking place, a field of knowledge called industrial computing has emerged. Universities are educating IT engineers to work in Industry 4.0 companies. Education organisations (schools, universities) educate not only computer scientists, but also engineers and technologists, who should have basic IT knowledge and digital skills. Technical competence needs digital competence, and vice versa, digital competence needs engineering knowledge. A new type of hierarchy of jobs is taking shape in Industry 4.0, the key to which is the collaboration of humans with advanced technologies with artificial intelligence and machine

learning algorithms, as well as the operation of information and computer systems to support business processes, including autonomous information systems with access to the cloud and the Internet of Things (Rotman, 2013; Daugherty, Wilson, 2018, Flores et al., 2020). There is no doubt that the next generations of IT tools are increasingly digital and increasingly autonomous (McKinsey Digital, 2015). Well-educated employees with technical and IT competences are already at the top of the occupational pyramid in the companies that make up Industry 4.0. Companies need IT specialists with different specialisations and operators of new technologies. Industry 4.0 opens up new opportunities for employees with qualifications and skills related to new technologies. Skills such as technological design, computer programming, database architecture, data analysis, production automation, robotics, etc. are growing in importance (PwC, 2019). Workers are needed with knowledge enshrined in the STEM model (science, technology, engineering and mathematics) (World Economic Forum, 2019) and with competences written in the form of the letter "T" (the letter "T" represents a combination of general competences, which are useful in many fields, and specialised competences, needed in at least one field. The 'T' arrangement is made up of basic technical competences, digital competences of varying degrees and soft competences. The 'T' model has been adapted to the needs of different industries (PwC, 2018; EC, 2020). Digital competences are built on the basic technical digital competences needed to make informed use of the Internet and service applications and to operate digital devices in or out of the workplace, and, for higher level skills, programming, i.e. creating code for IT programmes (EC Definition) Industrial digital competences are strongly linked to the technologies used in companies. Employees need knowledge, skills, behaviours, attitudes, competencies, abilities and character traits to interact with technologies (Kispeter, 2018). Digital skills include technical competences, ranging from basic to advanced skills to enable the use of digital technologies, and the cognitive, emotional and social competences necessary to use technical competences in the workplace (Ferrari, Comp, 2013; European Parliamentary Research, 2017). Among the 'human' competences, creativity, originality and own initiative, critical thinking, persuasion, negotiation skills, attention to detail, resilience, flexibility and complex problem solving are important (PwC, 2019; Astor, 2017; PARP). Other important qualities desirable in employees are emotional intelligence, leadership, as well as having influence and social networks (World Economic Forum Report, 2018). Companies need employees with technical, digital, social, communication and interpersonal skills (Głomb, 2020). There is a strong diversification of IT professions in companies with the automation of work and the development of ICT. The technologies of Industry 4.0 are a large set, consisting of both advanced manufacturing technologies and process technologies ancillary to manufacturing, as well as global business communication and cooperation technologies. Industry 4.0 companies need teams of applied IT specialists. The team, as a structural and functional creation, is better equipped to collaborate with the diversity of functions of Industry 4.0 technologies than the individual (employee). In Industry 4.0, technical competence encompasses a broad range of technological skills that

are supported by knowledge and defined based on the concept of so-called Key Enabling Technologies (KETs). The competence structure adapted to the needs of industry includes the use of manufacturing and advanced manufacturing technologies, the use of advanced materials and nanotechnologies, the use of life science technologies, the use of digital technologies -micro and nan electronics, photonics and artificial intelligence, as well as the use of cyber technologies for digital security and connectivity. Basic digital competences include the user's ability to operate basic digital solutions, and advanced digital competences include working with technologies using artificial intelligence, cloud computing and the Internet of Things. Artificial intelligence with machine learning, Big data and cloud computing, and the Internet of Things are three key segments that are considered to be fundamental in the development of digital competences of employees hired to operate production processes. (ARP, 2019). The period up to 2030 is expected to be a period of rapid development for machine learning and artificial intelligence. It is estimated that by 2030, more than 80% of process handling tasks will be performed by artificial intelligence systems. Tasks in the area of quantitative reasoning will be carried out by humans and machines combined, with humans still responsible for completing 80% of tasks in the area of multifunctional reasoning. The use of cloud computing is also expected to grow exponentially. 5G technology will create the conditions for a strong flowering of various smart city functionalities and services. Tools based on VR (Virtual Reality) and AR (Augmented Reality) will commonly enter education and management. Companies will use the Internet of Things (IoT) more widely than before. Robotization and automation of production will drive Industry 4.0 (ARP, 2019).

In Industry 4.0, technology is rapidly accelerating its development, so humans must learn to adapt to new situations and function in dynamic production systems. Increasingly, operators' tasks will be hybrid - a combination of human and machine skills. On the one hand, workers interact strongly with Industry 4.0 technologies, and Industry 4.0 operators support machines during their training phase (teaching them to work intelligently) and participate in explaining and interpreting the results of their work and maintaining them. On the other hand, machines in Industry 4.0 empower people and enhance their cognitive, communication and physical abilities (Daugherty, Wilson, 2018; Flores et al., 2020). First attempts to structure the interactions between human and machines are made by Romero et al. (2016) and Ruppert et al. (2018). The next was Fantini et al. (2020). The impact of Industry 4.0 technologies on machine operators has also been studied by other authors: Kaasinen et al. (2020), Zolotov´a et al. (2020), Segura et al. (2020), Mattsson et al. (2020), Taylor et al. (2020), Neumann et al. (2021). In their paper the operator is interpreted in different roles, depending on the technologies used. The results of these scientists' research were more or less developed Operator 4.0 profiles. Based on the first publications about Operator 4.0, Table 1 summarises the types of Operators 4.0.

Table 1.
Operator 4.0 based on Romero et al. (2016) and Ruppert et al. (2018)

1	Operator + Virtual Reality = Virtual Operator
2	Operator + Wearable Tracker = Healthy Operator
3	Operator + Intelligent Personal Assistant = Smarter Operator
4	Operator + Collaborative Robot = Collaborative Operator
5	Operator + Social Networks = Social Operator
6	Operator + Big Data Analytics = Analytical Operator
7	Operator + Augmented Reality = Augmented Operator
8	Operator + Exoskeleton = Super-Strength Operator

The widespread use of new technologies in Industry 4.0 increases the demand for new skills, which are a set of multiple skills to undertake and perform tasks in a new work environment that is increasingly flexible, geographically dispersed, prone to frequent and rapid change, and in which it implies the need to handle digital technologies and to collaborate with automated systems and machines using artificial intelligence (Report: Manual 4.0, p. 17). Companies need employees with technical, digital, social, communication and interpersonal skills. The World Economic Forum (2018), based on the O*NET Content Model, anticipates that the need for cognitive skills, content skills, systems skills and process skills will increase as technologies develop (Berger, 2016).

3. Methodology

The aim of this article is to analyse the digital professions by government websites: www.praca.gov.pl; www.prace.cz.

The analysis was based on job offers conducted by Job Centres One form is Internet offers reported on portals. The study of Internet job offers included offers in Poland and the Czech Republic. Information was aggregated to the country level. The subject of the study was job offers, pertaining to the period studied, in the form of advertisements seeking an employee for a single position, published once during the studied period. The analysis of job offers on the Internet boiled down to their collection, removal of repetitive ones, as well as those duplicating with offers reported to labour offices. The study was of a fragmentary nature. The survey is a kind of "snapshot" of offers presented in December 2022, January, 2023, and February 2023 (data was collected at the end of the month). The method presented, as mentioned, gives information of a piecemeal nature.

The results of the research showed that there is no significant difference between job offers addressed to occupational groups according to the Classification of Occupations and Specialities in Poland and the Czech Republic, so the offers were analysed together. The differences in the information content of the offers concerned only the offer of the employer itself, resulting from the scope of activities, therefore the analysis of the scopes of activities was omitted in order to unify the offers. The selected professions were presented in the order of key technological innovations of Industry 4.0 (Figure 1).

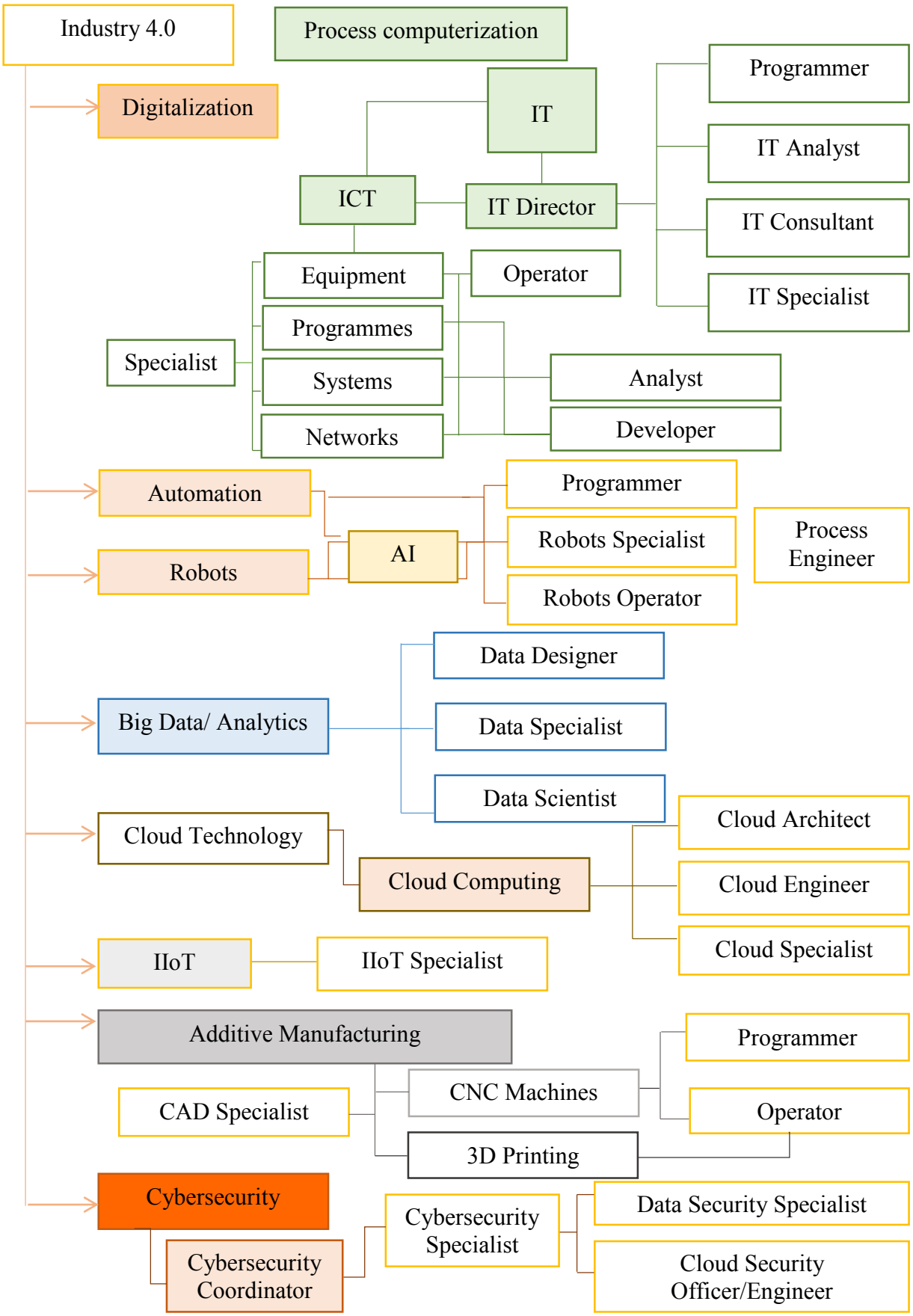

Figure 1. Structure of the list of occupations with digital competences (Own elaboration).

4. Example list of occupations with digital competences

There is a growing number of jobs for people with advanced digital skills in the labour market. Many of these jobs remain unfilled. More and more companies need employees with advanced digital skills. Here is a sample list of ICT professionals, advanced digital users and those with more than basic digital skills needed. This list is based on a review of the job listings of the websites: www.pracuj.pl; www.prace.cz. The structure of the list was presented in Figure 1. The paper uses the job descriptions available on these websites. The descriptions were shortened and their forms were put in order.

Process computerization

- **IT Programmer**: responsible for the entire development process and is the 'creative force' behind the programme. The person works a lot directly with clients to create the conceptual design and then works with other developers to figure out what the software code should look like.
- **IT Analyst**: responsible for analysis of requirements and process needs, schematic design (diagrams of parts of IT systems and their units), technical design analysis, analysis of functional requirements and legislative conditions, design of data structures, definition of interfaces, performance testing of IT devices/systems.
- **IT Consultant**: collecting data on the performance of IT systems, identifying opportunities for improvement, assessing feasibility, coordinating maintenance and development activities, performing technical project analyses, technical maintenance of computer systems and other hardware.
- **IT Director**: strategic responsibility, formulation of the organisation's system requirements; analysis of IT trends; assessment of IT management effectiveness and performance, analysis of IT systems, assessment of system reliability and performance, representation of the company in negotiations with IT suppliers and other parties.
- **Process Visualisation Specialist**: responsible for the graphical representation of equipment, operations and company conditions, ensuring clear graphical presentation of processes, overseeing the optimisation of various visualisation elements, including the improvement of event control.

ICT/Equipment, Programmes, Systems, Networks

- **Computer Applications Operator**: ensuring the flow of information from applications within the company; installing typical applications; configuring applications to operate peripheral devices; testing the correct installation of applications; operating applications; ensuring the security of the computer system (reporting any failures or malfunctions of applications); archiving data from supported applications.

- **Computer Equipment Operator**: supervising the operation of the computing centre equipment and all peripheral equipment installed in the company; computing centre upgrading (replacing packages, panels, etc.) and computer equipment, repairing simple defects; performing maintenance on system and application programs; participating in the installation of local computer networks; recovering subdirectories and their contents from damaged directories) and computer hardware, repairing simple defects; maintaining system and application programs; participating in the installation of local computer networks; recovering subdirectories with their contents from directories damaged during operation; marking bad clusters on (PC) disks damaged during operation; optimising the operation of hard disks (interleave, compress, etc.); installing and running application programs; creating new partitions on hard disks with different divisions and for different (PC) operating systems.
- **Computer Network Operator**: supervising the functioning of the network; diagnosing network faults; reconfiguring the network on the basis of documentation; replacing network devices; configuring network devices on the basis of documentation; carrying out minor repairs to the network; connecting end devices to the network (e.g. workstations, printers); periodically testing the condition of the network and network devices; reporting malfunctions of the network and network devices to the **network administrator**; carrying out technical support for network users.
- **Application Developer**: responsible for interpreting application assumptions and requirements, application architecture; preparing and creating algorithms; creating and using data structures; creating and modifying application code; testing code to detect and fix bugs; ensuring application reliability and security; preparing technical documentation and application manuals.
- **Application Improvement and Development Specialist**: managing application capacity and performance; undertaking application development activities, managing licences, security certificates, etc.; producing reports and statements from within the application; managing application maintenance costs; testing and configuring applications.
- **Computer Network Analyst**: network managing and operation; network developing - improving the functions and performance of the network; supervising the devices, supervising the documents; checking the correct operation of the network; creating a system of passwords to access the devices, supervising the compliance with the rules of their protection.

Automation, Robots, Artificial Intelligence (AI)

- **Automation and Robotics Engineer/Robots Programmer**: automated workstations by designing of continuous and discrete control systems; preparing the application of numerical methods for identification and optimization; designing of control structures and algorithms in the area of automated and robotic manufacturing systems; designing of industrial robot systems to perform activities such as welding, painting, machine operation, assembly; designing of transducer and sensor systems; computer programming and control; constructing of transducers and measuring devices; developing of technical and construction and technological documentation of designed equipment.
- **Robot Programmer**: writing the necessary programmes (the number of which increases with a larger base of manufactured parts); commissioning the robot (offline, online); participating in the programming process of robotised production lines; supervising the operation of the robots; making corrections and optimising existing solutions.
- **Industrial Robot and Manipulator Operator**: inspecting the technical condition of the industrial robot, finding and rectifying minor faults in the robot's mechanical and control assemblies, which may include faulty operation of the robot's axes, gripper, joints, control cabinet (contactors, switches, fuses), signalling systems, control panel; carrying out periodic technical inspections of the robot's general condition, organising a safe workplace; observing instructions and regulations on the operation and safety of the robot.
- **Artificial Intelligence Specialist**: responsible for the development of computer programmes or systems that simulate human thinking; development of algorithms and technological approaches (e.g. natural language processing, text analysis and data mining, semantic technologies and machine learning); other activities in the field of cognitive and robotic automation.

Data/Big Data/Big Data Analytics

- **Database Designer**: designing databases and system requirements; building logical and physical data model and mapping systems; commissioning systems; administering and managing relational databases; working with development team and data warehouse analyst team.
- **Database Specialist**: maintaining installations; administration of database systems; developing system installations (system upgrades, developing application sub-modules, etc.); data security control and backup; resolving and eliminating emergency situations.

- **Data Scientist**: reporting on data from information systems; providing support to users of databases by preparing analyses of data collected in information systems; optimising the structure of databases and working to improve information systems in order to report from them the necessary data for analysis.
- **Database Security Specialist**: managing the security and performance of databases; building the company's data protection system; overseeing compliance with data usage policies.

Cloud Technology/Cloud Computing

- **Cloud Engineer/Cloud Architect**: designing cloud application; cloud building; cloud model improving, cloud web services design (many companies are looking for cloud engineers with experience with OpenStack, Linux, Amazon Web Services, Rackspace, Google compute engine, Microsoft Azure and Docker. Familiarity and experience with APIs, orchestration, automation, DevOps and databases such as NoSQL are also important; companies that hire cloud specialists are most often planning to deploy cloud services or are looking to expand the use of cloud technologies in their business); overseeing the migration of data to the cloud.
- **Cloud Computing Specialist**: designing cloud applications, drawing up plans for uploading data to the cloud; creating new solutions for using cloud applications; administering the cloud and the data uploaded to it, including: transferring, managing and analysing data stored in clouds; designing and implementing cloud and hybrid IT solutions and new improvements to the cloud computing model; preparing the cloud; overseeing the implementation of cloud solutions; liaising with cloud stakeholders.
- **Cloud Architect**: responsible for data integration, migrating data to the cloud, deploying new data analytics, business intelligence and data science applications to the cloud, integrating tools and services across all areas of cloud computing.
- **Cloud Engineer/Cloud Software Engineer**: responsible for all technological tasks related to the operation of cloud computing platforms, including: design, planning, management, maintenance and support; his/her job description entails assessing an organization or a business’s infrastructure and transferring various functions to a cloud-based system; he/she is a software developer who is a specialist in the process of working on cloud computing systems.
- **Cloud System Engineer:** responsible for designing and maintaining cloud-based systems; developing new features or applications to help improve the overall user experience.

- **Cloud Network Engineer**: responsible for designing, building, and maintaining the network infrastructure of a cloud-based system. They work closely with IT teams to ensure that cloud resources are provisioned, managed, and maintained in an efficient and secure manner.

IIoT

- **IIoT Engineer/Specialist/Embedded Software Engineer**: responsible for the completion of all IIoT project requirements/ programmer, implementer, project analyst/ responsible for designing and implementing IIoT solutions.

Additive Manufacturing/3D Printing/CNC Machines

- **3D Printer Operator**: responsible for the spatial design of models of individual parts and assemblies; operating 3D printed computer modelling programmes; supervising the production of printed parts; managing consumables; maintaining equipment documentation; supervising printer maintenance work.
- **CAD Operator**: preparing 2D and 3D computer drawings, providing support for technical and maintenance functions in CAD design work; updating, testing new CAD/CAE tools; creating and applying changes to technical drawing models; managing changes to models, supporting engineers and designers.
- **CNC Operator**: setting up, fixing, configuring and calibrating CNC machines and accessories; checking dimensions of manufactured objects and performing error corrections; day-to-day control of the operation of the machine/CNC machine so that it can work in full cycles of the production of a large number of parts; checking the working area and the CNC machine; servicing the CNC machine and its diagnostics to ensure functionality following all company safety protocols
- **CNC Programmer**: programming of the CNC machine.

Cybersecurity

- **IT Security Specialist**: analysing, evaluating and proposing information security, ICT and IT security measures against identified threats; developing conceptual solutions to increase security in the use of direct communication and sales channels (Internet, telephone sales, etc.); resolving ongoing problems with the use of security in direct communication and sales channels.
- **Information Security and Online Communications Coordinator**: responsible for data oversight, proactive monitoring of network functionality; receiving reports/errors (written and telephone communication); liaising with the technical team, overseeing the improvement of systems security; basic network diagnostics, domain management, etc.

- **Cloud Security Specialist**: participation in the preparation of a plan for migration of applications/services to the cloud; assessment of technical documentation and participation in the development of cyber security analyses for implemented projects, taking into account compliance with internal regulations and market standards; preparation and coordination of security tests for implemented implementations; proposing the scope of optimisation of the security architecture of applications/services as part of cloud solutions in a multi-cloud environment; active cooperation with other teams taking care of the security and continuity of the operation of applications/services.
- **Systems/Networks/Equipment Security Officer**: setting up an access and security protection system; controlling the correct operation of the systems/network on an ongoing basis by monitoring it and responding to any disruptions and anomalies, reacting when users are found to be using the network inappropriately, adhering to network/systems access protection rules, regularly checking compliance with security rules (company security policy); indicating, where necessary, the need to install appropriate protection and threat detection mechanisms; providing training to employees on the use of networks/systems.
- **Cloud and Security Engineer/Officer**: responsible for adherence to ergonomics, professional ethics, health and safety and data protection legislation; participating in contract negotiations and setting the terms and conditions of cooperation with cloud service providers (ensuring that the conditions and requirements set out in the contracts are met); collaborating with legal departments and procurement agencies.
- **Cybersecurity Coordinator**: responsible for Cybersecurity strategy in the company.

5. Discussion

Digitalization or increasing usage and developments in ICT infrastructure, has created not only new ways of running the business. Managing a business in a digital environment means and includes running an e-business or, so-called, e-commerce via the Internet and other online electronic networks (Hafezieh, Akhavan, Eshraghian, 2011; Hafkesbrink, Schroll, 2010). George Pakein in 1975, said that technology would allow workers to merely press one button and information would reach all audiences (Huđek et al., 2019). Today, there are many terms for the transformation in the economy that are occurring under the influence of developments in ICT, e.g. post-industrial economy, knowledge economy economy, on-line economy, e-economy, and digital economy (Hafzieh, Akhavan, Eshragian 2011; Anckar, 2016, p. 36; Huđek et al., 2019).

The spread of digital technologies is having an impact on the changing employment structure, leading to the automation of routine tasks and the creation of different types of occupations, consequently leading to a demand for a workforce with developed ICT skills in almost every industry sector. Digital transformation is an effort to accelerate business through the use of information technology tools and the creation of new business development opportunities that can support companies' processes to make their target markets broader (Schallmo et al., 2018; Fitzgerald et al., 2013).

Digital skills are understood as characteristics that enable businesses to exploit the opportunities offered by information and communication technologies (ICT), thereby ensuring more efficient operations and discovering new ways of doing business (ITU, 2020). Digital competence is considered as the ability to understand and express by making analytical, productive and creative use of information and communication technologies and social software to transform information into knowledge, actions and services (Ferrari et al., 2012; Prospective Technological Studies, 2011; Torres-Coronas, Vidal-Blasco, 2011; Drydakis, 2022).

An employee in a digital enterprise encounters many applications (Drydakis, 2022): communication apps, networking apps, social media apps, customer relationship management apps, payments apps, accounting and finance apps, managing inventory apps, team and time management apps, project management apps, process management apps etc. The number of applications that an employee supports in a company is constantly increasing. Industry 4.0 takes advantage of modern technologies and the cyber environment and thus requires employees to have the knowledge and skills to seamlessly navigate this space. Technical skills and job-specific knowledge are important in the assessment of employees and necessary for the smooth functioning of the organisations.

The number of applications that an employee supports in a company is constantly increasing. The development of ICT makes it necessary for employees to continuously develop their competences and, in the event of a shortage of IT-competent employees in the company, employers make job offers. According to EU report (2022, p. 35), from 2012 to 2020, an average of 21% of all enterprises in the EU provided training to develop/upgrade the ICT skills of their personnel. The trainings in enterprises are organised for both IT and non-IT staff.

Eurostat (TESPR_SP410) defines four levels of digital skills: information skills, communication skills, problem-solving, software skills. Each group consists of several levels, which are constantly being completed. The list of competences is open, as new technologies are emerging. According to the EU report EU report (2022, p. 43), in the coming years there will be an increasing need for employees who can cooperate, use, handle, such technologies as: Big data and Analytics, Cloud computing, Green ICTs, cybersecurity, robotics process automation (RPA), AI and machine learning, software system for company management. In order to keep up with technological advances, two paths to competence development must be pursued in parallel: external education and training, both paths with forms of learning (different learning methodologies: blended, online, in-post, learning styles: visual, interactive and learning contexts: classroom, workplace.

Our analysis shows that employers are looking for employees with digital skills for various areas of business service in the strongly popularised concept of Industry 4.0. Industry 4.0 needs a wide range of competencies for employees operating next-generation technologies. This has already been pointed out by the authors of the publication (Cedefop, 2019; Daugherty, Wilson, 2018; Fantini et al., 2020; Ala-Mutka, 2011; Romero et al., 2016; Ruppert et al., 2018) and the topic is still relevant. On the Polish publishing market, a catalogue of digital competences was prepared by a team of Jasiewicz. The team of researchers divided competences into IT, communication and functional competences. The division seems to be the most accessible for grouping job offers on the basis of our analysis. In the first category, there are medium and high level ICT competences. In communication competences there are job offers for people dealing with the transmission of digital information. In the last group are the remaining job offers, which are strongly differentiated according to the processes carried out in the companies that are looking for employees. And although our analysis was presented according to the technologies and occupations in demand, in the future our scope of research will evolve towards describing levels of competence or only skills in relation to the technologies being developed.

The positions outlined in our analysis are closely related to automation in the manufacturing industry with a particular emphasis on programming skills. This means that a technical education or diplomas in electrical engineering, engineering or computer science will be useful in the roles listed. Employers are also looking for specialists with additional training in the area of robotics. It is worth remembering that working in automated production also requires soft skills like curiosity, creativity, empathy, problem-solving, and communication (Jelonek et al., 2020; Gorustowicz, 2019; Hecklau et al., 2016; Pezer, 2015, Gajdzik et al., 2022, Gajdzik, 2012, Gajdzik, Grebski, 2022). According to Jelonek et al. (2020) soft skills are related to the ability of emotional self-control, self-organization, but also coexistence with others in the community or the degree of openness to change. The ideal candidate should be able to solve problems efficiently and react quickly to change. In addition, the most important trait - both among entry-level employees and those in management positions - is to be courageous in the development process and to see Industry 4.0 not as a threat but as an opportunity.

6. Conclusion

Demand for IT professions in companies is growing with the development of the technologies of the fourth industrial revolution. IT professionals are needed by companies to improve digital business and build Industry 4.0. Digital competences take on particular importance in view of the development of digital technologies and widespread access to vast amounts of electronic information. At the same time, these skills are a prerequisite for action in almost all areas of the use of digital technologies digital technologies. Different groups of

innovative technologies need different IT competencies. Big Data and the Cloud need architects, specialists and researchers. Robotisation needs online and offline robot programmers, operators and other specialists. In additive manufacturing, programmers and operators, as well as CAD specialists, are needed to operate 3D printers and CNC machines. To build the company's cyber security, at every level of technology, people are needed for the digital security of the technology used. IT professions in companies need the support of engineers and technologists, as they are then better able to adapt technology to the needs of the company. In the further our research will focus on systematising process engineering professions.

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