

## **THE KNOWLEDGE AND SKILLS PROFILE OF ACCOUNTANT 4.0**

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### **Abstract**

Businesses are nowadays experiencing extensive transformation due to technologisation, automation and digitalisation of their production processes and operations. The knowledge and competences of employees is a very important factor for a company to cope with those challenges in the most competitive way. Organisations have to increase their Digital IQ to capture the expected benefits from technology investments. Workers need digital culture and skills to feel comfortable performing their job tasks and it turns out that people could be constraints for putting digitalisation into place. Firstly, it refers to hiring the proper personnel. The so called digital natives should be attracted, trained and retained and the HR specialist are more than concerned how to co-ordinate the HR strategy with Industry 4.0. Identification of the required employees' profiles and the missing skills and abilities are now of a higher priority. The necessary knowledge transfer, part of the strategic HR management, is facilitated by the convergence in research and development within regional conglomerations of companies along a common value chain. Secondly, it is a matter of investing in training programmes and continuous professional development to manage the missing expertise within organization boundaries.

The paper is inspired by the increasing digitalisation of businesses and the impact of technology innovations and their augmented application on the accounting profession. The aim of the research is to outline and discuss the accounting professional's profile in terms of the required knowledge and skills imposed by company's transformation in the Industry 4.0 context. There are many implications due to digitalisation of organisation business model, value chains, products and services that should be considered. The author's attempt is to perform and present a comprehensive analysis of their impact on the current status of the profession and future trends of development in terms of the required job skills and competences.

**Keywords:** Industry 4.0, accountant's profile, knowledge and skills.

## **Introducing the research problem**

Industry 4.0 or the “fourth industrial revolution” is a term<sup>2</sup> for referring to the next stage in the development of manufacturing industry. It is a response to the vast changing business environment, characterised with customer-driven markets, quicker product lifecycles, increasing variety of product variants and enhanced transparency in the global competition (KPMG, 2016, p. 17). Businesses are experiencing extensive transformation due to technologisation, automation and digitalisation of their production processes and operations.

Some argue that Industry 4.0 is not yet a reality but a concept and view it as an evolution rather than a revolutionary change of economic patterns (KPMG, 2016, p. 16). It is driven by digitalisation and integration of vertical and horizontal value chains, digitalisation of products and service offerings, and digital business models and customer access. Digital technologies as mobile devices, 3D printing, smart sensors, cloud computing, augmented reality, etc. are at the core of this transformation. Through the convergence of technologies, industrial structures, media and solutions, business efficiency, product quality and customer satisfaction are improving and additional value added is generated (PWC, 2016, p. 6; KPMG, 2016, p. 17). Some argue that due to such mergers, the boundaries between the real and virtual world evaporate thus resulting in the so called cyber-physical production systems (CPPs). CPPs could be described as “a smart network of machines, properties, ICT systems, smart products and individuals across the entire value chain and the full product life cycle” (Deloitte 2015, p. 4). In addition, machines are linked to plants, networks, humans, etc. via sensors and other tracking elements. CPPs lies at the heart of the so called “smartfactories”<sup>3</sup>.

How companies react to the aforementioned drivers of the change is a complicated issue as there are many prerequisites for the successful transition to “digital enterprises”. Business adaptation in the digital era requires good strategy for the right technology implementation. Companies with high degrees of digitalisation and integration, the so called “first movers”, have already been receiving the returns from their significant investments and considerably enhanced digital capabilities and expecting both revenue gains and cost reduction (PWC, 2016, p. 12). Despite the inevitability of the process, there are many implications from technological improvements that should be considered. Of central importance for the successful digital transformation of businesses are the human resources. The investments in staff recruitment and training areas important as the investments in IT infrastructure. Moreover, they are interdependent and

related in certain ways.

The knowledge and competences of employees is a very important factor for a company to cope with the challenges of Industry 4.0 in the most competitive way. Organisations have to increase their Digital IQ<sup>4</sup> (PWC, 2017) to capture the expected benefits from technology investments. Workers need digital culture and skills to feel comfortable performing their job tasks. It turns out that people could be constraints for putting digitalisation into place. Firstly, it refers to hiring the proper personnel. But the so called digital natives should be attracted, trained and retained and the HR specialist are more than concerned how to co-ordinate the HR strategy with Industry 4.0. Identification of the required employees' profiles and the missing skills and abilities are now of a higher priority. The necessary knowledge transfer, part of the strategic HR management, is facilitated by the convergence in research and development within regional conglomerations of companies along a common value chain

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<sup>2</sup>Another equivalent terms, mainly used in the English-speaking countries and USA, are: "the internet of things", "the internet of everything", "internet of things, services, data and people" and "the industrial internet" (Deloitte 2015, pp. 3-4).

<sup>3</sup>also called "factories of the future" or "digital enterprises".

<sup>4</sup>Digital IQ - the measurement of an organisation's abilities to harness and profit from technology (PWC 2015, p. 10; 2017, p.3).

(KPMG, 2016, p. 15). Secondly, it is a matter of investing in training programmes and continuous professional development to manage the missing expertise within organisation boundaries.

### **Aim of the paper and research methodology**

The paper is inspired by the increasing digitalisation of businesses and the impact of technology innovations and their augmented application on the accounting profession. The aim of the research is to outline and discuss the accounting professional's profile in terms of the required knowledge and skills imposed by company's transformation in the Industry 4.0 context. There are many implications due to digitalisation of organisation business model, value chains, products and services that should be considered. The author's attempt is to perform and present a comprehensive analysis of their impact on the current status of the profession and future trends of development in terms of the required job skills and competences.

The author is aware that a pinpoint precision is not possible due to the evolutionary rather than revolutionary way of transformation driven by the "internet of things, services, data and people" and the time needed to test and confirm the profile, its integrity and adequacy for performing the finance function within the "digital enterprise". On the other hand, the company's needs for certain accounting expertise has already been experienced by the profession representatives. Few surveys and other documents, prevailing those issued by the Big Four companies, are used as a frame of reference and as a focal point for the research.

### **General implications of Industry 4.0 convergence, digitalization and exponentially growing technologies**

Convergence, digitalization and exponentially growing technologies are the features of Industry 4.0 with an overall impact on the skills profile of employees in "the factory of the future". Their effect on accounting professionals is unarguable and they should be considered the main drivers for the changing role and functions of the profession in the era of "the fourth industrial revolution".

Industry 4.0 is characterised as an interdisciplinary and all-encompassing due to many *convergences* leading to integrated manufacturing systems and customer-oriented units in the modern enterprise. This specific merger of the online and offline worlds impacts the required employee's broad professional profile. Due to the convergence and interactions of different

systems, and the increasing complexity of the production process, employees are exposed to more challenging requirements regarding their qualification. Fundamental knowledge and expertise will be of a great demand for companies' successful transformation. It is obvious, that in such complicated organisation environment accountants should become interdisciplinary experts with an in-depth knowledge in many other areas beside their accounting and financial reporting competences. They need a profound understanding of company's business model and very good comprehension of its processes, production and logistics (KPMG, 2016, pp. 12-13, 39-40). Moreover, accountants will increase their participation in the decision-making process, strategic management and problem solving. They will transform to some kind of internal consultants giving advices to company's management and actively participating in company's activity forecasting, planning and control (ICAEW, 2017). The budget-oriented planning will be replaced by the more precise weekly, rolling corporate planning and will be based on current corporate data instead of outdated historical information (KPMG, 2016, p. 26). Changing their role as preparers of historical financial figures, accountants will have to work intensively with data analytics (Gamage, 2016), which complemented by purposefully developed business awareness and understanding, and their strong numeracy skills, could place them well across organisation boundaries.

In 2013, the Association of Chartered Certified Accountants (ACCA) and the Institute of Management Accountants (IMA) predicted in their joint report (ACCA & IMA, 2013) that in the future accounting profession will be transformed into some kind of professional hybrid, due to the interaction of finance, technology and information skills and competences. This statement supports the argument about the interdisciplinary expertise needed from accountants in Industry 4.0 context, which in our opinion should be reflected in their professional education and training.

*Digitalisation* is the second dimension of “the fourth industrial revolution” with a great impact on the skills profile of the future accountant. In 2016 PWC performed a survey exploring the benefits of digitalisation of company’s vertical and horizontal value chains, products and services. The key findings show that there are many benefits especially for “the first movers”. They are forecasting significant cost reduction and revenue gains of more than 30% at the same time and also expecting efficiency gains from their digital transformation and integration. The competitive landscape has already been changing with a very fast pace (PWC, 2016). In such organisation environment employees’ digital culture and skills are considered as the main driver for the change and one of the top management challenges. A successful strategy for companies will be to invest not only in technologies but also in appropriate training programmes for employees. Cyber security is another area which needs more specialised expertise especially for those processing and analysing huge volume of sensitive data.

Industry 4.0 is accelerated by *exponentially growing technologies* as robots, artificial intelligence, 3D printers, smart sensors, drones etc. They are at the core of businesses transformation and impose some additional demands in terms of the required knowledge and skills. Accountants should be familiar with the legal requirements and tax implications caused by the augmented application of digital technologies. Of central importance for the company’s wellbeing will be to provide remedies for a whole host of legal and tax issues, product liability and protection of intellectual property (Deloitte, 2015).

The most important issue when discussing the interdisciplinary skills and competences required from accountants in “the factory of the future” context, is the identification of the missing knowledge and abilities that should be acquired or developed from the profession due to the increasing impact of Industry 4.0 drivers. To manage with the missing expertise, accounting education and professional training should be adapted and continuously linked to the changing labour market requirements and employers’ demands for qualified human resources.

### **Outlining the knowledge and skills profile of Accountant 4.0**

Industry 4.0 is changing the structure and scope of accountants’ qualification profile by imposing new challenging requirements regarding their skills and competences. To feel comfortable in the organisation environment of “the digital enterprise” and perform successfully their job tasks, accounting experts should transform into hybrids with interdisciplinary knowledge and plenty of diversified skills and abilities (figure 1). Each element of the so

proposed profile will be briefly discussed in terms of Industry 4.0 characteristics and the main drivers for industry transformation.

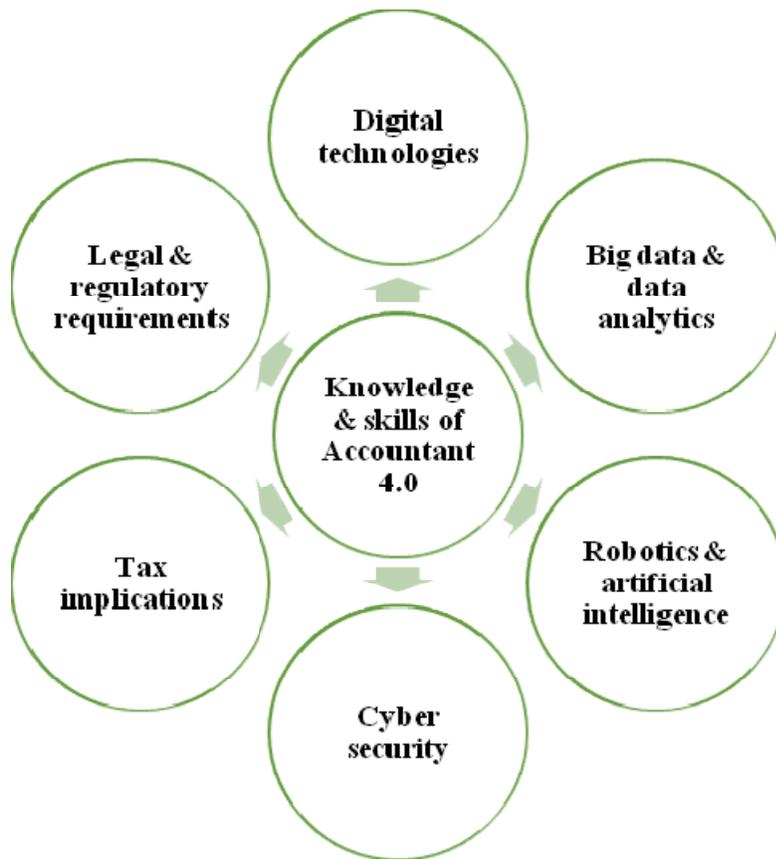


Figure 1 Knowledge and skills profile of Accountant 4.0

### *Digital technology competences*

In the context of digitalisation of businesses and the emerging technologies and their augmented application, accountant as many other experts within organisation, should develop digital skills in such technology-rich environment (PWC, 2016). The working patterns for accounting profession are changing due to mobile technologies, modern tools for social collaboration, cloud computing, digital service delivery, blockchains, augmented and virtual reality, etc.

For accountants in the finance function the *mobile technologies* are revealing new ways for communication and collaboration within and outside the company. Combined with cloud services, a permanent access to company's financial data is provided for the benefit of the management. Accounting professionals in practice now have a very powerful tool for attracting new customers despite the geographical boundaries and increasing clients' satisfaction from services performed. Collaboration with customers is enhanced by the *social media*, now heavily exploited by businesses. Social platforms as Facebook and Twitter are used as effective tools for fast distribution of company's data among its stakeholders. According to ACCA survey there are few benefits for accountants beside the aforementioned overcoming of barriers to communication. Decision-making and productivity will be enhanced and new investment opportunities will emerge. Another positive effect could be the time-saving for the month-end processing. Profession representatives should adapt their work performance patterns to this new environment and pay special attention and due care to the risk of sensitive data leakage, different financial implications and the more strategic role of the finance function within organisation (ACCA,2013).

*Cloud-based accounting software* is another powerful tool for strengthening the relationship with clients, gaining a real-time access to company's financial information. In fact, "the cloud" is changing the traditional way of "keeping the books" through speeding up and optimising the document flow and processing, time for recording of business transactions and datastorage. It is also a driver for transforming accounting services in practice. Accounting practitioners could now take the leading role in the strategic planning of their clients' businesses and act as virtual financial directors because of their greater business in sights and awareness. Cloud accounting is providing many opportunities for

expanding services offered, realising efficiency gains and extra profits (Preece, 2015). Unfortunately, despite the positive effects, there are some challenging issues. First of all, it is difficult to budget and manage the IT costs associated with the usage of cloud-based infrastructure, which makes the cost/benefit analyses useless in this case. Moreover, the possibility for 24-hours online access to the IT systems is extremely exaggerated.

Accountants can improve their own practice through both delivery and usage of *digital services* thus providing and gaining access to resources. Self-service features of services offered electronically will provide customers with an easy access to company's statutory and management reports, facilitate daily operations and improve efficiency and client satisfaction. For accounting practitioners, digitalisation of their business models will become a very important cost-saving factor, which requires relevant digital culture and skills.

*Augmented and virtual reality* and its impact on the profession is another area for consideration in the context of the business world digitalisation. How could accountants benefit from this innovation depends on their perception of technologies and their abilities to choose and implement the right ones with the most potential for accounting service improvements. Attracting new clients and developing new business lines are among the few opportunities for business expansion. The more effective usage of financial data will extract new business insights and improve decision-making and company's outcome.

Other skills related to the required digital literacy that should be addressed in our discussion are the *blockchain technologies*, which introduce new payment systems and the usage of virtual currencies thus changing the traditional concept of money, methods of exchange and the existing business models (ACCA, 2013; Stancheva-Todorova, 2019b). Electronic banking and alternative online payment platforms impact accounting practice in many ways and challenge the profession representatives. Firstly, automated links with the bank accounts are integrated in almost every accounting software, thus saving time and efforts from the minimised human interaction. Secondly, the number of users and retailers accepting "digital" currencies are increasing progressively. Their benefits of moving to a Bitcoin system comprise of lower transaction fees, instantaneous transfer, international competitiveness, fraud prevention and reduced liability.

From the accounting perspective, cryptocurrencies offer a potential for development. The CEO of the International Federation of Accountants, Fayeze Choudhury, stated that "Bitcoin poses opportunities to strengthen

and expand the scope of what accountants do and how we do it.” (CAANZ, 2015, p. 26). The accounting firms could expand their business advisory services and the profession could develop new specialisations. They could also exploit the first mover advantage by offering services that meet the tax and other legal regulations as anti-money laundering and counter-terrorism financial rules. Despite the plenty of opportunities, many challenging accounting and financial reporting issues should be addressed. Still the lack of a proper and widely accepted classification and reliable measurement basis for the transactions with cryptocurrencies is an area of concern. Bitcoin and other digital currencies have unique nature stemming from the way they are “mined” but not issued by the government authorities as compared to the traditional money. The existing disclosure problem should not be understated as well (Stancheva-Todorova, 2019b). Chandra, Ettredge and Stone argue that certain disclosures of cryptocurrency transactions will allow investors and creditors to assess the information asymmetry between different parties involved and will also help the users of financial statements to reduce the costs for gathering information (Chandra, Ettredge and Stone, 2006). Accounting regulators and standard setting bodies have to consider the impact of cryptocurrencies and blockchain technology on companies’ accounting and financial reporting and develop an adequate regulatory framework to ensure reliable and transparent information for users (Stancheva-Todorova, 2019b).

An action plan for accountants in terms of company digitalisation and technologisation is presented in table 1. It is based on the ACCA 2013 study on the impact of technology trends on the global accountancy profession. The survey summarises the activities required from accountants to cope with some of the challenges associated with digital technologies and their augmented business application.

**Table 1. Digital technology trends and actions needed from accountants**

<b>Digital technology trends</b>	<b>Actions</b>
<b>Mobility</b>	<ul style="list-style-type: none"> <li>• identify and deploy effective mobile solutions that can work in the decade ahead</li> <li>• manage the transition to full mobility in a consistent and safe manner</li> <li>• consider the potential offered by an interconnected internet of things, from mobile devices to appliances, cars, and industrial equipment.</li> </ul>
<b>Cloud</b>	<ul style="list-style-type: none"> <li>• explore ways of establishing actual costs</li> <li>• educate those outside the finance function (including practice clients) on the complexity of total cost calculations</li> <li>• clarify national and international tax regulations and complications</li> <li>• demand more granular use of, and price data from, cloud vendors – particularly infrastructure providers</li> </ul>
<b>Digital service delivery</b>	<ul style="list-style-type: none"> <li>• recruit those with the required digital literacy skills and/or develop them</li> <li>• plan tactically and strategically to deliver competitive advantage</li> <li>• consider the implications of businesses, advisers, regulators, and others becoming progressively more connected and exchanging data automatically</li> </ul>
<b>Augmented and virtual reality</b>	<ul style="list-style-type: none"> <li>• explore new ways to attract talent and deliver and access training</li> <li>• develop new approaches to measuring and analysing costs and return on investment</li> <li>• consider new ways to conduct business/enhance services by applying augmented reality</li> </ul>

<b>Payment systems</b>	<ul style="list-style-type: none"> <li>• acquire new skills to adapt and exploit new money paradigms and methods of exchange</li> <li>• use their experience and insight to innovate current systems and adapt to new and emerging payment systems</li> <li>• position themselves as advisers and guides as peer-to-peer platforms reduce dependency on banks</li> <li>• develop expertise and guidance on areas such as online and virtual payments and their taxation.</li> </ul>
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*Source:* ACCA, 2013, pp. 4-7, 12.

#### *Big data and data analytics*

In a data-driven organisation, data analytical skills are of a central importance for the successful career of accountants both in the finance function and in practice. Big data sets are used to provide new insights on businesses leading to better decision-making, risk management and strategic business solutions. Because of their diverse and complex nature and large volume, they require special technologies but also new job skills for managing the data to be analysed and audited. Data quality and security are also important areas and require special knowledge and competences. Accounting professionals are challenged to build such skills through proper education and training (ACCA, 2013; Stancheva-Todorova, 2018).

Professional accounting bodies as ACCA, the Institute of Chartered Accountants in England and Wales and the Chartered Global Management Accountants (CGMA) have already started to change their qualification modules content by introducing information technologies into the syllabi.

For instance, in April 2019, ACCA introduced a new data analytics unit as part of the Ethics and Professional skills module thus giving a direct response to “digitalisation and the latest technological developments affecting global business” (Bennett, 2019). In fact, some of the ACCA exams as Business Reporting and Strategic Business Leader have already introduced Big Data, disruptive technology and cyber attacks through various business scenarios. CGMA has also added some material on Big Data analytics in their 2015 syllabus (Gamage, 2016). Accounting educators are also experiencing high pressure to enhance the technological content of accounting courses. Programmes’ curricula and modules’ syllabi should be adapted to the current labour market requirements and employers’ expectations from graduates (Stancheva-Todorova, 2019a).

### *Robotics and artificial intelligence*

Accounting profession has been estimated as having high probability for automation. Bookkeeping is the most routine, time consuming and unquestionably susceptible to automation part of the accounting work. Complex business transaction are easily disaggregated, described in accounting terms and recorded into the ledgers. The process can be fully automated by using the machine learning technologies. The accuracy of accounting data will be improved as well as the timing of recording. Fraud prevention and detection is another area where artificial intelligence (AI) applications are possible and desirable. Another job task where AI is likely to be beneficial is the revenues forecasting (ICAEW, 2017). The accuracy of the revenues forecast is crucial for an operations budget and all other budgets derived from it. The use of predictive models, based on machine learning algorithms, can improve quality of the forecast data and consequently the processes of budgeting and strategic management. Financial accounting and reporting is another area with great potential for automation. A practical challenge is the increasing number of regulations that need to be transformed into if-then rules and decision trees suitable for AI algorithms (Stancheva-Todorova,2018).

Accountants can benefit from the intelligent systems as by using their capabilities they will be able to support decision-making by providing better and cheaper data, provide more profound analysis of data and give new insights on business and focus on more valuable tasks after freeing up working time due to AI applications (ICAEW, 2017, p. 8).An important question is what are the new skills required of accountants to benefit from deployment of AI technologies and create more value to the businesses.

One of the most required skills is the technical expertise in machine learning and the depth of knowledge depends on the organisation's size, investment policy and innovation strategy. Despite these factors, it is important for accountants to understand the significance of quality of the data used. Machine learning implies recognition and application of patterns based on existing data points or examples, deriving own algorithms and refining them in time (Shimamoto, 2018). "Teaching" the computer by using data sets requires special attention to their quality as mentioned earlier. Internal control procedures should be implemented to mitigate the risk associated with the inherent biases and other limitations of AI applications.

Communication skills and critical thinking will become increasingly important in the AI age (ICAEW, 2017). The ability to think critically is considered as a prerequisite for a successful transition from the classroom to the professional workplace. In addition, leadership skills will become more important with the changes of accounting roles. As the professionals increase their participation in company's strategic management and collaboration and partnership with other parts of the organisation, certain types of leadership will become indispensable. Among them are: strategic and organisational leadership; coaching and mentorship; a strong sense of ethics and cross-functional leadership.

#### *Cyber security*

The increased usage of personal and business information in our digital world raises the question of cyber-crime risk management. It is reported that the theft of digital information is the most common fraud (ACCA, 2013, p. 10) though the industrial espionage, sabotage by competitors and terrorist attacks on Industry 4.0 infrastructure should not be underestimated (KPMG, 2016, p. 57). Accountants will play an important role in risk identification, assessment and mitigation as they process, analyse and archive huge sets of sensitive data. They have to be familiar with and regularly review company's policies and procedures on data privacy and security. Special expertise on cyber-crimes, which turns out to become more complex over time, will be crucial for prevention and detection of cyber threats. Assurance on company's controls and policies associated with data privacy and security should become a focus of the internal auditfunction.

### *Taxation*

Tax dimension of “the fourth industrial revolution” brings many challenging issues to the accountancy profession. Restructuring of value chains and intangible assets allocations requires revision of the transfer prices systems and reconsideration of tax basis in terms of services location. Accountants in practice should be familiar with Industry 4.0 tax implications and the areas for tax optimization as internal group transfer pricing structures, withholding tax on licence payments, value added tax and customs duties, national and international tax rate differentials, etc. (KPMG, 2016). Assistance in the electronic audits expected in the near future is also required. Accountants in the finance function will rely on the expertise of company’s tax department. The efficient communication is a prerequisite for the proper accounting treatment of company’s activity in terms of taxation.

### *Legal and statutory requirements*

Transition to Industry 4.0 imposes a whole host of challenges due to the new and complex transactions and events of “the digital enterprise”, which proper accounting treatment requires interdisciplinary knowledge and efficient internal communication within the organisation. Accountants should have the needed knowledge and expertise on plenty of legal issues and be familiar with the existing legal and statutory requirements in the areas of: data traffic and storage, patents and licenses, exposure to liabilities and other commitments, intellectual property, employment, foreign trade, etc.(KPMG, 2016). Profession representatives should work more closely with other business units and with the legal department in particular.

### **Conclusion**

Digitalisation of businesses and the exponentially growing technologies are changing the role and functions of the accountancy profession, which turns into a hybrid due to the expanding demands of the labour market and employers. The qualification profile of Accountant 4.0 encompasses many interdisciplinary knowledge and

skills in different areas for both, accountants in the finance function and in practice. There are many challenges on the road to the “factory of the future” and a very important factor for the profession to cope with them in the most competitive way is to adapt to the new competence requirements and invest in proper accounting education, training programmes and continuous professional development.

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