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WHAT FUTURE SKILLS WILL BE NEEDED FOR FUTURE IT-PROFESSIONALS? AN EMPIRICAL STUDY

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Abstract

The currently EU-wide largest survey on the future of skills for Professionals in the IT sector reveals a new configuration in skill demands. The skill study differentiated between three sets of skills: Business, technical and Future Skills and surveyed IT and HR professionals from more than 300 organizations in 27 European member states to assess the importance of skills today and within the next three to five years. It took place in the Blockchain sector, which stands exemplary for digital transformation of economies. It turns out that participants attribute high to very high importance to Future Skills even when compared to technical and business skills. This brings up questions for new qualification pathways and strategies with a strong focus on Future Skills. The here presented study provides an in-depth analysis of surveys and research skill demands for IT professionals and an analysis of skill supply, which has been investigated through a multi-method and multi-stakeholder research design.

Keywords:

Empirical skills research, *Transversal skills, Future skills, IT professional, Skill intelligence, Skill mismatch.*

1. Introduction

Skill development is high on the agenda of regional, national, and institutional decision makers in policy and institutions and counts for large parts of a regions' innovation capacity and an individual's resilience against biographical risks.¹ A growing number of studies is investigating the efficiency and effectiveness of such skill development of educational systems world-wide (Ehlers, 2022). For higher education, the investigations claim a mismatch between what graduates are able to do and what society and the labour market expects them to be able to do. The latter being the ability to deal with a volatile, uncertain, complex, and ambiguous environment ahead. The phenomenon has recently been termed as "skill gap" in a so-called Delta Study by McKinsey involving more than 18,000 participants (NSDC, 2020). The skill gap concept is also expressed in individuals' perceptions: As biographies become increasingly flexible, individuals have a growing responsibility to develop individual competence strategies for their biographies at large. In this context, the fit between educational opportunities and occupational requirements must increasingly be prioritized and translated into individual learning and action strategies, in which "Future Skills" play an essential role (Ehlers, 2020).

While the skill debate is lead under various diverging flags and terminology, the Future Skills concept has now been precisely and operationally defined and conceptualized by Ehlers (2020, 2022) in the NextSkills Study resulting in 17 defined Future Skill profiles. The study is rooted in an analysis of the state of the art of research and is modelled on sociological theory, neo-institutionalism, and individualization approaches, involving educational theoretical approaches of action competences and new theories of organizational development (for a detailed account of research methodology and state of research on Future Skills see Ehlers, 2020). Section 3 describes the approach briefly.

The Future Skills model has been used as a basis for building a quantitative instrument to investigate IT professionals and human resource experts' opinions about the relevance of different skill sets in relation to Future Skills. The question being if what has been known as hard skills can be really understood as superior to so-called soft skills – or if on the contrary, the former soft skills are more relevant skills for the future. The quantitative study is part of a larger multi-part, multi-mix and multi-perspective study based on methods of the emerging field of labour market intelligence research (Brunner & Ehlers, 2021; Ehlers & Bonaudo, 2021). It has been conducted in 27 European member states and addressed to IT professionals and management staff in the

¹ The explicit focus of policy can be seen e.g. in the fact that 2023 has been declared the European Year of Skills (see European Commission, 2022).

IT sector. In addition to the analysis of skill demands, the study also investigates skill supply – looking at learning pathways for Future Skills in the IT sector through curricula analysis, expert interviews, as well as informal learning communities and fora.²

In section 2 we will explain our Future Skill concept and describe two other different sets of skills which have been used to define skill demands in the IT sector. In section 3 we will shortly describe the research methodology which has been followed to determine skill demands. We will also state the methodology used to analyze skill supply – although the results will not be part of this chapter. In section 4 we summarize the results of the skills demand analysis.

Overall, the studies reveal a gain in importance for Future Skills against other skill sets.

2. Skill Sets for the IT Professional of the Future: Beyond Technical and Business Skills.

For the study, three skill sets (see Fig.1) have been selected in order to investigate their future relevance for professionals in the IT industry: a set of Technical Skills, a second set of Business and Managerial Skills and a third set of Future Skills resulting from a large-scale future skill study.³

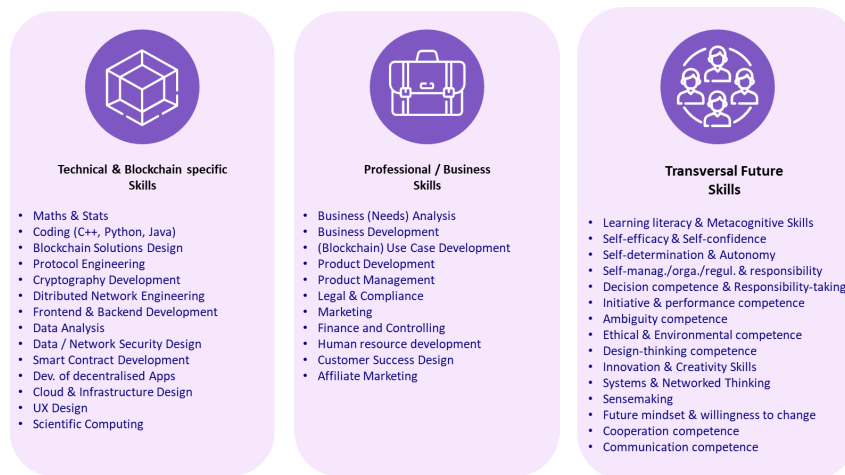


Figure 1 - List of Skills for future IT professionals

1 - Technical Skills (focus here on Blockchain) (Brunner & Ehlers, 2021): IT-specific skills relate to skills which are hard skills in the domain of digital technology and IT information technology development, informatics, programming, Distributed Ledger expertise, Blockchain security, Blockchain architecture, which in the core relate to domain-related knowledge, abilities, and attitudes of IT professionals

² The research has been conducted as part of the large-scale CHAISE Initiative together with 23 organisations from more than 16 European countries. CHAISE – being an acronym - stands for “A Blueprint for Sectoral Cooperation on Blockchain Skill Development”.

³ In a general understanding, we define “skills” as learnt or natural abilities of a person. Within the global debate on skills, talents, and competences, the discussion in literature is shifting to a more comprehensive concept of competences which includes skills and adds to it attitudes and knowledge (Erpenbeck et al., 2017, Ehlers 2020). The European Skills, Competences, Qualifications, and Occupations (ESCO) applies the same definition of “competence” as the European Qualification Framework (EQF). According to this framework, “competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development.” (ESCO, 2022).

2 - Professional / Business Skills (Brunner & Ehlers, 2021): Domain-related skills are defined by skills which are related to the field of profession of IT development but are comprised of skills which can be described or called complementing skills, like project management knowledge for IT and Blockchain-specific projects, business analysis skills for IT and Blockchain projects and alike

3 - Future Skills: Horizontal, transversal skills – often referred to as soft skills - are skills which enable professionals to act successfully in the changing and emergent environment of organizational future contexts. Research shows that these skills are of increasing importance (Ehlers, 2020) and the study is aimed to analyse the importance of these kind of skills for IT professionals in the Blockchain labour market development in Europe.

Figure 2 shows a summary of the 17 Future Skills.⁴

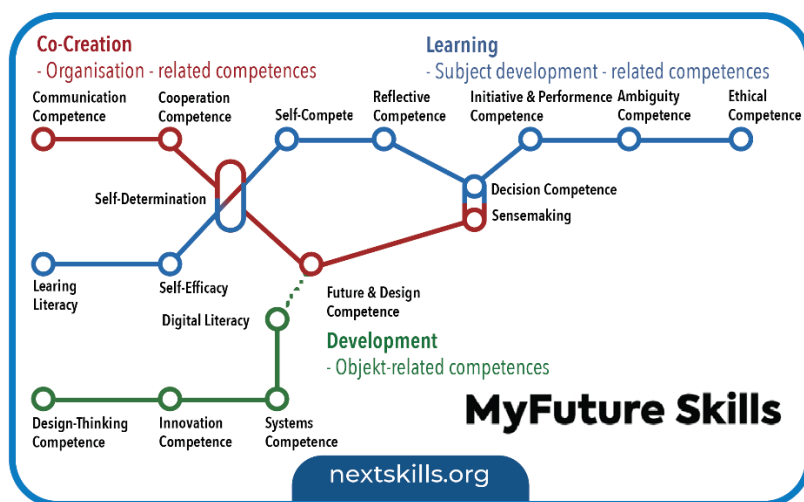


Figure 2 - Future Skills profiles (Ehlers, 2022)⁵

Future Skills is a concept which is directly connected to the former debate on key competences or 21st century skills (OECD, 2018; World Economic Forum, 2020) and which is now gaining increasing importance as a concept in educational policy and individuals' lives (Dettmers & Jochmann, 2021; Samochowiec, 2020). The importance of Future Skills has been stated in many studies both for the field of university graduates (Ehlers, 2020; Huber, 2016, 2019; Schlaeger & Tenorth, 2020; Wild et al., 2018) as well as for professionals in their jobs (Agentur Q, 2021; Dettmers & Jochmann, 2021; Stifterverband & McKinsey, 2018), and also internationally (Ashoka & McKinsey, 2018; McKinsey Global Institute, 2021; OECD, 2018; World Economic Forum, 2020). The body of studies indicates that research on Future Skills has established itself as a research field in its own right in recent years. Since 2016, 13 Future Skills studies are available within a Germany speaking context and at least 37 internationally. As a general trend, Future Skills concepts also include digital competencies, but place an emphasis on competencies of a transversal nature (e.g., ethical competence, dealing with ambiguity, etc.).

This also finds expression in the currently growing international field of research on Future Skills. Since 2015, there have been more than 37 international studies on Future Skills, with more to be published soon. Amongst them, the Organization for Economic Co-operation and Development (OECD) Skill Compass and concepts from the World Economic Forum which indicate a skills shift, which demand moving away from a knowledge based understanding of (higher) education to a multidimensional concept, including knowledge, but going beyond it towards so-called "key competencies" or transversal "Future Skills" (Ehlers, 2020; OECD, 2018; World Economic Forum, 2020).

3. Methodological Design

⁴ The 17 Future Skills identified in the NextSkills study by Ehlers (2020) were combined into 15 for the CHAISE study after consolidations with blockchain and IT experts.

⁵ An interactive Future Skills finder has been developed which can be accessed here: <https://nextskills.org/future-skills-finder/>

A variety of methodological approaches from the social sciences have been used for the study on Future Skills for IT professionals, contrasting the demand for skills with the supply for skills (Table 1). A number of different studies has been conducted in order to gain information about the demand of skills in the IT sector, as well as the supply (see Ehlers & Bonaudo, 2021). Amongst them, qualitative interviews with IT experts and training and education providers, job-ad analyses, community and fora analyses, and a Europe-wide skills survey (Brunner & Ehlers, 2021).

Table 1 - Research Flow and Data Collection

Research methods	Research activities	Data collected & analyzed
Quantitative standardized online survey	European Survey on Skills for IT professionals	304 Survey participants
Qualitative guideline-based interviews	In-depth expert interviews	36 interviews conducted (29 skill demand perspective & 7 skill supply perspective)
Qualitative document analysis	Job Ad analysis	459 Job ads collected ⁶ 314 analysed
Qualitative document analysis	Educational and training offerings with focus on Blockchain	133 Educational and training offerings collected ⁷ 120 analysed
Qualitative document analysis	Analysis of online fora and communities	17 Communities and fora analysed

For both perspectives – the skills demand as well as the skills supply – a number of data sources have been used.

Skills Demand

A detailed analysis of 314 job-ads collected from LinkedIn and further online job portals resulted in a description of preferred skills for job profiles. These data have been used to contextualize and define a Technical and a Business/ Managerial skill set. Together with the previously collected set of Future Skills, both the Technical and the Business skill set built the basis for designing the quantitative research questionnaire. More than 300 IT experts across 27 European countries rated the importance of the individual skill sets for three selected roles: architect, developer, and manager for the application context of the Blockchain sector. In addition, data from interviews of 28 IT experts have been collected to complement the data from the standardized surveys.

Skills Supply

For the skills supply perspective, 120 online training-offerings were simultaneously analysed according to the predefined skill set. In addition, 17 IT communities and forums were analysed according to skills and teaching methods. In order to get a more detailed insight into the training offered, 7 expert interviews were conducted with IT training providers, here with a focus on such forward-looking technologies like Blockchain.

4. Future Skills for IT Professionals

4.1 Overall Relevance of Future Skills

The quantitative data collected confirms that the Future Skills proposed in the NextSkills model are high on the agenda of IT professionals today and within the next three years. This holds true specifically if compared to skills sets on Technical Skills and Business Skills. The companies' assessment of how important transversal skills will be today and in the next 3 years shows that more than 90% of the respondents describe Future Skills today as either "somewhat important" or "very important". For the importance of Future skills in the next three years the vast majority (93%) of firms responded with either "very important" or "somewhat important".

Figure 3 provides an overview of the percentage of participants who describe each skill as important.

⁶ See registry of job ads: <https://chaise-blockchainskills.eu/registry-of-blockchain-online-job-vacancies/>

⁷ See registry of educational and training offerings: <https://chaise-blockchainskills.eu/registry-of-blockchain-educational-and-training-offerings/>

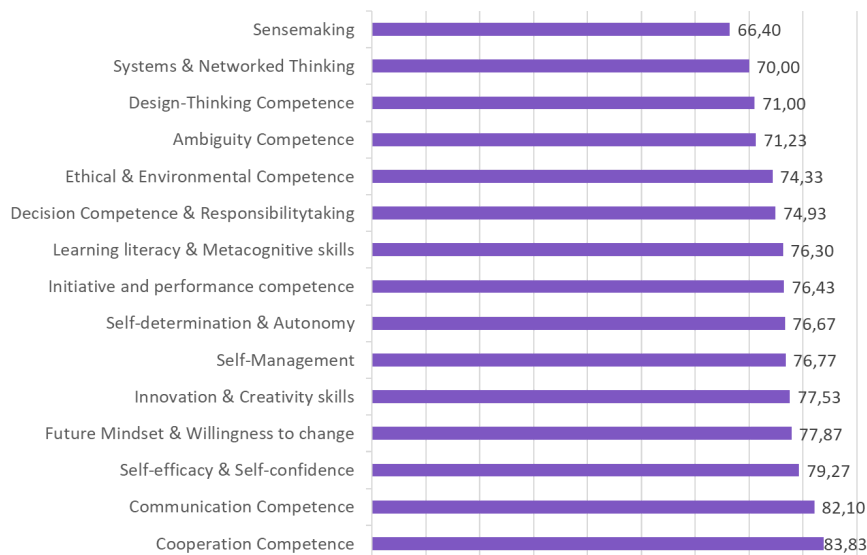


Figure 3 - Overview of the answers to the importance of the individual Future Skills⁸

As shown in figure 3 the most important Future Skills are cooperative competence (84%), communication competence (82,1%) and self-efficacy & self-confidence (79,3%). The following definitions and the definitions of the other skills can be found on nextskills.org:

- **Cooperation competence:** Cooperation competence as a Future Skill relates to the ability and disposition to cooperate and collaborate in (intercultural) teams either in face to-face or digitally supported interactions within or between organizations with the purpose of transforming differences into commonalities. Social intelligence, team-working competences, and consultation competence play a key role for this competence.
- **Communication competence:** Communication competence as a Future Skill entails not only language skills, but also discourse, dialogue, and strategic communication aspects, which – taken together – serve the individual to communicate successfully and in accordance with the respective situation and context, in view and empathy of her/his own and other's needs.
- **Self-efficacy & Self-confidence:** Self-efficacy as a Future Skill Profile refers to the belief and one's(self-) confidence to be able to master the tasks at hand relying on one's own abilities and taking over responsibility for one's decisions (Ehlers, 2020).

The following skills were described as important by fewer participants in the survey: Sensemaking (66.4%), Systems & Network Thinking (70%) and Design Thinking Competence (71%). These differences can all be explained by strong variations in the ratings of importance for each role profile. We will discuss these differences and possible explanations further in section 4.3.

The interest in Future Skills for individual job profiles is also highlighted in comparison to the importance rating of other skill sets, as shown in figure 4.

⁸ In the EU Survey on Skills for IT professionals, 304 survey participants from IT industry have been asked for which of the three defined job profiles they consider the 15 Future Skills to be important (for more details on the survey see Brunner & Ehlers, 2021; Ehlers & Bonaudo, 2021). Figure 3 shows the average number of times participants rated the skills as important across all three roles.

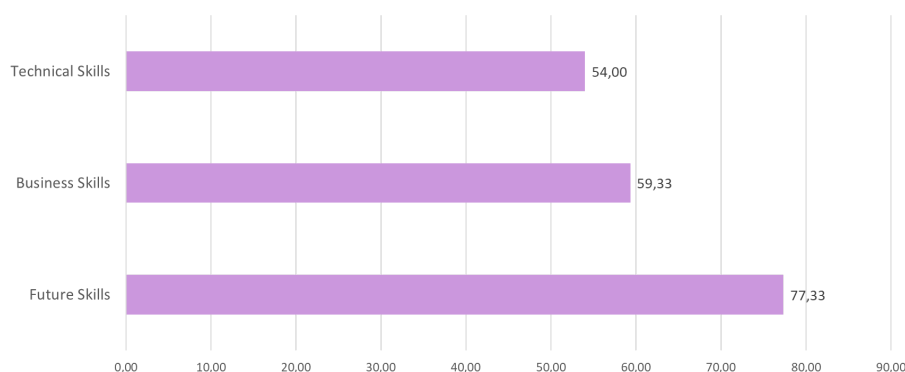


Figure 4 - Assessments of Importance of different Skill Sets

As can be seen in Figure 4, it is evident that Future Skills are regarded as very important skill sets across all job profiles. Even in a strongly IT-centric occupational field such as blockchain, they are rated more important than technical skills set. This indicates a clear skill shift from technical knowledge to Future Skills.

4.2 Comparing Importance of Different Skill Sets in IT Job Profiles

Skills are context bound and – for professionals - a particular skill gains its value through enabling professional performance, understood as successful action. While the general context of the study was aiming at defining skills for IT professionals at a general level, an additional analysis step has been undertaken: An analysis of the perceived skills requirements for certain role-profiles within the sector of IT professionals. The participants of the study were therefore additionally asked to relate the importance of skills to three different job role-profiles: Architect, Developer and Manager –all related to the sector of Blockchain. In the study, the three role-profiles are clearly described. (1) The IT or Blockchain Architect designs the multileveled architecture of a large IT or Blockchain system and software landscape and ensures the coherence of all aspects of a project as an integrated system. (2) The Developer role-profile codes applications, in our case Blockchain applications, and takes care of problem solving at the micro level. (3) The Manager of Blockchain applications and systems is tasked to track implementation progress, maintain close cooperation with business managers, and monitor the process quality to ensure that products meet their technical and business objectives. In a role-profile specific section of the study, participants have been asked to rate the important of the three different skills sets for the different role-profiles stated above.

304 participants from 13 countries took part in the survey, and rated different statements on a scale from very high to very low, depending on how important a skill is for the respective role. For the data evaluation, the highest two evaluation scores “very high” or “very important” and “somewhat high” or “somewhat important” were aggregated.

The data analysis shows that the skill set for Future Skills is the set rated with highest importance over all three role-profiles. Figure 5 gives an overview of the distribution of the importance of the different skills according to roles.

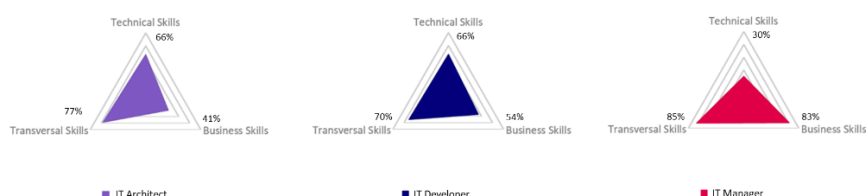


Figure 5 - Skill profiles per role for IT Professionals

Secondly, the analysis shows that the three skill sets used have a distinct importance and can be distinguished from each other. Thirdly, the analysis shows that professional roles do not rely on one competence profile only, but that domain specific skills and Future Skills complement each other in creating wholistic professional skill

portfolios.

4.3 Future Skills in Comparison

In an additional step of analysis, the value and inner structure of the skill set of Future Skills has been questioned. The aim was to analyse which importance the participants attributed to each skill within the three-given role-profiles and to extract the inner Future Skill characteristic for each role-profile. An overview is given in fig. 6. While self-efficacy and self-determination are rated similarly important for all roles, there is a difference in skills such as creativity, system thinking, sensemaking, design thinking, future mindset, and ethical thinking. Here it can be seen that operational roles such as the Blockchain Developer are assigned a lower importance for some skills than the strategic roles of the Blockchain Architect or the Blockchain Manager. The Blockchain Manager, in his connecting role between the teams, has a strong focus on organization-related skills (cooperation, communication, sense making, etc.), while the Blockchain Architect has a stronger focus on object-related skills (system thinking, design thinking, innovation, etc.).

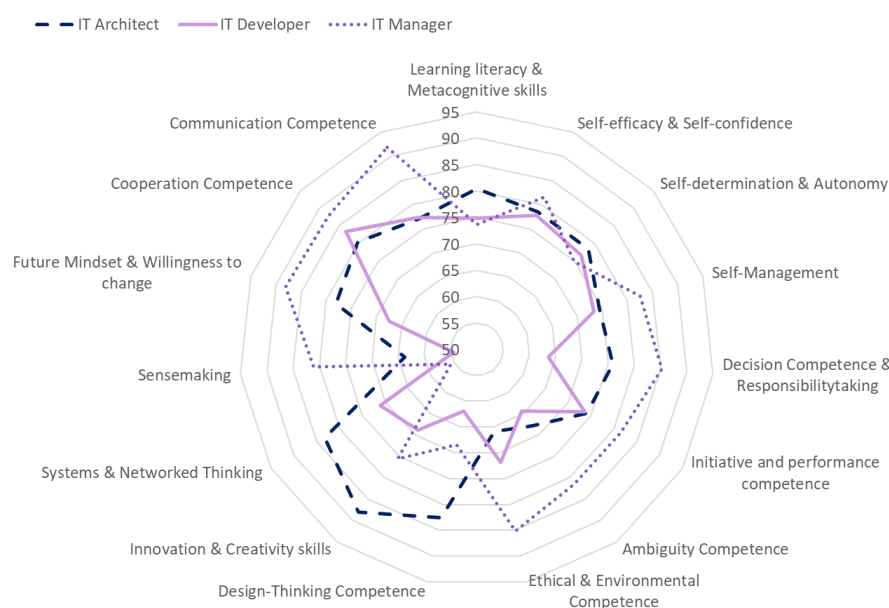


Figure 6 - Importance of Transversal Skills for different roles of IT professionals

A clear skill shift from so-called hard skills to transversal Future Skills can be observed in this area. IT professionals predominantly require transversal skills, which is also related to the many changes and innovations in the IT working environment. It requires professionals who can continuously adapt to their fast-moving environment. Transversal Future Skills are indispensable in this context.

As far as formal education is concerned, the interviewed experts (n=36) are divided. In many job-ads an academic education in the field of computer science or informatics is required, but some experts do not find traditional education particularly important and refer to short courses offered by numerous e-learning platforms such as Udemy and Coursera. On the other hand, these courses are also criticized for being too generic and superficial. In many cases they offer only a surface introduction to the topic. There is also a lack of face-to-face training sessions with supervision, which can be useful for practical training. To develop especially the missing Future Skills, it was clearly emphasized in the survey and in the interviews that training, and education programs should be as interactive as possible. The focus should be on practical application, dealing with real world problems, and working on concrete projects. But also, entrepreneurial skills and working in interdisciplinary teams were highlighted as important for the learning process. Especially in solution and use case design, extensive industry knowledge is a basic requirement. This rising demand of real-world use cases and practical learning shows the need for work-based oriented learning modules. Specialized knowledge of the basics of IT technologies should be taught as well as project-related skills. The involvement of experts and needs from the public sector and the economy offers further added value. However, self-learning in forums and via videos should also be encouraged, as future professionals need to continuously develop themselves on the job and should

internalize this ability to self-learn in their formal education.

5. Summary and Conclusion

The study shows that higher education will have to move quite a bit from its current position. The new paradigm of higher education will have to be geared towards supporting the development of new and emerging skill needs and focus on learner agency. Learner agency refers to the feeling of ownership and control that learners have over their own learning (Schoon, 2018). When students believe their actions can make a difference, they become more confident, engaged, and effective learners. Every student can develop their agency – but they must be supported by their teachers and learning community to do so (Schoon, 2018).

The following conclusions can be drawn from the empirical research findings:

1. Skill profiles can be clearly defined: As shown in section 4.2 & 4.3, the different job profiles have different skill needs according to industry experts. Even in the case of Future Skills, a distinction can be made depending on the role which skills are rated as important.
2. Sectorial needs can be clearly described: By means of a targeted approach, it is possible to identify a clear sector need. The blockchain sector that is the focus here is still growing and yet job profiles can be clearly defined and distinguished from each other, and the respective need determined.
3. Future skills are on the rise: Future skills are not only described as increasingly important but exceed the importance of subject-specific skills for different role profiles (see section 4.1).
4. Method for skill analysis expert supported foresight procedures like Delphi studies and qualitative methods to avoid blind spot problems: In addition to the quantitative European-wide surveys and the analyses of job ads, forums and online courses, the expert interviews and focus groups provided important information on how the development of Future Skills can be promoted (see section 4.3).
5. Future Skills are in general important, but some can be identified as more important for certain job profiles than others: Job profiles that are more generalist or have more interfaces in collaboration with other people or departments show a higher rated need for Future Skills than job profiles that have more isolated areas of responsibility (see section 4.2).

The multi-method and multi-stakeholder approach in skill research in very dynamic fields of work, such as blockchain, provides a good information base for closing the skills gap. Especially between the advertisement in job ads, the discussion in online forums and the perspective assessment of blockchain experts, a lack of awareness for Future Skills in the high-tech community can be identified. Future Skills need to be codified in a way that is known to the general public in order to be properly used by recruiters in job ads and to find resonance in existing networks. The online communities are the first port of call for many blockchain enthusiasts, and this is where the topic of Future Skills should be addressed. Through better anchoring in formal education especially in ICT programs, more attention can be created for Future Skills. Furthermore, human resource managers should be educated about the importance of Future Skills. Higher education institutions and industry players should join forces and facilitate practice-oriented training in this area. In addition, there should be a regular exchange to prepare students with real world use cases for the new dynamic challenges of the working world.

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