STIFTERVERBAND
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Future skills – Discussion paper 1

FUTURE SKILLS: WHICH SKILLS ARE LACKING IN GERMANY

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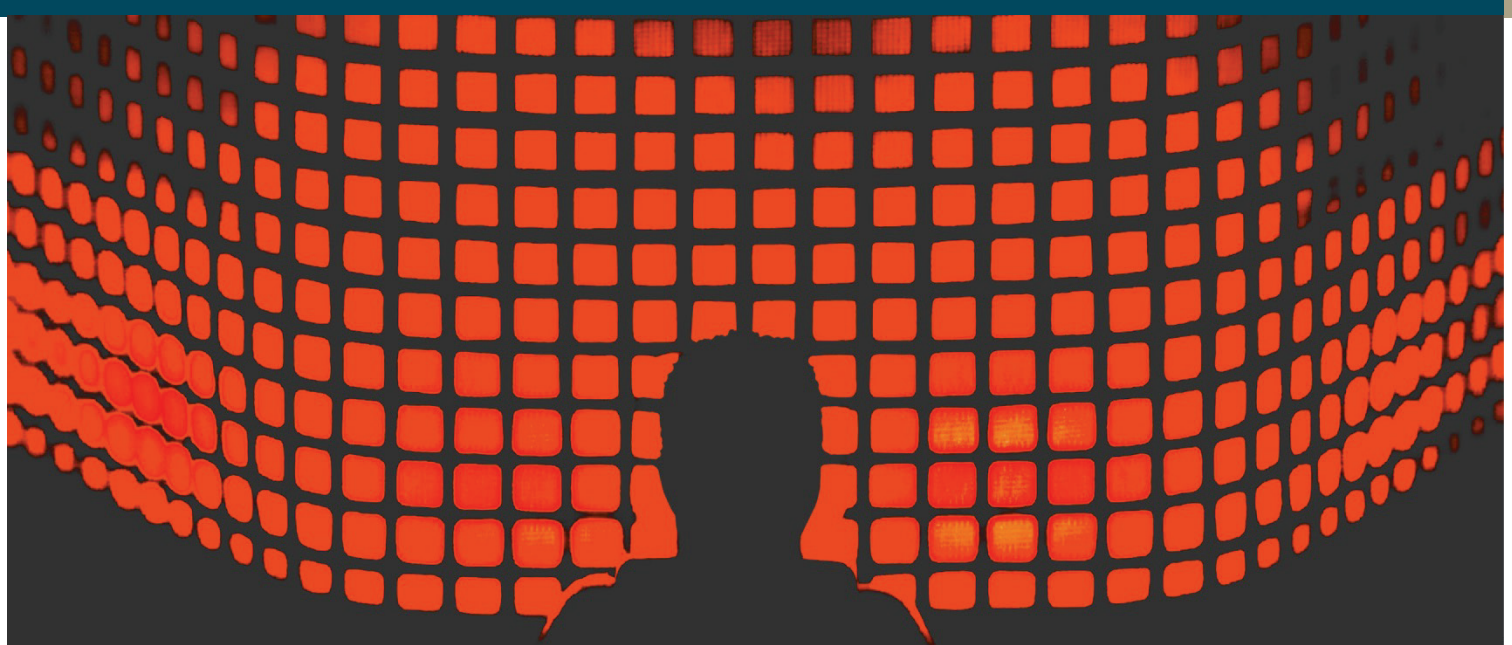


FUTURE SKILLS®

In cooperation with:

McKinsey&Company

FUTURE SKILLS: WHICH SKILLS ARE LACKING IN GERMANY?

- **Working together with businesses, the Stifterverband and McKinsey have compiled a Future Skills Framework that outlines the skills currently needed in the economy and society.**
- **The framework defines future skills as skills that will become far more important in a professional context or for continued participation in society in the next five years.**
- **These include shaping transformative technologies (artificial intelligence, smart hardware, robotics) as well as key digital and non-digital qualifications (digital interaction, adaptability, entrepreneurial thinking).**
- **The demand for technology specialists is high: In the next five years, Germany will need around 700,000 more people with technological skills than are available today.**
- **In addition, over 2.4 million workers must be retrained in key skills such as agile working, digital learning, and collaborative methods.**

- By 2023, some 700,000 people will need to acquire strong technological skills to meet the demand for tech specialists in the economy.

1. INTRODUCTION

The workplace of the future will be increasingly shaped by digital information and processes. Traditional professions will change and new job profiles will emerge. The ability to use digital technologies and Internet-based applications will become more important in virtually all industries and occupations. And new forms of interaction and knowledge production will also influence day-to-day life beyond the world of work, touching practically every area of life. Against the backdrop of an ever-changing society, familiarity with digital technologies and collaborative methods will become a central prerequisite — not just for economic success, but also for participation in society.

But which skills will be needed in the workplaces and society of the future? How great is the demand of German business for these future skills? This discussion paper offers an initial approach to answering these questions.

It takes the assumption that, although broad categorizations of future skills have already been defined (e.g., by the OECD, World Economic Forum, McKinsey Global Institute, Ashoka Foundation), the current demand for these skills in German business has not yet been sufficiently addressed. In the first part of this paper, the Stifterverband and McKinsey have worked with businesses to analyze today's skills challenges and to develop a framework of relevant future skills. The study is based on a mix of quantitative and qualitative surveys (for more information on the methodology, see the boxes on pages 3 and 8). The Future Skills Framework is neither intended to be a rigid, general categorization nor to replace the above-mentioned frameworks. Instead, it seeks to map the latest trends and demands in the German economy, predict skills gaps, and in so doing deliver short to medium-term triggers for education policy as well as universities and further training institutions. The framework forms the conceptual basis of the future skills initiative of the Stifterverband, and will be regularly updated and adapted to changing circumstances.

» The framework aims to map the short to medium-term demands of the German economy and to highlight trends.

CONTEXT AND METHOD OF THIS STUDY

This discussion paper was compiled as a collaboration between the Stifterverband für die Deutsche Wissenschaft e.V. and McKinsey & Company, Inc. It is the first of a total of four papers that will set out the analytical framework for the future skills initiative of the Stifterverband. The subsequent papers will deal with the future of HR work in businesses (Paper 2), the future skills challenges for universities and further training institutions (Paper 3), and the resulting recommendations for politicians (Paper 4).

In terms of methodology, the results below are based on a combination of quantitative and qualitative approaches: First, a workshop was held with 40 participants representing start-ups, established companies, education institutions, politics, the civil service, and various associations. This was followed by a standardized online survey of a total of 607 German companies in industry, insurance and banking. At the same time, 20 guided expert interviews were conducted with HR officers from a range of companies. At all times, it was ensured that companies of all sizes, from start-ups and SMEs to large corporations, were represented in the sample. The discussion papers also drew on the earlier findings of the future skills initiative of the Stifterverband as well as McKinsey's work on the topic.

Building on this framework, the second part of this paper will deliver an initial approximation of the future demand for individual future skills in businesses.

This in turn will be differentiated according to demand for specialists with a specific skill in new technology fields and demand for key cross-disciplinary qualifications. The calculations and analyses show that there is high demand for training in both areas, which can be covered by very different measures.

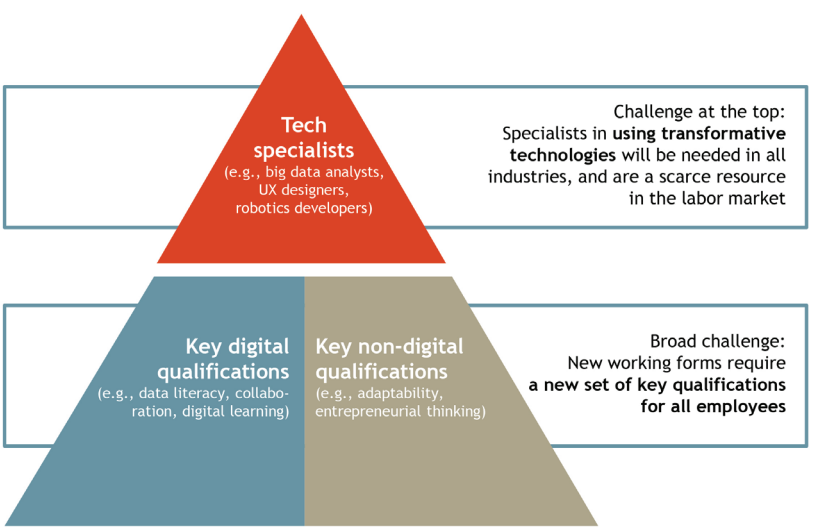
2. THE FUTURE SKILLS FRAMEWORK: 18 SKILLS IN 3 CATEGORIES

In this study, future skills are defined as skills that will become more important for professional work and/or participation in society in the next five years — across all industries and branches. In concrete terms, this means that future skills refer to a key subset of all skills needed in the future, on the one hand covering the next five years, and on the other in terms of increasing cross-disciplinary importance. Under this definition of future skills, all skills are excluded that are either industry or subject-specific, or whose importance will decline relative to other skills. They continue to be vital in many sub-sections of the economy, and thus remain a central focus of training and further training. The horizon of five years was chosen because it is long enough to realistically realize the effects of developments that can already be seen today. At the same time, it is also short enough to draw concrete conclusions about future skills despite the rapid technological development.

Under this horizon, digitization and new working forms will pose two challenges for businesses, both at the top and broadly (see graphic). First, the job portfolio will continue to shift toward IT roles, the recruitment for which will pose an increasing problem in the areas of transformative technologies in particular, for example blockchain technology and artificial intelligence. Secondly, the forms of work and activities will change for the vast majority of all employees, many of whom will therefore need a new set of digital and non-digital key qualifications.

» New forms of work and activities will demand a new set of digital and non-digital key qualifications.

GRAPHIC 1: THE DUAL CHALLENGE



Source: Stifterverband, McKinsey

Based on the statements of HR officers and drawing on current concepts, the Stifterverband and McKinsey have developed a Future Skills Framework that differentiates between two categories:

Technological skills cover those skills that are needed to shape transformative technologies. These include established transformative technologies such as the Internet (web development, UX design) as well as emerging fields (blockchain technology and smart hardware). One particularly important area is the ability to analyze complex data, and the related development of artificial intelligence. Those who master these technological skills possess the latest IT skills and are able to apply it. This category will create new job profiles across all sectors, for example data scientists. Even today, many job profiles are dominated by technological skills, particularly in start-ups.

Basic digital skills as a second category refers to skills that allow people to play an active role in a digitized world. These skills will be needed in future both in a person's professional life and to participate in society (Digital Citizenship), and are increasingly demanded by employers. They include digital knowledge generation (digital learning) and confident handling of online data (digital literacy), as well as the ability to work collaboratively. Those who have mastered these skills can work in collaborative and agile teams, interact effectively, and make critical decisions in an increasingly digital world.

While only individual people require specific technological skills, the basic digital skills should be mastered by as many people as possible.

Classic skills represent the third category. These include skills and abilities—for example adaptability, creativity, and perseverance—that will gain in importance in working life in the coming years. Those who possess these classic skills will find new situations easier to handle and be able to analyze and solve problems in an increasingly volatile and complex working world.

In order for companies to survive in future, it is vital to deliver a mix of technological skills, basic digital skills and classic skills. It is not enough simply to employ employees who "only" have individual, specific skills. The challenge is to select or train people in such a way that they offer the broadest possible range of all future skills relevant to their working context.

TABLE 1: THE FUTURE SKILLS

CATEGORY	SKILL	DESCRIPTION
Technological skills	Complex data analysis	Analyze large data volumes efficiently using analytical methods to mine information; also covers developing artificial intelligence (AI)
	Development of smart hardware/robotics	Develop physical components for "intelligent" hardware-software systems (Internet of Things), e.g., robots
	Web development	Master programming languages for back-end and front-end development of web applications (mobile in particular)
	User-centric designing (UX)	Design products that aim to offer optimized functionality, intuitive handling, and an attractive user experience
	Conception & administration of networked IT systems	Apply a complex IT infrastructure with cloud functionality and interfaces to other IT systems, including continuous administration and further development
	Blockchain technology development	Build decentralized databases ("distributed ledgers") using blockchain technology
	Tech translation	Moderate between technology experts and non-experts
Basic digital skills	Digital literacy	Command the most basic digital skills, e.g. careful handling of digital personal data, use of the latest software, interaction with AI
	Digital interaction	Understand others by interacting via online channels and respond appropriately ("digital etiquette")
	Collaboration	Collaborate on projects effectively and efficiently across distance and disciplines to achieve better results as a team than as individuals
	Agile working	Develop precisely what delivers added value to the customer working in a team responsible for the end product using iterative methods (rapid prototyping)
	Digital learning	Build solid knowledge on selected topics from a range of digital information sources
	Digital ethics	Critically examine digital information and the impact of digital actions, and take the appropriate ethical decisions
Classic skills	Problem-solving	Using a structured approach and reasoning, resolve concrete problems for which there is no ready-made answer
	Creativity	Develop original improvement ideas (e.g., for existing business processes) or ideas for innovations (e.g., for new products)
	Entrepreneurial thinking & self-initiative	Independently work using initiative as part of a project or organization
	Adaptability	Show an open mind to new technological developments, use them to the benefit of the organization, and apply them to different situations
	Perseverance	Complete tasks such as challenging projects with focus and responsibility, while overcoming resistance

3. FUTURE SKILLS REQUIREMENTS UNTIL 2023

» "Pure knowledge will become less and less important. The importance of skills that enable the application of knowledge, however, is growing rapidly."

CEO, start-up

As outlined above, businesses face a dual challenge against the backdrop of advancing digitization and the development of new forms of work: On the one hand, they must resolve the problem of the already scarce number of experts with technological skills — that classic industrial companies and service providers continue to find so difficult to recruit. On the other hand, it is essential that the majority of the remaining workforce be given the new digital and non-digital qualifications they need in Workforce 4.0. Developing a better understanding of which future skills will be needed in future and to what extent is not just important as a planning and decision basis for companies, but also for politicians and education institutions.

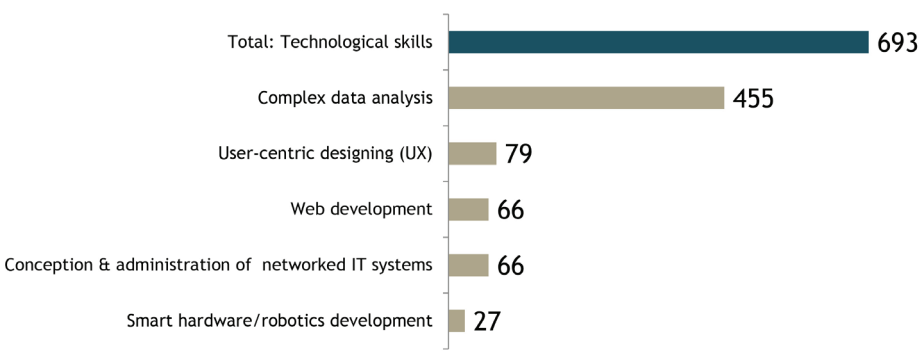
The following section will first estimate the future demand for technological specialists before more closely examining further training needs at the level of digital and non-digital key qualifications. In both instances, the quantification is based on the online survey of 607 companies in industry, insurance and banking.

3.1 BY 2023, AROUND 700,000 ADDITIONAL TECH SPECIALISTS WILL BE NEEDED

In the area of technological skills, the survey reveals around 700,000 people with the appropriate capabilities will be needed by 2023 in business alone (see Graphic 2). This demand is based on the difference between the number of employees who currently possess individual technological skills and the number that the survey suggests should possess these skills in five years (see Box 3 for the methodology).

GRAPHIC 2: AROUND 700,000 PEOPLE WITH TECHNOLOGICAL SKILLS SOUGHT

Number of additional people with technological skills that will be needed in industry, insurance and banking by 2023, in thousands.



Source: Stifterverband, McKinsey

» Complex data analysis is by far the tech skill with the greatest demand gap.

When this figure of 700,000 people is broken down according to the underlying future skills, the demand for people with the ability to perform complex data analyses is shown to be 455,000 people, which is by far the biggest share, and accounts for over half the total demand for technological skills. This high figure indicates that businesses will gather and process large data volumes even more intensively than before and that artificial intelligence based on complex data analysis will play an ever greater role.

The area of complex data analysis also has the greatest impact on job profiles outside IT departments, influencing almost all areas of companies — from Research and Development, Sales and Marketing, to HR and Organization. And yet it is not just in different functional areas that more experts with complex data analysis skills will be needed in future: Owing to the increased data collection possibilities that digitization brings, new business models will emerge beyond the traditionally data-intensive industries like insurance that will be based on the analysis and interpretation of large data volumes. Expertise in complex data analysis will therefore become a central interface competence in companies across industries and functional areas.

SURVEY METHODOLOGY AND EXTRAPOLATION OF THE FUTURE SKILLS DEMAND

In June 2018, 607 companies comprising large corporations, start-ups, and small to medium-sized enterprises were surveyed online and asked to what extent employees possess or will need to possess any of the above-mentioned future skills. The extrapolation is based on the assessments of these companies.

The additional demand for technological skills is calculated as the difference between workers in industry, insurance and banking with a high level of education (in accordance with the International Standard Classification of Education (ISCED) of UNESCO, Levels 5 and 6) who currently possess the individual skills, and the number that businesses believe should possess these skills in five years. For example, in the area of complex data analysis, the survey shows that 455,000 more specialists will be needed in five years than currently work in this area. The rounded figure of 455,000 is calculated as a percentage difference (percentage of all employees that will require these skills in five years minus the percentage that already possess these skills), multiplied by the total number of workers in industry, insurance and banking with a high level of education.

At 27,000, demand in the area of smart hardware/robotics development is estimated to be significantly less. One possible explanation for this may be the fact that the required skills are relatively similar to the key skills previously needed in engineering, which means there is already a large pool of suitably trained workers. Due to the ongoing and central importance that software plays in business models, these results could also be interpreted as evidence of businesses possibly focusing on the area of software or simply underestimating the importance of hardware and robotics.

In terms of blockchain technology, it was not possible in many cases to put a figure on demand, and this has therefore not been included in the calculation. However, it is clear that demand in this technology is developing very dynamically, as evidenced for example by analyses of the online job site Indeed, measured in visitor numbers to one of the biggest job portals in Germany and worldwide. From January to December 2017 alone, the number of advertised positions that contained a reference to blockchain rose by 625%, while search queries that included the term blockchain rose by 661% over the same period. Although this huge rise is still based on low absolute figures, the example shows how quickly new technologies can impact demand for certain qualifications in the labor market.

Therefore, assuming a demand of 700,000 people, in the next five years around 140,000 people each year on average would have to acquire advanced technological skills — solely for the area of the economy analyzed in this paper, which is equivalent to around 60% of workers in Germany. If these results are also applied to the public sector, the demand for people with technological skills rises to around 1.1 million — an immense training challenge.

» By 2023, around 140,000 people on average each year must acquire advanced tech skills to meet the demand of business. This does not even include the demand of the public sector.

According to businesses, this demand can be covered in different ways: First, through targeted recruitment of graduates from the relevant disciplines. Second, the existing workforce can be helped to build these skills through appropriate further training, for example providing machine engineers with further training in smart hardware and robotics. Third, technological skills can also be passed on more as part of dual training, for example in web development or UX design. Fourth, German companies are increasingly active in the global labor market, and can recruit tech specialists worldwide. Some businesses also indicate that they may base their technology activities in countries in which technology specialists are available in sufficient numbers. Discussion papers 2 and 3 of this series will analyze the challenges facing HR departments and education institutions.

3.2 KEY DIGITAL AND NON-DIGITAL QUALIFICATIONS: ONE IN FOUR WORKERS REQUIRES FURTHER TRAINING

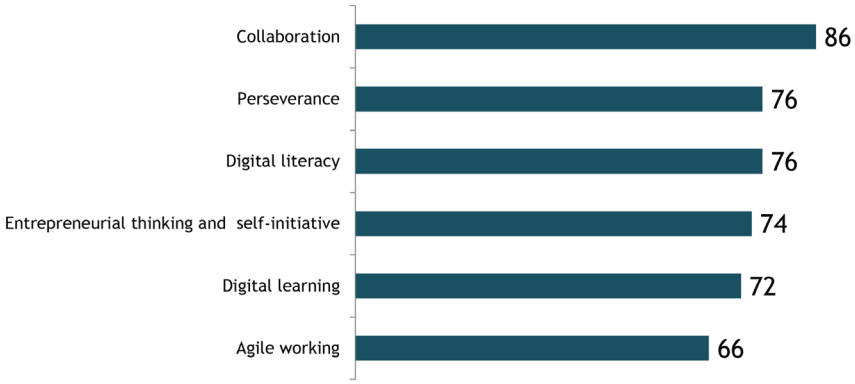
Various skills and abilities will become key qualifications for all types of role in Workplace 4.0 from Sales Manager to Administrative Assistant — for example, routine handling of electronic data, basic understanding of data privacy, collaboration with others, continuous learning, and largely independent working. This finding was confirmed by the HR officers surveyed, who unanimously agree that the greatest demand for further training in the coming years will be in the area of key digital and non-digital skills.

» "When it comes to soft skills like creativity and collaborative working, we find that employees are not aware that they require further training. Soft skills, however, are particularly critical because they cannot be replaced by artificial intelligence."

CEO, start-up

GRAPHIC 3: COLLABORATIVE WORKING REQUIRED

Percentage of employees who will require the future skill in five years, in % (selection)



Source: Stifterverband, McKinsey

The future skill needed by most employees is the ability to collaborate, which is increasingly being supported and shaped by digital technologies. Nine in every ten employees will need to master this skill. Around three-quarters of employees require basic digital knowledge and should show perseverance and self-initiative. Although demand for people who have mastered agile working is the lowest, two-thirds of workers should still possess this skill.

Comparing the number of people who already have the individual skills and the number that businesses believe will need these skills in five years reveals a large training gap. The greatest demand is in *digital learning*: To ensure that around three-quarters of employees have digital learning skills in five years, some 3.8 million must receive further training by that time. *Digital literacy* skills must be reinforced for 2.8 million people over this period, and further training requirements are equally high in the areas of *collaboration* and *digital interaction*. The lowest, still significant, demand is in the area of *entrepreneurial thinking*, where around 2.4 million people require further training.

Although these figures may seem high due to the radical nature and speed with which digitization and automation are changing the workplace, they are not unrealistic. The importance of further training has continued to increase in recent years, and the pool of people participating in further training has constantly expanded. In 2016, for example, one in two adults aged between 18 and 64 took part in some sort of further training. So although it appears ambitious to meet the demand, it is not impossible.

The skills gap in cross-disciplinary qualifications can only be closed if people continue to receive targeted further training at work. One-off “training courses” are not enough; instead systematic and continuous further training and upskilling in the workplace is necessary as part of lifelong learning.

4. CONCLUSION AND RECOMMENDATIONS

Demand for around 700,000 people with technological skills and further training requirements for more than 2 million people in cross-disciplinary qualifications — these figures demonstrate the size of the challenge that Germany faces in education in the years ahead. The calculation of the demand presented in this paper should be understood as an approximate attempt to quantify this demand.

Nevertheless, however the demand materializes in real terms in future — the time to act is now. Above all, it is important to expand the current tools of the *Bundesagentur für Arbeit*, to continuously analyze the ever-accelerating demands of the labor market, and to communicate these developments publicly. By employing such a strategy of constant monitoring, businesses and private further training providers can also develop new offers and adapt their current contents and formats. It is vital that education institutions, and the university and career training system align themselves more with the required future skills and develop corresponding education and training courses.

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