

Which Future Skills Are Critical to Success Today and in the Future? Quantitative and Qualitative Study Based on a Survey of Representatives of German Industrial Firms and Associations in Manufacturing

Stefan Stark¹

¹Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania

Correspondence: Stefan Stark, Economics and Business Administration, "Alexandru Ioan Cuza" University of Iasi, Romania.

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Abstract

Purpose: The study aims to provide company managers with a basis for considering the need for company-specific future skills and deriving suitable and sustainable qualification measures from this in good time.

Design/methodology/approach: Based on an online survey of works council committees and HR departments, the question is to be answered as to which competencies will be imperatively needed in the future in order to be able to meet future tasks and requirements in the professional world.

Findings and Originality: The study aims to identify current needs and anticipate skills gaps. This should enable companies today to identify and build up the necessary skills of tomorrow. The study can serve as an impetus for a strategic orientation in the human resources policy of companies. In this way, it makes a contribution to ensuring competitiveness in the long term and placing the human factor at the center.

Keywords: future skills, current needs, skill gaps, strategic orientation

1. Problem Statement

The world of work is facing major changes. The rapid pace of technological development demands answers to the question of how the future world of work is to be shaped. Topics such as digitization and automation will have a major impact on the world of work. In addition, the transformation of society toward climate neutrality is bringing about far-reaching changes. In managing these changes, however, it is important to remember that it is people who shape social and economic progress. As a result of the imperative transformation, the world of work will undergo fundamental and rapid change: some jobs will be lost, many others will be created. A significant proportion of current jobs will change in some way. For this change, companies need employees who are fit for the tasks of the future and who are confidently willing, able and allowed to develop the future. With this in mind, the skills needed to shape the future positively for all must be built now. The initiated study aims to answer the following questions: What skills will be needed in the future? How great is the industry's need for such future skills in the next 5 years?

2. Theoretical Framework

2.1 Conception

This study was designed and prepared in the period from April to October 2021. The aim of the study is to derive the required future skills and to show their quantitative demand for the next 5 years. Future Skills in this study are based on the understanding of the Stifterverband für die Deutsche Wissenschaft (Stifterverband für die Deutsche Wissenschaft, 2018). To answer the question of which Future Skills are needed today and in the future, the author used a data-based approach: with the help of modern machine learning methods, Future Skills clusters were identified in a data-based analysis of several thousand job advertisements. These were subsequently validated with focus group experts through interviews. The identified future skills clusters thus represent the assessment of the range of manufacturing companies in German industry. In the further course of the study, the

quantitative demand for future skills for the next 5 years was determined indicatively with the help of a survey of 245 participating companies from the metal industry.

2.2 Derivation of the Future Skills Clusters

The starting point is the range of job advertisements from companies from 2018 to 2020. The data covers the skills demanded by the companies. From this database, more than 6,000 skills were identified using information retrieval methods (machine learning processes) and then grouped into future skills clusters using a hierarchical clustering method. In this process, related skills were grouped that were particularly frequently searched for in combination. This established approach to deriving Future Skills (compare, among others, Stifterverband für die Deutsche Wissenschaft, 2018; Organisation for Economic Cooperation and Development, 2019; World Economic Forum, 2020; McKinsey Global Institute, 2018; Institute for the Future, 2020; Fraunhofer-Zentrum für Internationales Management und Wissensökonomie, 2020; Bundesarbeitgeberverband Chemie e.V., 2021). The result is a taxonomy with a total of 28 future skills clusters and the most important associated future skills.

2.3 Significance for the Metal Industry

This study focuses in particular on the metal industry. The demand for a Future Skills cluster makes a statement about how often the corresponding Future Skills were demanded by companies in the last three years (2018 to 2020). Growth describes the trend of demand for corresponding Future Skills in 2019 compared to the previous year 2018. The year 2019 is most suitable for estimating growth as it represents the most current trends without short-term changes during the Corona crisis.

2.4 Demand for Future Skills in the next 5 years

The indicative demand for future skills in the metal industry in the next 5 years was determined with the help of an online survey. To this end, metal industry companies were surveyed in September 2021 on the current state of future skills and the target state in 5 years. A total of 245 companies took part. The estimates of the companies surveyed form the basis for a corresponding extrapolation. For the extrapolation of the demand, the ratio of the sample size to the actual size of the metal industry in Germany is taken into account. Various functions in the company are represented among the respondents: Company management (excluding shareholders) [21%], HR department [52%], works council [15%], development and design [6%] and other functions [6%].

3. Future-Skills-Cluster

3.1 Categories

According to common definitions, future skills provide information about which attitudes, values, skills, competencies and knowledge will be decisive in the coming years in order to be able to shape the future sustainably and successfully. In this study, Future Skills are defined according to the current status as skills and knowledge with strongly increasing importance for the current working life and that of the next 5 years. They are therefore not conclusive, but should be understood as an important subset of all skills required in the future. The time horizon of 5 years was chosen because it is long enough to realistically include effects of developments that are already foreseeable today. At the same time, the time span is still short enough to be able to make reliable statements about future skills despite the rapid pace of development (based on the Stifterverband für die Deutsche Wissenschaft, 2018). The future skills taxonomy developed with the help of the data-based approach and validated in expert discussions results in 28 future skills clusters for the German metal industry.

3.2 Technological Capabilities

Germany wants to lead the way in economically successful, intelligent, resource-saving and climate-friendly technologies (Ministerium für Wirtschaft, Arbeit und Wohnungsbau Baden- Württemberg, 2020). This includes the desire to be a leader in the digital transformation as well as to take a top position in key technologies such as AI or sustainable and resource-saving technologies (Landesregierung Baden-Württemberg, 2021). The ten technological future skills clusters for Germany derived from the data-based analysis describe, on the one hand, the skills and knowledge needed to be able to shape the digital transformation. This is reflected, among other things, in the future skills clusters of software development, data management, IT infrastructure & cloud, and software-based control of business processes. In this context, IT protection also plays an important role. Especially for SMEs, cyber attacks can lead to situations that threaten the existence of the company. The importance of skills in this area can be seen in the Future Skills Cluster Cybersecurity. On the other hand, data-based analysis reveals new skills in the area of knowledge-intensive key technologies, which requires a top position in the global innovation competition. This is covered, for example, by the Future Skills clusters Data Science & AI, Intelligent Hardware & Robotics, and Sensor Technology & IoT. The sustainability & resource-saving technology cluster (e.g. Green IT) will also be of central importance in the future in order to be

able to achieve the ambitious environmental and climate policy goals.

3.3 Industrial Capabilities

As an innovative and leading industrial country, Germany is striving for "Best Available Technology" (BAT), (Landesregierung Baden-Württemberg, 2021). In the midst of the profound upheaval in industry driven by digitalization and decarbonization, new expertise and skills are needed in concrete industry-specific disciplines. Industry 4.0, for example, increasingly requires automation and networking. For the automotive industry, for example, to be able to produce "computers on four wheels", (Deutsche Presse-Agentur, 2021), new expertise is needed, as demonstrated, for example, by the Future Skills cluster Assisted & Autonomous Driving. In the metal industry, economic success and climate neutrality should go hand in hand. In this context, the Future Skills cluster Alternative Drive Technologies is gaining in importance. In order to shape structural change in the metal industry, classic disciplines such as engineering are reinventing themselves. This can be seen, for example, in the Industrial Engineering (e.g., automation) and Electrical Engineering (e.g., microtechnology) Future Skills clusters.

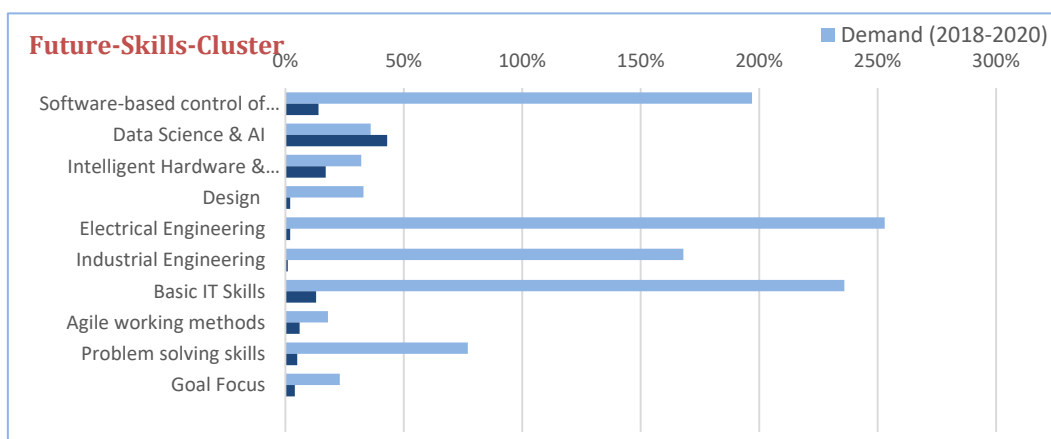
3.4 Digital Key Qualifications

The development and use of new technologies is the basis for successfully shaping structural change and digital transformation. It is crucial that as many people as possible are willing and able to deal with digital technologies and new forms of work in a sour and competent manner. Digital key qualifications comprise skills and knowledge that enable people to find their way in a digitized environment and actively participate in shaping it. As a result of the COVID-19 crisis, the digital transformation of the world of work has accelerated, with digital collaboration (e.g., online meetings, online workshops) in particular gaining in importance. New skills are needed not only for development, which are mapped by the Future-Skills clusters Digital & Data Literacy (e.g., Digital Information Search / Assessment / Selection) and Digital Collaboration & Interaction (e.g., Digital Team Skills), among others. The rapid pace of change also requires agile ways of working. In the future, interaction and communication between humans and automated systems will increase significantly. This will require a language for "digital understanding", which is reflected in the Future Skills cluster Programming Skills. This means that more and more people will have to learn to "speak" in the digital world as well, not only to communicate here, but also to help shape it.

3.5 Interdisciplinary Skills

A rapidly changing and complex working world with new forms of work requires an expanded set of generic skills. Generic skills are all qualifications and competencies that go beyond the typical professional skills and relate, for example, to social interaction with the environment, but also to personal and methodological competencies. Central in times of volatility and non-commitment are goal orientation and problem-solving skills, which emerge from the data as future skills clusters. In addition, leadership skills are becoming more important than ever in order to bring employees along with them in the change processes. In the constant change of market requirements, entrepreneurs have the greatest opportunities to achieve success. This can be seen in the results of the data analysis, for example, in the Future Skills clusters of initiative and creativity. Finally, increasing communication in a digitally changing working world requires new skills in dealing with one another.

Table 1. Future skills cluster with special significance for the metal industry



Source: Author's representation.

4. Data Analysis Results

For the metal industry, the data analysis of job advertisements provides 12 future skills clusters of particular importance (see figure below, in descending order by size of demand). These are Future Skills clusters that were in above-average demand in the metals industry in 2018-2020 and whose demand grew at an above-average rate year-on-year in 2018/2019.

4.1 Demand for Technological Skills

The German metal industry is playing a pioneering role in the transformation to a showcase country for digital change. Accordingly, the technological future skills clusters of software-based control of business processes and data science & AI are of outstanding importance for this industry. Demand for the software-based control of business processes future skills cluster is by far the highest - companies in the German metals industry are already looking for corresponding skills on a large scale. In the course of digitization and Industry 4.0, the enormous potential of digital key technologies is also to be leveraged here. Accordingly, demand for the future skills cluster Data Science & AI in the German metal industry is showing the greatest growth of all future skills clusters.

4.2 Demand for Industrial Capabilities

In view of global developments such as digitalization and decarbonization, the German metal industry is in the midst of structural change. This structural change is accompanied by a very strong demand for the future skills clusters Electrical Engineering and Industrial Engineering. Many companies are looking for employees who can transform processes and operations with their engineering and IT backgrounds, bringing skills in areas such as automation or human-machine interaction. Demand for the corresponding Future Skills cluster shows the largest year-over-year growth within the Industrial Skills category in 2018/2019.

4.3 Demand for Digital Key Qualifications

The digital transformation in the German metal industry requires a broad digital understanding of all employees. Accordingly, the Future Skills cluster Basic IT Skills plays a prominent role and the demand for corresponding skills is particularly high. The speed of digital and technological change requires ways of working that are attuned to this. The COVID 19 crisis has demonstrated this once again. The demand in the German metal industry for the Future Skills cluster Agile ways of working is already significantly higher than the demand in Germany as a whole.

4.4 Demand for Generic Skills

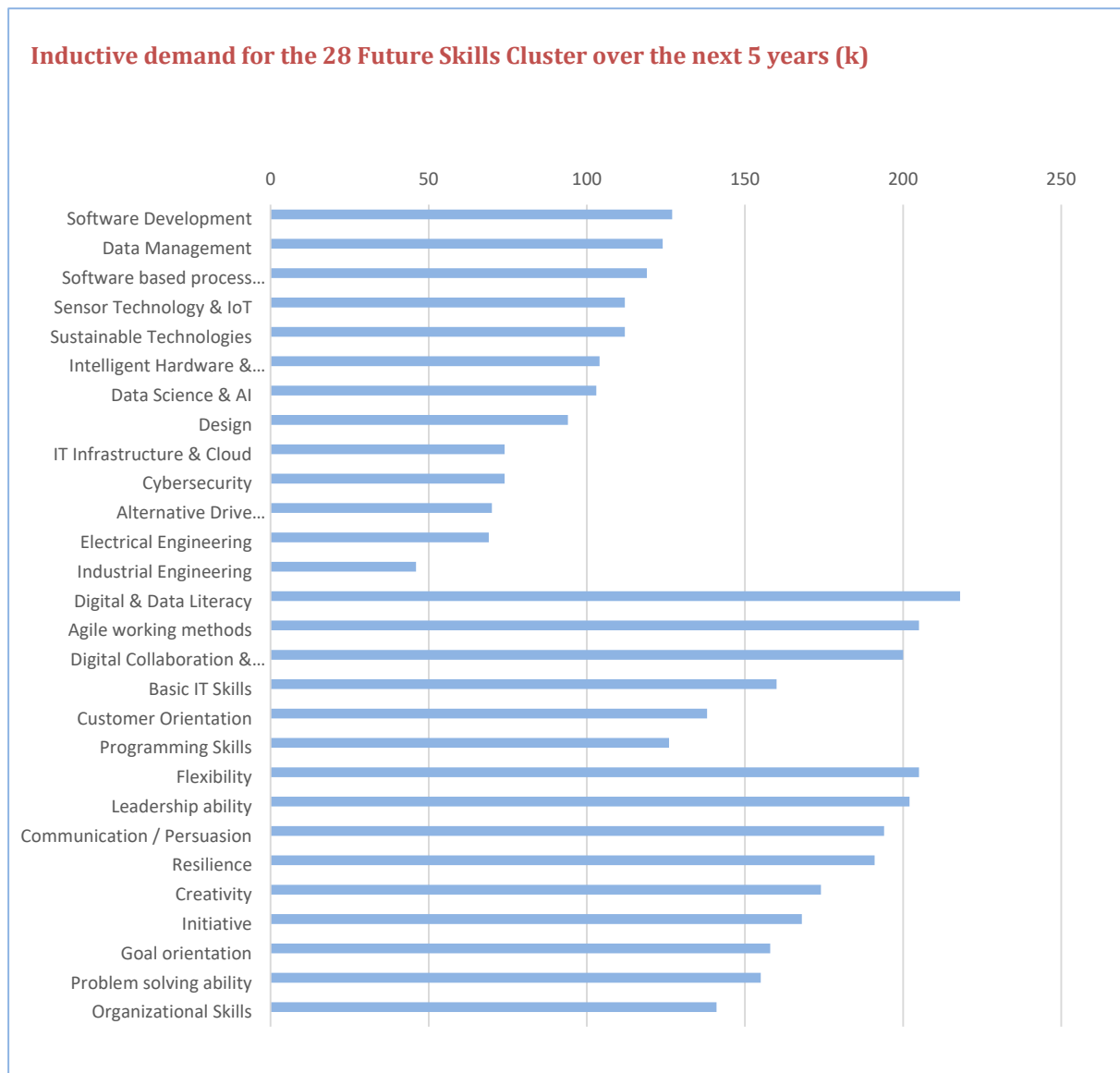
More than ever before, the rapid pace of change requires interdisciplinary skills to shape change. In this context, the Future Skills clusters of problem-solving skills and goal orientation are of particular importance in the German metal industry.

5. Discussion and Conclusions

In order to obtain an indication of which skills will be in demand in the next few years and to what extent, the additional demand for future skills in the German metal industry up to 2026 was determined by means of a survey of 245 companies. The companies' estimates of demand are to be understood as an indication. This results in the indicative quantified demand of the metal industry in Germany for the 28 Future Skills clusters (cf. following figure, in descending order according to the size of the demand). Note: When reading this information, it is important to keep in mind that one person can possess several skills. The figures assume a number of around 710,000 employees, (e.g. Statistisches Landesamt Baden-Württemberg, 2021; Baden-Württemberg International, 2020).

Based on the indicative projections of the 245 companies, it can be concluded that the German metal industry will need more than one million more skills from the technological future skills clusters in the next five years. The greatest demand for skills is in the area of digital transformation, including the future skills clusters of software development, data management and software-based control of business processes. This initially indicates a strong focus on automation. According to the companies surveyed, there is a need for central digital key skills in the next 5 years, affecting almost one-third of all employees in the metal sector, above all Digital & Data Literacy, Agile Working Methods and Digital Collaboration & Interaction. The high demand for interdisciplinary skills is also noteworthy. In times of change, companies believe that flexibility and leadership skills in particular are taking on an increasingly strong role. Even if the estimate of the need for future skills from the perspective of the companies is merely an indication, one thing is certain: one of the biggest training offensives in history awaits the country and the world.

Table 2. Indicative demand for the 28 Future Skills Clusters over the next 5 years



Source: Author’s representation.

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