

Association for Information Systems

## AIS Electronic Library (AISeL)

---

Wirtschaftsinformatik 2021 Proceedings

Track 3: Student Track

---

# Differences Between the Required Skills of Workers in Agile Positions in Germany and the US According to Current Job Offers

Céline Madeleine Aldenhoven  
*Technische Universität München*

Dominik Korbinian Brosch  
*Technische Universität München*

Barbara Prommegger  
*Technische Universität München*

Helmut Krcmar  
*Technische Universität München*

Follow this and additional works at: <https://aisel.aisnet.org/wi2021>

---

Aldenhoven, Céline Madeleine; Brosch, Dominik Korbinian; Prommegger, Barbara; and Krcmar, Helmut, "Differences Between the Required Skills of Workers in Agile Positions in Germany and the US According to Current Job Offers" (2021). *Wirtschaftsinformatik 2021 Proceedings*. 9.  
<https://aisel.aisnet.org/wi2021/XStudent/Track03/9>

This material is brought to you by the Wirtschaftsinformatik at AIS Electronic Library (AISeL). It has been accepted for inclusion in Wirtschaftsinformatik 2021 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact [elibrary@aisnet.org](mailto:elibrary@aisnet.org).

# Differences in Skill Requirements for Agile Workers in the German and the US IT Industries

Céline Madeleine Aldenhoven, Dominik Korbinian Brosch, Barbara Prommegger,  
and Helmut Krcmar

Technical University of Munich, Chair for Information Systems and Business Process  
Management, Munich, Germany

{celine.aldenhoven,dominik.brosch,barbara.prommegger,helmut.krcmar}@tum.de

**Abstract.** The IT industry is getting more and more agile. Therefore, it is important to know about the required skills for agile workers in this industry. In this study, we analyzed 1000 job advertisements from online job portals to determine the differences in skill requirements for agile workers in the IT industry in Germany versus the U.S. We found that searches for non-technical skills are greater in the U.S. than in Germany. Test and Requirements Management are the most important management concept searches in both countries. JavaScript is searched more often in the U.S. This study contributes to a better understanding of the required skills of agile workers in Germany and the U.S.

**Keywords:** Skills, Agile, IT workforce, programming languages, non-technical skills

## 1 Introduction

Over the last several years, digital globalization has grown exponentially, fueled by highly skilled IT professionals working behind the scenes. As a result of this ongoing transformation, skilled workers are in high demand, leading to more openings in the IT industry [29]. But how are software projects efficiently organized? According to a survey among IT professionals in the U.S. [12], most software projects are already done with an agile or leaning toward the agile approach. The survey revealed that in 2004, only 4% of the surveyed companies used agile methodologies. By 2014, all the firms had adopted them. One significant benefit of the agile approach mentioned by the respondents was, “agile enhances collaboration between teams that usually do not work together”. Therefore, collaboration skills are an essential component of the non-technical skills requested by recruiters. This is also reflected in the first principle of the Agile Manifesto [25]: “Individuals and interactions over processes and tools”.

This is why we proposed the question, what skills are recruiters actually looking for today as they recruit personnel for an agile environment. As technology changes and agile working methodologies evolve, the required skills for a successful career in the IT industry evolve with the market. The shift to agile methodologies specifically requires more team interaction [25]. Therefore, soft skills for agile workers become increasingly important [23]. Several studies have been conducted on the skills and

requirements needed to serve the rapidly expanding IT market, particularly from its new hires [4], [10], [21]. Those studies exposed two important gaps: 1) between the skills recruiters searched for versus the skills required by future employers [10] and 2) between the skills employers need and the skills learned in academia [4], [21]. Unfortunately, most of these studies were conducted in the U.S. with U.S. datasets. There is a lack of surveys in this area with European datasets. Due to the change to agile methodologies, we expect that the required skills of the IT workforce have also changed. Therefore, a review of sought-after technical and non-technical skills of agile workers is necessary.

The study aims to identify the required skills for workers in agile positions in the U.S. and in Germany (Ger) and uncover the differences in required skills in these two countries. Our paper also elaborates on the reasons behind these differences.

## **2 Theoretical Background**

To learn more about previous research conducted in related fields, we reviewed the literature on the topics of agile skills, IT industry skills, skills, agile, and skill recruitment. A surprising number of papers were primarily focused on the technical skills required in the IT industry, whereas others studied required non-technical skills [10], [15]. Most of the papers evaluating job advertisements also categorized the skills. During our research, we also found substantial evidence on the impact of non-technical skills on the performance of IT teams [3], [5], [7], [19], [23], underlining the importance of these skills. Furthermore, some papers studied the change in required skills over time and made predictions for future job requirements [9], [11].

### **2.1 Changing Requirements Have Led to Changing Job Advertisements**

Over the years, the information systems researchers reviewed technical and non-technical requirements in job advertisements. Technical skills were always important and evolved as the technology required but not so much quantitatively. Litecky et. al. [17] stated it best in an analysis of job advertisements from the 1990s and 2000s, *“Although application and web development skills are still in demand, the programming languages and tools used for development have changed.”* This notion is apparent in work by Todd et. al. [20]. Non-technical requirements were usually less prevalent in job advertisements, although Gallivan et. al. and Lee et. al. [10], [16] showed the increased need for them. Work by Gallivan et.al. [10] revealed the need for more non-technical skills even as the rate of communication and interpersonal skills was declining. The results indicated a recruitment gap between the required skills in job listings and the actual skills required by employers. The discrepancy was noted by Wade et. al. [24].

As of the mid-2000s, non-technical skills gained prominence in job advertisements. In 2007, Kennan et. al. [15] looked at the required skills in job listings for information systems graduates in Australia and learned that *“Personal Characteristics and Communications Skills [...] were mentioned in close to 75% of ads.”* and *“Computer*

*Languages occurred in more than 50% of the ads.*”. This finding was also reflected by Florea et. al. [8], who analyzed the skills required for software testers. The study showed that non-technical skills, including communication, are very important for testers. They saw an increase in the *“requirements regarding being a team-player, flat-learner, independent-working and having openness and adaptability skills.”*. Furthermore, they found minimal difference in a comparison of skills required for testing in an agile environments and positions where agile knowledge was not explicitly stated.

## **2.2 Skills of the Agile Workforce**

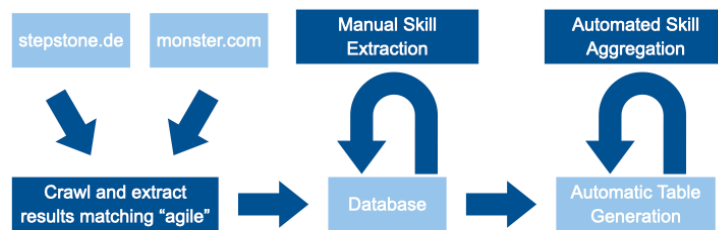
Working agile changed the requirements for workers on agile teams. Workers are required to communicate more and to know about the whole value chain of development [30]. Therefore, the skill profile of agile workers must be much more differentiated than the one of non-agile workers.

Further investigation of non-technical skills in IT and information systems jobs revealed papers highlighting the importance of non-technical skills for successful IT projects. Csapo et. al. [5] showed that *“employees spend more than 75% of their time communicating in interpersonal situations, as well as on a variety of other levels within the organization and externally.”*. This finding reinforces the importance of non-technical skills, especially communication skills. Venkatesh et. al. [23] provided another view on the agile work environment and showed that organizational skills are critical in reducing stress and enabling success in IT teams. Emotional intelligence supports the same goals [19]. The importance of non-technical skills is also apparent in employer surveys [13], [14]. Interestingly, this is more important for software and IT service providers than for non-IT companies, as they search more for non-technical skills [11].

## **3 Research Method**

Given the lack of literature analyzing the differing requirements in IT skills between the U.S. and Germany, especially in the agile context, we chose to take an explorative approach to find unexpected results. To that end, we performed a qualitative analysis of two different job sites and collected 1000 job advertisements using the keyword “agile”. We followed the guidelines of the skill paper by Gallivan et. al. [10] and others [4], [6], [18], for the data collection process via Monster.com. Our U.S. data were sourced from monster.com following previous research in the field [4], [6], [18]. Monster.com was used because of its popularity and continuity of information [10]. For German job postings, we used stepstone.de, a popular job advertisement platform in the country [32]. We designed our workflow to be as generic and reproducible as possible to facilitate further work in the field.

Our workflow was divided into three stages, as illustrated in Figure 1. First, we extracted the data from job sites and pushed them into a database. Next, we developed a tool for manually extracting skills from full-text job descriptions and categorized them using a general skill layout to simplify the evaluation process. Finally, we developed a tool to generate real-time tables from the categorized skills layout and other data, such as the title/role of the job or the location of the job.



**Figure 1.** Data Collection Process

### 3.1 Data Crawling and Collection

Initially, we explored the structure of both sites to develop a structure for our database. We collected a unique identifier for each job, the job title, company name, job description, job location country, and data source, in our case stepstone.de or monster.com. Where available, we extracted the industry name, job location city, posting date, job category, and other metadata seen in our publicly available code<sup>1</sup>.

With our initial database configuration complete, we developed the corresponding crawler for both monster.com and stepstone.de. For each crawler, we queried one job offer at a time with a slight delay in between to ensure that no relevant extra load was put on the servers. After letting our crawlers run, we noticed that many job advertisements on monster.com were posted in the “Staffing/Employment Agencies” industry. These advertisements were very generic and allowed little conclusion about the required skills and responsibilities of the role. Therefore, we decided to filter them out and focus only on companies directly searching for employees. To limit our dataset to job ads requiring “agile” knowledge, we filtered the job description with the word “agile”.

### 3.2 Skill Extraction and Classification

Our team of two people reviewed 50 job postings each to get a sense of the different skill requirements and to make categorization notes. In a later meeting, we created a coding scheme on the basis of experience, technical, and non-technical skills. In the experience category, we stated the required minimum for an educational degree and

<sup>1</sup><https://bitbucket.org/agiletum/monster-crawler/>,  
<https://bitbucket.org/agiletum/stepstone-crawler/>,  
<https://bitbucket.org/agiletum/monster-server/>

years of work experience. We categorized technical skills into multiple categories on the basis of our knowledge of previously analyzed datasets. Programming Languages and Frameworks, Management Concepts, Non-Technical Skills, Certificates, Degree, Testing Knowledge, Deployment Knowledge, and Job Title were the final categories in our tables.

We include three of the above categories in this paper, as they reveal the most interesting results: 1) Non-technical skills, as seen in Table 4 2) Programming Languages and Frameworks (defined as Programming languages to implement algorithms such as JavaScript, Java, or PHP, as well as scripting and markup languages such as HTML/CSS and XML, we categorized Frameworks under their main written language), and 3) Management Concepts (covering software development processes such as Scrum and IT project management concepts and methodologies such as Continuous Integration, Microservices, or DevOps).

To further categorize non-technical skills, we adapted the coding scheme created by Ahmed [28] and extended it with six more categories as seen in Table 4 of the appendix. Exact pattern matches and other details of our workflow are available in our source code<sup>1</sup> and in Table 4.

## 4 Results

We analyzed 500 datasets from the U.S. and Germany, respectively, for a total of 1000 job advertisements. The following results are based on the categories of “non-technical skills”, “management concepts”, and “programming languages and frameworks”. In our dataset, U.S. job listings mentioned 24.7 skills in average, while German ones mentioned 13.3 in those categories.

First, we provide insights into the most frequently mentioned non-technical skills for agile workers. Table 1 provides an overview of in-demand non-technical skills. We found that non-technical skills, such as communication skills, problem solving skills, and leadership skills were mentioned more often in the U.S. than in Germany. U.S. job advertisements searched 37.5% more often for communication skills (U.S.: 59.4%, Ger: 43.2%), two times more often for analytical and problem-solving skills (U.S.: 78.0%, Ger: 38.6%) and over two times more often for leadership skills (U.S.: 84.0%, Ger: 40.0%). Organizational skills were mentioned twice as often in the U.S. than in Germany (U.S.: 78.8%, Ger: 39.2%). The skills more often searched for in Germany than in the US were language skills and the ability to work independently.

**Table 1.** Non-technical Skills of Agile Workers in the U.S. and in Germany

<b>Skill</b>	<b>The U.S. (Total)</b>	<b>The U.S. (%)</b>	<b>Germany (Total)</b>	<b>Germany (%)</b>
Work in teams	451	90.2	355	71.0
Leadership skills	420	84.0	200	40.0
Organizational skills	394	78.8	196	39.2
Analytical and problem-solving skills	390	78.0	193	38.6
Being innovative	350	70.0	197	39.4
Being motivated	323	64.6	136	27.2
Communication skills	297	59.4	216	43.2
Work with clients	288	57.6	143	28.6
Interpersonal skills	194	38.8	85	17.0
Fast learner	176	35.2	33	6.6
Presentation skills	115	23.0	29	5.8
Ability to work independently	87	17.4	102	20.4
Open and adaptable to change	50	10.0	43	8.6
Travelling	39	7.8	71	14.2
Languages	16	3.2	323	64.6
Other	9	1.8	61	12.2
Total	498 / 500	99.6	489 / 500	97.8

Next, we provide insights into the most requested knowledge concerning management concepts for agile workers. Table 2 provides an overview of the results mentioning management concepts. In Germany, the most important skills are Scrum, Test Management, and Requirements Management. In the U.S., our findings were similar, except that Scrum was replaced by IT Project Management. Continuous Integration/Deployment (CI/CD) knowledge is almost three times more often requested in the U.S. than in Germany (U.S.: 30.4%, Ger: 10.2%). A similar trend is visible for Test-Driven Development (TDD), which is more than two times more popular in the U.S. (U.S.: 10.2%, Ger: 4.8%). Test management is 72.8% more in demand in the U.S. (U.S.: 58.4%, Ger: 33.8%). Finally, project management skills are 2.8 times more prevalent in U.S. job advertisements (U.S.: 64.2%, Ger: 22.6%).

**Table 2.** Management Concepts of Agile Workers in the US and in Germany

Skill	The U.S. (Total)	The U.S. (%)	Germany (Total)	Germany (%)
IT project management	321	64.2	113	22.6
Requirement management	310	62.0	126	25.2
Test management (automation, continuous)	292	58.4	169	33.8
Scrum	194	38.8	187	37.4
CI/CD	152	30.4	51	10.2
Coding practices	96	19.2	46	9.2
Risk management	95	19.0	14	2.8
DevOps	76	15.2	61	12.2
TDD	51	10.2	24	4.8
Design patterns	46	9.2	14	2.8
User stories	44	8.8	17	3.4
Microservices	37	7.4	18	3.6
Scaled agile	37	7.4	18	3.6
Kanban	34	6.8	60	12.0
Industry knowledge (business & markets)	30	6.0	14	2.8
Other	175	35.0	120	24.0
Total	491 / 500	98.2	500 / 500	100.0

Finally, we provide insights into the most requested programming languages and frameworks of agile workers in our dataset. Table 3 provides an overview of the results. JavaScript was more popular in the U.S. than in Germany. While 28.2% of all U.S. agile job advertisements in IT mentioned JavaScript knowledge, only 17.6% of German job advertisements in our dataset searched for this language. According to our collected data, JavaScript dominates the U.S. IT industry in terms of programming languages. Furthermore, HTML/CSS knowledge is more than 2.8 times more requested in the U.S. than in Germany (U.S.: 22.2%, Ger: 7.8%). Of the top five programming languages in the U.S. and Germany, all executable programming languages have support for object-oriented development; 49% of German job advertisements and 26% of U.S. job ads did not mention any specific programming language.



**Table 3.** Programming Languages and Frameworks of Agile Workers in the US and in Germany

Skill	The U.S. (Total)	The U.S. (%)	Germany (Total)	Germany (%)
JavaScript (including frameworks)	140	28.0	88	17.6
SQL	140	28.0	75	15.0
Java (including frameworks)	128	25.6	106	21.2
HTML/CSS	111	22.2	39	7.8
Python	76	15.2	45	9.0
C#	74	14.8	51	10.2
C++	47	9.4	35	7.0
Scala	38	7.6	6	1.2
NoSQL	23	4.6	18	3.6
XML	15	3.0	1	0.2
Bash/Shell/PowerShell	11	2.2	5	1.0
PHP	10	2.0	13	2.6
C	4	0.8	9	1.8
ERP/CMS	4	0.8	8	1.6
Other	77	15.4	54	10.8
Total	370 / 500	74.0	255 / 500	51.0

## 5 Discussion

The following section reveals our results, including theoretical and practical implications, and points to possibilities for future research.

### 5.1 Geographical Differences in Non-technical Skills for Agile Workers

Our results show that communication, problem-solving, and leadership skills are mentioned more in the U.S. than in Germany. Almost all U.S. job advertisements search for these skills versus three-quarters of the job ads in Germany. This finding draws a different picture than the one provided by Gallivan et. al. [10]. They stated that he “found ongoing evidence of a recruitment gap where, despite many firms’ stated emphasis on well-rounded individuals with business knowledge and strong ‘soft skills,’ the job advertising aspect of the recruiting process continues to focus on ‘hard skills’.” [10, p. 1]. Our findings, 16 years later, show an improvement in this regard, closing the recruitment gap (where soft skills are needed but not listed in job advertisements), identified by Gallivan et. al. [10], at least for agile job postings in the IT industry.

Language skills are the most important non-technical skill for agile workers in Germany. More than three-fifth of the job offers explicitly require knowledge of a language, mostly German or English. Therefore, the question is whether the same soft skills recruitment gap that Gallivan et. al. identified [10] can be identified in Germany several years later. The answer would require further research as to the skills that German firms really want from their agile workers. Assuming the recruitment gap by Gallivan et. al. [10] exists in Germany 16 years later, it would be an interesting topic to research to learn whether recruitment trends from the U.S. are swapping over to Germany in a timely manner.

According to our results, U.S job listings mentioned almost twice as many skills than German ones on average. Therefore, the result that non-technical skills are more important in the U.S. could also be the case because U.S. job listings had included more skills in general. Our findings state that U.S. firms ask for more skills in general, which may indicate that U.S. job listings are structured differently than German ones. This could be a result of cultural differences of the recruitment process. For future research it is interesting to see if all the skills mentioned in U.S. job listings really have to be fulfilled from the new hire.

Our results support Venkatesh et al. [23] who highlighted the agile workers' need for organizational skills. The authors stated, although the use of the agile methods may improve clear role perceptions and work exhaustion of developers, organizational skills are needed to effectively collaborate. Thus, the high value of non-technical skills in U.S. job listings for the IT industry is a very good step toward hiring effective agile teams. German employers should place more emphasis on non-technical skills in the recruitment process of agile workers, or they risk falling behind [23].

## **5.2 Agile Workers in the US Need to Have a Broader Knowledge of the Whole Workflow than in Germany**

Our results show that CI/CD knowledge, TDD and test management skills, and requirement management are more important for agile workers in the U.S. than in Germany. This indicates that in the U.S., agile team members must know the whole workflow, from requirements engineering through test management and deployment, whereas in Germany, the workflow is distributed into multiple roles.

The findings also suggest that agile job descriptions follow the Agile Manifesto [25] more closely. The goal “Working software over comprehensive documentation” is reflected in the adoption of Test-Driven Development, meaning that the functions of the software are defined by tests rather than extensive documentation and specification. This aligns with the need for test management and requirements management, as good requirement management is needed for planning and writing tests. The need for CI and CD skills is reflected in the usable product increment, a very important part of the Scrum process [26]. It is surprising to see that CI/CD is much less important for German agile workers.

### 5.3 High US Demand for Web Technologies and JavaScript for Agile Workers

Surprisingly, there is a big difference between programming languages used in the agile working IT industry in Germany and the U.S., as shown in Table 3. Although JavaScript, including frameworks such as JQuery, React, Vue, and Angular, is the most searched for programming language in the U.S., with less than one-third of ads mentioning it, only about one-fifth of German job ads request JavaScript knowledge. When comparing this to programming languages currently used by developers worldwide, on the basis of the 2020 StackOverflow Developer Survey [27], we notice that our results for the U.S. are quite similar to those of the survey, and they both show the lead of JavaScript. Additionally, HTML/CSS, C#, and Python are all more popular in the U.S. than in Germany. Java is the most required language in Germany in agile jobs, with more than one-fifth of the advertisements requiring it, according to our results.

Comparing our results with data collected by Gallivan et. al. [10], the change is clearly visible. In 2001, C was the most popular programming language. Today, it is not even in the top ten. Similarly, COBOL has completely vanished from our results. By contrast, although object-oriented programming languages were required in less than nine percent of job advertisements in 2001, currently, all the top five programming languages except HTML/CSS, which is not an executable programming language, allow object-oriented programming. Compared with the results by Gallivan et al. [10], we see a similar pattern in Germany as in the U.S., with a clear focus on object-oriented languages. C is still more popular in Germany than in the U.S. Generally, it seems as though newer frameworks, such as Node.js and Angular, or generally newer programming concepts, are more widespread in the agile IT industry in the U.S. than in Germany. This might be an indication that German companies adopt new technologies slower than U.S. companies. However, this requires further study.

The radical change in the last two decades serves as an example of the need to learn and adopt new technologies in the IT industry. Programming languages required today will not be the same ones required 20 years from now, although current graduates entering the job market will then still be in the middle of their careers.

### 5.4 Implications for Theory and Practice

With our paper, we contribute to two fields of research. First, we contribute to skills literature [1], [2], [4], [7], [8]. Our results provide a better understanding of the current skill requirements in Germany and the U.S. Second, we contribute to agile literature [3], [23], [26], [30]. We show differences in agile working between the two countries.

With our updated dataset and the focus on agile skills, we have looked at the recruitment gap from previous researchers [10], [24] and compared it to our findings. We found the recruitment gap to be larger in Germany than in the U.S. This study contributes to recruitment gap research both in the U.S. and in Europe. Furthermore, we show that universities should focus even more on building soft skills to make their students more competitive in the job market. This assertion supports previous research in the field from other countries.

Apart from that, our paper has direct practical relevance for companies, students, and young professionals. For German companies, it might serve as a reminder to promote critical non-technical skills in job advertisements, as these are the skills used in everyday business. Communication skills, problem solving skills, and leadership skills are underrepresented in the German job market. The differences we illuminated regarding the adoption of new technologies might encourage employers to actively search for employees with knowledge in recently introduced technologies. Finally, this paper serves as a useful summary for students and young professionals on the non-technical skills required for agile jobs in Germany and the U.S.

## 5.5 Limitations

Our research was conducted with certain limitations. First, the term “agile” limited our search to jobs containing this particular tag. This leaves room for fitting job advertisements on our topic that we do not analyze. There may exist some job advertisements mentioning Scrum or Kanban for instance, but not the word “agile”. Those job advertisements do not contribute to our findings in any way. Second, with our decision to choose the monster.com and stepstone.de platforms, we cannot be sure that we captured a representative dataset for all agile jobs in Germany and the U.S. However, we do not suspect any bias regarding specific skills in stepstone.de and monster.com. Third, there could also be cultural differences in the recruitment process. This might influence the way recruiters formulate their job advertisements, which is not a factor analyzed in our data. Hence, the conclusion that US workers need more soft skills might be a derivative from a cultural difference. Ahmed et. al. concluded that *“cultural difference does not have a major impact on the choice of soft skills requirements in hiring new employee in the case of the software development profession.”* [31, p. 1]. Therefore, it could also be the case that the soft skills requirements are the same for the U.S. and Germany, but U.S. firms explicitly state them in their job listings, while German ones do not. This is not analyzed in our paper.

## 5.6 Further Research

With our system for evaluating job listings, it is now possible to expand the analyzed categories to include more subdomains, such as operating systems, deployment methods, and testing methods, to allow further research in the field of IT job requirements. Additionally, more work is required to further evaluate if and how many trends in technology are adopted first in the U.S. and then in Germany, which might provide interesting insights into the future development of the German IT skills market.

Although many of the well-known tech companies, such as Apple or Google, are from the U.S., more research is needed to see how the required skills in job listings are reflected in the success of agile teams. It would also be very interesting to review how the performance of agile teams compares to non-agile teams and how this is reflected in job advertisements.

Furthermore, as previously mentioned in our limitations, it would be interesting to review the influence of cultural differences in job advertisements and how the content of the job listings reflect the actual needs of employers.

## 6 Conclusion

As the digitalization expands globally, more jobs are being created in the IT industry. To fill those jobs with highly qualified workers, it is essential to know what skills are needed by the companies operating in the IT industry. With the increasing adoption of agile practices in IT, the required skills for agile workers are of critical importance.

This paper aims to fill a research gap, as most of the studies about required skills have been made using U.S. rather than European datasets. By investigating current job listings in the U.S. and Germany, we provide a better understanding of the required skills for workers in agile positions.

There were three key findings in our results. First, we learned that non-technical skills, including communication, problem solving, and leadership skills, are more important in the U.S. than in Germany. Second, we found that Test Driven Development (TDD) and Continuous Integration/Deployment (CI/CD) skills are required more often in the U.S. than in Germany. Third, we saw that JavaScript is more popular in the U.S. than in Germany, as are general modern web development languages such as HTML and CSS.

With our findings, we contribute to a better understanding of the required skills of agile workers in the U.S. and Germany. There are many other directions to investigate using the foundation of our data. These include assessing new job advertisements with our tools, studying U.S. trends as they move to Germany, and venturing further into the details of the data that we already collected.

## References

1. Aasheim, C. L., Williams, S., Butler, E. S.: Knowledge and skill requirements for IT graduates. *Journal of Computer Information Systems*, 49(3), 48-53. (2009)
2. Alghamlas, M., Alabduljabbar, R.: Predicting the Suitability of IT Students' Skills for the Recruitment in Saudi Labor Market. Paper presented at the 2019 2nd International Conference on Computer Applications & Information Security (ICCAIS). (2019)
3. Barke, H., Prechelt, L.: Role clarity deficiencies can wreck agile teams. *PeerJ Computer Science*, 5, e241. (2019)
4. Capiluppi, A., Baravalle, A.: Matching demand and offer in on-line provision: A longitudinal study of monster. com. Paper presented at the 2010 12th IEEE International Symposium on Web Systems Evolution (WSE). (2010)

5. Csapo, N., Featheringham, R. D.: Communication skills used by information systems graduates. *Issues in Information Systems*, VI (1), 311-317. (2005)
6. Debortoli, S., Müller, O., vom Brocke, J.: Comparing business intelligence and big data skills. *Business & Information Systems Engineering*, 6(5), 289-300. (2014)
7. Debrah, Y. A., Reid, E. F.: Internet professionals: job skills for an on-line age. *International Journal of Human Resource Management*, 9(5), 910-933. (1998)
8. Florea, R., Stray, V.: Software tester, we want to hire you! an analysis of the demand for soft skills. Paper presented at the International Conference on Agile Software Development. (2018)
9. Gallagher, K. P., Goles, T., Hawk, S., Simon, J. C., Kaiser, K. M., Beath, C. M., Martz Jr, W. B.: A typology of requisite skills for information technology professionals. Paper presented at the 2011 44th Hawaii International Conference on System Sciences. (2011)
10. Gallivan, M. J., Truex III, D. P., Kvasny, L.: Changing patterns in IT skill sets 1988-2003: a content analysis of classified advertising. *ACM SIGMIS Database: the DATABASE for Advances in Information Systems*, 35(3), 64-87. (2004)
11. Goles, T., Hawk, S., Kaiser, K. M.: Information technology workforce skills: The software and IT services provider perspective. *Information Systems Frontiers*, 10(2), 179-194. (2008)
12. Hewlett Packard Enterprise LP: Agile is the new normal, <https://softwaretestinggenius.com/docs/4aa5-7619.pdf> (Accessed 21. October 2020)
13. Janicki, T. N., Lenox, T., Logan, R., & Woratschek, C. R.: Information systems/technology employer needs survey: Analysis by curriculum topic. *Information Systems Education Journal*, 6(18), 3-16. (2008)
14. Keil, M., Lee, H. K., Deng, T.: Understanding the most critical skills for managing IT projects: A Delphi study of IT project managers. *Information & Management*, 50(7), 398-414. (2013)
15. Kennan, M. A., Willard, P., Cecez-Kecmanovic, D., Wilson, C. S.: IS early career job advertisements: A content analysis. *PACIS 2007 Proceedings*, 51. (2007)
16. Lee, D. M., Trauth, E. M., Farwell, D.: Critical skills and knowledge requirements of IS professionals: a joint academic/industry investigation. *MIS quarterly*, 313-340. (1995)
17. Litecky, C., Prabhakar, B., Arnett, K.: The IT/IS job market: a longitudinal perspective. Paper presented at the Proceedings of the 2006 ACM SIGMIS CPR conference on computer personnel research: Forty four years of computer personnel research: achievements, challenges & the future. (2006)
18. Park, S.-K., Jun, H.-J., Kim, T.-S.: Using Online Job Postings to Analyze Differences in Skill Requirements of Information Security Consultants: South Korea versus United States. Paper presented at the PACIS. (2015)
19. Rezvani, A., Khosravi, P.: Emotional intelligence: The key to mitigating stress and fostering trust among software developers working on information system projects. *International Journal of Information Management*, 48, 139-150. (2019)
20. Todd, P. A., McKeen, J. D., Gallupe, R. B.: The evolution of IS job skills: a content analysis of IS job advertisements from 1970 to 1990. *MIS quarterly*, 1-27. (1995)
21. Trauth, E. M., Farwell, D. W., Lee, D.: The IS expectation gap: Industry expectations versus academic preparation. *MIS quarterly*, 293-307. (1993)
22. Valentin, E., Carvalho, J. R. H., Barreto, R.: Rapid improvement of students' soft-skills based on an agile-process approach. Paper presented at the 2015 IEEE Frontiers in Education Conference (FIE). (2015)
23. Venkatesh, V., Thong, J. Y., Chan, F. K., Hoehle, H., Spohrer, K.: How agile software development methods reduce work exhaustion: Insights on role perceptions and organizational skills. *Information Systems Journal*. (2020)

24. Wade, M. R., Parent, M.: Relationships between job skills and performance: A study of webmasters. *Journal of Management Information Systems*, 18(3), 71-96. (2002)
25. Beck et. al.: Manifesto for Agile Software Development. Agile Manifesto, <http://agilemanifesto.org> (Accessed: 2. September 2020)
26. Scrum Guide: Scrum Guides, <https://www.scrumguides.org/scrum-guide.html> (Accessed: 2. September 2020)
27. Stackoverflow: Stackoverflow Developer Survey 2020, <https://insights.stackoverflow.com/survey/2020#technology-programming-scripting-and-markup-languages-professional-developers> (Accessed: 2. September 2020)
28. Ahmed, F., Capretz, L. F., Campbell, P.: Evaluating the Demand for Soft Skills in Software Development. Paper published by the IEEE Computer Society. (2012)
29. U.S. Bureau of Labor Statistics: Which industries need workers? Exploring differences in labor market activity, <https://www.bls.gov/opub/mlr/2016/article/which-industries-need-workers-exploring-differences-in-labor-market-activity.htm> (Accessed: 18. October 2020)
30. Agile connection: Practice Soft Skills through Collaboration to Become Truly Agile, <https://www.agileconnection.com/article/practice-soft-skills-through-collaboration-become-truly-agile> (Accessed: 18. October 2020)
31. Ahmed, F., Capretz, L. F., Bouktif, S., & Campbell, P.: Soft skills requirements in software development jobs: A cross-cultural empirical study. *Journal of systems and information technology*. (2012)
32. Institute for Competitive Recruiting: Deutschlands Beste Jobportale 2020, <http://deutschlandsbestejobportale.de/index.html> (Accessed: 25. December 2020)

## Appendix

**Table 4.** Soft Skill Categorization by [28] and Coding Scheme for the Skills of Agile Workers Germany and the US

<b>Soft skill</b>	<b>Definition according to (Ahmed, 2012)</b>
Communication skills	The ability to convey information so that it's well received and understood.
Interpersonal skills	The ability to deal with other people through social communication and interactions under favorable and inauspicious conditions.
Analytical and problem-solving skills	The ability to understand, articulate, and solve complex problems and make sensible decisions based on available information.
Team player	Someone who can work effectively in a team environment and contribute toward the desired goal.
Organizational skills	The ability to efficiently manage various tasks and to remain on schedule without wasting resources.
Fast learner	The ability to learn new concepts, methodologies, and technologies in a comparatively short timeframe.
Ability to work independently	Can carry out task with minimal supervision.
Innovative	The ability to come up with new and creative solutions.
Open and adaptable to change	The ability to accept and adapt to changes when carrying out a task without showing resistance.
<b>Additional soft skill</b>	<b>Definition based on analyzed job offers</b>
Work with clients	The ability to work directly with clients.
Traveling	The ability to travel for a certain part of the work time.
Languages	The ability to speak a certain language.
Motivated	Being motivated, a self-starter or similar.
Leadership skills	The ability to lead a team and motivate others
Presentation skills	The ability to present in front of an audience.