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EMPLOYEES' CHALLENGES AND NEEDS FOR RE-SKILLING WHEN WORKING WITH SOFTWARE ROBOTS

Research full-length paper

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Abstract

The growing rate of automatization by software robots affects more and more people and results in changes in businesses of all sizes. Impacts can be observed at both the organizational and individual employee levels. A number of studies of software robots' advantages and disadvantages on an organizational or industry-specific level have been carried out. However, there is limited knowledge about the employees' perceptions of challenges and new skills needed when working with software robots. This study addresses this gap by using questionnaire responses from employees who have worked with software robots. This study aims to contribute to prior knowledge by identifying comprehensive sets of subcategories for employees' perceptions of (1) the challenges as well as (2) the new skills needed with software robots. As practical implications, our findings can help organizations and individual workers prepare for the implementation and use of software robots by identifying potential challenges, planning for overcoming such challenges via suitable skills, and providing training for employees. Many respondents mentioned learning new technical skills as a challenge, and because they have had to work with software robots, they have acquired additional knowledge, such as programming skills. Challenges related to reskilling constitute an interesting topic for further research.

Keywords: software robots, Robotic Process Automation, RPA, challenges, skills

1 Introduction

Rapid technological development has come to affect nearly all industries. Recently, digitalization has been accelerating due to unexpected global changes, such as the COVID-19 pandemic. Consequently, advancements in digitalization have also meant that the process of automating different work roles/positions has been accelerated. In fact, a World Economic Forum (2020) predicts that 85 million jobs may be displaced by a shift in labor division between humans and machines by 2025. Robotic process automation (RPA) is one of the technologies enabling automation, and it is based on virtual software robots' performance in information technology (IT) ecosystems that use established applications (Hofmann, Samp and Urbach, 2020; Lacity and Willcocks 2016; Penttinen, Kasslin and Asatiani, 2018). In RPA software, the robot imitates the same actions that an employee would perform within one or several systems (Aguirre and Rodriques, 2017). For example, a software robot can open Microsoft Excel, navigate to a selected spreadsheet, change values in specified cells, and save the data before closing the application (Hofmann, Samp and Urbach, 2020). This very simple example shows how this type of automation can be adopted for multiple kinds of business processes and tasks. Accordingly, the RPA market is one of the fastest-growing segments in the enterprise software market (Rashid and Ray, 2021). It is estimated to grow to $22 billion by 2025 (Forrester, 2022). Forrester (2022) estimates that robotics and automation will transform as much as 80% of all jobs by 2030. This forecast puts pressure on both organizations and employees to prepare for future challenges, as well as requirements for employees to become more skilled or reskill when working with robots.

Even though technological developments yield many potential benefits, such as enhanced productivity and cost reduction, challenges have resulted from the implementation of software robots, especially how employees respond to new work alongside robots (Seiffer, Gnewuch and Maedche, 2021). Organizations need to adjust their human resource management strategies, and individual employees need to acquire updated skills and competence requirements in continuously changing conditions. Skills that are required to succeed are nowadays similar to those skills that were previously only specific to IT professionals. For example, a bank clerk at a customer service counter can today work closely with a software robot in the back office, making pre-decisions for a bank loan. The work of software robots also requires supervision, and increasingly, it is the subject matter expert who handles them. In case robots make mistakes, employees who know the actual process content in-depth must be involved in the troubleshooting process, not just IT professionals or programmers.

Due to the increasing number of software robots involved in different work contexts, this topic has received growing attention from researchers. Seiffer, Gnewuch and Maedche (2021) conducted a systematic literature review to investigate how employees respond when working with software robots. Moreover, a recent study carried out by Pramod (2021) revealed that the RPA implementation "challenges fall into major categories such as technical, operational, human and strategic aspects" (p. 1574). One means to overcome these challenges is to enhance employee awareness and skill development. According to Lacity and Willcocks (2016), building company-wide skills and capabilities is one of the most important ways to achieve the benefits of automation. Pramod (2021) has called for more research on how reskilling affects RPA implementation. In this paper, we aim to respond to this call by investigating employees' perceptions of challenges when working with robots and how employees have already taken steps to reskill. The goal of this study was to respond to the following research questions (RQ):

- RQ1: What kinds of challenges do employees experience when working with software robots?
- RQ2: What kinds of new skills do employees need to learn when working with software robots (based on employees' perceptions)?

To address these questions, we conducted an online questionnaire and collected written, open-ended responses about challenges and skills from employees who had worked with software robots. We collected the data from persons who had worked with software robots by using the online platform Amazon Mechanical Turk (MTurk). Our pool of respondents had worked in various job positions, allowing us to obtain a more general view throughout many different industry sectors. A total of 202 responses were included in the dataset analyzed.

As a theoretical contribution, this research aims to increase the understanding of employees' points of view regarding challenges and reskilling needs. Previously, software robots use has been studied at the organizational or industry levels, but research into associated challenges and skills from employees' perspectives has been limited, especially for those who use software robots at work.

As for practical implications, this research can benefit both the organizational and individual levels. Organizations can benefit from knowledge of the challenges their employees experience in their daily tasks. They can implement more accurate automation strategies, implementation planning, and training programs, and consequently perhaps gain a significant competitive advantage. Furthermore, individuals can do their work task planning or even career planning if they are more familiar with the challenges and skill requirements associated with working with robots.

The structure of this paper is as follows. We first elaborate on the background of software robots' use in workplaces as well as the benefits and challenges of growing automation through this form of technology. After describing the methodology, we present our results. Finally, we discuss the theoretical contributions, practical implications, and limitations of this study and suggest topics for future research.

## 2	Background of working with software robots

Working with software robots is no longer a new phenomenon in the corporate world. Notably, it is also no longer an emerging topic relevant only to larger companies and manufacturing industries. A variety of different industries are adopting software robots in their strategic technology development roadmaps. Recent research (Pramod, 2021) revealed that RPA has been adopted mostly in the following industries: financial services, banking, and insurance. The healthcare, manufacturing, telecom, agriculture, and energy sectors have also implemented RPA. In addition, Pramod (2021) argued that there are hints that other sectors, such as retail, e-governance, construction, and tourism are exploring the possibilities of RPA.

As more industries take steps to implement RPA, interestingly, an increasing number of small and medium-sized companies are investing in software robots to improve productivity (Statista, 2019). One of the reasons is that automating with RPA is usually a more lightweight and faster solution for standard automation, as RPA targets the existing information system's user interface rather than deeper logical and data layer development (Tømmervåg, Bach and Jæger, 2022).

Software robots can perform mundane, rule-based routine processes that involve structured data and deterministic outcomes (Aguirre and Rodriques, 2017; Lacity and Willcocks, 2016). Such automation, when successfully implemented, enables organizations to build high-performing human–robot teams. When freed from repetitive tedious tasks, employees can concentrate on more value-adding initiatives that demand decision-making, creativity, problem-solving, and social skills (Lacity and Willcocks, 2016). Ideally, humans and computers can complement each other seamlessly. In addition to increased productivity and the possibility of focusing human resources on more appropriate tasks, research has shown multiple other reasons and benefits why companies are increasingly adopting this technology. Software robots can bring measurable benefits, such as cost reduction, improved quality by reducing errors, time savings and headcount reductions for repetitive tasks, and better compliance (Aguirre and Rodrigues, 2017; Kroll, Bujak and Darius, 2016).

Along with obvious benefits and opportunities, there are risks, disadvantages, and challenges. Previous research has pointed out that one of the challenges is that software robots are seen as a threat or burden to the organization or individuals (Waizenegger and Angsana, 2020). For example, fear of losing a job to a robot can cause instability within the organization or decrease employees' commitment to the company. There are some examples in the literature (e.g., Ford, 2015) and in media headlines in which robots have been presented as a threat to our society. Often, robots also learn and adjust to new situations, for example, by receiving information from other robots and machines (West, 2018). Such characteristics may also create challenges for the employees when robots change their routines and workers have difficulties for anticipating such changes.

Furthermore, an organization's performance can be measured by its employees' competency (Harvey, Novicevic and Speier, 2000). Competency refers to the main abilities of the organization, but it also refers to individual employees' knowledge and skills (Holtkamp and Pawlowski, 2015). Rapid changes in work conditions challenge old working methods and employees' skills. The use of robots and automation does not seem to only require a one-time update for skills but rather a continuous process of learning throughout people's careers (Abe, Abe and Adisa, 2021). How does increasing the level of automation change actual work and employees' competency and skill requirements within these new conditions? As manual work becomes increasingly more automated, presumably, employees' qualifications will be impacted. Interestingly, some employees have shifted from manual work to more supervisory roles, in this case, supervising their previous work tasks performed by software robots. According to Andriole (2018), RPA skills are considered among the special skill sets required for digital transformation. In this study, we are not looking only at specific RPA skills (i.e., solution-specific skills, such as Uipath or Blueprism skills), but rather at how employees describe the various new skills needed when working with software robots. To explore these issues further, we aim to investigate related challenges and needs for learning new skills based on actual employees' experiences and their points of view.

3 Methodology

3.1 Data collection

To answer our research questions and understand employees' perceptions of various challenges and skills related to using software robots at work, we used an online questionnaire and collected written, open-ended responses. We chose this approach because collecting textual descriptions of respondents' experiences enables researchers to explore previously unmapped areas and gain understanding of a real-world phenomenon in practice (e.g., Bitner, Booms and Tetreault, 1990; Gremler, 2004). Modern technologies, such as software robots, have yielded fast-changing phenomena. Understanding phenomena sometimes means diving into complex behavioral and social events that happen at the technology user level. To identify a comprehensive set of categories for perceived challenges and skills, we reached a large number of employees who have actual experience using software robots at work by conducting a questionnaire that mainly featured open-ended questions via Amazon Mechanical Turk (MTurk), an online crowdsourcing platform. MTurk has been used successfully for examining human perceptions and experiences in relation to technology (Lowry et al., 2016; Salo, Makkonen and Hekkala, 2020) and has several advantages. For example, MTurk hosts a large number of workers (Difallah, Filatova and Iperoitis, 2018), does not require any specific expertise from its users, and offers respondents full anonymity. Furthermore, Mason and Suri (2012) referred to previous studies that showed how MTurk is a valid means for collecting research data and that there is correspondence between the behavior of MTurk workers in the United States and other offline and online settings.

The data collection was conducted as part of a larger project that targeted employees who use various technologies at work. For this study, we included only respondents who reported that they had been working with software robots (more than tried/trialed). In our questionnaire, we defined software robots as follows: Software robots refer to the use of (bot) programs to automate computer tasks usually performed by people. Software robots is often used synonymously with the term Robotic Process Automation (RPA). Examples of software robots or RPA include systems that conduct automatic filing of information, order automatically items from a supplier, or analyze data sets and identify trends from them.

We first conducted a pre-test and a pilot questionnaire in December 2021. After minor changes in wording and question ordering, the main dataset was collected between January 2022 and March 2022. The pilot study was included in the final dataset. In MTurk, one can set certain qualification criteria to obtain enough qualified data. We required that the respondent had reported location country as the United States, and that the respondent was an MTurk Masters Worker or had at least 95% human intelligence task (HIT) approval rate combined with a minimum of 1000 approved HITs. In addition to the open-ended questions, we had an attention question to ensure that the respondents had read the questions and focused on answering them. This was one of the ways that helped us to exclude responses (e.g., we noted bot or spam answers or respondents who did not answer the actual question). We also excluded responses, for example, when the text was copied from the internet, or the respondents had clearly clicked through the questions writing same words to each question.

Altogether, the final dataset consisted of 202 employees who had worked with software robots. All respondents had reported their location as the United States. Their average age was 39 years. Of the respondents, 39% were women, 60% men and 1% had chosen not to disclose. The respondents' working environments differed from banks to service counters and from military to law offices. Additionally, the job positions list was diverse. For example, there were sales managers, marketing managers, school teachers, stock brokers, realtors, financial advisors, IT directors, software developers, and data analysts.

For the aim of this paper (i.e., to understand the employees' challenges and new skills needed when working with software robots), we asked the following open-ended questions:

- What has felt challenging when working with a software robot?
- What kinds of new skills/know-how have you needed when working with a software robot?

The responses for each question ranged from a few words to numerous sentences of text, typical response consisting of 1-3 sentences.

3.2 Data analysis

According to Berg (2009), content analysis is suitable for identifying themes, meanings, and patterns from a dataset (e.g., text). We thus followed Berg's (2009) guidelines for the general process of content analysis. There are 7 stages in the process. Berg suggested that after determining the research questions (Stage 1), the second step (Stage 2) is to determine analytic categories, which means finding key themes or constructs for the data. These broader categories typically come from the literature or are linked to the research questions. In Stage 3, the researcher(s) reads through the data again and establishes more detailed categories based on the data (e.g., creating category labels based on the keywords in the data). The next stage (Stage 4) is to determine the criteria for sorting the data into the selected categories. In Stage 5, researcher(s) checks whether there is a need to revise the categories or the criteria for sorting the data. In Stage 6, researcher(s) can count the number of mentions in each category and search for patterns from the textual materials. Finally, (Stage 7) researcher(s) reflects the findings with the relevant literature and provides explanation for the findings.

To form the research questions, we reflected our research aims with relevant literature concerning digitalization and software robotic implementation challenges, along with literature on employees' competence and skills (Holtkamp and Pawlowski, 2015; Johansson et al., 2020; Kokina et al., 2021; Merchel et al., 2021). As such, we chose to focus in this paper on employees' perceptions of challenges and skills when working with robots.

We then identified data-driven categories for the challenges that the employees experienced. The first author started the labeling process by searching for recurring keywords and phrases. The first author noted several recurring issues and keywords. For example, many respondents mentioned challenges with the initial setup or programming of the software robots or learning how to use them in the implementation phase. After this round of analysis, we sorted the recurring issues and keywords into larger chunks. Preliminary labels for the detailed categories (here: subcategories) were identified. Then, the first and second authors went through the data thoroughly again and sorted the response into the subcategories. We needed to revise the criteria in some subcategories when more data had been covered. If a new theme did not match any of the preliminary subcategories, a new subcategory was established. After this analysis stage, 15 subcategories were found (e.g., debugging/error handling, learning new software, or robot set-up/writing the code/programming). All subcategories were sorted/numbered in a spreadsheet to analyze the individual answers separately in each subcategory. After this stage, we counted how many mentions each subcategory had. After discussions with the authors, we decided to merge some subcategories, as the data content was related to the same phenomena. Consequently, we sorted the subcategories into 5 challenge types, which are referred to as the main categories.

Next, we focused on data concerning employees' responses about the new skills they had acquired. We repeated the previous content analysis stages by first searching for recurring keywords and phrases, then identifying labels for the textual passages and developing subcategories, and finally categorizing the text into the subcategories. We found several categories (e.g., programming skills, troubleshooting, and data interpretation) and after analyzing them, we noted that there were connections between the perceived skills needed and the main challenge categories (i.e., most of the skills reflected the challenges identified in the earlier phase). Therefore, we decided to sort the subcategories for skills into the 5 main categories of the challenges. Then, we counted the mentions in each subcategory. We present the findings in the following Results section. Finally, as suggested by Berg (2009), we went back to previous research and reflected our findings with it. We return to this in the Discussion section.

4   Results

In contrast to ample research on the many benefits of software robots, our research shows that there are different types of challenges. Although we did not aim to investigate whether the challenges were related to new skills or vice versa, our results showed obvious indications of this. As such, the employees' perceptions of the new skills needed when working with robots have similarities to the challenges experienced: the employees' perceptions of the needed skills appeared to stem from the challenges that they had experienced.

According to our results, the three most frequently mentioned challenges were related to the following broader categories:

- Learning to set up and/or to use the software robot
- Change and error management
- Machine vs. human (i.e., accepting that the robot is a machine, not a human)

In addition to these 3 main categories, we found only a few mentions of other challenges. While the fear of being replaced by a robot in an employee's work or position was not an emerging issue in our data, our questions aimed at identifying challenges when actually working with robots and, hence, our research design may not capture the fears of being replaced. Furthermore, only 4% responded that they had not experienced any challenges when working with the robot.

Main categories for challenges	Subcategories for challenges	Mentions
Learning to set up and/or to use the software robot	Programming/coding, robot set up	44
	Learning to use new software and/or target systems	57
	Using the robot efficiently	8
Change and error management	Error handling, debugging, and troubleshooting	42
	Getting technical support	2
	General malfunctions, such as internet connection errors	13
Machine vs. human	Non-standard or more complex tasks	16
	Trusting the accuracy	18
	Lack of cognitive skills	17
Other	Insufficient documentation	3
	Fear of being replaced	2
No challenges	-	8

Table 1.   Categorized results on experienced challenges

In terms of the needed skills, 17% of the employees reported that they did not need to learn any specific new skills due to the use of software robots in their work. However, some of the same respondents mentioned that basic computer skills are necessary to be able to work with a software robot. Overall, the majority of the employees described a variety of new skills that they had acquired due to automation changes in their work. After analyzing the skills that the 202 employees reported in their answers, the majority of the skills were linked to the challenges. Additionally, a few skills that were not linked to the main challenge categories emerged; for example, employees needed to practice their patience skills.

Main categories for challenges	Subcategories for the related new skills needed/reskilling	Mentions
Learning to set up and/or to use the software robot	- Programming - Skills using specific software - Skills related to robot functionality	142
Change and error management	- Troubleshooting skills	18
Machine vs. human	- Communication: learning key words/commands - Data interpretation - Thinking logically/algorithmic, decision-making - Analysis skills	26
Other	- Time management skills - Documentation - Patience	4
	- No specific new skills or just basic computer skills	34

Table 2.   Categorized results on reskilling needs

4.1   Employees' challenges and skills related to learning to set up and/or to use the software robot

The process of learning to use a software robot is not always straightforward. Employees' experiences with using software robot technologies or even basic computer systems vary. Many employees might be starting to use a software robot as their virtual assistant in a situation where there is no earlier experience, while others are more used to adopting new software regularly in their work. More than half of the total responses referred to challenges with the robot's setup, usage, and operation.

Of the 202 employees, 21% mentioned that they needed to overcome challenges with initial programming and coding. This is an interesting point, as very few of them called themselves IT professionals and instead referred to themselves as business specialists in their fields.

> *"The programming side of these can be complex. They also can be difficult to fully understand from an outsider's perspective."*

> *"It is difficult to write the script or software unless you have experience in doing so."*

Setting up the robot should be done carefully, as this critical implementation phase impacts the entire end result.

> *"The initial set up to establish the work parameters of the system—a slight mistake during this part of the process can create a significant amount of unusable data."*

Working with software robots requires learning the actual software on which the robot is built; 15% of employees found this to be one of the biggest challenges in their work with the software robot.

> *"Learning the software is always the biggest challenge for me, if I am unfamiliar with it and then making sure everything is linked together properly in order for the software robot to do its job correctly."*

> *"Knowing how to manipulate the software in order to achieve good result."*

These employees said they needed to learn more details about the target systems that the robot was using to learn how automation actually works. Some described that they found it difficult to learn how to launch the bot, adjust to the right settings, and learn about data filtering, system shortcuts, and other technical features.

> *"The challenging part of working with a software robot is usually fine-tuning it to work with your specific software application. You may need to spend some time tweaking the robot's settings and parameters until it operates exactly the way you want it to."*

Some employees described starting to use a software robot as a learning curve that can be frustrating but eventually rewarding.

> *"What felt challenging was learning how to properly modify the settings so that I could use the bot in the intended way. It was a bit of a learning curve as well, but once I got passed this, it was otherwise simple to use."*

> *"There has been a few instances when the settings have reverted back to start point, which is not only challenging but frustrating. This has now happened less and less, but still happens every once in a while."*

> *"The coding is a bit trial and error, as it always is, to design a software robot that will meet your needs. It gets a bit frustrating, but the overall goal when reached is worth it."*

It is worth mentioning that a challenge does not necessarily mean that the employee finds it negative.

> *"The challenge was trying to figure out, through trial and error, how it worked and behaved. This is a nice kind of challenge, though I enjoy this kind of activity."*

To overcome these challenges, there is an evident need for technical reskilling. According to the responses, 42% of employees reported that they had acquired new skills, such as basic or even advanced programming. In total, approximately 70% had learned some new skills related to the new software or user interface. Some employees said that IT support is still necessary, but others reported that after learning some coding, they could now fix some errors on their own.

> *"We've had to learn some programming in order to assist us with the robot, though most of it is handled from our IT team."*

> *"Need to learn the programming language to make same changes when certain issues occur."*

Some employees mentioned that they learned specific programming languages, such as C#, HTML, Python, and JavaScript.

> *"Well, I had to teach myself Python and JavaScript, so I needed those new skills, and it was kind of difficult. The early stuff was easy, but the intermediate level was more challenging. There are also new programming languages popping up, but I haven't looked into those. And, of course, my work occasionally will use new software, so I have to adjust the scripts to deal with that."*

Learning new skills, such as programming and coding, can give more depth to one's professionalism. For example, a specialist in the banking/financial/insurance industry described his experience as follows:

> *"I have had to learn programming languages that I am not familiar with, but that has actually really enhanced my overall depth and knowledge with the coding community and my skillset, so I am really happy with my accomplishments with that."*

Most of the technical skills mentioned were related to the overall usage of the software robot. This means that, at minimum, the respondents needed to learn data entry, the right inputs and outputs, and how the robot operates in a system. Some employees reported that they must learn to memorize formulas, commands, and other case-specific parameters.

4.2   Challenges and skills related to change and error management

The second most frequent challenge category was related to change management and error handling. For example, the robot might not function as expected, or errors occur if there are even the smallest changes in the system on which it is working. Several employees said they needed to wait for someone to do the debugging and fix the error or make changes.

> *"When something breaks and we don't understand why, and someone has to go and look through all the codes to fix it."*

> *"As the technology is still newly utilized by my organization, if something goes wrong with it, we typically have to wait for our higher-level support team to fix it."*

> *"It is challenging when changes need to be made. Because the software robots are programmed by highly skilled individuals, changes and enhancements are often queued up and must wait for resources."*

In some cases, employees themselves need to troubleshoot and repair the robot. This can be frustrating and time-consuming if you are not particularly an expert in software programming or do not fully understand how the robot works. Even if you are a developer, troubleshooting can be a challenge.

> *"If there is ever a malfunction or some sort of problem, I really have no idea what to do."*

> *"When a problem occurred, that would need troubleshooting. There was the physical computer, the software, the output, and the process that could all have something wrong with it. This spurred on by a lack of error logging or descriptive error messages makes it difficult to track with."*

> *"Sometimes, there are errors and situations when the robot makes a mistake. I then have to correct that, and it puts me behind on my work."*

> *"Any time the robot doesn't successfully complete the task is challenging. It's hard to diagnose what went wrong with something that you don't fully understand how it works."*

> *"It didn't always find the root cause of the problem. I was the developer of it and worked to improve it over time, as I saw more situations."*

> *"That they sometimes don't cooperate and make mistakes that you have to fix on rare occasion. If it doesn't operate as expected, I have to correct the mistake and then have someone fix it. I constantly have to double-check to make sure they are working properly and making no mistakes. Additionally, their tendency to freeze up at the worst moments when you're super busy."*

In our study, a small set of respondents mentioned that they had learned about troubleshooting or error handling after they had started working with the software robot. Being able to diagnose where the error or problem occurred is the first thing to learn. Next can be, for example, how to adjust settings and change the input type or source.

> *"I think you have to be decently versed in basic computing. You have to be comfortable using a computer, deploying software, and being able to do basic troubleshooting, which comes with years of computer experience."*

Additionally, some target systems where the robot is supposed to perform, work online, and have a bad or entirely lost internet connection can cause lags or errors. Figuring how the internet browser works is one of the skills that some employees need to learn to work with the software robot online.

> *"Sometimes there are lags or error pages. It's dependent on internet connection."*

> *"When I lose internet connection, it is hard to get the job done."*

4.3   Challenges and skills related to machine vs. human

Some employees find it challenging to trust the robot's performance, even in cases where no errors have occurred. For example, employees question the accuracy of the robots' work results, or they have doubts that the robot has missed something important. This could also mean extra work for the employees to manually recheck, review, or monitor the work, which in turn can negatively affect productivity and efficiency, which are usually the goals of automation.

> *"The software is not always 100% correct, so it does require human review."*

> *"I didn't have any errors with the software, but it was challenging at first to trust the software to be accurate the first time I used it. I personally double-checked it for errors because it was a challenge to have faith in a new system for me."*

> *"Some systems can be hard to get used to and to rely on. There is always a degree of uncertainty during the first phases of use. It was challenging to ultimately trust that the software was."*

> *"It's challenging to feel safe letting things run on their own. You want to monitor to make sure something doesn't go wrong."*
>
> *"I wasn't always sure the software robot was doing the right thing, so I always have to go in and double check to make sure it's working properly."*
>
> *"Not knowing the full extent of what the software can do or validating what I am currently doing. Needing a second opinion or reviewing the information is challenging when working with software robots, as I'm unaware of their accuracy for certain tasks."*

Even though technology is continuously improving to incorporate more artificial intelligence features and capabilities, today's software robots do not possess nearly as developed cognitive skills as humans do. Although the artificial intelligence field has advanced significantly, such as through the incorporation of machine learning into software robotics, most software robots are still quite simple and "dumb" and can only perform precisely defined tasks. This was also reflected in the responses.

> *"It couldn't understand nuances or novel situations."*
>
> "*It doesn't have the capacity to think; like it only takes specific commands and can't reason out what we want from it if something is a little different than its designed process."*
>
> *"Learning how to interpret and apply outcomes in a human subjective way."*
>
> *"Software robots are not great at picking up nuance and tend to think in black and white."*

These problems might occur, especially when the robot needs to deal with non-standard or more complex issues. Some employees also mentioned that software robots are not very customizable.

> *"Wanting things to be a bit more dynamic. Sometimes, I want the robot software to do more, but it is not trained to expand."*

When working with a software robot, employees need to develop their analysis and decision-making skills. Data interpretation was also mentioned by a few employees. For example, an assistant manager in a retail business described the situation as follows:

> *"It still takes a lot of careful consideration and experience to analyze the data presented and make an informed decision. You have to know when to use the algorithm as a guideline and when the information should be ignored."*

According to our research, it seems that, in some cases, employees experienced that they needed to learn to teach the robot. To be able to do this and get the robot to understand correctly, employees themselves needed to learn to think more logically or algorithmically and be more systematic, for example, in the installation process.

4.4   Other challenges and skills

As is common in content analysis, some themes did not fall into any main category. We found responses that included the following challenges. Some employees mentioned a lack of or poorly written documentation as a challenge. Documentation practices were also mentioned as a new skill that some employees had learned.

> *"Some of the documentation was a bit obtuse and hard to understand."*
>
> *"Little or poorly written documentation."*
>
> *"Documentation is either bad or nonexistent."*

Some employees brought up their worry or fear of being replaced by a robot as a challenge.

> "*Many skills, highly developed through experience and once prized, have become obsolete. The specter of advanced AI programming has put a question mark after the prolonged continuation of many existing employment opportunities.*"

Only a few of the employees in our data described that they did not experience any challenges. Below are some examples of how they perceived their experiences working with the software robot.

"There isn't really anything challenging about working with a software robot because it's just on a computer. It's typically an easy task."

"Nothing really. I am very familiar with tech and computers, so I usually get things right away."

"Not at all, it's just a matter of proposing it. The initial disadvantages (if any) are more than compensated for by its use."

5   Discussion

5.1   Contributions of the study

Overall, our study contributes to prior knowledge by identifying comprehensive sets of subcategories for (1) challenges that the employees experience when working with software robots and (2) the employees' perceptions about the new skills needed when working with software robots. Such categorizations can help researchers and practitioners (e.g., organizations) to understand the variety of different challenges that may emerge when implementing and using software robots at work as well as the potential areas for skill development that would need attention (e.g., support and facilitation from the organization). We elaborate on these two aspects as follows.

First, we provide a broader understanding of the challenges related to working with robots. Prior literature has described challenges, for example, at the organizational level (e.g., Pramod, 2021; Herm et al., 2021), but less at the individual employee level. Recently, Seiffer, Gnewuch and Maedche (2021) conducted a study which gives an overview on employees' responses to software robots. Their suggestion for future research was to carry their research further to be able to understand individual-level impacts. In this study, we contribute to this call and explain employees' perceptions on the challenges. More specifically, we provide insights from employees who had worked with software robots, and identify several challenge categories that are relevant when working with software robots.

Second, skills related to software robots/RPA reflect a special skillset that is needed in digital transformation at work currently as well as in the future, and organizations may need to rethink their work processes and talent development (Andriole, 2018; Lacity and Willcocks, 2016; Merchel et al., 2021). Recent study conducted by Johansson et al. (2020) concluded that the use of software robots had impacts on the employees' job characteristic "skill variety" and therefore sets requirements for acquiring new skills. Our findings support prior literature that working with software robots reflects reskilling needs. We provide additional insights emphasizing that learning programming is one of the most important skills as well as solution-specific technical skills to use the robot.

The practical implications of this study can be observed at the organizational and individual levels. As software robots perform some of the most tedious tasks, there is a need to define new skill requirements for reconstructed jobs or entirely new job positions (e.g., see World Economic Forum, 2020). This cannot be done only in the closed conditions of the human resources department. Instead, employees' must be involved in the planning and defining their work and its' processes. In our research, we decided to ask employees about their newly acquired skills, and as the results show, there are some specific areas through which organizations can enhance their competence to meet the criteria and make them eligible to work with software robots. Our study can help organizations gain knowledge of how critically important the very first phases are when implementing software robotics, what challenges employees will most likely face, and how they should respond to employees' reskilling needs. This knowledge is important for both C-suite decision-making and manager-level work organizing. Specifically, we recommend that when organizations conduct strategic planning for automation, the managers and employees who work with software robots are included in the planning process. Similarly, robotics implementation should incorporate the viewpoints of respective managers and employees. Hiring and retaining highly skilled workforce is an acknowledged challenge in range of industries (Barker, 2019). By identifying concrete employees' challenges, organizations have better possibilities

to attract and retain top tech professionals. Consequently, organizations may even gain significant competitive advantage.

Furthermore, we see some practical implications for individuals. Individuals can better do their work task planning or even career planning if they are more familiar with the challenges and new skill requirements of working with robots. Working with a software robot does not always mean that employees need to be programmers, but according to our study, at least some understanding of programming helps employees manage tasks. Additionally, basic technical skills on how to use the robot software are needed. Individuals must understand that working with the robot efficiently is a constant learning process that sometimes requires creativity and extra patience from employees.

5.2   Limitations and future topics

There are two main limitations related to this study. First, the research target group was wide when it came to the selection of demographic factors. We conducted an online questionnaire on a crowdsourcing platform and targeted employees working in random industries, and the respondents represented multiple job positions. However, we deliberately aimed to gain a comprehensive view of the potential challenges and skills needed. For future research, we suggest conducting research for more focused contexts (e.g., based on work tasks, industries, or employee roles) to understand the details of working with software robots in specific settings/tasks as well as comparing potential differences across such contexts. Second, we collected written, self-reported data from the respondents via an online questionnaire. While we received a wide understanding of the phenomenon, direct contact with the employees (e.g., via interviews) would enable researchers to ask for more details.

Our findings also generate possibilities for future research. Previously, Kokina et al. (2021) showed that accountants play different roles and have different competencies and skills in their companies' automation initiatives. They named the roles as follows: Identifiers, Explainers, Trainers, Sustainers, and Analyzers. We found preliminary insights that the employees skills related to working with robots are linked to the (informal or formal) roles of the employees. Therefore, we encourage researchers to examine the relationship between needed skills and employees' work roles in the context of using software robots at work. For example, researchers could utilize the roles proposed by Kokina et al. (2021): identifiers, explainers, trainers, sustainers, and analyzers. Finally, our study revealed that the perceived challenges and needs for skills are related to each other. As such, we believe that this study provides insights for further studies investigating how the challenges and needs for skills are connected.

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