

Can bots Support Employees in Lessening Digital Fatigue during e-work: Research Results

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Abstract: The pandemic situation has obliged organizations to shift all possible tasks to the Internet and to replace on-site work by its remote version. Without a preparation stage, companies were forced to adopt remote working at the individual-level and cloud computing at the organization level simultaneously. As a consequence, the accelerated shift toward digital work forced employees to rapidly learn how to use various ICT tools (which were not necessarily compatible with each other) and how to implement them into a daily routine. The protracted pandemic has led to many employees working from home, especially those doing knowledge-based work, and has often imposed remote work without the on-site option. This has led (and is still leading) to digital fatigue of workers (a phenomenon that negatively affects the performance of both the employee and the organization), the effects of which have already been named and described by scientists. One solution to unburden employees could be by relieving them from everyday, repetitive, and often tedious jobs. By delegating these tasks to bots (especially those that may be subject to automation), it will enable employees to deal with more creative and knowledge-based tasks that require attention and do not cause the same level of fatigue and weariness. In this paper, the research question enquires whether there are commonplace digital processes in organizations that can be automated. If yes, then which technologies are used on a regular basis to automate the processes. The conducted literature review helped to distinguish three categories of standard digital processes suitable for automation – Information and Communication Technology (ICT) based processes (written and spoken), Robotic Process Automation (RPA) and processes of searching for specific information. The empirical research was conducted using the CATI questionnaire in 2020 on 400 organizations which use cloud computing for daily routines. The results indicate that the identified processes are indeed subject to automation, and organizations use bots for RPA most (27.5%), and voice chatbots least (3.75%). The use of bots is also shown to be statistically dependent on a company's scope and size.

Keywords: chatbots, digital fatigue, ICT, standard communication, RPA

1. Introduction

The pressures of e-work affect everyone creating and using knowledge in a remote working environment regardless of the sector, which leads to the urgent need for effective solutions to lessening digital fatigue as E-work is characterized by using IT tools.

The Covid pandemic brought about a rise in the degree of remote work instead of on-site work or even its complete substitution. Companies had to undergo an accelerated transition to the cloud and the implementation of cloud solutions in order to survive on the market. That process was sometimes unintended, unprepared and rushed. Some companies did have plans to shift to CC solutions before the pandemic, so in their cases the shift was just implemented faster than planned therefore in those cases it was a thought-through process. Unfortunately, in other cases it was more chaotic. The introduction of any new solution is usually accompanied by more (often detailed) messages in the form of an increased number of instructions and documentation, which the employee has to become acquainted with.

Along with Cloud computing, the communication tools and methods in the form of information and communication technology (ICT) and computer mediated communication (CMC) have become crucial in enabling communication with team members in geographically disperse circumstances. Among ICT tools that cover synchronous and asynchronous communication channels, Coleman (1997) enumerated "electronic mail, bulletin boards, audio/video/data conferencing, automated workflow, electronic voting and collaborative writing". Since the majority of companies were unprepared for the sudden change in communication processes, all the above channels came into usage, overlapping each other and struggling for priority. Moreover, they were not digitally synchronized. As a result, the use of all of these channels, necessity of its integration and the excessive information overload from the messages received led to increased tiredness, so called prolonged fatigue, which, unhealed, caused chronic fatigue (*chronic fatigue syndrome* CFS), and may turn into exhaust (Ostrowska 2020, Jurzysta 2020; Czarnecka, Słocińska 2016).

Evidence suggests (Nadler, 2020, Lee et al. 2021) that one of the diagnosed increased workloads from remote working causing digital fatigue is communication overload. The necessity to be available around the clock online, constantly ready to provide communication in various forms (oral or written) and with the use of various and disparate tools (Teams, e-mail, telephone) is having a detrimental impact. If some of the messages could be standardized in form and content for the purpose of automation, then bots could be used to replace employees in the communication of repetitive and time-consuming messages.

The aim of this paper is to diagnose whether companies have standardized communication processes in terms of its content and form as well as to learn what types of bots are being used for these purposes – ITC communication bots, RPA or for search purposes. Moreover, it is worth investigating whether the amount of instructions rose and the detail of the structure increased – as predicted, or did employees experience more decentralization and gain empowerment. The research results presented indicate the directions taken by enterprises, and may inspire further activities and contribute to understanding the phenomenon and support non-manufacturing sectors.

2. Theoretical background

When studying the literature on the development of organizations, apart from the concept of “knowledge sharing” other terms can be found like: “knowledge transfer”, “knowledge exchange”, “knowledge dissemination”, “knowledge diffusion”. These are often understood similarly and used interchangeably. Some authors, however, suggest such concepts should be distinguished – the deliberate, targeted and one-way action, aimed at finding a specific application (it is known in advance what knowledge, where from, to whom and for what purpose it is to be passed on) should be described separately to dissemination with no specific purpose (Albrychiewicz-Słocińska 2020; King 2006; Davenport, Prusak 2000). Regardless of the name and intention, it is a phenomenon that occurs through interactions between people by means of various communication channels – direct and indirect. The type of communication channel used affects the quantity and quality of the transferred knowledge, some channels facilitate; others hinder or even prevent the effective transfer of a specific type of knowledge. In a broader perspective, there is an interdependence between communication and knowledge (from a human perspective) – communication is a tool for acquiring, sharing and retrieval of knowledge.

Having acknowledged that the method of communication affects the quality, complexity and quantity of acquired knowledge as well as the possibility of future usage, and pointed out that certain knowledge may require or not require specific channels of communication, methods and tools, we turn to communication patterns in this paragraph. During the Covid pandemic, the communication patterns changed from those dominated by direct forms to those that are mainly indirect. Therefore, the regularly used methods of sharing knowledge (Czarnecka, Daróczy, 2017) also had to be adapted to the prevailing conditions of largely remote work. Immediate questions directed to colleagues with greater seniority is no longer as accessible and easy as before. At the same time, the number of messages that contained instructions, regulations, as well as indications and new ordinances related to the need to adapt to the prevailing new situation of geographical dispersion and its coordinated use has increased dramatically. These possible changes may be categorized in the following way – see Image 1.

specificity of tasks	less instruction but more detailed	more instruction and more detailed
	less instruction and less detailed	more instruction but less detailed
number of instructions regulations and documents		

Image 1: Possible change of number and specificity of communicated instructions after implementing Cloud Computing

Remote work minimizes real-life communication. Working as a team via instant messaging and video communication does not compensate for the loss of in-person communication for sociable people and the excessive increase in digital communication is detrimental to job performance (Charlampous et al., 2019). The increased number of messages transmitted and their frequency may result in communication overload. In the literature, the concept of digital fatigue has been defined and described, and also suggestions for dealing with it (Leonardi 2021) can be found. It was defined as „a state of mental exhaustion and reduced motivation and concentration due to the overuse of digital devices and platforms” (Korunovska, Spiekermann, 2014). Digital fatigue can be recognized and diagnosed, and there already exist suggestions and proposals for dealing with it

– by self-care e.g. separating work and personal life, to set boundaries and monitor mental exhaustion, planning in times throughout the day for self-care, encourage physical activity (Collins-Pisano, et. al., 2021; McGaughey, et. al., 2021)

There are three main reasons identified for digital communication fatigue: information content repetition, excessive formats and software used and incompatible hardware formats. Receiving an overwhelming number of messages, not all of which carry new information (content repetition), in order to be up to date and not to miss important information, requires employees to read each of them and afterwards assess whether the information is known (repetition), is new or perhaps there is a gap in information needs due to a missing message that was thought to have already been passed on, or should have been passed on (by someone other than expected). At the same time, employees also have to extract the important or urgent messages from the masses of communicated messages. This incoming information is received in various formats (written, voice recordings, pictures), transferred via various applications and sometimes sent to different devices (e.g., information in the form of picture transferred by SMS by the phone, by e-mail to the notebook, or voice message sent via Teams to the computer). This clearly will lead to an increase in exhaustion. A fatigued employee sometimes fails to hear correctly or fails to read carefully (the long list of incoming e-mails) therefore they send queries about items that have already been sent, but missed due to inattentiveness. Repeated inquiries lead to an unnecessary exchange of messages, wastes time, and frustrates the senders having to repeat it, etc. The employee could spend this time on other, more productive activities, resulting in a company's development. Such repetition and time-wasting could easily be eliminated by introducing bots as job support. A bot is a program installed on a PC, server or virtual machine that can perform certain tasks instead of a human being. According to Forrester Research (*Forester...*) by the end of 2021, the number of bots performing administrative, sales and related tasks will reach approx. 4 million.

Since remote workers rely heavily on using Information and Communication Technology (ICT) to communicate and collaborate with colleagues, supervisors, subordinates and clients, chatbots (voice-chat or written-chat) could support them (Adamopoulou, Moussiades, 2020). ICT is defined as “the array of primarily digital technologies designed to collect, organize, store, process and communicate information within and external to an organization” (Ritchie, Brindley 2005, p.206). A chatbot is a type of software that allows people to conduct conversations in natural, human language (Ait-Mlouk, Jiang, 2020), using a text or voice interface. Chatbots are able to lead many conversations at the same time and deliver the necessary information in a few seconds – which is much faster than a customer service representative. Chatbots are more than simple programs that automatically answer frequently asked questions. Increasingly, they are advanced digital assistants who learn and develop their skills based on their interaction with users.

Task-oriented and *conversational* chatbots (Gao, Galley, Li, 2019) are two types distinguished from the vast variety of bots. Task-oriented chatbots are rather basic and focus on performing a single function, they usually answer users' questions according to a specific key based on pre-programmed answers, such as closed-list question sets. They work well when supporting various customer service processes, e.g., interactive FAQ. Conversational chatbots, also known as virtual assistants, simulate a conversation similar to a conversation with another human being. In addition to programmed dialogue scenarios, they also use advanced technologies such as (Bu, et. al., 2022): Natural Language Understanding, machine language processing (*Neuro Linguistic Programming*), Machine Learning, and Sentiment Analysis. They can provide the appropriate answer or fulfill a specific request, they use text and graphic interfaces, audio analysis and video processing. They can be based on automated rules, artificial intelligence, or both. They are better in personalizing communication, they “learn” their interlocutor's communication patterns and can even recognize moods. Thanks to this, they are able to provide answers in line with the context of the conversation and they can anticipate the needs of users or offer them recommendations. They can also be used for instant messaging (Facebook, Messenger) and live chats on a website. The list of advantages is long and include primarily: – 24/7 availability, fluent natural language communication in real time and personalization of communication.

For the purpose of unifying the wide variety of document formats, RPA bots are suitable (Bu, Jeong, Koh, 2022). According to the Institute for Robotic Process Automation and Artificial intelligence, the “Robotic process automation (RPA) is the application of technology that allows employees in a company to configure computer software or a “robot” to capture and interpret existing applications for processing a transaction, manipulating data, triggering responses and communicating with other digital systems” (*IRPA&AI*). Therefore, RPA bots may be understood in two ways – as robots doing human tasks and as a software solution. Considering these two

approaches, and having in mind the context of this article (assisting communication whilst doing remote work), it is justified to advocate integrating both approaches in the form of software that handles highly repeatable, laborious and time consuming, multi-series communication activities previously performed by people. This reduces the risk of human error caused by boredom and exhaustion to a minimum and therefore enables the use of human creativity for strategic, unconventional and inventive tasks as a consequence of unleashing such opportunities. In the case of automation of manual office processes, bots can relieve employees from repetitive work in favour of their expert skills.

RPAs are able to automatically log into the system no matter whether it is ERP, CRM or a web page, they go through the entire path for the exploration of individual elements of applications and select information relevant to the task that should be performed from a specific location. It can, for example, edit Excel, Word, PDF, etc. documents, work on files and folders (create, delete, update, move, etc.) support e-mails by extracting data, composing and sending messages, as well as recognize texts in graphic files or execute system commands. And it can repeat the same things unlimited times for different accounts, and then combine the collected information with data from other areas of the system or other systems. Since no special, dedicated solutions is needed, RPAs are used to configure software or log into existing solutions to modify, retrieve, and process data in the same way an employee would do it, but is triggered “manually” or as a hybrid model (*IRPA&AI*).

The advantages of RPAs (Bu, Jeong, Koh, 2022) are that RPA bots usually do not require any special integration with the organization's software, since it uses screen scraping and a physical user interface. Therefore, no change in organizational processes is required. Implementation is easy because setting up RPA bots follows the same rules as creating macros and logs for actions, modern solutions already allow for automatic bot learning based on a review of employees' activities. Despite RPAs ensuring elasticity, they will not substitute for intellectual activities related to cognitive tasks, although they can automate a lot of menial work – thereby allowing automated transfer of documents between different systems which does not take up the time of employed specialists and, thus, automates workflow.

The areas particularly sensitive to robotization are departments where office work focuses on supporting business processes with the use of various software for processing large amounts of data (mainly calculation sheets) and applications as well as using ERP systems, updating data in CRM – e.g. accounting, controlling, Human Resources, sales departments or legal departments.

A different group of bots (considered here a separate category) are devoted to the intentional search for specific information. These are automatically programmed indexing robots and scrapers to retrieve information e.g., from websites (Czarnecki, et. al., 2021). They can monitor, for example, changes to the website, click on links, search for specific terms in the text, and otherwise surf the Internet independently according to requirements. For example, a robot can search for competitors' prices for comparison purposes.

3. Research method and results

The research question formulated was to ask whether there is a possibility of categorizing some of the messages and standardizing them to automate a certain range of communication in order to relieve employees of such a burden. For the purpose of the article, several steps were undertaken. Initially, we established whether there are messages that may be a subject of standardization – either because of form or because of content. This seems to be parallel to the growth of the number of documents, instructions and regulations sent as well as with determining whether the instructions are more or less detailed.

The comparative element of the growth in the amount of documents sent is interesting when assessing the dynamics of the phenomenon, however, in the case of this elaboration, the focus is on relieving the employee from the existing excesses and overloading, rather than determining the amount of this excess over time. When an increase in the amount of instructions occurs, it is assumed that it is better to automate this part of the communication (content), especially since messages may arrive through different channels, and the information contained therein might be transferred in various formats that must then be integrated (manually or RPA). Determining whether instructions are more or less detailed– will in turn qualify whether people have empowerment in the workplace or perform tasks in a very structured and imposed way. The second case anticipates in this paper an automation. Instructions that are better suited for automation in terms of form are

those which can be repeatedly forwarded to different recipients and duplicated, because non-automated ones can become distorted.

Having established the interdependence between the number and specificity of instruction and the possibility of standardization and automation of the form and content of messages, the bots used for this automation may be distinguished – these are RPA, writing and talking chatbots and search-bots.

The research was carried out in 2020 on 400 companies in the manufacturing industry that use cloud solutions in their daily work. In 2020, 18.25% of companies declared a decrease in the number of instructions, regulations and documents, whereas 9.5% of companies noticed an increase. Moreover, 36.00% of companies concluded that assigned tasks are more detailed, with 1.5% declaring the opposite. In comparison, in 2018, 10.00% of companies declared a decrease in the number of instructions, regulations and documents, whereas 20.50% of companies noticed an increase. Moreover, 17.50% of companies judged that assigned tasks are more detailed, with 10.25% declaring the opposite (Zalewska-Turzyńska, 2018). This reveals that the trend had changed within 2 years – with tasks becoming less detailed and burdened with less instructions to be done. Detailed numbers in each of categories are shown below in image 2.

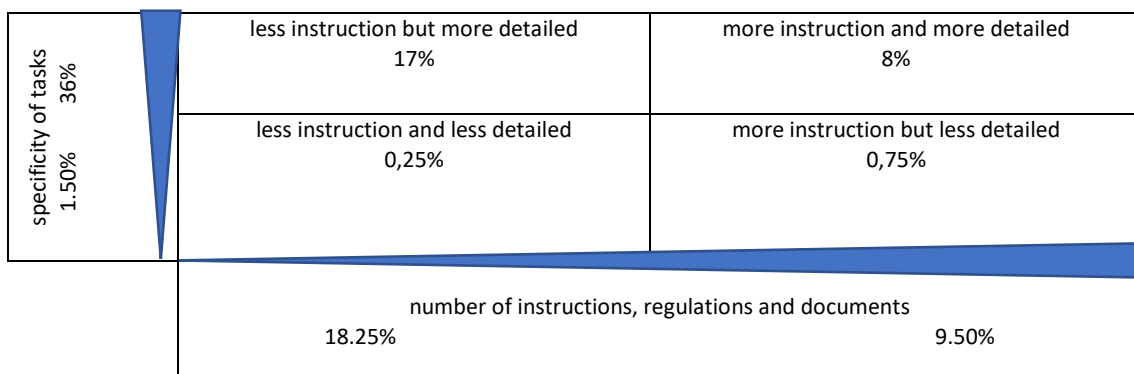
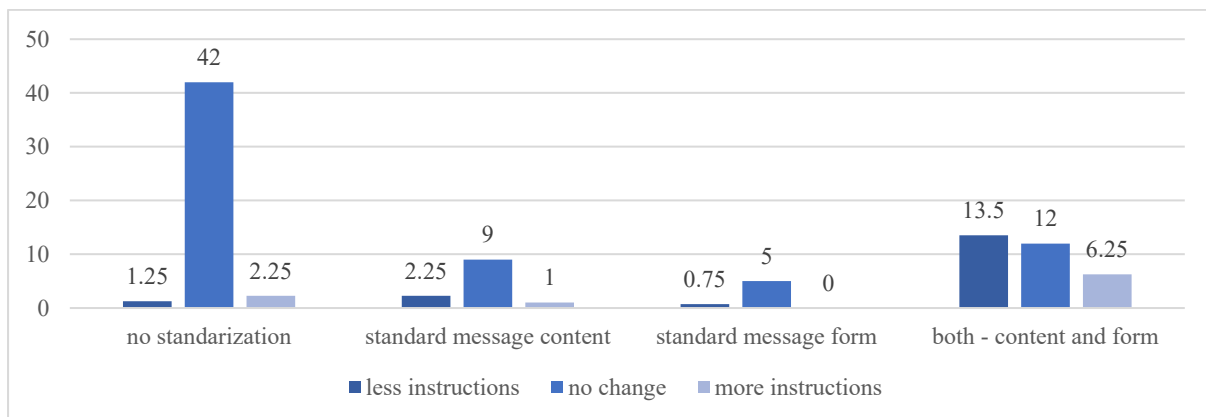


Image 2: Change in communicated instructions after implementing Cloud Computing – research outcomes*

*The categories inside the grid do not sum up in rows and columns to ‘external ones’ (e.g. in column 17%+0.25%≠18.25%) because of ‘no change’ category (e.g., the number of instructions changed but specificity not at all)

The amount of instructions was confronted with the possibility of standardization of the content and form of the message. 13.5% of companies that declared a decrease in the amount of received instructions also declared content and form of message standardization. 42% of companies declared a status quo – no change in the number of instructions and in their standardization. Detailed information is presented in Image 3 below.

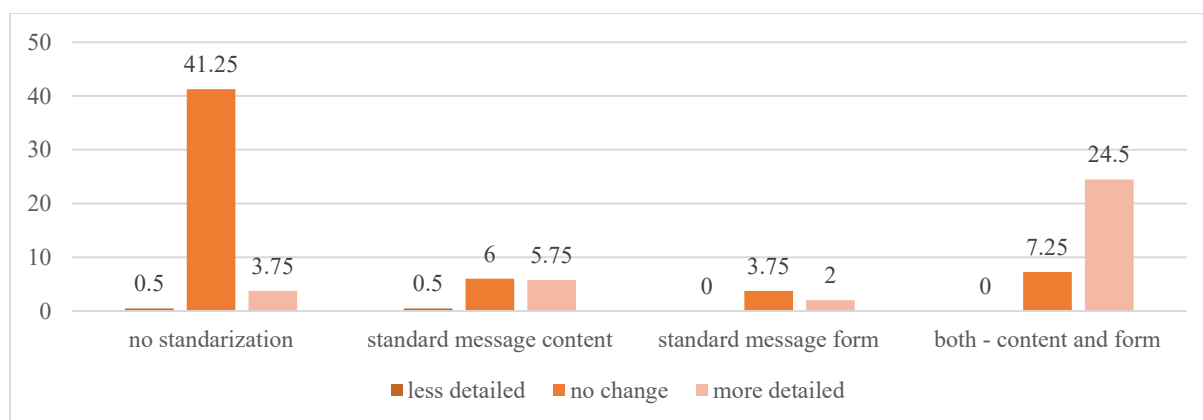


P < 0,001 V-Kramer < 0,001

Image 3: Number of instructions versus message standardization in %

41,25% of companies that declared no change in specificity, declared no standardization at the same time, whereas 24,5% of companies declared more detailed task specification and standardization of content and form. These outcomes seem to be logical – if no change in task specificity occurred no standardization occurred, i.e.,

there was no change at all. At the same time, more instructions followed the need for and the actual introduction of content and form standardization. Interestingly, there are also groups of companies of which 6% introduced standardization of message content and 3.75% of different companies declared standardization of message form, although they declare no change in task specificity,. This information is presented in Image 4 below



P < 0,001 V-Kramer < 0,001

Image 4: Specificity of tasks versus message standardization in %

Because of the limited size of this elaboration, the data are presented in synthetic form in the two tables shown below – Table 1 shows details related to the size of researched companies, Table 2 with scope.

Content standardization most frequently is declared as being implemented by medium companies (20.75%), but less frequently (3.5%) by micro companies. Form standardization is most often declared by medium companies (17.50%).

Organizations most commonly use bots for RPA (27.5%), and least for voice chatbots (3.75%). Looking at the data in terms of company size, writing bots are used most by medium companies (13.75%) of all researched companies, and least frequently used are voice bots in large companies (0.25%).

Table 1: Size of company versus standardization and automation of communication in %

	Size of company				overall	Chi-squared V Kramer	Pearson/ V Kramer
	Micro	Small	Medium	Large			
Standardized content	3.50	9.00	20.75	10.75	44.00	,001	,001
No standard content	10.50	14.00	24.00	7.50	56.00		
Standardized form	3.25	7.50	17.50	9.25	37.50	,009	,170
No standard form	10.75	15.75	27.00	9.00	62.50		
RPA	3.00	4.50	11.75	8.25	27.50	,001 /	,001
Writing Bots	0.50	6.00	13.75	2.25	22.50	<,001 /	<,001
Voice Bots	0.75	1.75	1.00	0.25	3.75	,095 /	,095
Search Bots	3.00	1.00	5.00	1.50	10.50	,010 /	,010

In terms of content, national companies used content standardization most (11.25%), whereas international companies used standard form (25.25%). Looking at the data in terms of company scope, national and international companies use writing bots most (both equally 11.25%). None of the regional companies declared using writing bots. Search bot usage does not show statistical dependence in relation to the size of the enterprise.

Table 2: Scope of company versus standardization and automation of communication in %

	Scope of company			overall	Chi-squared / V Kramer	Pearson/ / V Kramer
	regional	national	international			
Standardized content	2.50	11.25	3.25	44.00	<,001	<,001
No standard content	2.25	28.00	25.75	56.00		
Standardized form	2.50	9.75	25.25	37.50	<,001	<,001

No standard form	2.25	29.75	35.50	62.50	<,001
RPA	2.50	4.25	20.75	27.50	<,001 / <,001
Writing Bots	0.00	11.25	11.25	22.50	,009 / ,009
Voice Bots	0.25	3.25	0.25	3.75	<,001 / <,001
Search Bots	0.25	5.25	5.00	10.50	,293 / ,293

There is no statistical dependence between message standardization and chat bots and search bots. If the bots are being used, it is for standardization of both content and form of the messages. RPA is declared to be used in 19.25% of researched companies to standardize communication content and form, whereas writing bots in 12.25% of companies for the same purpose. Detailed information is presented below in Images 5 and 6.

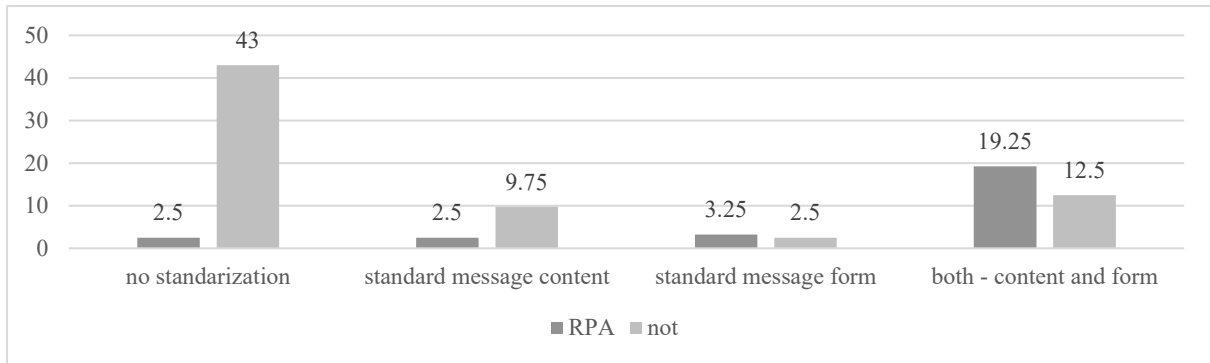


Image 5: Standardization versus RPA bots

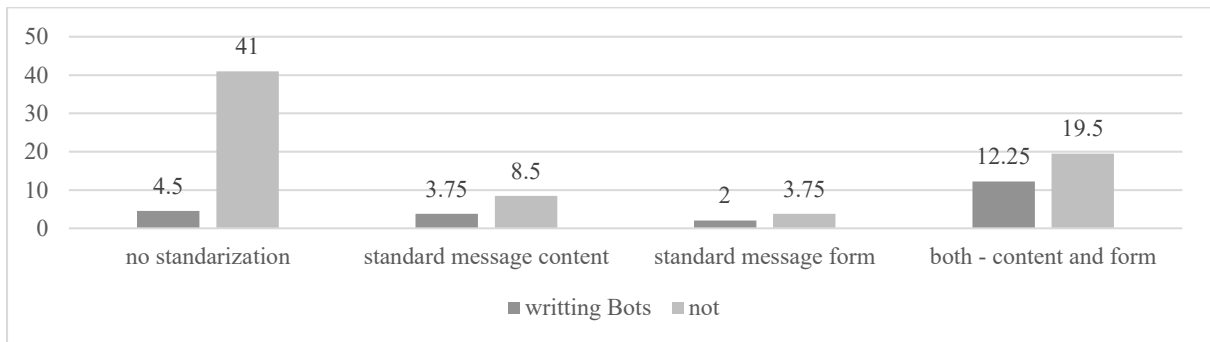


Image 6: Standardization versus writing bots

For companies which say the amount of instructions grew, the most popular are writing bots and RPA (both by 5%), whereas for those companies which issued less instructions the same solutions are being implemented, but more eagerly (11.25% for writing bots and 10.75% RPA). Search bots are not used in any of these two cases. Search bots are used by companies that declared no change in the amount of instructions (10.5%).

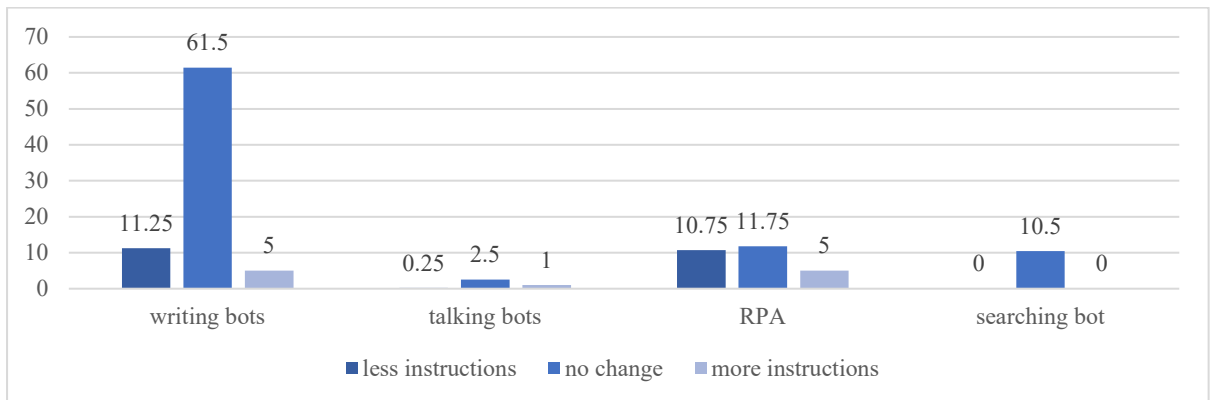


Image 7: Instructions quantity versus types of bots used

When the task became less detailed, bots were almost not used, but when tasks were judged as more detailed, the usage of bots rose – RPA 19.25%, writing 15.25%, talking and search equally 2.25%. Companies that declared

no change in the specificity of tasks also introduced bots to everyday routine, this time RPA and search equally 8.25%, writing bots 7%, talking bots 1.25%.

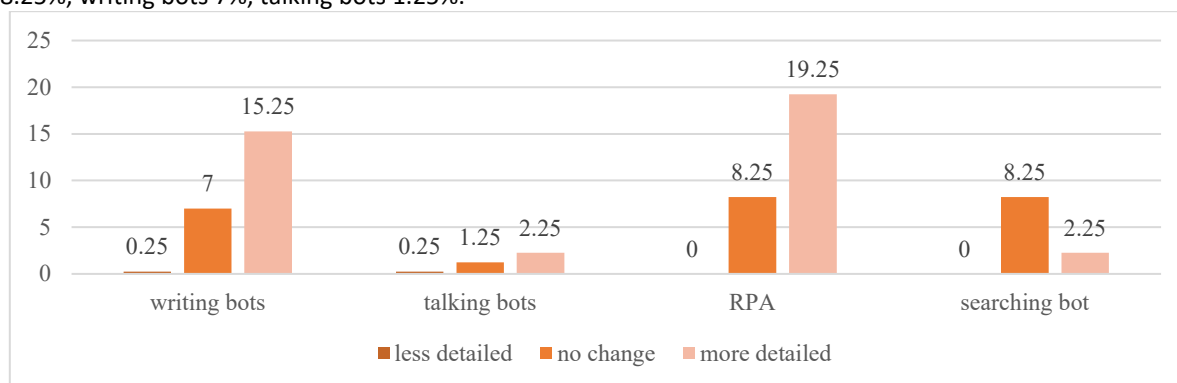


Image 8: Specificity of tasks versus types of bots used

4. Conclusion

1. The amount of instructions, regulations and documents was said to have risen in 9.50% of the companies researched, while it dropped in 18.25%. The specificity of tasks given to employees was declared as less detailed in 1.5% of researched companies, while 36% more detailed. The change in the amount of instructions was expected to be high in the unstable situation of lock downs and remote work, however, the numbers are far below 50%, which was surprising.
2. Companies more frequently declared that they did not use standardization than use it, but if they did standardize they standardized content more eagerly than form (44% content standardization to 37.50% form). It was expected that the form of communication is easier to be standardized than content, whereas research showed the opposite.
3. Medium companies responded that they used both content and form communication standardization most (20.75% and 17.50% respectively). Large companies were expected to use standardization most but perhaps they had standardized communication earlier, therefore there was not much left to standardize.
4. If companies introduce RPA bots they usually made the most use of it standardizing both message content and form. The same is true for writing bots.
5. When the specificity of tasks rises, companies eagerly use all types of bots. In the case of the number of instructions, the dependence is not so obvious.
6. Organizations use bots for RPA most (27.5%), and voice chatbots least (3.75%) for the tiring, repetitive work of combining different types of messages from different sources and files.

The evidence suggests that by implementing bots to do repetitive, boring and tiring jobs, employee's time can be devoted to more developing and innovative tasks.

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