The Use of AI-Based Assistance Systems in the Service Sector: Opportunities, Challenges and Applications

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Abstract. The growth in digitalization and, above all, the use of artificial intelligence offers major opportunities for companies but also poses substantial challenges. Current technology is beginning to reshape and redistribute the division of labor and the responsibility for decision-making between humans and technological systems. This necessitates new approaches to work design as well as new skills on the part of employees. This paper first considers various scenarios for the future of work and then focuses on the service sector. We examine the challenges that such scenarios represent as well as their potential to increase productivity while also reducing the workload on employees. On the basis of two examples of AI-based assistance in the service sector, we illustrate current and future uses of this technology.

Keywords: Future of work · Artificial intelligence · Assistance system · Work design · Service sector

1 The Evolution of Work in the Digital Age

"Artificial intelligence (AI) has emerged from the lab and is now permeating everyday life and the world of work at breathtaking speed" [1]. The growth in digitalization and, above all, the accompanying use of artificial intelligence (AI) are the subject of much discussion in political, business and academic circles worldwide [2, 3].

Digitalization – understood as the practically unlimited availability and analyzability of large volumes of data, the connectivity of cyber-physical systems within and among companies, and the redistribution of responsibilities between people and increasingly autonomous technological systems – is now remolding economic systems and social structures [4–6].[1]

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[1] "TransWork – Transformation der Arbeit durch Digitalisierung" (TransWork – the transformation of work through digitalization), a project funded by the German Federal Ministry of Education and Research (FKZ 02L15A160), examines these aspects.

The drivers of this change are new business models that, with the help of digital infrastructure, are now creating new value chains. This has unleashed trends such as a greater customer-centricity and the emergence of increasingly personalized services [5, 7].

At the same time, the use of new technologies such as AI-based assistance systems is changing the working environment. Artificial intelligence is a "branch of information technology, which uses algorithms in order to emulate, within a computer system, cognitive capabilities such as learning, planning or problem-solving. The concept of AI also denotes systems that exhibit behavior that would generally be held to presuppose human intelligence" [8]. As a self-learning system, AI is able to efficiently process abstractly described tasks and problems without each step having to be explicitly programmed by a human. Furthermore, such a system should be able to adapt to changing conditions and its environment [6, 8].

As the current discussion shows, the changes to the workplace brought about by digitalization present both challenges and opportunities for companies of all kinds. The advent of AI promises not only to increase productivity and enhance the use of resources but also, and most importantly, to generate major new market potential [9].

In order to utilize this potential – with regard to its technical, organizational and social aspects – it will be necessary to design new and intelligent work systems. This is a task now being pursued in the field of human factors engineering and ergonomics.

In this paper, we first consider various scenarios for the future of work and then focus on the service sector. In the process, we look at the current challenges facing the service sector as well as the potential of AI-based assistance systems to increase productivity while also reducing employee workload.

The impact on employment of increasing digitalization and, in particular, the use of artificial intelligence has been the subject of some controversy. For example, there are studies based on job categories that predict a widespread replacement of human tasks by (AI-based) automation over the next 10 to 20 years (see, for example, [10]). By contrast, studies focusing primarily on the likelihood of tasks being automated anticipate a substantially lower level of replacement (for an overview, see [11, 12]). Finally, forecasts based on specific digitalization scenarios assume that the overall impact on the labor market in the period until 2030 will be almost neutral [13, 14].

What all these studies underline is that over the next few years we can expect to see fundamental changes to the labor market as a result of the automation of various activities and the emergence of new tasks and jobs. All of these will involve the design of new forms of work [15].

The nature of these (future) jobs will be defined primarily by the way in which the human-technology interface is designed. Two scenarios illustrate how labor might be divided in the future: the specialization scenario (also known as the technology-as-tool scenario) and the automation scenario [16]. In the specialization scenario, technology assists in the human decision-making process and may also, on this basis, be used for employee-training purposes. At the same time, workers retain a larger share of responsibility for medium-order and, if appropriate, lower-order decisions. In the automation scenario, by contrast, (AI-based) technology is used to optimize processes and solve problems automatically. Given this reduction in employee autonomy, it is assumed that this scenario will entail a stark polarization in qualification levels – with,

on the one hand, low-skilled employees and, on the other, highly qualified ones being retained for a small number of residual tasks [3, 16, 17].

The challenge is therefore to design forms of work that remain humane while also promoting skills and boosting productivity. To achieve this, we need to generate synergies between human capabilities and the potential offered by technology. A good example here is the use of AI-based assistance systems that combine high technical performance with the human ability to react and adapt. Such systems provide employees with individually tailored support within an optimized work process. This not only improves work performance but also creates a working environment that fosters learning and innovation [18].

2   AI-Based Assistance Systems in the Service Sector

In a study conducted in 2019, Fraunhofer IAO asked company representatives – from the secondary and tertiary sectors – about the current and future role of AI within their own company. Of the companies surveyed, 75% said they were currently working on issues related to artificial intelligence. Sixteen percent of companies said they were already using concrete applications in this field and, on this basis, rated their current value to the entire company as "high" (4 out of 5 possible points) and expect them to become "increasingly important" (4.4 points) in the future. The study also shows that the chief benefits anticipated from AI are accelerated processes and increased workforce productivity. The majority of the companies already using AI employ it to assist with customer-related processes and processes with a high degree of customer interaction. AI-based assistance is primarily used in processes related to the provision of services (59%), followed by customer service and support (39%) [3].

The results of the study, along with an expectation that the transition to the digital economy will accelerate the structural shift towards more services, underscore the importance of looking more closely at changes in the service sector [13].

In contrast to manufacturing, the service sector involves a high degree of communication, coordination and cooperation with the customer. At the same time, it deals in an intangible, customized "product" with a high degree of customer input. As such, it features a host of areas in which digitalization can be used to improve productivity and help design forms of work that promote learning on the job [19, 20]. The use of digital assistants, especially those based on artificial intelligence, will create opportunities for new and innovative products, for the design of better and more-efficient processes, and for a speedier communication with the customer [6]. For example, AI-based systems can be used to provide employees with a highly versatile decision-making tool that analyzes data, provides updates on the job status and predicts future developments [21, 22]. This in turn helps remedy any temporary difficulties in service provision, thereby enhancing the entire process for the company, the workforce and the customer alike [19].

From a human factors and ergonomics perspective, it is important, when using artificial intelligence, to pay particular attention to the design of the decision-making architecture and the form of human-technology cooperation. In order to make proper use of employees' existing skills and to ensure they retain responsibility for certain

tasks, technology should essentially be used to provide assistance and support. In the case of AI systems equipped with advanced cognitive skills such as problem-solving abilities, it is particularly important to ensure that employees are still required to perform tasks that require a higher cognitive input, if the work environment is to remain one that promotes learning on the job. For the same reason, it is also important to avoid overburdening employees with tasks that require excessive cognitive input [3].

3   Examples of AI-Based Assistance Systems for Sales Representatives and Office Workers

In the provision of a service, both the provider and the customer are part of a collaborative, integrative process and therefore have an interdependent relationship [20]. Service provision is a process that contains both autonomous and integrative components. In the autonomous sphere, the service provider is responsible for instructing employees on processes and quality standards, and for gathering, processing and providing, in a structured form, all the relevant information for this purpose. In the integrative sphere, service provision also involves active cooperation and coordination with the customer. Individual customer specifications and highly dynamic processes – due, for example, to conflicting objectives on the part of different actors – make standardization difficult in the service sector [19, 20].

To increase the productivity of service-related activities, modifications can be made to each of the various elements of service provision: autonomous, relational and heteronomous. For example, productivity on the self-controlling, service-provider side (the autonomous element) is influenced by material and social factors such as standardization in work organization, process optimization and the use of technology. Alternatively, if the aim is to increase productivity by improving the interaction and communication with the customer (the relational element), this can be achieved by professionalizing interactive processes, both direct and indirect. Finally, potential for increased productivity also lies in ensuring that customer processes are compatible with established provider processes. This concerns customer coordination and management of the customer relationship (the heteronomous element). Designing these three elements in such a way as to increase productivity will result in an improvement along the entire value chain [19, 20].

The following two examples are intended to illustrate how AI-based assistance systems can be used to provide support for service-related processes.

In the first example, we consider the autonomous element of service provision on the basis of the principal tasks performed by a sales representative. In the autonomous sphere, there are three design approaches to increasing productivity in service-related activities: a technologizing of processes, a standardizing of processes, and learning on the job.

The chief task of a sales representative is to manage existing customer relationships and forge new ones. For this purpose, a sales representative must carefully prepare and document customer meetings. This demands a knowledge of each individual customer's needs and of any services and products they may already use. Sales representatives are each assigned a large portfolio of customers. This can make it difficult to

keep track of all the names and information. When preparing for a customer meeting, a sales representative will manually collate all the available data from a variety of company systems. An average day in the life of a sales representative is made up of meetings, unexpected alterations to the schedule, and downtime as a result of last-minute cancellations.

How might a new digital assistant help sales representatives to be better prepared for appointments and to make more productive use of downtime? Such a digital assistant uses AI-based methods to gather and summarize all the relevant customer information according to previously defined criteria. It therefore helps prepare the sales representative for all customer meetings as well as any appointments that are arranged at short notice so as to fill downtime. On the journey to the customer, the assistant provides the sales representative with concise and condensed learning nuggets – info modules, in either spoken or written form – that are user-specific and can be completed in a matter of minutes. These learning nuggets provide the sales representative with all the available facts on the customer – including recent reports, company information, services already used etc. It is an opportunity for the sales representative to refresh key facts while on the road – a courtesy that the customer will value.[2] The same applies when it comes to documenting the appointment: that evening, the sales representative can instruct the digital assistant, via voice command, to perform routine tasks such as updating the customer file. Following this voice input, the assistant will perform further AI-supported activities such as forwarding personal messages (e.g., compliments) and dispatching product information. In other words, the digital assistant enables employees to make more profitable use of their downtime.

The second example illustrates how an electronic listening assistant for use in communications with the customer can provide support in the relational sphere. Here, the design approach for increasing productivity in service-related activities is twofold: a technologizing of the informational elements and a professionalizing of the communicative and emotional elements [19]. A pilot application, currently being developed and tested at Fraunhofer IAO, provides support for call-center employees while on the phone. The digital assistant records, transcribes and analyzes the call in real time. On this basis, the assistant is able, for example, to identify the customer and then supply the hotline employee with the relevant customer file from the company system. While the customer explains the reason for the call, the digital assistant scans previous conversations for specific keywords so as to identify any opportunities for upgrading the current contract or marketing new business. These cross-selling and upselling recommendations are displayed onscreen to the hotline employee. At present, hotline employees must manually enter into the system every item discussed, either during or after the call. In this case, however, the electronic listening assistant automatically generates call notes and, if necessary, provides the employee with relevant contract documents or information material. This system is intended not only to improve customer communications and increase productivity in the value-creation process but also

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[2] "Learning Systems", an AI Innovative Center funded by the Baden-Württemberg State Ministry for Economic Affairs, Labor and Housing, is to evaluate by means of a quick check "DafNe" the feasibility of downtime optimization for sales representatives.

to lighten the employee's load. By providing product information specific to the employee's needs and learning nuggets containing details on current offers, it also enables the employee to learn about the precise content of selected services. At the same time, the data generated by the electronic listening assistant can be used for the purposes of machine learning, thereby contributing to the system's continuous enhancement and enabling the company to undertake validated improvements to services, processes and products.

It is therefore clear that AI offers potential in various spheres for designing work processes that not only promote learning on the job but are also more effective and efficient. However, the examples presented here also demonstrate that there is no one specific AI-based system that will improve a specific service. Indeed, there are many different design approaches. These include not only the development and utilization of digital tools and assistance systems but also, and above all, modifications to work organization and a requisite redesign of work activities and a reformulation of the related requirements made of employees. The identification of the most suitable design processes for this purpose and their implementation will remain major fields of research. Here, at Fraunhofer IAO, we will continue to investigate these topics.

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