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A note on the applications of artificial intelligence in the hospitality industry: preliminary results of a survey

Joanna Citak[a], Mieczysław L. Owoc[a,*], Paweł Weichbroth[b]

[a]*Wrocław University of Economics and Business, 118/120 Komandorska Street, 53-345 Wrocław, Poland*
[b]*Gdańsk University of Technology, Faculty of Electronics, Telecommunications and Informatics, Department of Software Engineering, Gabriela Narutowicza 11/12, Gdańsk 80-233, Poland*

Abstract

Intelligent technologies are widely implemented in different areas of modern society but specific approaches should be applied in services. Basic relationships refer to supporting customers and people responsible for services offering for these customers. The aim of the paper is to analyze and evaluate the state-of-the art of artificial intelligence (AI) applications in the hospitality industry. Our findings show that the major deployments concern in-person customer services, chatbots and messaging tools, business intelligence tools powered by machine learning, and virtual reality & augmented reality. Moreover, we performed a survey (*n* = 178), asking respondents about their perceptions and attitudes toward AI, including its implementation within a hotel space. The paper attempts to discuss how the hotel industry can be motivated by potential customers to apply selected AI solutions. In our opinion, these results provide useful insights for understanding the phenomenon under investigation. Nevertheless, since the results are not conclusive, more research is still needed on this topic. Future studies may concern both qualitative and quantitative methods, devoted to developing models that: a) quantify the potential benefits and risks of AI implementations, b) determine and evaluate the factors affecting the AI adoption by the customers, and c) measure the user (guest) experience of the hotel services, fueled by AI-based technologies.

1. Introduction

In the last few decades, the service sector has played a larger role in modern society. Among several sectors where intelligent technologies have been successfully implemented [11, 17, 48], those oriented towards customers, whereby

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* Corresponding author. Tel.: (+48) 507-017-111; fax: (+48) 71-36-79-611.
   E-mail address: mieczyslaw.owoc@ue.wroc.pl

strictly connected with fulfilling their needs and innovations addressed to the hospitality industry, seem to be quite promising and acceptable by customers.

With the help of AI, businesses operating in the hospitality industry are able to leverage their on-site services, processes and improve customer (guest) experiences. Keeping in touch with guests and fulfilling their needs is important, and is of interest for preserving overall quality. Since AI enables the delivery of personalized experiences, the concept of a smart hotel has recently been coined [29], gaining considerable attention of both academia [3, 23, 30] and business communities [13, 36, 45].

However, to the best of our knowledge, few studies have been devoted to the analysis of the artificial intelligence (AI) application penetration in the hospitality industry [2]. To fill this gap, this study aims to analyze and evaluate the state-of-the art research in this area by adopting a qualitative approach, in particular by using literature review and logic analysis. In this regard, we took advantage of the available information resources, namely Scopus and Google Scholar. It is worth noting that these providers are well-recognized and highly appreciated by the scientific community, covering scholarly literature from almost any discipline.

The rest of the paper is structured as follows. Section 2 is devoted to the related works. Section 3 presents methodology applied in the research followed by results and discussion of the obtained outcomes (Section 4). Finally, the last section concludes the paper with further research (Section 5).

2. Related Work

Regardless of the industry, the automation and robotization of business processes has proved to deliver considerable competitive advantage [42], by integrating AI technologies into the decision-making processes with corporate strategy [20]. Moreover, there is much evidence that AI is poised to drive innovation by accelerating the development of new services and products [4, 37, 50]. Now, however, one question arises: *what is artificial intelligence*?

Let's go back to 1998, when John McCarthy, one of the founders of the discipline of artificial intelligence, asked the same question. He claimed that "it is the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable" [28]. Since we support his view on AI, one should not forget that innumerable answers have been given so far, whereby having unrepentant supporters as well as strong opponents.

For a more detailed overview, the interested reader is referred to the works of Leg and Hutter [26], Kok *et al*. [21], and Dobrev [7]. Another interesting lecture regarding artificial intelligence applications can be found in studies of Owoc *et al*. [31, 32, 34], Pondel *et al*. [24, 39, 46], and Hernes *et al.* [12, 9, 5].

In recent years, artificial intelligence (AI) has been penetrating into different kinds of business sectors, including the hospitality industry [14, 18, 44]. Rather than serving as a replacement of humans [33], AI is generally seen as a supporting tool [15], processing and analyzing massive amounts of data with the aim of enhancing customer oriented processes [25]. Actually, the AI application rationale seems to be supported by the potential to increase organizational performance and reach strategic goals faster [47].

In this line of thinking, for instance, Ruel and Njoku claim that AI and robotics are expected to have important implications for the nature, structure and conditions of work [44]. Although the use of artificial intelligence within the hotel industry is still in the early stage in terms of research and deployment [51], one could already point to its successful practical applications. Due to the limitations of this study and the complexity of the topic, only a few examples are discussed below that we believe to have common occurrence and strong importance.

2.1. In-Person Customer Service

Due to the natural language processing techniques and ability to rapidly learn, AI solutions can "speak" in a human-like language [19, 49]. Typical activities, that can be held without an employee, concern room bookings, reservations, check-outs, answering customers inquiries, solving typical problems, or even assisting with hotel services.

The best example of this so far has been an AI robot called *Connie* [22], implemented by the Hilton group. The robot is able to provide tourist information to customers who interact with it. Most impressively, it is able to learn

from human speech and adapt to individuals. Ultimately, this means the more customers speak to it, the better it will get.

2.2. Chatbots and Messaging

AI chatbots have been utilized on social media platforms, allowing customers to ask questions and get almost instantaneous responses, 24 hours a day, seven days a week. This is invaluable to hotels, because it provides the type of response times that are almost impossible to maintain with human-to-human interaction. One of the most recognizable examples is *Sam* [41], intelligent travel chatbot, which is especially useful for frequent flyers and business travelers [40].

2.3. Business Intelligence Tools powered by Machine Learning

By definition, business intelligence (BI) is "a set of methodologies, processes, architectures and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making" [8]. Recent findings show an increase in studies regarding BI and Big Data in the hospitality industry [27].

The modern BI platforms are often combined with machine learning (ML) techniques to uncover hidden patterns and in-depth insight in data. Now, advances in processing power have made the development and executing of complex data models more accessible for the hospitality industry. An example of this has been seen with the Dorchester Collection hotel chain, which has made use of the *Metis* AI platform [10]. By using this technology, an organization is able to sort through data collected via surveys, online reviews etc. and the AI has been able to then analyze this to draw conclusions about overall entity performance.

2.4. Virtual Reality & Augmented reality

One of the most common uses of virtual reality in the hospitality sector so far, has been the creation of virtual travel experiences using 360 degree video technology. Through this, users can experience a virtual recreation of different aspects of travel, from the flight, to the arrival, and on to some of the key sights.

2.5. Findings

Artificial intelligence is playing an increasingly important role in hospitality management, primarily because of its ability to carry out traditionally human functions at any time of the day. Moreover, It is claimed that AI implementation can bring measurable benefits such as cost reduction, elimination of human error and delivery of better services [38].

It is worth noting, that the directions of development concern not only autonomous and on-site solutions, but also mobile applications, enabling customers to interact with a hotel's facilities and equipment [1]. Furthermore, one can observe the increase in the number of hotels with integrated voice command technology, having deployed the smart-voice tools as the personal assistants [43].

3. Methodology

The questionnaire comprised 19 questions. The aim of the survey was to examine the knowledge of artificial intelligence methods and openness to them, and to study the public's response to their use in the hospitality industry. The survey was conducted on-line between April and May 2021. The respondents were of different ages, live in towns and villages of different sizes and come from abroad or are currently staying abroad. Each of the respondents completed the questionnaire independently, i.e. without the interviewer asking questions.

The data were collected by using a Google Forms questionnaire. The link was sent via e-mail to the interested users. In total, 178 responses were recorded, and were subjected to further analysis, which was conducted by using the well-known spreadsheet software.

Fig. 1. The distribution of the respondents age.
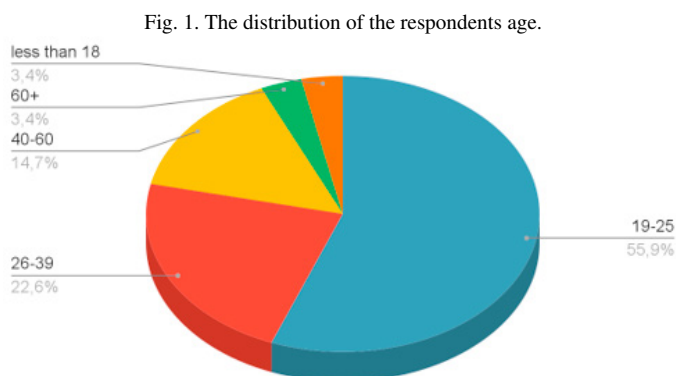
As one can see on Figure 1, more than half of the respondents belong to the 19-25 age group. The least numerous groups were people over 60 years old and under 18's (minors and school students). These were also the only groups of respondents in which the number of men and women were equal, as in the other groups, women dominate.
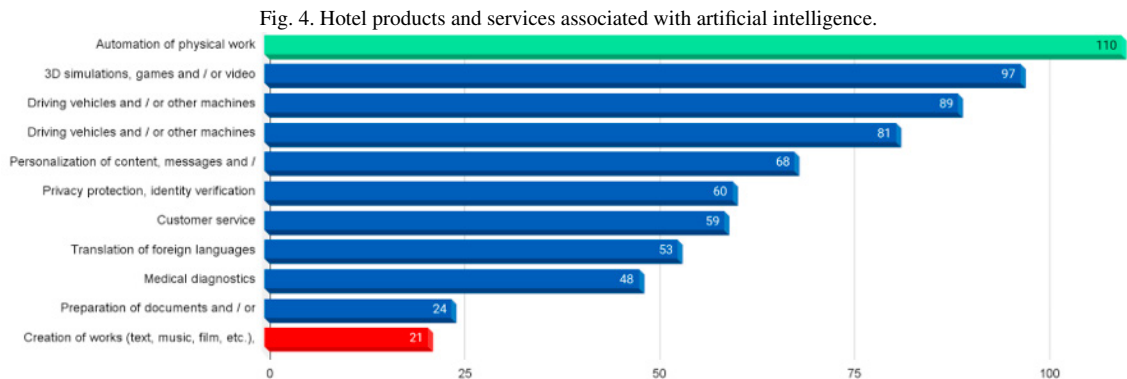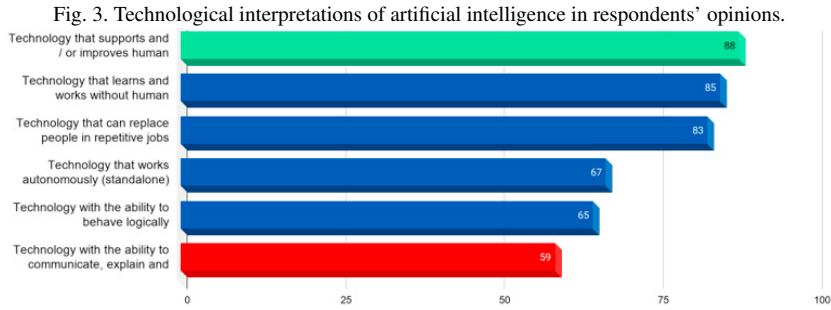
4. Results

4.1. Interpretation of AI

On the Figure 2, one can see that almost half of the respondents believe that their knowledge about artificial intelligence is sufficient, as about 30% believe that they have little knowledge. The least number of respondents think that they have no knowledge or have a lot of knowledge. The conclusions are very simple, as most people know about the existence of artificial intelligence, but their level of knowledge about it is relatively low. Taking into account the number of age groups (the majority of people being 19-25 years old), a different result could be expected, assuming that these are people who have been dealing with technology since childhood.

Fig. 2. Respondents knowledge about artificial intelligence in their own assessment.
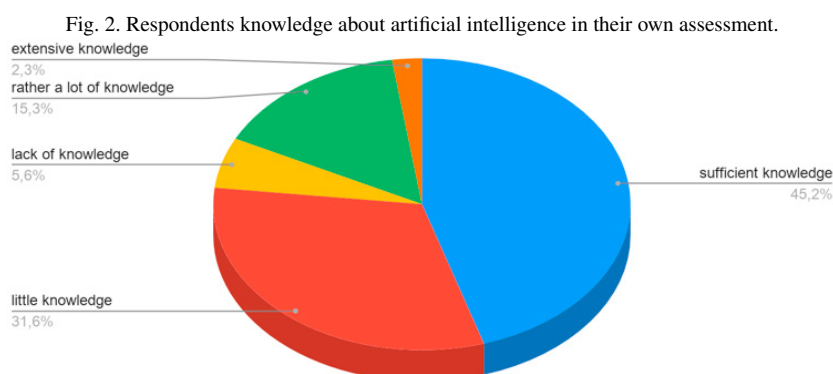
The respondents were asked to choose three answers that, in their opinion, best describe the term "artificial intelligence". The option chosen most often by almost half of the respondents is "technology that supports and/or improves human decisions". The least popular answer, which was voted on by every third respondent, is "technology with the ability to communicate, explain and solve problems". Moreover, a few answers also cast for the option: "A technology capable of learning and acting without human intervention". Figure 3 presents a summary of this topic.

The next task of the respondents was to select up to five types of services and/or products that, in their opinion, are most associated with artificial intelligence technology. In this regard, Figure 4 depicts a collection of answers provided by the sample of respondents.

Fig. 3. Technological interpretations of artificial intelligence in respondents' opinions.

Fig. 4. Hotel products and services associated with artificial intelligence.

The largest group of respondents indicated the automation of physical work. Moreover, 3D simulations, video games and driving were also ranked highly and were chosen by over half of the respondents. The lowest number of votes was given to creating works and artistic activity as well as preparing documents and/or analyzes.

4.2. Implementation of AI in the hotel sector

The respondents were asked to evaluate individual elements related to their stay in the hotel and assign each of them a score on a scale of 0-3 (where 0 = element completely unimportant, 3 = element very important).

Table 1. Opinions of respondents about of AI solutions in hotels.

Solutions	Answers			
	0	1	2	3
Opening doors with magnetic cards	5,1%	18,1%	28,2%	48,6%
Opening the door with facial recognition, fingerprint or eye scan.	34,5%	27,7%	18,6%	19,2%
Rooms controlled by telephone	17,5%	23,7%	30%	28,8
Self-service check-in / check-out	14,7%	20,9%	23,2%	41,2%
Humanoid robots (looking like humans) serving guests (e.g. at the reception desk)	52%	26,5%	13%	8,5%

The results show that the most important aspect for the respondents is contact with staff, including their smile and professional approach. The presence and interest of employees is very important for almost half of the respondents, and important for more than a third. A definite minority of respondents consider this element to be completely unimportant. Two elements - adjusting the room to the requirements and matching the references as well as the use of basic technological solutions (air conditioning, TV, Wi-Fi, magnetic cards), gathered very similar voices.

Almost half of the respondents consider these elements to be very important, less than 40% as important, and only about 3% as completely unimportant. The latest technological solutions were the least popular. The results show that we are accustomed to basic technology, which has been with us for a long time, and that hotel guests increasingly

appreciate the personalization of services. The lack of attention to highly technologically advanced elements was also shown.

The next question concerned the payment method by the eye (PayEye [35]), it was extended to three questions about security, convenience and choosing this method of payment.

Table 2. Respondents' answers on usefulness of the eye payments.

Questions	Answers				
	definitely yes	rather yes	hard to say	rather no	definitely no
Do you think that this way of making payments is safe?	10,2%	23,1%	32,2%	16,4%	18,1%
Do you think it is more convenient than paying by card / blick / phone?	11,9%	25,4%	30,5%	19,2%	13%
Would you choose this way of making payments?	8,5%	13,6%	17,5%	28,8%	31,6%

Most of the respondents would rather not and would definitely not choose this method of making payments, over 30% of respondents are also not able to determine whether this method of payment is safe and more convenient than standard card / telephone payments or the newer Blik method. This is probably due to the lack of knowledge of such a payment method, which was introduced to the market relatively recently, especially in Poland.

4.3. Supporting hotels through artificial intelligence solutions

Another question concerned the use of artificial intelligence solutions during a pandemic. More than three quarters of the respondents believe that it is definitely important, and almost half believe that it is rather important to look for modern technology solutions that would facilitate a safe stay, as almost every tenth respondent is of a different opinion. Over 15% of respondents do not have an opinion on this subject.

Fig. 5. Opinions of respondents on importance of intelligent technology during pandemia.
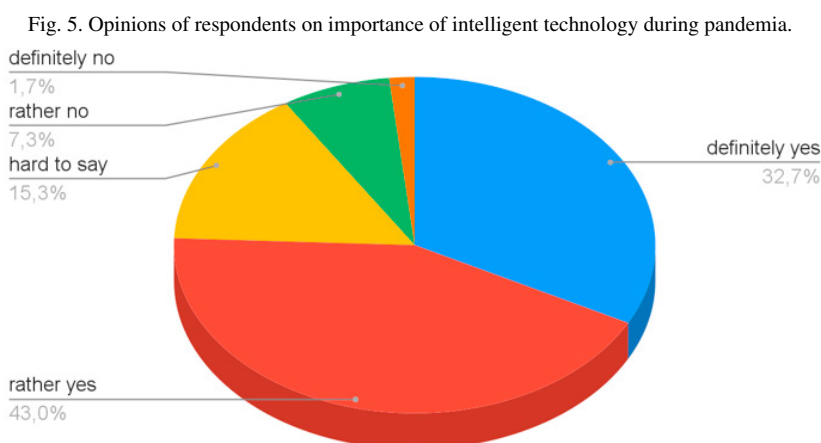
On the one hand, one should not forget the AI is claimed to be a key player in fighting with the COVID-19 pandemic [6, 16], which is the worst health emergency the world has seen in the last century.

5. Conclusions

Orientation on supporting customers through offering different services using intelligent technologies seems to be very obvious. The implementation of innovations in the hotel sector can also attract customers and be helpful for the staff (though not in every case). Customers are different and sometimes don't want to change their habits staying in hotels. Our research was performed during the pandemic period, so for current clients it was definitely a non-typical time, but applied technologies became relatively helpful.

Our findings can be summarized as follows. Firstly, they are simply a few elements of research concerned with the implementation of AI in the hotel industry. Secondly, levels of AI solutions in hospitality units are different - in the case of hotel networks, the process of using innovations looks better. Thirdly, knowledge about AI and its applications is rather limited despite the relatively young age of respondents. Finally, according to customer opinions, automation of physical work and services connected with leisure are the most expected, while translation, the preparation of documents and activities connected with creativity are not important. Last but not least, the most important AI solutions in the hotel services are self-service check-in/check-out and supporting guest's entering or exiting the hotel. Yet, our respondents indicated that the aid of the humanoid robots are still an unattractive facility.

Future studies might concern both qualitative and quantitative methods, with regard to developing models that: a) quantify the potential benefits and risks of AI implementations, b) determine and evaluate the factors affecting the AI adoption by the customers, and c) measure the user (guest) experience of hotel services, which are fueled by AI-based technologies.

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