

AI in Restaurant Business: a Challenge for Science and Practice in Serbia

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Abstract

The present research analyzes the current state of AI (artificial intelligence) in the restaurant sector in Serbia. Google survey based on relevant key words (artificial intelligence, restaurant, gastronomy, and restaurant business) estimate high level of presence technological companies offering solutions for restaurants. But, process of AI implementation is relatively slow in Serbia, and the main aspect of AI use is substitution of human tasks by AI. Survey of Serbian scientific database "Scindeks" shown scientific research of AI in the field of restaurant business is far behind the developed countries. Screening the use of AI in Serbian restaurants based on polling of 48 managers indicate that AI application in Serbian restaurants is limited. In general, staff has low level of knowledge and development of skills about AI, but they are ready to learn. Also, as consequence of that situation, level of representation of AI in restaurant is low.

Key Words:

Artificial intelligence, Restaurant business, Technology, Smart Business

Introduction

Innovations in the restaurant industry imply any changes, whether it is a complete novelty, a novelty taken over from the competition or an improvement of already existing products and services (Su, 2011). Lee, Hallak, and Sardeshmukh (2016) distinguish five possible areas of innovation (product, service, process, management and marketing innovation). Unlike manufacturing activities, there are some specifics in the restaurant business. Restaurant products are made of tangible (product in the classical sense) and intangible (service) components (Shcherbak, 2016). Also, restaurant products are difficult to protect with patents and copyrights, but their continuous introduction into restaurants provides a competitive advantage. Another characteristic of restaurant services compared to industrial services (where machines are increasingly used) is the more significant involvement of staff in the service process (Shcherbak, 2016). Also, for employees in restaurants, there is no scheduled part of working time to deal with the development of innovations, so innovations are mostly the result of teamwork realized during working hours as part of regular work activities (Albors-Garrigos, Barreto, García-Segovia, Martínez-Monzó, & Hervás-Oliver, 2013).

Innovations in the restaurant industry can be achieved by introducing: 1) culinary innovations (Lee et al., 2016), 2) innovative equipment (Albors-Garrigos et al., 2013), 3) innovative services (Lee et al., 2016), 4) innovative food preparation and serving techniques (Albors-Garrigos et al., 2013), 5) marketing innovations (Lee et al., 2016), 6) innovative design and atmosphere (Ivkov, Blešić, Simat, Demirović, Božić, & Stefanović, 2016), 7) innovative technologies (Shcherbak, 2016), 8) innovation in management (Lee et al., 2016; Shcherbak, 2016), 9) eco-innovation (Sharma, Chen, & Liu, 2020), etc.

Artificial intelligence (AI) is a relatively new technology based on the simulation of human intelligence operations by computer (Wang, Di Renzo, Stanczak, Wang, & Larsson, 2020). The application of this technology helps people to achieve better business results, but its use requires new knowledge and skills (Ruel, & Njoku, 2021). It use require a detailed understanding of how to take advantage new opportunities and technologies in order to perform required tasks in particular business (Davenport, & Ronanki, 2018). Many studies are focused on investigation possible applications of AI in restaurant business considering the applicability and effects of AI in business processes (Berezina, Ciftci, & Cobanoglu, 2019, Ivanov, Gretzel, Berezina, Sigala, & Webster, 2019, Maier, & Edwards, 2020), while detailed empirical data are limited due to low adoption AI in practice (Ivanov et al. 2019; Cain, Thomas, & Alonso, 2019). But, it can expect that increasing academic interest in AI in the restaurant business (Berezina et al. 2019; Blöcher, & Alt, 2021) will contribute to transfer of AI to practical activities.

AI can be applied in different industries and services like smart farming, food processing industry, healthcare industry etc., including restaurant business (Blöcher, & Alt, 2021, Indrajeet, Jyoti, Noor, & Shah Nawaz, 2021, Lee, & Yoon, 2021, Li, Yin, Qiu, & Bai, 2021). For example, machine learning (ML) application is useable for different aspects of restaurant business: ML in food delivery, AI-based customer feedback system, food vending terminals and applications, AI-based online restaurant search engine, voice assistants, self-ordering kiosk system, robotics for food industry and revenue predicting using ML (Indrajeet et al. 2021). Although AI technology is not completely new, its application in restaurant business is recent phenomenon. But, the adoption of AI in restaurant industry can lead to improvements in customer service processes and productivity growth (Berezina et al. 2019; Blöcher, & Alt, 2021, Daradkeh, Hassan, Palei, Helal, Mabrouk, Saleh, Salem, & Elshawarbi, 2023). Also, the development of robots for restaurant business is attractive. That includes either virtual service robots (i.e. chatbots, digital assistants) or physical robots (Murphy, Gretzel, & Pesonen, 2019, Santiago, Borges-Tiago, & Tiago, 2024, Spence, 2023).

In general, AI application in restaurant business was much more discussed by researchers from the US or Asia than by researchers from the Europe (Blöcher, & Alt, 2021). According to our knowledge, this topic almost was not the subject of researchers from Serbia. Therefore, through this research we wish to obtain basic information about AI application in restaurant business in Serbia and answer to research questions: What is current situation with the use of AI in the restaurant industry in Serbia?

Methodology

This study consist of three parts: 1) general analysis of data about AI in restaurant sector based on search relevant documents on Google; 2) analysis scientific papers subjected to AI in restaurant business; 3) screening use of AI in Serbian restaurants.

General analysis of data about AI in restaurant sector was conducted using adapted methodology described by Blöcher & Alt (2021), who studied AI and robotics in the European restaurant sector. Therefore, first step was data collection by search relevant documents on Google. For this aim several key words on Serbian were used: artificial intelligence, restaurant, gastronomy, and restaurant business. Initial search using keywords artificial intelligence and restaurant resulted in 308.000 documents. When word gastronomy was added number of documents was reduced to 8.700. After that restaurant business as additional key word was added and number of documents was reduced on 7.510. These documents can be mainly classified as newspaper articles, announcements on informative internet portals, announcements on the websites of educational and scientific institutions, announcements on the websites of companies. By reviewing the offered documents, those whose content is relevant to the research objective were singled out. The final number of documents was 68. Based on content of those documents we analyzed: 1) application fields of AI in Serbian restaurants; 2) which type of AI are included in that applications; 3) response of costumers and service provider to the use of AI in restaurants.

Analysis scientific papers subjected to AI in restaurant business were realized based on review scientific papers in scientific database Scindeks (information system that covers all scientific fields and

contains all scientific papers published in Serbia). Based on the keywords, artificial intelligence and restaurant not a single scientific paper was found in the database. Search repeated only with keyword artificial intelligence and list a list of 98 scientific papers was selected. Selected papers were studied to determine if any of their segments touch on the application of AI in the restaurant industry.

Screening the use of AI in Serbian restaurants was realized based on analysis of 48 restaurants from 5 cities (Belgrade, Novi Sad, Kragujevac, Niš, Zrenjanin). On the portal www.tripadvisor.com 20 best ranked restaurant from mentioned 5 cities were selected. E-mail given on this portal used to ask restaurant managers to answer a short questionnaire, and link to a Google questionnaire was added. The survey conducted in January 2024. The instrument used in this study was designed on the basis of eight elements (items) describing use AI in restaurants: 1) level of knowledge about AI between staff of restaurant; 2) level of representation of AI in restaurant; 3) development of staff skills for using AI; 4) willingness of staff to learn the new skills needed to use AI. The questionnaire consisted of eight closed-ended Likert-type questions rating the items. All questions were measured using a Likert scale of 1 (strongly disagree) to 5 (strongly agree). Total 48 managers from contacted restaurants answered. Data analysis was done using the One-way ANOVA and t-test (using statistical package STATISTIKA 5.0).

Results interpretation

General analysis of data about AI in restaurant sector

Data obtained from documents selected for analysis indicate many opportunities for AI application in restaurant business in Serbia. AI can be used in restaurants for ordering food using mobile applications or websites, for the process of creating personalized offers, analyzing data about consumers in order to align business with their requirements and needs. Several documents were shown that there are many solutions for application of AI in high quality restaurants. Also, several technological companies offer solutions which support one or several different activities in restaurant process of work. From 26 companies which offer AI solutions for restaurants 20 is focused on applications for reservations, food ordering and assisting waiters in tracking orders and billing. Data obtained by Blöcher, and Alt (2021) point to the wider application of AI in restaurant business in Europe including application in front-of-house processes (reputation management, marketing, reservation, customer operations) and in back-of-house processes (management of business and finance, supply chain management, food and beverage preparation, human resources). Kreutzer, and Sirrenberg (2020) categorized AI applications to four application fields: natural language processing (NLP), computer vision, (3) robotics, and (4) expert systems. According to data from 68 documents found in a Google search, the current application in the Serbian restaurant industry can mostly be characterized as natural language processing. The main aspect of AI use is substitution of human tasks by AI. Namely, AI can substitute humans in different activities including food preparation and distribution, ordering process dishes, online reservation, choice of menu, payment choices, ads etc. (Hanks, Line, & Mattila, 2016). In Serbia, some restaurants use chatbots to inform users about the menu and ingredients of the dishes. Also, some restaurants use virtual assistants who answer users' questions, make reservations, and recommend dishes that match the user's requests. Although AI offers numerous benefits for restaurants, research shows that service users do not have a favorable reaction to its implementation (Nozawa, Togawa, Velasco, & Motoki, 2022). Similar to that, despite the various possibilities that AI offers for the improvement of restaurant business, process of AI implementation is relatively slow in Serbia. The reason is the fact that the mentality of the population is such that it is difficult to accept novelties. However, the implementation of new technologies is inevitable and can be expected to grow in the future.

Scientific research of AI regarding restaurant business

Despite research of AI in all sectors including restaurant business is very actual and focus on many different aspects in many parts of world (Berezina et al., 2019, Blöcher, & Alt, 2021, Daradkeh et al., 2023, Li et al., 2021), situation in Serbia is opposite. Based on survey of Serbian scientific database "Scindeks" it is evident scientific research of AI in the field of restaurant business is far behind the developed parts of the world. Although Serbian scientists in other fields of science are very active in AI

research, only one paper was published in the field of hospitality. This paper investigates digital skills in tourism and hospitality as precondition for AI implementation in that sector (Lazić, Bradić Martinović, & Banović, 2023).

Despite the fact, AI is increasingly used in the food and hospitality industry, its application in Serbian restaurants is limited. Managers of Belgrade restaurants evaluated use of AI in restaurants. Based on their responses, items were ranked according to importance (Table 1). According to the analysis of descriptive parameters, items whose scalar averages (Mean) range from 1.86 to 3.64. On the list of four items, “Willingness of staff to learn the new skills needed to use AI” occupies the first position with an average score of 3.64. Namely, managers of restaurants consider that willingness of staff to learn the new skills needed to use AI is medium. Slightly lower values of scalar averages were determined for the following items: “level of knowledge about AI between staff of restaurant” – 2.48; “Development of staff skills for using AI” – 2.22. Item “Level of representation of AI in restaurant” had value 1.86, indicating very low level of representation of AI in restaurants.

Table 1: Elements of AI use in Serbian restaurants

Position	Item	Mean	SD	SE
1.	Willingness of staff to learn the new skills needed to use AI	3.64	0.977	0.095
2.	Level of knowledge about AI between staff of restaurant	2.48	1.122	0.062
3.	Development of staff skills for using AI	2.22	1.131	0.074
4.	Level of representation of AI in restaurant	1.86	0.956	0.066

Notes: 1= strongly disagree; 5= strongly agree; SD – standard deviation; SE – standard error
Source: Author’s research

Obtained results are in accordance with finding of Dani, Rawal, Bagchi, and Khan (2022) who estimate that still many people are unaware of the potentials that AI posses. Although Ivanov, Kuyumdzhiev, and Webster (2020) concluded that the stimulation effect of AI may motivate workers to improve skills so as to avoid being replaced by the new technology, our results are less optimistic. But, taking into account that staff in sample restaurant has relatively low level of knowledge and development of skills, which coincide with low level of representation of AI in Serbian restaurants, it is necessary to stimulate staff education in field.

Implications for the advancement of hospitality research and practice

In accordance with need for more research on application AI technology in restaurant business this paper analyzed the current situation in Serbia. Taking into account the fact this topic was not be subject of scientific research, we expect that results of this paper will contribute to activation of scientists to direct investigation to this area. The paper provided empirical evidence about availability offers of technological companies, but also are summarized options of AI is available on Serbian market. Also, collected data should offer practical guidance for decision makers in the restaurant sector.

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