ЕКОНОМИКА
ISSN 0350-137X, EISSN 2334-9190, UDK 338 (497,1)
Vol. 70, july-september 2024, № 3
P. 1-9

Nikola Ćurčić[1],
"Tamiš" Research and Development Institute, Pančevo

Aleksandar Grubor[2],
University of Novi Sad, Faculty of Economy in Subotica

Boris Jevtić[3],
University Union Belgrade, Computing Faculty RAF

ORIGINAL SCIENTIFIC ARTICLE
DOI: 10.5937/ekonomika2403001C
Received: July, 02. 2024.
Accepted: September, 04.. 2024.

IMPLEMENTING ARTIFICIAL INTELLIGENCE IN TRAVEL SERVICES, CUSTOMER SATISFACTION GAP STUDY AT SERBIAN AIRPORTS

Abstract

AI technologies have significantly transformed various sectors, including travel and airport operations. This research aims to investigate the implications of implementing artificial intelligence (AI) in airport services on passenger satisfaction and overall travel experiences, as well as how AI technology shapes the way airports support passengers throughout their journey. The study conducted empirical research at Serbian airports with a sample size of 668 passengers. Participants provided their attitudes and satisfaction ratings on 10 statements regarding the impact of AI technology implementation in airport services. The findings from regression analysis reveal a high level of AI implementation in airport services, particularly concerning passenger experience and security. However, passengers express less satisfaction with the implementation of chatbots and virtual assistants, AI algorithms, and certain AI tools that do not meet their expectations. Specifically, passengers feel they do not always receive sufficient instant responses, real-time flight information in the case of delays, or effective issue resolution at the analyzed airports. These results contribute valuable insights to the AI literature and offer implications for future implementations of these technologies in industry, marketing, and technology development. Moreover, they can guide managerial practices and investments in future digital technologies aimed at enhancing passenger experience.

Keywords: *artificial intelligency, passanger satisfaction, passanger experience, Serbia, travel industry.*

JEL: *M15, Q31, Z32, 014, R41.*

ПРИМЕНА ВЕШТАЧКЕ ИНТЕЛИГЕНЦИЈЕ У УСЛУГАМА АВИПРЕВОЗА, ГЕП СТУДИЈА ЗАДОВОЉСТВА КОРИСНИКА НА АЕРОДРОМИМА У СРБИЈИ

Сажетак

Технологије ВИ су значајно трансформисале различите секторе, укључујући путовања и аеродромске услуге. Ово истраживање има за циљ да

[1] curcic@institut-tamis.rs, ORCID ID /0000-0003-3375-2690

[2] aleksandar.grubor@ef.uns.ac.rs, ORCID ID /0000-0001-9798-0401

[3] boris.jevtic10@gmail.com, ORCID ID /0000-0001-9497-0582

проучи импликације примене вештачке интелигенције (ВИ) у аеродромским услугама на задовољство путника и укупна искуства путовања, као и на то како ове технологије обликују начие на које аеродроми подржавају путнике током њиховог путовања. Спроведено је емпиријско истраживање на српским аеродромима на узорку од 668 путника. Учесници су дали своје ставове и оцене задовољства на 10 изјава у вези са утицајем примене ВИ технологије у аеродромским услугама. Налази из регресионе анализе откривају висок ниво примене вештачке интелигенције у аеродромским услугама, посебно у погледу искуства путника и њихове безбедности. Испитаници су, такође изразили мање задовољства код примене четботова и виртуелних асистената, алгоритама вештачке интелигенције и одређених ВИ алата који не испуњавају њихова очекивања. Сматрају да не добијају увек тренутне одговоре, информације о лету у реалном времену у случају кашњења, недовољна је ефикасност у решавању проблема на анализираним аеродромима. Ови резултати доприносе литератури о вештачкој интелигенцији, маркетингу, искуству коринсика, као и подтицању будуће примене ових технологија у индустрији. Доприноси и менаџерској пракси и улагањима у будуће дигиталне технологије са циљем побољшања искуства путника.

Кључне речи: *вештачка интелигенција, задовољство путника, искуство путника, Србија, туристичка привреда*.

Introduction

As opportunities expand and societal interests evolve, more people are inclined to travel and explore new destinations. The demand for air travel is projected to continue rising, forecasted to 8.2 billion annually by 2037 (IATA report, 2024). The growth is expected to generate substantial global benefits, potentially supporting 100 million jobs over the next 20 years. While this growth represents a significant success for the aviation industry, it also poses considerable responsibilities for airports and airlines. To manage the associated safety risks, strict regulations for passengers, staff, and aircraft must be rigorously enforced. Effective management is crucial to ensure safety throughout airport processes and flights, necessitating updates to handle the increasing number of passengers. Passengers now seek a connected, safe, secure, seamless, efficient, and highly personalized travel experience. Technological advancements (Miletić et al., 2020; Špiler et al., 2023; Jevtić et al., 2014; 2020; 2024), adoption of digital processes for assessing and identifying travelers' needs have significantly impacted the aviation industry (Ćurčić & Grubor, 2023; Srebro & Jevtić, 2024; Srebro et al., 2024). Consequently, the authors conducted empirical research with 668 passengers from Serbian airports in 2023 to assess passenger's satisfaction with the level of AI implementation in airport services, as an extension to bigger research on relations of peeved quality of airport services (Ćurčić, 2023). The paper addresses the following research questions: RQ1: How satisfied are customers with the AI-based services provided at these Serbian airports?, RQ2: What are the primary discrepancies between customer expectations and actual experiences with AI technologies in travel services at Serbian airports?, RQ3: Which AI technologies are

most effective in enhancing customer satisfaction in the context of travel services at Serbian airports?, RQ4: What enhancements can be made to current AI implementations to better align with customer expectations and enhance overall satisfaction? The abstract, introduction, and literature review are provided in the first part of the paper, while the research description, final results, discussion, conclusion, and references are presented in the second part.

The paper addresses the following research questions: RQ1: How satisfied are customers with the AI-based services provided at these Serbian airports?, RQ2: What are the primary discrepancies between customer expectations and actual experiences with AI technologies in travel services at Serbian airports?, RQ3: Which AI technologies are most effective in enhancing customer satisfaction in the context of travel services at Serbian airports?, RQ4: What enhancements can be made to current AI implementations to better align with customer expectations and enhance overall satisfaction? The abstract, introduction, and literature review are provided in the first part of the paper, while the research description, final results, discussion, conclusion, and references are presented in the second part.

Literature review

Main Artificial Intelligence Technologies Implemented in Airport Services Concerning Customers is:

- Facial Recognition Systems, employed for security and boarding processes to enhance efficiency by quickly and accurately verifying passenger identities. The implications of using facial recognition technologies in airports and other settings, particularly concerning privacy and bias, are discussed in works by Ho et al., 2024; Yeung et al., 2020);
- Automated Check-In and Bag Drop. AI-powered kiosks allow passengers to check in and drop off their luggage without human assistance, reducing wait times and streamlining the process. Self-service bag drop systems enhance the passenger experience by reducing congestion, improving space utilization, and increasing passenger satisfaction, though initial resistance from passengers unfamiliar with the technology is noted (BEUMER Group, 2021). Additionally, automated bag drop systems are crucial for streamlining airport operations, improving efficiency, and managing increased passenger volumes while reducing manual labor costs (AIQ Consulting, 2022);
- Chatbots and Virtual Assistants. These AI technologies provide real-time customer support, answering queries related to flight schedules, gate information, and general airport services through text or voice interfaces. Agarwal et al. (2022) provide a comprehensive analysis of the literature on chatbots and virtual assistants across various industries, including airport services, highlighting technological advancements and research trends in this field. Bălan (2023) systematically reviews the business research literature on chatbots and voice assistants, emphasizing their transformative role in the customer interface across sectors, including travel and hospitality. The adoption of AI chatbots in travel and tourism services is examined by Springer

(2023), focusing on how these technologies enhance customer service, streamline operations, and improve the overall passenger experience, as well as exploring future trends; Personalized Customer Service. AI algorithms analyze passenger data to offer personalized recommendations and services, such as lounge access, dining options, and retail offers. Research by Ryu and Park (2019) and Redha (2013) provides insights into personalized customer service in airports, including customer relationship management, passenger behavior and satisfaction, the impact of service quality on the overall experience, and systematic literature reviews on personalized services;

- Security Screening Enhancements. AI technologies improve the effectiveness of security screenings by analyzing X-ray images, detecting prohibited items more accurately, and speeding up the screening process. Enhancing security screening at airports is critical for ensuring passenger safety and preventing security threats (Alrayes et al., 2022);
- Language Translation Services. AI-powered translation tools assist international travelers by providing real-time translations of signs, announcements, and customer service interactions. These services are vital for facilitating communication between passengers and airport staff, particularly in international airports.

Methodology

The empirical research sample consists of 668 respondents, passengers in transit, either transferring, departing, or arriving at airports in Serbia in 2022, during defined times. Data was collected online using a structured questionnaire, which included 8 general questions about the respondents' profiles and 10 statements related to the key research variables. The study defines the independent variable as the Level of AI technologies used in airport services (LAI) and the dependent variable as the Passenger's Satisfaction Level (PSL). The hypothesis formulated for this study posits that the level of AI technologies implemented in airport services (LAI) significantly impacts the level of passenger satisfaction (PSL). Table 1 presents descriptive statistics, including frequencies and probabilities, detailing the profile of the respondents.

Table 1. Descriptive Statistics on Respondent Profiles

Level	Sub-Level	Count	Prob
Airports/Serbia	Belgrade	404	0.60479
	Niš	264	0.39521
Gender	Female	277	0.41467
	Male	391	0.58533
Level of education	Higher education	361	0.54042
	Secondary education	307	0.45958

Level	Sub-Level	Count	Prob
Age	(18-28)	140	0.20958
	(29-42)	262	0.39222
	(43-56)	208	0.31138
	(57-65)	45	0.06737
	(>65)	13	0.01946
Social status	Employed	561	0.83982
	In pension	13	0.01946
	Unemployed	94	0.14072
Level of personal income (€)	>1000	117	0.17515
	From 300-500	158	0.23653
	From 501-700	208	0.31138
	From 701-1000	185	0.27695
Travel experience	With	449	0.67216
	Without	219	0.32784
Travel direction	Departure / Arrival	596	0.89222
	Transfer	72	0.10778
Total		668	1.00000

Source: Authors' calculations

The study employed correlation and regression analyses, performed using SAS JMP 17 software. Respondents rated their opinions on a weighted Pearson scale from 1 to 5, where 1 signifies complete dissatisfaction, 2 signifies partial dissatisfaction, 3 signifies neutrality, 4 signifies partial satisfaction, and 5 signifies complete satisfaction (T.2).

Table 2. Distribution of respondents' attitudes towards various statements

Claims	Attitude				
AI technologies level in the airports' services (LAI)	1	2	3	4	5
LAI1. Personalized travel recommendations enhance the overall travel experience.	41	70	89	270	198
LAI2. Chatbots and virtual assistants provide instant responses, real-time flight information, and issue resolution.	42	73	97	261	195
LAI3. AI-driven facial recognition technology automates check-in, security screening, and boarding, optimizing passenger flow, reducing wait times.	36	70	107	259	196
LAI4. AI algorithms improve booking and reservation processes	71	74	174	121	228
LAI5. AI-driven video surveillance systems significantly enhance passenger and airport security.	41	73	94	276	184
Passenger's satisfaction level (PSL)					
PSL1. Passenger satisfaction is the process of evaluating how well the AI technologies used in airport services meet passengers' needs.	47	69	93	271	188
PSL2. Passenger satisfaction also includes dissatisfaction when the level of AI technology used does not meet their expectations.	73	95	220	157	123
PSL3. The value of airport services matches the price paid by the passenger.	28	38	62	129	411

PSL4. Passenger satisfaction is an emotional response to the experience (pleasant/unpleasant) with the level of AI technology used in airport services.	43	82	107	256	180
PSL5. Passenger satisfaction with airport services is an expression of happiness resulting from the development of the passenger's own digital skills.	49	69	104	260	186

Source: Authors

Results

Table 3. Means and values and standard deviation for the variables

Variables	Mean	Std Dev
AI technologies used in the airports' services (LAI)	3.7086826347	1.1620625054
Passenger's satisfaction level (PSL)	3.7233532934	1.1406590119

Source: Authors

The data in Table 3 indicates that AI technologies are relatively well integrated into airport services at Serbian airports. The average value for the level of AI integration (LAI) is 3.709, and the average passenger satisfaction level (PSL) is 3.723, suggesting a generally high level of satisfaction among respondents. The standard deviation for LAI is 1.162, indicating some variability in perceptions of AI technology use, with some respondents perceiving a high level of use. Similarly, the standard deviation for PSL is 1.141, reflecting variability in passenger satisfaction and indicating diverse experiences and satisfaction levels among passengers. Regarding the gap study for the statements, the research results show that passengers believe: LAI2: Chatbots and virtual assistants do not provide sufficient instant responses, real-time flight information, or issue resolution at the analyzed airports. Similarly, LAI4, which concerns AI algorithms improving booking and reservation processes, received lower scores (mean value 3.54, standard deviation); and PSL2 (mean value 3.24, standard deviation): Passenger satisfaction includes dissatisfaction when the level of AI technology used does not meet their expectations, also received lower scores.

Table 4. Parameters

Term	Estimate	Std Error	t Ratio	Prob>|t|	Std Beta	VIF
Intercept	0.1588869	0.030028	5.29	<0.0001	0	.
AI technologies used in the airports' services (LAI)	0.9611139	0.007727	124.39	<0.0001	0.979148	1

Source: Authors

From Table 4, it can be concluded that both coefficients (Intercept and AI technologies level used in airport services (LAI)) are highly statistically significant, with p-values less than 0.0001. This indicates that both coefficients are significant predictors of the dependent variable, passenger satisfaction level (PSL). According to the passengers' assessments, the level of AI technologies used in airport services (LAI) has a very strong positive effect on PSL, with a standardized beta coefficient of 0.979148. This implies

that an increase in the level of AI technologies significantly and positively correlates with, and thus increases, passenger satisfaction (PSL). Low standard errors (0.030028 for the intercept and 0.007727 for the level of AI technologies) indicate high precision in the coefficient estimates. A VIF value of 1 for the level of AI technologies indicates no multicollinearity issues, suggesting that the research model is stable and the coefficients are reliably interpretable. Respecting above results the further formula can be defined:

$$\text{Passenger's satisfaction level (PSL)} = \\ = 0.1588869 + 0.9611139 \cdot \text{AI technologies level in the airports' services (LAI)} \quad (1)$$

This function shows that, with a constant intercept value of 0.1588869, each one-unit increase in the level of AI technologies used in airport services (LAI) contributes to an approximate increase of 0.9611139 units in passenger satisfaction level (PSL). The dominance of higher education among the sample, along with a higher proportion of frequent travelers (67%), influenced the research results favoring the utilization of AI technologies in airport hubs. This trend is further accentuated by the predominance of younger travelers who actively seek AI tools to evaluate airport service quality, reflecting their digitally savvy nature and specific travel service requirements. Additionally, the significant presence of employed travelers in the sample further reinforces this inclination towards AI technology adoption. Based on given analysis, the research hypothesis can be confirmed H_0= AI technologies implemented in airport services (LAI) has a significant impact on passenger**'s** satisfaction (PSL). (The assessment of statistical significance it is [$F(1, 666) = 15472.23$, $p < 0.0001$].

Conclusion

The research on AI technologies used at Serbian airports, assessed through passenger feedback, indicates a generally positive outcome concerning customer satisfaction and the level of AI implementation. Passengers' assessments reveal a strong positive correlation between AI integration and their satisfaction levels. The findings demonstrate that AI technologies are relatively well integrated into airport services at Serbian airports. However, there is notable variability in passenger experiences and satisfaction levels. The gap analysis identifies specific areas requiring improvement, including the performance of chatbots and virtual assistants in providing instant responses and real-time flight information, as well as the effectiveness of AI algorithms in booking and reservation processes. These tools did not consistently meet passenger expectations. This research highlights the substantial benefits and impacts of AI on airport management. Future investments should prioritize enhancing operational efficiency, improving intelligent decision-making, bolstering safety and security measures, personalizing passenger experiences, and achieving cost savings and revenue generation. AI-powered systems have the potential to automate and optimize various airport processes, offering personalized services and improved experiences to passengers.

References

AIQ Consulting . (2022). Automated Bag Drop Systems and Their Impact on Airport Operations, AIQ Consulting, available at: https://www.aiqconsulting.com/aiq-news/airport-automation-building-airport-capacity-beyond-2022-part-2/.

Agarwal, S., Agarwal, B. and Gupta, R. (2022). Chatbots and virtual assistants: a bibliometric analysis", *Library Hi Tech*, 40(4) 1013-1030. https://doi.org/10.1108/LHT-09-2021-0330.

Alrayes, F.S.; Alotaibi, S.S.; Alissa, K.A.; Maashi, M.; Alhogail, A.; Alotaibi, N.; Mohsen, H.; Motwakel, A. (2022). Artificial Intelligence-Based Secure Communication and Classification for Drone-Enabled Emergency Monitoring Systems. Drones, 6, 222.

Balan, C. (2023). Chatbots and Voice Assistants: Digital Transformers of the Company–Customer Interface—A Systematic Review of the Business Research Literature, *J. Theor. Appl. Electron. Commer. Res.* 2023, *18*(2), 995-1019; https://doi.org/10.3390/jtaer18020051

BEUMER Group. (2024). Self-Service Bag Drops: Enhancing The Passenger Experience, BEUMER Group, available at: https://www.beumergroup.com/knowledge/airport/self-service-bag-drops-enhancing-the-passenger-experience/

Ćurčić, N. (2023). *Relacije percipiranog kvaliteta usluge aerodroma, satisfakcije i lojalnosti korisnika usluga avioprevoza u Srbiji i Crnoj Gori*. (Doktorska disertacija), Ekonomski fakultet u Subotici, Univerzitet u Novom Sadu., available at: https://www.cris.uns.ac.rs/searchDissertations.jsf

Ćurčić, N. & Grubor, A. (2023) Niš airport service quality and passenger satisfaction. *International Journal for Quality Research*, 17(4) 1207–1216. https://doi:10.24874/IJQR17.04-15

Đurić, N. (2024). Konceptualni model ključnih prediktora i konsekvenci satisfakcije potrošača. *Anali Ekonomskog fakulteta u Subotici*, *51*, 63-79. https://doi.org/10.5937/AnEkSub2300024D

Ho, D.E., Black, E., Agrawala, M., & Fei-Fei, Li. (2024). Evaluating Facial Recognition Technology: A Protocol for Performance Assessment in New Domains Stanford university, available at: https://hai.stanford.edu/sites/default/files/2020-11/HAI_FacialRecognitionWhitePaper

IATA. (2024), Report (available at: Passenger numbers to hit 8.2bn by 2037 - IATA report | Airlines)

Jevtić, B., Kvrgić, G., Corić, G., Beslac, M. (2020). Challenges of ICT Skills of SME Employees, *Limes plus*, 2020, 1, 121-142. DOI: 10.5281/zenodo.4601507.

Jevtić, B.,& Marković D. (2014). New information technologies and economic growth, *Institut of Economic Sciences, Monography,* 565-638.

Jevtić,B., Beslać,M., Janjušić, D., Jevtić M. (2024). The Effects Of Digital Natives' Expectations Of Tech Hotel Services Quality On Customer Satisfaction, *International Journal for Quality Research* 18(1), 1-10, DOI: 10.24874/IJQR18.01-01.

Miletić, V., Miletić, S., & Ćurčić, N. (2018). Profitabilno poslovanje organizacije kao ishod unapređenja konkurentnosti primenom koncepta CRM. *Anali Ekonomskog fakulteta u Subotici*, *40*, 33-48. https://doi.org/10.5937/AnEkSub1840033M

Miletić, V., Ćurčić, N., & Simonović, Z. (2020). Quality standardization: A factor of sustainable competitiveness of companies in Serbia, *Anali Ekonomskog fakulteta u Subotici*, 44, 99-114. DOI: 10.5937/aneksub2044099m

Ryu, Y.K & Park, J-W. (2019). Investigating the Effect of Experience in an Airport on Pleasure, Satisfaction, and Airport Image: A Case Study on Incheon International Airport, Sustainability 11(17):4616. DOI:10.3390/su11174616.

Redha, W. (2013). The Impact of Airport Service Quality Dimension on Overall Airport Experience and Impression, UNLV Theses, Dissertations, Professional Papers, and Capstones. 1906. http://dx.doi.org/10.34917/4478325.

Springer. (2023). Adoption of AI Chatbots in Travel and Tourism Services, Proceeding, 713–727, available at: https://link.springer.com/chapter/10.1007/978-981-99-3236-8_57.

Srebro, B., & Jevtić, B. (2024). Improving Decision-Making Efficiency Through AI-Powered Fraud Detection and Prevention, *Interantional Congress on Project Management of ICT*, Aranđelovac, 2024.

Srebro, B., Paunović,L., & Jevtić, B. (2024). Unraveling Hospitality: Exploring Human, Digital, and External Forces in Marketing Communications, *Simorg,* 2024.

Špiler, M.,Milošević, D., Miškić, M., Gostimirović, L., Beslać, M., Jevtić, B. (2023). Investments in digital technology advances in textiles, *Industria Textila* , 74(1), 90-97. DOI: 10.35530/IT.074.01.202287

Yeung,D., Balebako, R., Gaviria,C.I.G, & Chaykowsky,M. (2020). Face Recognition Technologies: Designing Systems that Protect Privacy and Prevent Bias, Research & Commentary, 2020.