ROBOTIC SYSTEMS IN FOOD AND BEVERAGE PREPARATION FACILITIES: KEY IMPLICATIONS FOR LEADERS AND HUMAN RESOURCES

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A B S T R A C T

The aim of this paper is to examine and analyze the use of robotic systems in facilities for food and beverage preparation. The research was conducted using a specially designed questionnaire, which was completed by 219 respondents working in food and beverage preparation facilities during 2023. The data analysis applied descriptive statistics, Kolmogorov-Smirnov test, Levene's test, Mann-Whitney U test and Kruskal-Wallis H test. Research results showed that more than 60% employees in food and beverage preparation facilities consider that robotic systems perform routine and simple tasks (67.12%), allow employees to focus on more complex tasks (66.67%), are faster and more efficient (61.93%), provide significant cost savings (64.68%), and do not fear that a robotic system will replace them (76.71%). The obtained results could serve as a basis for leaders and human resource managers in facilities for food and beverage preparation when considering the implementation of robotic systems.

Introduction

Every workplace at the time of the fifth industrial revolution (Industry 5.0) has gained new attributes and characteristics. The workplace is getting more and more integrated with modern robotic systems, which are replacing many human-performed tasks. In the field of food and beverages preparation it is crucial to establish and maintain high quality standards. Robotic systems provide many opportunities and benefits. Employees will no longer have to do physically demanding, monotonous, routine, and boring jobs (Kwanya, 2023). Furthermore, mobile robots and exoskeletons make some tasks easier and less physically demanding, enabling women to work in roles previously dominated by men (Breque et al.,

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2021). Tasks such as packing, palletizing, picking, placing, injecting, pouring, polishing, screwing, dosing, welding, and gluing are traditionally where robots are extensively utilized (Doyle Kent & Kopacek, 2020). With technological advancements, modern robots are increasingly employed in creative tasks, including those held by scientists, researchers, medics, and programmers (Murashov et al., 2016). Jobs in customer service, such as bank tellers, cashiers, travel agents, and receptionists, face a high likelihood of being phased out in the future (Fantina et al., 2022). Human resources, finance, accounting, insurance, telecommunication, information technology systems, education, banking, supply chain management, legal services, real estate management, and logistics are among the areas where robots are increasingly being used (Lievano- Martinez et al., 2022; Siderska, 2020). There were already 12 million service robots in operation, with the potential for exponential growth (Solaiman, 2017). In 2015, a density of 160 robots per 10000 employees was observed in Italy, 301 in Germany, and 501 in South Korea (Carrozza, 2019). Most industrial robots are used in the automotive (35%) and electrical/electronics (31%) industries (Hudson, 2019). Robots are being more and more implemented in agriculture with the aim to increase agricultural productivity, optimize the efficiency, and taking jobs that are dull, dirty, and dangerous (Van Wynsberghe et al., 2022). Robots are considered as an integral element of the fourth agricultural revolution oriented to contemporary information and communication technologies and agricultural robots (Benos et al., 2023).

There are numerous benefits of robots and robotic systems at the workplace. Robots are less expensive than humans and make fewer mistakes during work. They are unaffected by working conditions such as noise, pollution, and temperature, and they can process much more data in less time (Abok & Kwanya, 2016; Nakitare et al., 2020). Contemporary robotic systems can automate non-standardized, non-routine, and intellectual tasks (Ivančić et al., 2019), as well as to improve the quality and variety of products and services (Ing et al., 2022). One of the most significant advantages for organizations is that robots are highly efficient and productive. Apart from the benefits, some of the identified disadvantages of robots include a lack of creativity, a lower level of interaction, intense feelings of oddity and a lack of social interaction, and the inability to react adequately in some unstructured, sudden, and unexpected circumstances (Ivanov, 2019; Savela et al., 2021). Furthermore, many human workers distrust robots, viewing them as volatile, uncertain, complicated, and ambiguous (Kopp et al., 2021; Maddahi et al., 2021).

Currently, various types of robots are found in tourism and hospitality, such as reception robots, porter robots, guide robots, concierge robots, and room service delivery robots (Song et al., 2022a). In the hospitality industry, robots perform a range of tasks such as checking in guests, cleaning rooms, delivering items, providing concierge services, preparing food, making drinks, entertaining guests, guiding guests, and presenting information (Huang et al., 2021; Chen et al., 2023). A key feature of service robots is their humans-like appearance or behavior, which allows them to execute more complex activities (Fu et al., 2022). According to predictions, service robots will replace around 25% of employees in the hospitality business by 2030 (Bowen & Morosan, 2018).

The role and importance of robotic systems in food and beverage preparation facilities

Robotic systems can perform a variety of tasks in food and beverage preparation facilities in a safer, more individualized, and more effective manner. In practice, many kitchens employ robotic systems such as the dishwasher packaging robot, the burger flipping robot, and the sausage frying robot, which can chop food, peel lettuce, stir-fry, check fruit ripeness, and assess food freshness and quality (Sochacki et al., 2023). Furthermore, modern kitchen robots perform various tasks such as slicing vegetables, whisking ingredients, baking, grilling, retrieving items, and preparing meals (Bernier, 2023). Rising operational costs, declining profitability, and labor shortages have led to increased use of robotic systems in food and beverage preparation facilities (Tanksley, 2023). In contrast to the food industry and food/beverage preparation, agriculture has long been resistant to this robotization trend, because agricultural production has high level of unpredicability and dynamism (Marinoudi et al., 2021). Moreover, agricultural work has unique requirements due to its extremely seasonal nature, therefore the typical robotics development trends from other industries cannot be easily copied and transferred to agriculture (Martin et al., 2022). *Table 1* presents various types of robots used in food and beverage preparation facilities.

Table 1. Example of robots used in facilities for food and beverage preparation and service

Name of the robot	Location	Food	Activities
Rube Goldberg-esque	San Francisco, California	Hamburger	Handles the entire burger-making process: grinding beef, frying patties, toasting buns, dispensing condiments and assembling burgers.
BreadBot	Walla Walla, Washington	Bread	Blends, prepares and cooks the dough using a mix of dry ingredients.
Picnic Pizza Station	Seattle, Washington	Pizza	Automates pizza preparation, reducing food waste, while enabling users to customize the machine for adding precise, consistent amounts of cheese, sauce and toppings to each pizza.
BaristaBots	Atlanta, Georgia	Coffee	Automated kiosk-style machines that take and fulfill custom coffee orders.
Blendid	Sunnyvale, California	Smoothie	Utilizes a mechanical arm to dispense ingredients, blend, pour into a cup, and serve.
Bear Robotics' self-driving Servi robots	Redwood City, California	Food and drinks delivery	Runs food or drinks, buses table, greets and seat guests, equipped with multiple cameras for navigating custom floor plans.
Matradee	Austin, Texas	Food and drinks delivery	Obstacle-avoiding delivery robot with up to 12 hours of battery life.

Source: Adapted from Gottsegen, 2023

The most common use of robots in food and beverage preparation facilities is to perform manual and repetitive tasks, while other tasks are predominantly handled by human employees. However, with advancing technology, robots are increasingly capable of preparing meals from start to finish (Berezina et al., 2019).

Robotic system appliances offer a high degree of accuracy, uniform taste, and quality, adhering to safety regulations, and providing consistency and efficiency in food and beverage preparation (Bernier, 2023). In terms of food preparation, robotic systems are more efficient and reliable than human employees, producing results that are more consistent, precise, and result in less food waste (Tanksley, 2023).

Research methodology, materials, and methods

The aim of this research is to examine and analyze the use of robotic systems in facilities for food and beverage preparation, and to provide recommendations to leaders and human resource managers on effectively guiding the adoption process of robotic systems. The imposed hypotheses are:

Hypothesis 1: The application of robotic systems in facilities for food and beverage preparation has numerous positive effects.

Hypothesis 2: Personal characteristics of employees, such as gender, age, education, marital status, and children, influence their perception of the use of robotic systems in facilities for food and beverage preparation.

Hypothesis 3: The country where respondents work influences their perception of the use of robotic systems in facilities for food and beverage preparation.

The empirical research was conducted using a specially designed questionnaire. The first part of the questionnaire included questions about respondents' gender, age, education, country, employment type, marital status, children status, and type of facility in which they are employed. Following these profile questions, respondents were asked to answer statements regarding their perceptions of the effects of robotic systems in their working environment in facilities for food and beverage preparation. Eight statements were grouped into a scale named "Effects of the Application of Robotic Systems in the Work Environment" and were measured on a seven-point Likert scale, from 1 (strongly disagree) to 7 (strongly agree).

From October to November 2023, the questionnaire was distributed among employees in facilities for food and beverage preparation in four countries: Serbia, Croatia, Bosnia and Herzegovina, and Montenegro. The questionnaire was sent to 719 employees in facilities for food and beverage preparation. After two kind follow-up e-mails, a total of 458 respondents filled in the questionnaire indicating the response rate of 63.70% which is considered as acceptable in social sciences (from 30% to 70%) (De Vaus, 2013), especially in hospitality industry where is much harder and challenging to collect answers (Keegan & Lucas, 2005). Out of all respondents, 219 of them answered that they already have robotic systems at their workplace, while other respondents do not have those systems implemented. For further analysis of data was used answers from 219 respondents (30.46% response rate). All responses were analyzed using the Statistical Software for Social Sciences, SPSS, version 21.0.

Cronbach's Alpha coefficient for the measurement scale "Effects of Application of Robotic Systems in the Work Environment" was 0.752, indicating high reliability for the scale (DeVellis, 2003). The normality of the data distribution was examined using the Kolmogorov-Smirnov test, along with histograms, skewness, kurtosis, the normal probability curve, and the boxplot. The results for the scale "Effects of Application of Robotic Systems in the Work Environment", with a significance (Sig.) of 0.000, indicated that the assumption of normal data distribution was not met. As a result, non-parametric statistical techniques were used for statistical analysis within the measurement scales. Mann-Whitney U test was used to compare differences between two groups, while the Kruskal-Wallis H test was used to compare differences among three or more groups with a 95% confidence interval. Levene's test for equality of variances was applied in all tests comparing differences between groups, meeting the assumption of variance homogeneity in all cases ($p > 0.05$).

Research results

Table 2 shows the basic information about the respondents who participated in this research and have implemented robotic systems at their workplaces. Nearly an equal number of men and women participated in the research. In terms of age, more than half of the respondents (56.6%) are between 36 and 55 years old, followed by those aged 18 to 35 years (39.7%). A small number of respondents (3.7%) are over 55 years old. More than half of the respondents (54.3%) have completed high school, followed by those with a college or university education (29.2%). The majority of respondents are from Croatia (38.8%), followed by Serbia (27.4%). Regarding employment type, the majority are in indefinite employment relationships (72.6%). More than 60% of respondents have a partner and children.

Table 2. Basic information about respondents

	Answers	**N**	**%**
Gender	Male	110	50.2
	Female	109	49.8
Age	18-35	87	39.7
	36-55	124	56.6
	Over 55	8	3.7
Education	Primary School	7	3.2
	Secondary School / High School	119	54.3
	College/University Undergraduate for Bachelor Programs	64	29.2
	University / Graduate School for master's Programs	26	11.9
	University / Graduate School for PhD Programs	3	1.4

	Answers	N	%
Country	Serbia	60	27.4
	Croatia	85	38.8
	Bosnia and Herzegovina	48	21.9
	Montenegro	26	11.9
Employment type	Permanent or Full Time Employment	159	72.6
	Seasonal or Contractual Employment	60	27.4
Marital status	Married/Partnership	153	69.9
	Single/Divorced/Widowed	66	30.1
Children status	With children	134	61.2
	Without children	85	38.8

Source: Authors' calculations

Regarding the workplaces of the respondents (as shown in *Table 3*), the majority are employed in hotel restaurants (30.6%). The next largest group works in pizzerias and restaurants serving Chinese or Mexican food (24.7%).

Table 3. Workplaces of survey respondents

Workplaces	N	%
Hotel restaurant	67	30.6
Exclusive restaurant	47	21.5
Classic bar-restaurant	27	12.3
Pizzeria, restaurant serving Chinese or Mexican food	54	24.7
Cafeteria, caffe bar, bistro, beach bar	24	11.0

Source: Authors' calculations

Table 4 presents the responses to the statements in the measurement scale "Effects of the Application of Robotic Systems in the Work Environment". The highest mean values were for the statements indicating that employees do not fear being replaced by robotic systems at work (5.71) and that robotic systems allow employees to focus on more complex tasks (5.18). More than 60% of respondents believe that robotic systems perform only routine and simple tasks (67.12%), enable employees to focus on more complex tasks (66.67%), are faster and more efficient (61.93%), provide significant cost savings (64.68%), and do not fear replacement by robotic systems (76.71%).

Table 4. Results regarding the scale "Effects of the Application of Robotic Systems in the Work Environment"

Statements	Answer	N	%	M	SD
Robotic systems perform only routine and simple tasks.	Agree	147	67.12	4.34	2.260
	Neutral	9	4.11		
	Disagree	63	28.77		
In certain workplaces, robotic systems have totally replaced humans.	Agree	106	48.40	4.12	2.559
	Neutral	6	2.74		
	Disagree	107	48.86		

Statements	Answer	N	%	M	SD
Robotic systems provide customers a unique experience.	Agree	90	41.28	3.81	2.438
	Neutral	18	8.26		
	Disagree	110	50.46		
When compared to humans, robotic systems are faster and more efficient.	Agree	135	61.93	4.77	2.559
	Neutral	6	2.75		
	Disagree	77	35.32		
Robotic systems result in significant cost savings.	Agree	141	64.68	4.99	2.508
	Neutral	6	2.75		
	Disagree	71	32.57		
Robotic systems allow employees to focus on more complex tasks.	Agree	144	66.67	5.18	2.468
	Neutral	7	3.24		
	Disagree	65	30.09		
I do not fear that a robotic system will take my place at work.	Agree	168	76.71	5.71	1.924
	Neutral	22	10.05		
	Disagree	29	13.24		
I feel comfortable working in an environment where robots are my colleagues.	Agree	111	50.68	4.34	2.260
	Neutral	34	15.52		
	Disagree	74	33.79		

Source: Authors' calculations

To examine the proposed hypotheses, a Mann-Whitney U test was conducted. The results are presented in *Table 5.*

Table 5. Mann-Whitney U test results for hypotheses examination

	Answers	N	M	Md	U	Z	p
Gender	Male	108	96.34	4.75	4584	-2.565	0.010*
	Female	106	118.14	5.38			
Employment type	Permanent or Full Time Employment	154	110.83	5.31	4480	-0.416	0.678
	Seasonal or Contractual Employment	60	106.90	5.13			
Marital status	Married/Partnership	148	106.40	5.25	4590.5	-0.580	0.562
	Single/Divorced/ Widowed	66	111.77	5.31			
Children status	With children	129	103.68	5.38	5175.5	-0.832	0.405
	Without children	85	110.88	5.13			

Source: Authors' calculations

Mann-Whitney U test results revealed statistically significant differences in responses between males (Md=4.75, n=108) and females (Md=5.38, n=106), U=4584, Z=-2.565, p=0.010.

However, Mann-Whitney U test results did not show statistically significant differences regarding employment type, marital status, or children status.

Additionally, the Kruskal-Wallis H-test was conducted to examine the proposed hypotheses. The results of this test are presented in *Table 6.*

Table 6. Results of the Kruskal-Wallis H-test

	Answers	N	M	Md	χ2	df	p
Age	18-35	87	109.17	5.25	0.108	2	0.947
	36-55	119	106.42	5.12			
	Over 55	8	105.44	4.87			
Education	Primary School	7	97.29	4.87	12.831	4	0.012*
	Secondary School / High School	115	115.25	5.50			
	College/University Undergraduate for Bachelor Programs	63	111.60	5.25			
	University / Graduate School for master's Programs	26	71.42	3.50			
	University / Graduate School for PhD Programs	3	60.83	4.25			
Country	Serbia	84	97.58	4.69	33.219	3	0.000*
	Croatia	58	81.31	4.00			
	Bosnia and Herzegovina	24	147.85	5.94			
	Montenegro	48	136.33	5.81			

Source: Authors' calculations

The Kruskal-Wallis H-test results revealed no statistically significant differences in responses based on respondents' age, χ2(df=2, n=214) =0.108, p=0.0947.

Further, Kruskal-Wallis H-test results showed that there are statistically significant differences in responses based on education levels, χ2(df=4, n=214) =12.831, p=0.012. Compared to other educational levels, respondents with secondary education showed the highest median score (Md=5.50), followed by those with a high school education (Md=5.25).

Finally, the Kruskal-Wallis H-test results revealed statistically significant differences in responses based on the country of the respondents. The results, χ2(df=3, n=214) =33.219, p=0.000, indicated that respondents from Bosnia and Herzegovina had the highest median score (Md=5.94) compared to other countries.

Discussion of research findings

Results from the conducted research confirmed *Hypothesis 1*, indicating that the *application of robotic systems in facilities for food and beverage preparation leads to numerous positive effects*. More than 60% of respondents stated that robotic systems perform routine and simple tasks (67.12%), enable employees to focus on more complex tasks (66.67%), are faster and more efficient (61.93%), provide significant cost savings (64.68%), and do not fear that a robotic system will replace them (76.71%).

Statistical tests (Mann-Whitney U test and Kruskal-Wallis H-test) showed statistically significant differences in the answers of respondents regarding their gender and education, while there were no statistically significant differences concerning age, marital status, and number of children. Female respondents and those who have completed secondary and high school education are more positively oriented towards the application of robotic systems. This partially confirms *Hypothesis 2*, which proposed that p*ersonal characteristics of employees such as gender, age, education, marital status, and children influence perceptions of robotic system applications in food and beverage preparation facilities*. Gender and education impact perceptions, while age, marital status, and number of children have no impact.

Furthermore, the Kruskal-Wallis H-test confirmed *Hypothesis 3*, suggesting that *the country where the respondents work influences their perception of robotic systems in food and beverage preparation facilities*. Respondents from Bosnia and Herzegovina gave the highest mean values, indicating the most positive perceptions of robotic systems in facilities for food and beverage preparation. They are followed by employees from Montenegro, Serbia, and finally, Croatia.

Various studies have shown that robots have replaced humans in many tasks within the hospitality industry, improving ease of tasks and service quality, streamlining service processes, and freeing employees from repetitive and monotonous tasks (McCartney & McCartney, 2020; Liu et al., 2022; Song et al., 2022b). The use of robots offers numerous organizational benefits, including lower costs, higher productivity, and profits (Kim et al., 2023; Madhan et al., 2023), as well as attracting customer interest and improving customer experiences while reducing employees workload and stress (Song et al., 2022a; Palrão et al., 2023; Xu et al., 2023). These changes herald the advent of Hospitality 5.0, representing collaborative work between humans and machines to achieve a resilient, sustainable and human-centric world (Xu et al., 2023).

The adoption of modern technological solutions requires extensive changes in human resource management and leadership styles (Hajal & Rowson, 2020). Firstly, facilities for food and beverage preparation implement robotic systems to better position themselves in the market and attract customers interested in modern technologies. Robotic systems also largely address labor shortages and excessive employee workloads (Berezina et al., 2019). Leaders should recognize that, alongside the benefits, some identified disadvantages of robots include a lack of creativity, limited interaction levels, and an inability to adequately react in unstructured, sudden, or unexpected situations (Ivanov, 2019). Moreover, modern robots will pose new challenges to employees' social and psychological well-being, as limited interaction with colleagues can lead to a lack of excitement, challenge, and team spirit (Starchos & Schüll, 2021). Key messages for leaders and human resource managers are:

- Bearing in mind that one of the biggest obstacles to implementing robots is employee awareness and perceptions (Tanksley, 2023), leaders need to build a culture of acceptance of robots in the workplace. This is particularly important as interactions between humans and service robots, which are intended to coexist and continuously improve their features, will intensify.

- Employees should acquire adequate knowledge and skills regarding robots, including organized training on robotic systems, how to work alongside them, and monitoring their fundamental features. Employees need sufficient knowledge to adjust and leverage their new 'co-workers'.
- It is important to eliminate employees' fear of job loss. Leaders should clarify that robots will take over monotonous, simple, and routine tasks, allowing employees more time for demanding activities. Furthermore, the application of robots necessitates the presence of employees to supervise their work and creates new positions for technical maintenance of robots.

With a planned and systematic approach by leaders and human resource managers in implementing robotic systems, employees can be well-educated and aware of the benefits for both the organization and themselves.

Conclusion

The purpose of this research was to examine and analyze the key benefits of robotic systems in facilities for food and beverage preparation and to provide useful insights for leaders and human resource managers in these facilities considering the introduction of contemporary robotic solutions. The survey, conducted in 2023 involving 219 respondents working in food and beverage preparation facilities in four countries (Serbia, Croatia, Bosnia and Herzegovina, and Montenegro), revealed numerous benefits of using robotic systems. Their appliance is primarily manifested in the automation of routine and simple tasks, enabling employees to focus on more complex tasks. Robotic systems have proven to be faster and more efficient than human labor and offer significant cost savings. More positive perceptions of robotic systems in these facilities were noted among female respondents, those with secondary and high school education, and respondents that work in Bosnia and Herzegovina compared to the other three countries. The majority of respondents do not fear that robotic systems will replace them.

The significance of this research lies in the fact that food and beverage preparation facilities are relying more and more on robotic technologies, which might save costs and increase efficiency. The food industry is among those where automation will likely have a big impact in the future.

The results have significant implications for leaders and human resource managers. They highlight the need for adequate organizational preparation for the introduction of robotic systems in food and beverage preparation facilities. Through a planned approach, employee training, and effective communication, employees can be made aware of the benefits and positive effects of robotic systems. Furthermore, research results clearly indicated the potential for robotization in food and beverage preparation facilities in the future. In this manner, stakeholders and policy makers can be better informed about the deployment of robotic systems. They may use obtained findings as the basis for evaluation of the whole impact of robotic systems in food and beverage preparation facilities and make well-informed decisions, particularly concerning the lack of skilled human employees.

This research provides valuable insights but also has limitations. The participant pool was limited to 219 respondents from four countries: Serbia, Croatia, Bosnia and Herzegovina, and Montenegro. Due to national and cultural differences, the results cannot be generalized to other countries. Additionally, the closed-ended nature of the survey questions limited the depth of analysis and conclusions. Therefore, future research on this topic should employ diverse methods such as case studies, observations, and interviews to comprehensively understand the benefits of robotic systems from various perspectives and organizational contexts. Moreover, with ongoing technological advancements, longitudinal studies are recommended to examine shifts in employees' perceptions and behaviors towards robotic systems over time.

Conflict of interests

The authors declare no conflict of interest.

References

1. Abok, V. A., & Kwanya, T. (2016). Maximising the potential of social media to deliver academic library services to students: A case study of the Technical University of Kenya Library. *Inkanyiso, 8*(2), 147–155.
2. Benos, L., Moysiadis, V., Kateris, D., Tagarakis, A.C., Busato, P., Pearson, S., & Bochtis, D. (2023). Human-Robot Interaction in Agriculture: A Systematic Review. *Sensors (Basel), 23*(15), 6776. doi: 10.3390/s23156776
3. Bernier, K. (2023). Cooking Robots: Revoluationizing the Modern Kitchen, Retrieved from https://howtorobot.com/expert-insight/cooking-robots-revolutionizing-modern-kitchen (November 21, 2023)
4. Berezina, K., Ciftci, O., & Cobanoglu, C. (2019). Robots, Artificial Intelligence, and Service Automation in Restaurants. In S. Ivanov & C. Webster (Eds.), *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality* (pp. 185–219). Emerald Publishing Limited, Leeds. doi:10.1108/978-1-78756-687-320191010
5. Bowen, J., & Morosan, C. (2018). Beware hospitality industry: the robots are coming. *Worldwide Hospitality and Tourism Themes, 10*(6), 726-733. https://doi.org/10.1108/WHATT-07-2018-0045
6. Breque, M., De Nul, L., & Petridis, A. (2021). *Industry 5.0 towards a sustainable, human-centric and resilient European industry.* European Commission, Brussels.

7. Carrozza, M. C. (2019). *The Robot and Us. An 'Antidisciplinary' Perspective on the Scientific and Social Impacts of Robotics*. Springer, Switzerland.
8. Chen, M., Wang, X., Law, R., & Zhang, M. (2023). Research on the Frontier and Prospect of Service Robots in the Tourism and Hospitality Industry Based on International Core Journals: A Review. *Behavioral Science, 13*, 560. https://doi.org/10.3390/bs13070560
9. De Vaus D. (2013). *Surveys in Social Research*. Routledge, London. https://doi.org/10.4324/9780203501054
10. DeVellis, R. F. (2003). *Scale Development. Theory and Application*. Sage Publications, Inc.
11. Doyle Kent, M., & Kopacek, P. (2020). Do We Need Synchronization of the Human and Robotics to Make Industry 5.0 a Success Story? In N. M. Durakbasa & M. G. Gençyılmaz (Eds.), *Digital Conversion on the Way to Industry 4.0. ISPR 2020. Lecture Notes in Mechanical Engineering* (pp. 302–311). Springer, Cham. https://doi.org/10.1007/978-3-030-62784-3_25
12. Fantina, R., Storozhuk, A., & Goyal, K. (2022). *Introducing Robotic Process Automation to Your Organization. A Guide for Business Leaders*. Apress.
13. Fu, S., Zheng, X., & Wong, I. A. (2022). The perils of hotel technology: The robot usage resistance model. *International Journal of Hospitality Management, 102*, 103174. https://doi.org/10.1016/j.ijhm.2022.103174
14. Gottsegen, G. (2023). 14 Restaurant Robots Changing the Food Industry (updated by Velazguez, Rose on Apr 3, 2023). Retrieved from https://builtin.com/robotics/robots-in-restaurants-food-service (November 21, 2023)
15. Hajal, G. EI., & Rowson, B. (2020). The future of hospitality jobs. *Research in Hospitality Management, 10*(1), 55-61. DOI: 10.1080/22243534.2020.1790210
16. Huang, D., Chen, Q., Huang, J., Kong, S., & Li, Z. (2021). Customer-robot interactions: Understanding customer experience with service robots. *International Journal of Hospitality Management, 99*, 103078. https://doi.org/10.1016/j.ijhm.2021.103078
17. Hudson, J. (2019). *The Robot Revolution. Understanding the Social and Economic Impact*. Edward Elgar Publishing, UK.
18. Ing, L.Y., Grossman, G., & Christian, D. (2022). Digital Transformation: 'Development for All'? In L.Y Ing & D. Rodrik (Eds.), *New Normal, New Technology, New Financing* (pp. 76-88). ERIA and IEA, Jakarta.
19. Ivanov, S. (2019). Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries? *Zeitschrift für Tourismuswissenschaft, 11*(1), 25-43. DOI: 10.1515/tw-2019-0003

20. Ivančić, L., Suša Vugec, D., & Bosilj Vukšić, V. (2019). Robotic Process Automation: Systematic Literature Review. In C. Di Ciccio, R. Gabryelczyk, L. Garcia-Banuelos, T. Hernaus, R. Hull, M. Indihar Štemberger, A. Ko, & M. Staples (Eds.), *Business Process Management. Blockchain and Central and Eastern Europe Forum Proceedings* (pp. 280-295). Springer, Switzerland.
21. Keegan, S. N., & Lucas, R. (2005). Hospitality to hostility: dealing with low response rates in postal surveys. *International Journal of Hospitality Management, 24*(2), 157-169. https://doi.org/10.1016/j.ijhm.2004.06.006
22. Kim, T., Lee, O-K. D., & Kang, J. (2023). Is it the best for barista robots to serve like humans? A multidimensional anthropomorphism perspective. *International Journal of Hospitality Management, 108*, 103358. https://doi.org/10.1016/j.ijhm.2022.103358
23. Kopp, T., Baumgartner, M., & Kinkel, S. (2021). Success factors for introducing industrial human–robot interaction in practice: An empirically driven framework. *The International Journal of Advanced Manufacturing Technology, 112*(3), 685–704. https://doi.org/10.1007/s00170-020-06398-0
24. Kwanya, T. (2023). Working with Robots as Colleagues: Kenyan Perspectives of Ethical Concerns on Possible Integration of Co-bots in Workplaces. In D. O. Eke, K. Wakunuma & S. Akintoye (Eds.), *Responsible AI in Africa. Challenges and Opportunities* (pp. 65-99). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-08215-3_4
25. Lievano-Martinez, F. A., Fernandez-Ledesma, J. D., Burgos, D., Branch-Bedoya, J. W., & Jimenez-Builes, J. A. (2022). Intelligent Process Automation: An Application in Manufacturing Industry. *Sustainability, 14*, 8804. https://doi.org/10.3390/su14148804
26. Liu, X. S., Yi, X. S., & Wan, L. C. (2022). Friendly or competent? The effects of perception of robot appearance and service context on usage intention. *Annals of Tourism Research, 92*, 103324. https://doi.org/10.1016/j.annals.2021.103324
27. Maddahi, Y., Kalvandi, M., Langman, S., Capicotto, N., & Zareinia, K. (2021). RoboEthics in COVID-19: A case study in dentistry. *Frontiers in Robotics and AI*, *8*, 612740. https://doi.org/10.3389/frobt.2021.612740
28. Madhan, K., Shagirbasha, S., Kumar Mishra, T., & Iqbal, J. (2023). Adoption of service robots: exploring the emerging trends through the lens of bibliometric analysis. *International Hospitality Review*. DOI 10.1108/IHR-12-2022-0058
29. Marinoudi, V., Lampridi, M., Kateris, D., Pearson, S., Sørensen, C.G., & Bochtis, D. (2021). The Future of Agricultural Jobs in View of Robotization. *Sustainability*, *13*(21), 12109. https://doi.org/10.3390/su132112109

30. Martin, T., Gasselin, P., Hostiou, N., Feron, G., Laurens, L., Purseigle, F., & Ollivier, G. (2022). Robots and transformations of work in farm: a systematic review of the literature and a research agenda. *Agronomy for Sustainable Development, 42*, 66, https://doi.org/10.1007/s13593-022-00796-2
31. McCartney, G., & McCartney, A. (2020). Rise of the machines: towards a conceptual service-robot research framework for the hospitality and tourism industry. *International Journal of Contemporary Hospitality Management, 32*(12), 3835–3851. doi:10.1108/ijchm-05-2020-0450
32. Murashov, V., Hearl, F., & Howard, J. (2016). Working Safely with Robot Workers: Recommendations for the New Workplace. *Journal of Occupational and Environmental Hygiene, 13*(3), 61-71. https://doi.org/10.1080/15459624.2015.1116700
33. Nakitare, J., Sawe, E., Nyambala, J., & Kwanya, T. (2020). The emerging roles of academic librarians in Kenya: Apomediaries or infomediaries? *Library Management, 41*(6/7), 339–353. DOI 10.1108/LM-04-2020-0076
34. Palrão, T., Rodrigues, R. I., Madeira, A., Mendes, A. S., & Lopes, S. (2023). Robots in Tourism and Hospitality: The Perception of Future Professionals. *Human Behavior and Emerging Technologies*, 7172152. https://doi.org/10.1155/2023/7172152
35. Savela, N., Oksanen, A., Pellert, M., & Garcia, D. (2021). Emotional reactions to robot colleagues in a role-playing experiment. *International Journal of Information Management, 60,* 102361. https://doi.org/10.1016/j.ijinfomgt.2021.102361
36. Siderska, J. (2020). Robotic Process Automation – a driver of digital transformation? *Engineering Management in Production and Services, 12*(2), 21-31. doi: 10.2478/emj-2020-0009
37. Solaiman, S. M. (2017). Legal personality of robots, corporations, idols and chimpanzees: A quest for legitimacy. *Artificial Intelligence and Law, 25*(2), 155–179. https://doi.org/10.1007/s10506-016-9192-3
38. Song, Y., Zhang, M., Hu, J., & Cao, X. (2022a). Dancing with service robots: The impacts of employee-robot collaboration on hotel employees' job crafting. *International Journal of Hospitality Management, 103*, 103229. https://doi.org/10.1016/j.ijhm.2022.103220
39. Song, H., Wang, Y-C., Yang, H., & Ma, E. (2022b). Robotic employees vs. human employees: Customers' perceived authenticity at casual dining restaurants. *International Journal of Hospitality Management, 106*, 103301. https://doi.org/10.1016/j.ijhm.2022.103301
40. Sochacki, G., Abdulali, A., Khadem Hosseini, N., & Iida, F. (2023). Recognition of Human Chef's Intentions for Incremental Learning of Cookbook by Robotic Salad Chef. *IEEE Access, 11,* 57006 – 57020. DOI: 10.1109/ACCESS.2023.3276234

41. Starchos, I., & Schüll, A. (2021). Stressed by Boredom in Your Home Office? On „Boreout" as a Side-effect of Involuntary Distant Digital Working Situations on Young People at the Beginning of Their Career. In *Proceedings of the 23rd International conference on Enterprise Information Systems* (pp. 557-564). DOI: 10.5220/0010479405570564
42. Tanksley, T. (2023). Robots in Food Service: Everything you NEED to know. Retrieved from https://www.richtechrobotics.com/blog/robots-in-food-service, (November 23, 2023)
43. Van Wynsberghe, A., Ley, M., & Roeser, S. (2022). Ethical Aspects of Human–Robot Collaboration in Industrial Work Settings. In M. I. Aldinhas Ferreira & S. R. Fletcher (Eds.), *The 21st Century Industrial Robot: When Tools Become Collaborators. Intelligent Systems, Control and Automation: Science and Engineering* (pp. 255–266). Springer International Publishing, Cham, Switzerland. https://doi.org/10.1007/978-3-030-78513-0_14
44. Xu, J., Hsiao, A., Reid, S., & Ma, E. (2023). Working with service robots? A systematic literature review of hospitality employees' perspectives. *International Journal of Hospitality Management, 113*, 103523. https://doi.org/10.1016/j.ijhm.2023.103523