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ROBOTS IN TRAVEL, TOURISM AND HOSPITALITY

KEY FINDINGS FROM A GLOBAL STUDY

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BALL STATE UNIVERSITY

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EXECUTIVE SUMMARY

Between March 2018-October 2019 an online questionnaire was disseminated to learn about how people feel about the use of robots in travel, tourism, and hospitality. After a draft version of the questionnaire was checked and finalized with the assistance of experts in the field, the original questionnaire was translated from English into 11 other languages by native speakers. In October 2019, the survey was closed and the resulting sample had 1676 respondents from 103 countries and territories.

The major findings of the research are:

- Respondents tend to favour using robots to collect garbage, clean common areas, and carry or store luggage, while respondents tend to be against using robots to offer security services or assist in emergency situations.
- Respondents are slightly more in favour of using robots for the check-out process than for other aspects of the reception experience in a hotel.
- In general, respondents consider robots as very suitable for housekeeping tasks, and show support for robot use for the delivery of laundry and the taking of laundry orders.
- The respondents, as a whole show a general willingness to have robots do many tasks in the food service industry, apart from preparing food.
- In terms of personal services offered by robots in the travel, tourism, and hospitality industry, the respondents did not show a high level of approval for such services as hairdressing, giving massages, dancing with guests, or babysitting.
- In terms of the use of robots for events, the data suggest that respondents are generally in favour of using robots to supply information to event participants.
- The data from the survey show a great deal of scepticism in terms of accepting the use of self-driving vehicles, whether a car, train, bus, ship, or airplane. Self-driving airplanes are the technology that respondents seem to be most against.
- The data suggest that customers expect that the use of robots will cause a reduction in costs to them as end consumers of services.

ACKNOWLEDGEMENTS

May the Robotic Force be with You!

ROBOTS IN TRAVEL, TOURISM AND HOSPITALITY:

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Chapter 1

INTRODUCTION

Similar to other service firms[1], travel, tourism, and hospitality companies have started to actively use social robots in serving their customers[2]. The first hotel staffed with robots, Henn na hotel (http://www.h-n-h.jp/en) was opened in 2015 in Nagasaki, Japan. The hotel was considered as a disruptive innovation and received significant media and academic attention since then. Other robot-staffed hotels opened as well[3]. Robots are used in hotels for room service delivery and as robotic concierges[4], in museums and art galleries[5], as cooks, hosts and waiters in restaurants[6], for food and drink order delivery[7], during events[8], as autonomous vehicles / taxis[9], in theme parks[10], for provision of information and cleaning at airports[11], and for the implementation of many other activities.

Robots perform the repetitive, dull, dirty, and dangerous tasks that human employees prefer to avoid[12]. Their adoption is driven not only by the economic factors (e.g. competitiveness, costs, or service quality[13]), but by the lack of sufficient human employees as well due to low birth rates in developed economies[14]. From the perspective of the travel, tourism, and hospitality companies, robots transform their business processes[15] – operations, marketing[16], human resource management, and financial management. On the one hand, robots can be used to create experiences for tourists[17], they increase the service capacity of companies that adopt them, improve productivity, save employees' time, and generate additional revenues[18]. On the other hand, robots are relatively expensive at the moment[19] with limited technological functionalities, they require reengineering of service processes and adapting the premises of the property (e.g. hotel, restaurant, airport, and other transport station) to be robot-friendly[20]. Therefore, companies need to implement a comprehensive cost-benefit analysis before deciding to adopt service robots[21].

From a customer perspective, robots are service agents that deliver services to them. Customers have different attitudes towards robots[22] and willingness-to-pay for robot-delivered services[23]. Furthermore, they have different preferences about which

services, activities, and tasks are suitable for robotisation, shaped by their attitudes towards robots in general, gender[24], and occupation[25]. These preferences influence customers' intentions to use service robots in a travel, tourism, and hospitality context[26]. Henn na hotel has learned this first-hand. In January 2019, the hotel announced that it had terminated the use of half of its robots, because they caused more work for the human employees and annoyed some of the customers[27]. It turned out that not all customers accepted the robots and considered that some of the activities performed by robots in the hotel were not suitable for robotisation.

In light of the above discussion, this report presents part of the results of the first global study on customers' perceptions on robots in travel, tourism, and hospitality implemented by the authors in 2018-2019. Specifically, the report presents the methodology of the research and elaborates on the key results regarding the activities that customers perceive as appropriate for robotisation, their preferences to be served by robots, and their willingness-to-pay for robot-delivered services. Finally, the report provides recommendations to travel, tourism, and hospitality companies how to implement successfully robotic technologies in their operations.

Chapter 2

METHODOLOGY

This research project received ethics approval from Ball State University, USA (IRB protocol #1194315-1). Data collection took place during the period March 2018-October 2019 via an online questionnaire. The draft versions of the questionnaire were checked by experts in the field and the necessary corrections were made. The final version was developed in English language and translated into 11 other languages by native speakers.
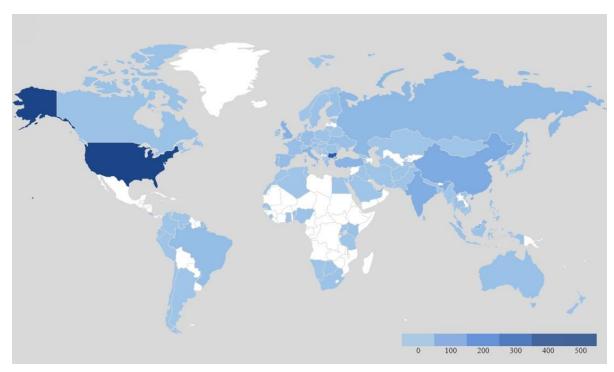
The link to the questionnaire was distributed by email and in various social media groups and pages. Hosco (an online network of hospitality schools, employers, and talents) and the administrators of different social media pages shared the link to the questionnaire to their followers. Unfortunately, none of the contacted hotel corporations or online travel agencies agreed to share the link to their social media followers – they either did not respond to the emails or explicitly declined to do it. In order to stimulate participation[28], respondents were given the opportunity to win one of five electronic vouchers worth $100 each. Funding for the vouchers was provided by Zangador Ltd., Bulgaria.

The questionnaire included several blocks of questions. This report focuses on those questions that related to respondents' perceived appropriateness of robot use in the implementation of different tasks in travel, tourism and hospitality companies, their preferences towards the 'human employees-robots' ratio when using travel, tourism, and hospitality services, and their willingness-to-pay for fully robot-delivered travel, tourism, and hospitality services.

The final sample includes 1676 respondents from 103 countries and territories. Figure 2.1. presents a map with the geographic distribution of respondents, while Table 2.1. provides a more detailed breakdown by gender, age, and country of residence.

Table 2.1. *Demographic characteristics of respondents*

		Frequency	Percent
Gender	Male	775	46.2
	Female	901	53.8
Age	18-30	824	49.2
	31-40	405	24.2
	41-50	253	15.1
	51-60	128	7.6
	61-70	56	3.3
	71+	10	0.6
Country of residence	United States of America	409	24.4
	Bulgaria	324	19.3
	China	79	4.7
	India	70	4.2
	Taiwan	63	3.8
	United Kingdom of Great Britain and Northern Ireland	60	3.6
	Turkey	50	3.0
	Italy	48	2.9
	Russian Federation	37	2.2
	Portugal	35	2.1
	Malaysia	32	1.9
	United Arab Emirates	30	1.8
	Spain	24	1.4
	Brazil	23	1.4
	Germany	21	1.3
	France	20	1.2
	Ukraine	15	0.9
	Cyprus	14	0.8
	Australia	13	0.8
	Netherlands	13	0.8
	South Korea	13	0.8
	Finland	12	0.7
	Canada	11	0.7
	Austria	10	0.6
	Indonesia	10	0.6
	Other 78 countries	240	14.3
Total		**1676**	**100.0**

Figure 2.1. *Geographic distribution of respondents*

Chapter 3

PERCEIVED APPROPRIATENESS OF ROBOT USE IN TRAVEL, TOURISM AND HOSPITALITY

The respondents to the survey were asked to rate eighty different activities/tasks that they would personally consider as appropriate to be performed by service robots in travel, tourism, and hospitality companies. Respondents were given a seven-point scale with which to respond, with extremely inappropriate (1) on the lower end to extremely appropriate (7) on the higher end of the response scale.

Figure 3.1 below illustrates the mean responses for the general activities shared by all travel, tourism, and hospitality companies. The findings illustrate that there is a great deal of variation in terms of what respondents judge to be appropriate for service robots to do. The consensus of the respondents is that *garbage collection* is a task that is very appropriate for robots to do, with a mean response of 5.79 on the seven-point appropriateness scale for that activity. This stands in contrast with *serve as guards/security*, something only receiving a mean score of only 3.92.

What is noteworthy is that in terms of how respondents measure the appropriateness of the use of service robots for tasks, those tasks that are considered unpleasant to humans, such as lifting heavy things, carrying things, and cleaning common areas; are the most likely to be rated in ways that illustrate the respondents find it appropriate to use a robot for the task. On the other hand, the findings show that respondents are much less likely to find it appropriate to use a service robot in positions in which human health and security or human judgement is highly valued.
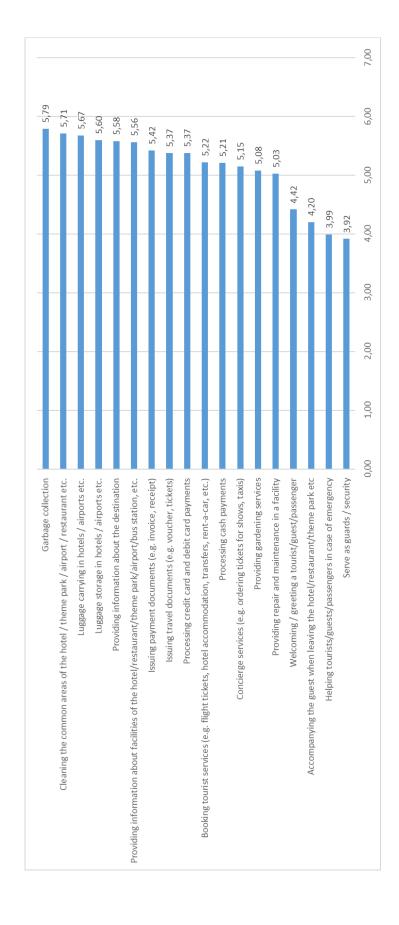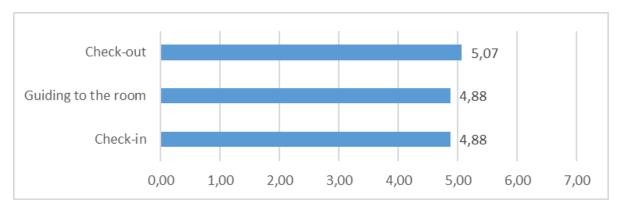
Figure 3.1. *Perceived appropriateness of robot application in travel, tourism and hospitality – common activities*

Figure 3.2. *Perceived appropriateness of robot application in travel, tourism, and hospitality – hotel reception*

When asked about the appropriateness of using robots for the reception in hospitality establishments, using the same seven-point appropriateness scale, the mean values were quite close for all three activities, as shown in Figure 3.2. However, there is some indication that respondents found that the use of robots for the *check-out process* was slightly more acceptable than some other aspects of the hotel reception.
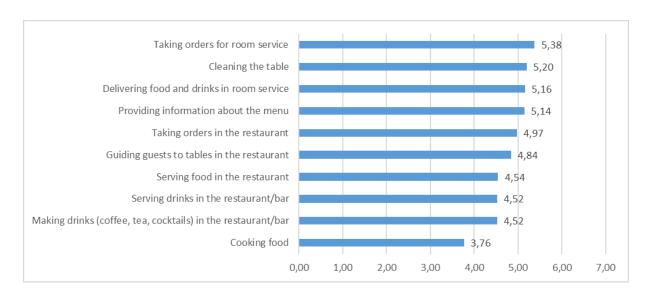
- For the check-out process the mean appropriateness score of respondents was 5.07, a score slightly higher than how respondents rated other aspects of the use of service robots for the check-in process.
- For the check-in and guiding guests to the room, the mean appropriateness score was only 4.88.

Figure 3.3. *Perceived appropriateness of robot application in travel, tourism, and hospitality – housekeeping*

In general, respondents were very supportive of using robots for housekeeping activities as Figure 3.3 shows. There was some variation in the responses - the mean responses show that laundry-related activities (*delivering ready laundr*y, *delivering new towels, linen*, and *laundry service*) seem to be the tasks that most consider most appropriate for robots to do.
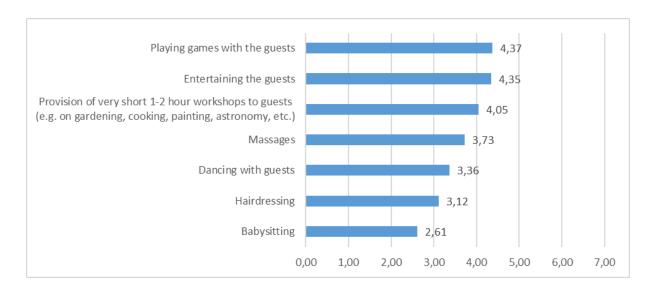
- The delivery of ready laundry was found to be the task most appropriate for robots to do (mean score from respondents was 5.64).
- Cleaning the guest's room was considered the least appropriate from the housekeeping activities, only garnering a mean response of 5.18 from the respondents, but nonetheless much above the mid-point (4) of the seven-point scale used in the questionnaire.

Figure 3.4. *Perceived appropriateness of robot application in travel, tourism, and hospitality – restaurants, food and beverages*

Figure 3.4 shows the mean responses about the appropriateness of using robots for various tasks in restaurants. The results are suggestive that robots would be most accepted for *taking orders*, *cleaning the table*, *delivering food and drink*, or the *provision of information* about the food; while the *making of food and drink* and the *delivery of food and drink in the restaurant/bar* are considered more appropriate for humans.

- The consensus of the respondents is that the taking of orders for room service is the task that is most appropriate for robots, with regards to food service, garnering a mean score of 5.38 on the seven-point appropriateness scale.
- However, the cooking of food seems to be something that respondents thought was much better left to humans, only earning a mean score of 3.76.
- Serving food and drink and making drinks was only considered slightly more appropriate than cooking the food, earning a mean score of 4.52 to 4.54.

Figure 3.5. *Perceived appropriateness of robot application in travel, tourism, and hospitality – additional services in hotels*

When asked about other services that robots could do in travel, tourism, and hospitality setting, there was a great deal of variation, as shown by the mean respondents' ratings. Generally, *playing games with the guests* and *entertainment* were seen as more appropriate for robots than those dealing more closely with a person's personal space, as the data in Figure 3.5 show. The data suggest that respondents feel comfortable with robots entertaining them but are more cautious about leaving a child's welfare in the hands of a robot, manipulating a person's hair, dancing with guests, or giving massages to clients.
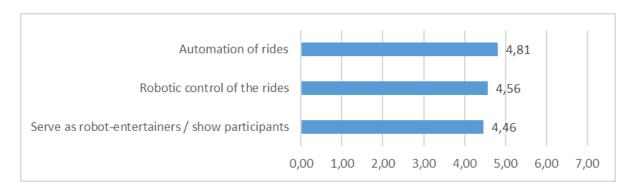
- The results show that respondents are generally accepting of entertainment for guests and educating guests (mean scores between 4.05 to 4.37).
- However, there is a great amount of scepticism, as shown by the data, since the mean appropriateness rating for babysitting by a robot is only 2.61.

Figure 3.6. *Perceived appropriateness of robot application in travel, tourism, and hospitality – travel agencies and tourist information centres*

Respondents were asked about the use of robots by travel agencies and tourist information centres. Findings indicate that the provision of information is generally considered appropriate for robots but that respondents expect more human intelligence and interaction from a tour guide.

- The provision of information seemed somewhat more agreeable to respondents, with a mean of 5.18.
- The appropriateness of using a robot as a tour guide was not as highly rated as being appropriate (mean 4.57).

Figure 3.7. *Perceived appropriateness of robot application in travel, tourism, and hospitality – theme parks*
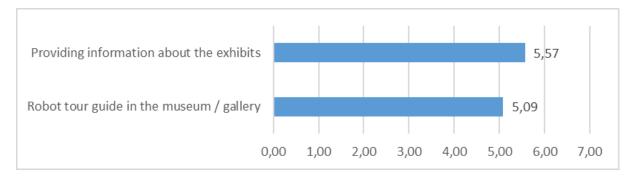
When asked about theme parks and robots, there was little variation in responses in terms of how respondents felt that robots should be employed, as Figure 3.7 shows. However, there is an indication that the automation of rides is rated somewhat more as an appropriate task for robots than the others asked about.

Figure 3.8. *Perceived appropriateness of robot application in travel, tourism, and hospitality – events*
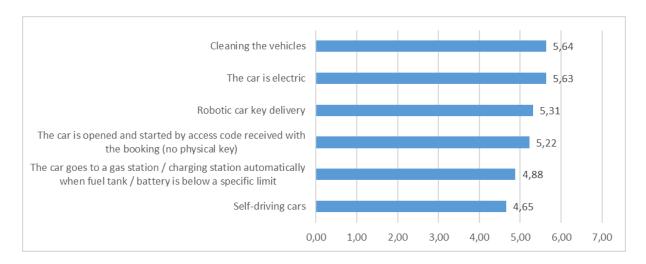
When asked about how robots could be used in events, there was a great deal of variation with regards to how respondents felt it was appropriate to use robots, as Figure 3.8 illustrates. As with some other issues asked about, the *provision of information* seems to be deemed as something most appropriate.

- The mean response of those asked about the appropriateness of using robots for the provision of information about an event was 5.50.
- However, there was also a great deal of agreement that robots should also be used to guide people to seats (mean score of 5.01).
- However, there seem to be much less enthusiasm towards the other ways that it was considered for using robots for events.

Figure 3.9. *Perceived appropriateness of robot application in travel, tourism, and hospitality – museums and galleries*
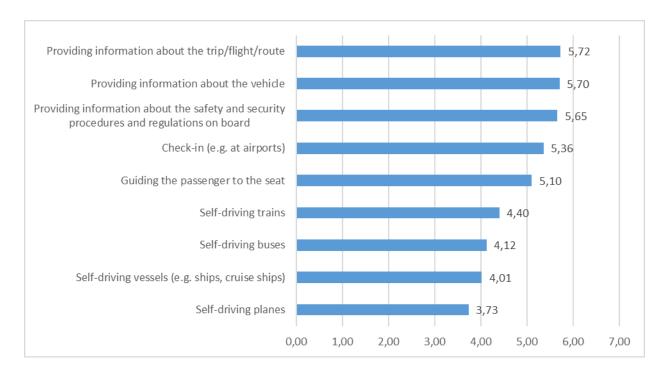
Respondents were also asked about museums and galleries and the appropriateness of using robots to provide information or to guide guests. Figure 3.9 illustrates the mean scores of the respondents. It illustrates that respondents are slightly more in favour of using robots to *provide information* than to *guide guests* in a gallery or museum.

Figure 3.10. *Perceived appropriateness of robot application in travel, tourism, and hospitality – rent-a-car*

Respondents were also asked about the appropriateness of using robots in car rental operations. The results illustrate significant variation in terms of what is expected to be appropriate for robots in car rental operations, generally showing some scepticism in terms of self-driving cars.
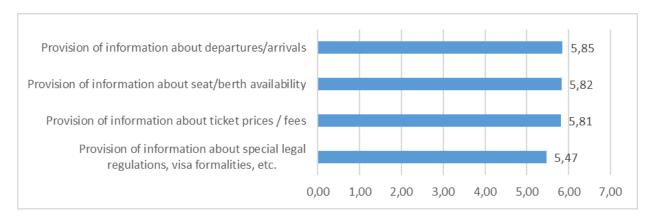
- While there is a general consensus that robots should be used to *clean* the car (mean score of 5.64)
- The mean of 4.65 with regards to having *self-driving cars* suggests some scepticism of the efficacy and safety of that technology, although the mean is slightly above 4 (mid-point of the 7-point scale).

Figure 3.11. *Perceived appropriateness of robot application in travel, tourism, and hospitality – airplanes, buses and trains*

Respondents were also asked about the appropriateness of using robots for various modes of transportation (airplanes, buses, and trains). Consistent with the findings above, it was found that there is a moderate amount of scepticism with regards to the use of self-driving forms of transportation, while there is more support for the use of robots in other aspects of transportation modes.

- The use of *self-driving planes* only had a mean appropriateness score of 3.73.
- The use of *self-driving vessels* on water only had a mean value of 4.01.
- The use of *self-driving buses* only gathered a mean value 4.12
- The use of *self-driving trains* was the mode of transportation that had the highest level of approval with a mean appropriateness score of 4.4, probably because some respondents have already used automated metro trains.

Figure 3.12. *Perceived appropriateness of robot application in travel, tourism, and hospitality – airports and other train stations*

Respondents were also asked about how appropriate it would be to use robots in airports and other transport stations. There was little variation in the responses, as the mean responses for each of the tasks asked about received nearly identical scores, with the exception of the provision of information about legal and visa regulation, as Figure 3.12 illustrates. Nevertheless, all means were significantly higher compared to the mean values for other tasks and tourism sectors such as theme parks or additional services in hotels.

Chapter 4

PREFERENCES TOWARDS HUMAN EMPLOYEES-ROBOTS RATIO

Respondents to the survey were asked about their preferences with regards to how robot- or human-intensive they would expect their experiences to be in various venues regarding travel, tourism, and hospitality. Figure 4.1 below illustrates the mean responses on a seven-point preference scale in which 1 represents a preference to be only served by robots and 7 represents a preference to be served only by humans.

- The data show that there is more of a preference for human service in restaurants and bars (mean response 5.05 and 5.12, respectively).
- However, on the other end of the spectrum of preferences, there seems to be a greater willingness to be served by robots in train stations (4.25), bus stations (4.26), and rent-a-car establishments (4.3); although the actual mean values indicate that respondents would prefer slightly more human employees than robots in these service settings.

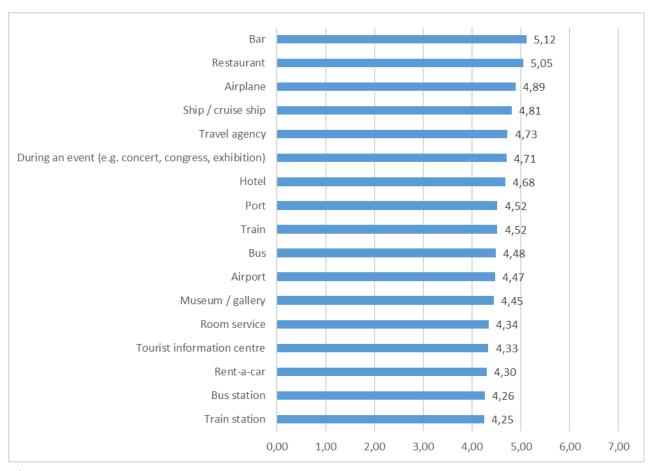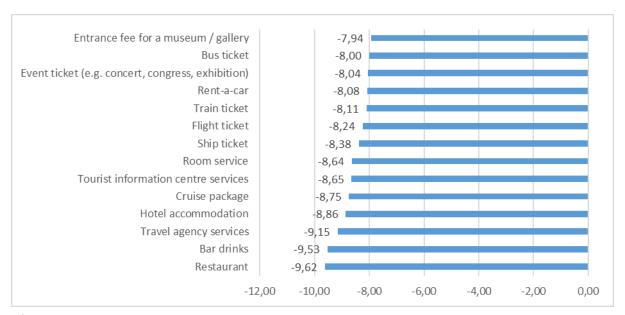**Figure 4.1.** *Preferred human-employees-robots ratio*

Note: Coding: 1-I prefer to be served only by robots, 4- I prefer to be served by approximately equal number of human employees and robots, 7- I prefer to be served only by human employees

Chapter 5

WILLINGNESS-TO-PAY FOR ROBOT-DELIVERED SERVICES IN TRAVEL, TOURISM AND HOSPITALITY

Respondents were asked to rate their willingness to pay in an operation that is fully robotized. The responses to the question of paying for fully robotized services is shown in Figure 5.1, with positive numbers indicating a willingness to pay more and negative numbers illustrating a willingness to pay less compared to the price of the same service provided only by human employees. The findings illustrate that across the board, respondents feel that robotized services should make the services cheaper and expect to pay less. However, the findings also show that the most radical reduction in costs that respondents expect should take place in bars and restaurants.

Figure 5.1. *If you were to be served entirely by robots in the following industries, instead of human employees, how much would you be willing to pay for a fully robotised service compared to a service fully delivered by human employees?*

Note: Percentage difference compared to the price of a fully human-delivered service

Chapter 6

CONCLUSION AND RECOMMENDATIONS

The findings of this global survey on the use of robots in travel, tourism, and hospitality shows that there are patterns in terms of how people consider the use of robots in these industries. The findings suggest that:

- There is a perception that robots are best used for unpleasant tasks such as disposing of garbage, cleaning up areas, and carrying and storing heavy items. Thus, it seems that the public is most in favour of using robots to do menial and difficult physical work that may be unpleasant for humans to do.
- People perceive that robots should not be used in position that require sophisticated judgement calls, such as security work or assisting guests during emergencies.
- The public seems to be generally accepting of using robots to deliver services at receptions in hotels and other accommodation facilities.
- The public generally accepts the use of robots in housekeeping operations, especially if they are used to deliver things to the guest.
- There is a high level of scepticism with regards to allowing robots to prepare food, although there are many other tasks that many are in favour of using robot to do in a bar or restaurant.
- There is a great deal of suspicion in terms of using robots to babysit or provide hairdressing services, while providing other services to guests, such as entertainment seems to be more likely to be accepted by the public.
- There is a general perception, as reflected in many of the tasks asked about, that robots are useful and acceptable as machines that can provide information to customers.
- There is a high level of scepticism with regards to having self-driving technologies (self-driving car, busses, trains, cruise ships, and airplanes), especially when the self-driving technology is in an airplane.
- The public seems to expect that in restaurants and bars, there should be more human interaction than robotic interactions, although there are other facilities (rent-a-car, bus stations, and train stations) where there is not such a high

expectation of human interaction and thus, robots may be more present in the labour force.

- The general consensus of the public is that robots should drop the cost of services provided, especially in the provision of food and drink.

There seems to be a good deal of data that reinforces the notion that robots should do the dangerous, dull, and dirty work that humans presently do but also that there is significant support for the use of robots in providing information to tourists and travellers. The findings suggest that the public generally accepts that robots should be used for some dull, dangerous, and dirty jobs but is especially sceptical of using robots for tasks that require more nuanced judgement, especially if those tasks can be directly linked to the wellbeing of humans, such as working as a security guard, babysitting, or flying an airplane. The use of robots in these industries, then, should be done in a cautious way that enables customers to see the benefits, keeping service levels high and cutting the cost of services to the end-user.

The future is more automated and travel, tourism, and hospitality industries have to realize that[29]. The technologies that allow for automation improve in quality by the day and the demographics in developed countries illustrate a long-term labour shortage in service industries[30]. This research is one small step towards assisting the industry to go forward in an intelligent way that gives guidance, assessing which tasks may be automated with little resistance from the public and highlighting those that may be automated although there is public scepticism with regards to the automation of those tasks.

The future is more robotic than the present, but humans will not go the way of the horse. This research should assist in showing industry the best path towards further robotization, while keeping the human in charge and better served by the robots.

<p align="center">May the Robotic Force be with You!</p>

REFERENCES

[1] Wirtz, J., Patterson, P., Kunz, W., Gruber, T., Lu, V. N., Paluch, S., & Martins, A. (2018). Brave New World: Service Robots in the Frontline. *Journal of Service Management*, 29(5), 907-931; van Doorn, J., Mende, M., Noble, S. M., Hulland, J., Ostrom, A. L., Grewal, D., & Petersen, J. A. (2017). Domo Arigato Mr. Roboto Emergence of Automated Social Presence in Organizational Frontlines and Customers' Service Experiences. *Journal of Service Research*, 20(1), 43-58;

[2] Ivanov, S., & Webster, C. (Eds.) (2019c). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. Bingley: Emerald Publishing; Ivanov, S., Webster, C. & Berezina, K. (2017). Adoption of robots and service automation by tourism and hospitality companies. *Revista Turismo & Desenvolvimento*, 27/28, 1501-1517; Collins, G. R., Cobanoglu, C., Bilgihan, A., & Berezina, K. (2017). *Hospitality information technology: Learning how to use it.* (8th ed.). Dubuque, IA: Kendall/Hunt Publishing Co. Chapter 12: Automation and Robotics in the Hospitality Industry (pp. 413-449); Murphy, J., Hofacker, C., & Gretzel, U. (2017). Dawning of the age of robots in hospitality and tourism: challenges for teaching and research. *European Journal of Tourism Research*, 15, 104-111; Ivanov, S., Gretzel, U., Berezina, K., Sigala, M., & Webster, C. (2019) Progress on robotics in hospitality and tourism: a review of the literature. *Journal of Hospitality and Tourism Technology*, 10(4), 489-521;

[3] Liu, C. (2018). China's Alibaba to open its first automated hotel. *Nikkei Asian Review*. Retrieved on September 10, 2019 from https://asia.nikkei.com/Business/Companies/China-s-Alibaba-to-open-its-first-automated-hotel; Cadell, C. (2019). At Alibaba's futuristic hotel, robots deliver towels and mix cocktails. *Reuters*. Retrieved on September 10, 2019 from https://www.reuters.com/article/us-alibaba-hotels-robots/at-alibabas-futuristic-hotel-robots-deliver-towels-and-mix-cocktails-idUSKCN1PG21W

[4] Lukanova, G., & Ilieva, G. (2019). Robots, artificial intelligence, and service automation in hotels. In Ivanov, S. and Webster, C. (Eds.) *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, Bingley: Emerald Publishing Limited, pp. 157-183; López, J., Pérez, D., Zalama, E., & Gómez-García-Bermejo, J. (2013). Bellbot-a hotel assistant system using mobile robots. *International Journal of Advanced Robotic Systems*, 10(1), 40; Yu, C. E. (2019). Humanlike robots as employees in the hotel industry: Thematic content analysis of online reviews. *Journal of Hospitality Marketing & Management*, 1–17. Doi: https://doi.org/10.1080/19368623.2019.1592733; Dogan, S., & Vatan, A. (2019). Hotel Managers' Thoughts Towards New Technologies and Service Robots' at Hotels: A Qualitative Study in Turkey. In Cobanoglu, C., Cavusoglu, M., & Corbaci, A. (Eds.). *Advances in Global Business and Economics*, Volume 2, pp. 382-399.

[5] Recuero Virto, N. & Blasco Lopez, M. F. (2019). Robots, artificial intelligence and service automation to the core: Remastering experiences at museums. In Ivanov, S., & Webster, C. (Eds.) (2019). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. Bingley: Emerald Publishing, pp. 239-253; Levere, J. L. (2018). *Artificial intelligence, like a robot, enhances museum experiences*. Retrieved on February 4, 2020 from https://www.nytimes.com/2018/10/25/arts/artificial-intelligence-museums.html

[6] Berezina, K., Ciftci, O., & Cobanoglu, C. (2019). Robots, artificial intelligence, and service automation in restaurants. In Ivanov, S., & Webster, C. (Eds.) (2019). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. Bingley: Emerald Publishing, pp. 185-219; Yu, Q., Yuan, C., Fu, Z., & Zhao, Y. (2012). An autonomous restaurant service robot with high positioning accuracy. *Industrial Robot: An International Journal*, 39(3), 271-281; Lee, W. H., Lin, C. W., & Shih, K. H. (2018). A technology acceptance model for the perception of restaurant service robots for trust, interactivity, and output quality. *International Journal of Mobile Communications*, 16(4), 361-376; Acosta, L., González, E.,

Rodríguez, J. N., & Hamilton, A. F. (2006). Design and implementation of a service robot for a restaurant. *International Journal of Robotics & Automation, 21*(4), 273-280.

[7] Purdue University (2019). *Purdue University welcomes delivery robots*. Retrieved on September 10, 2019 from https://purdue.edu/newsroom/releases/2019/Q3/purdue-university-welcomes-delivery-robots.html

[8] Ogle, A., & Lamb, D. (2019). The role of robots, artificial intelligence, and service automation in events. In Ivanov, S. and Webster, C. (Eds.) *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, Bingley: Emerald Publishing Limited, pp. 255-269; The Vibe Agency. (2018). *Robots in events*. Retrieved on September 10, 2019 from http://www.thevibeagency.com/robots-in-events/

[9] Cohen, S. A., & Hopkins, D. (2019). Autonomous vehicles and the future of urban tourism. *Annals of Tourism Research*, *74*, 33-42; Tussyadiah, I. P., Zach, F. K. & Wang, J. (2017). Attitudes Toward Autonomous on Demand Mobility System: The Case of Self-Driving Taxi. In Schegg, R. & Strangl, B. (Eds.) *Information and Communication Technologies in Tourism 2017*. Proceedings of the International Conference in Rome, Italy, January 24–26, 2017, pp. 755-766.

[10] Coates, C. (2020). *Christie products power the world's first robot theme park in South Korea*. Retrieved on February 4, 2020 from https://blooloop.com/news/christie-robot-theme-park-south-korea/; Boucher, G. (2020). Disney's Spider-man robot: Watch theme-park automaton in aerial action. Retrieved on February 4, 2020 from https://deadline.com/video/disneys-spider-man-robot-watch-theme-park-automaton-in-aerial-action/

[11] Hornyak, T. (2020). Meet the robots that may be coming to an airport near you. Retrieved on February 4, 2020 from https://www.cnbc.com/2020/01/10/meet-the-robots-that-may-be-coming-to-an-airport-near-you.html

[12] Ivanov, S., & Webster, C. (2019e). Economic Fundamentals of the Use of Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality. In Ivanov, S., & Webster, C. (Eds.) (2019). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. Bingley: Emerald Publishing, pp. 39-55; Ivanov, S., & Webster, C. (2019f) Robots in tourism: a research agenda for tourism economics. *Tourism Economics* (forthcoming). https://doi.org/10.1177/1354816619879583

[13] Naumov, N. (2019). The impact of robots, artificial intelligence, and service automation on service quality and service experience in hospitality. In Ivanov, S. and Webster, C. (Ed.) *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, Bingley: Emerald Publishing Limited, pp. 123-133.

[14] Webster, C., & Ivanov, S. (2020). Demographic Change as a Driver for Tourism Automation. *Journal of Tourism Futures* (forthcoming). Doi: 10.1108/JTF-10-2019-0109.

[15] Ivanov, S. (2019). Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries? *Zeitschrift für Tourismuswissenschaft* 11(1), 25–43.

[16] Murphy, J., Gretzel, U., & Pesonen, J. (2019). Marketing robot services in hospitality and tourism: the role of anthropomorphism. *Journal of Travel & Tourism Marketing*, 36(7), 784-795.

[17] Tung, V. W. S., & Au, N. (2018). Exploring customer experiences with robotics in hospitality. *International Journal of Contemporary Hospitality Management* 30(7), 2680-2697; Tung, V. W. S., & Law, R. (2017). The potential for tourism and hospitality experience research in human–robot interactions. *International Journal of Contemporary Hospitality Management*, 29(10), 2498-2513; Qiu, H., Li, M., Shu, B., & Bai, B. (2019). Enhancing hospitality experience with service robots: the mediating role of rapport building. *Journal of Hospitality Marketing & Management*, 1-22. Doi: https://doi.org/10.1080/19368623.2019.1645073

[18] Ivanov, S. (2019). Ultimate transformation: How will automation technologies disrupt the travel, tourism and hospitality industries? *Zeitschrift für Tourismuswissenschaft* 11(1), 25–43.

[19] Robots are still quite expensive, although their prices are dropping significantly in recent years, and there are attempts to make affordable robots for hospitality companies, e.g. Thangiah, S. R., Karavias, M., Caldwell, R., Wherry, M., Seibert, J., Wahbeh, A., Miller. Z., & Gessinger. A. (2019). Greggg: A

Scalable High-performance, Low-cost Hospitality Robot. In Ivanov, S., & Webster, C. (Eds.) (2019). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. Bingley: Emerald Publishing (pp. 135-154).

[20] Ivanov, S., & Webster, C. (2017a). Designing robot-friendly hospitality facilities. *Proceedings of the Scientific Conference "Tourism. Innovations. Strategies"*, 13-14 October 2017, Bourgas, Bulgaria, pp. 74-81.

[21] Ivanov, S., & Webster, C. (2018). Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies – a cost-benefit analysis. In Marinov, V., Vodenska, M., Assenova, M. & Dogramadjieva E. (Eds) *Traditions and Innovations in Contemporary Tourism*, Cambridge: Cambridge Scholars Publishing, pp. 190-203; Ivanov, S., & Webster, C. (2019d). Conceptual Framework of the Use of Robots, Artificial Intelligence and Service Automation in Travel, Tourism, and Hospitality Companies. In Ivanov, S., & Webster, C. (Eds.) (2019). *Robots, Artificial Intelligence and Service Automation in Travel, Tourism and Hospitality*. ISBN: 978-1-78756-688-0. Bingley: Emerald Publishing, pp. 7-37.

[22] Ivanov, S., Webster, C. & Garenko, A. (2018). Young Russian adults' attitudes towards the potential use of robots in hotels. *Technology in Society* 55, 24-32; Ivanov, S., Webster, C. & Seyyedi, P. (2018). Consumers' attitudes towards the introduction of robots in accommodation establishments. *Tourism* 63(3), 302-317; Kazandzhieva, V., & Filipova, H. (2019). Customer attitudes toward robots in travel, tourism, and hospitality: A conceptual framework. In Ivanov, S. and Webster, C. (Ed.) *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, Bingley: Emerald Publishing Limited, pp. 79-92; Tussyadiah I.P., & Park S. (2018). Consumer Evaluation of Hotel Service Robots. In: Stangl B., Pesonen J. (eds) *Information and Communication Technologies in Tourism 2018*. Springer, Cham, pp. 308-320.

[23] Ivanov, S., & Webster, C. (2019f) Robots in tourism: a research agenda for tourism economics. *Tourism Economics* (forthcoming). https://doi.org/10.1177/1354816619879583

[24] Webster, C., & Ivanov, S. (2019). What do people think robots should do in hospitality and tourism? Preliminary findings from a global study of market segments. *Proceedings of the AIRSI2019 Conference "Artificial Intelligence & Robotics in Service Interactions: trends, benefits, and challenges"*, 8-9th July 2019, Zaragoza, Spain, pp. 55-71.

[25] Ivanov, S., & Webster, C. (2019a). What should robots do? A comparative analysis of industry professionals, educators and tourists. In Pesonen, J. & Neidhardt, J. (Eds.) *Information and Communication Technologies in Tourism 2019*, Proceedings of the International Conference in Nicosia, Cyprus, 30.01-01.02.2019, pp. 249-262.

[26] Ivanov, S., & Webster, C. (2019b). Perceived appropriateness and intention to use service robots in tourism. In Pesonen, J. & Neidhardt, J. (Eds.) *Information and Communication Technologies in Tourism 2019*, Proceedings of the International Conference in Nicosia, Cyprus, 30.01-01.02.2019, pp. 237-248.

[27] Newman, P. (2019). The Henn Na Hotel in Japan is firing most of its robotic workforce and hiring humans instead — highlighting the limits of automation. *Business Insider*. Retrieved on September 10, 2019 from https://www.businessinsider.com/henn-na-hotel-fires-robots-hires-humans-2019-1; Shead, S. (2019). World's first robot hotel fires half of its robots. *Forbes*. Retrieved from: https://www.forbes.com/sites/samshead/2019/01/16/worlds-first-robot-hotel-fires-half-of-its-robots/#78bf9dfde1b1

[28] Illum, S. F., Ivanov, S., & Liang, Y. (2010). Using virtual communities in tourism research. *Tourism Management* 31(3), 335-340.

[29] Webster, C., & Ivanov, S. (2020). Future tourism in a robot-based economy: a perspective article. *Tourism Review* (forthcoming). https://doi.org/10.1108/TR-05-2019-0172

[30] Webster, C. (2019). Halfway there: the transition from 1968 to 2068 in tourism and hospitality. *Zeitschrift für Tourismuswissenschaft*, 11(1), 5-23; Webster, C., & Ivanov, S. (2020). Demographic Change as a Driver for Tourism Automation. *Journal of Tourism Futures* (forthcoming). Doi: 10.1108/JTF-10-2019-0109.

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