Contents lists available at ScienceDirect

# Technology in Society

# Robots as restaurant employees - A double-barrelled detective story

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ABSTRACT

The paper evaluates the perceptions of Turkish restaurant managers and customers towards service robots. The sample includes 26 managers and 32 customers. Data were collected through semi-structured interviews. The findings reveal that robots are suitable for dirty, dull, dangerous and repetitive tasks. Customers have mostly positive attitudes towards robots while managers – mostly negative. However, respondents agree that robots improve service quality. A mixed service delivery system based on human-robot collaboration is perceived as the most appropriate. Customers are willing to pay more for the robotic service experience. Theoretical and managerial implications are discussed as well.

## 1. Introduction

The hospitality industry is often regarded as the 'people's business', i.e. people serve people. However, technological advances have allowed hospitality companies to introduce various technologies such as self-service kiosks [1], virtual and augmented reality [2,3], chatbots [4], blockchain [5], and other technologies. Robots are some of the latest additions in the technological arsenal of hospitality companies [6–8], including in restaurants [9–17]. Companies turn to robots and other automation technologies to cut costs, improve service quality and competitiveness, streamline operations [6,18]. More recently, the pandemic has stimulated contactless services, and robots are seen as one of the technological tools to provide physically distant service [19]. Demographic factors and the lack of sufficient employees in the hospitality labour market in developed economies are the factors that would drive the long-term adoption of robots and automation technologies as well [20].

This paper focuses on robots in restaurants. The restaurant industry is an interesting area of application of robots because of several reasons. First, restaurants have well-structured and well-defined operational procedures for storage, preparation and serving foods and drinks. The codified knowledge is exemplified in the service operations manuals, recipe books, HACCP (hazard analysis of critical control points) procedures. This explicit knowledge facilitates process automation and allows algorithms to be developed and programmed [21]. Second, as a result of the well-defined operational procedures, restaurants have already started to use automation technologies such as self-ordering kiosks in fast-food restaurants [1]. Third, the restaurant service includes front- and back-of-house operations with and without customer involvement, respectively, that have different degrees of automatability. Hence, although general restaurant operations are well-defined from an engineering point of view, they are not equally well automatable. Therefore, robots would have different applicability for front- and back-of-house operations [9,16]. Fourth, the restaurant service is infused with interactions between the service providers and the patrons and shape the perceived service quality [22]. The use of robots in service delivery would change patrons' perceptions of a restaurant's service quality. Fifth, the restaurant service's impact goes beyond the restaurant's premises and influences tourists' overall perceptions of the destination [23]. Thus, tourists' positive or negative experience with robots in restaurants might impact their perceptions of the robot restaurants and the destination as a whole.

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Unlike previous studies that focused either on supply- (managers, owners, employees) or demand-side (customers/patrons/tourists) perspectives, this paper adopts a more holistic approach and considers both perspectives. Specifically, the paper aims to: (*i*) understand the restaurant owners and managers' perceptions of service robots, (*ii*) understand the restaurant patrons' perceptions of robots in restaurant services, and (*iii*) explore the preference of suppliers and patrons on the service delivery systems (human-based, robotic or mixed service delivery system).

The paper uses Turkey as an empirical geographical setting due to several reasons. First, the restaurant industry in Turkey is large: it includes approximately 100.000 outlets [24] and employs around 2 million people. These figures are expected to increase in the coming years [25]. Second, the food and beverage sector is considered one of the vast and the most established sectors in tourism: it accounts for 16% of the total tourism expenditure (Sabah, 2019). According to Tourism Restaurant Investors and Gastronomy Enterprises Association, the Turkish food and beverage market size exceeded 110 billion Turkish liras (or approximately 20 billion USD) in 2019 [26]. Third, the current Covid-19 pandemic has severely harmed the restaurants in the country; they face a profound loss in revenue because governmental restrictions have lasted for over a year. Thus, re-designing the service system of restaurants may help to recover and revive the restaurant industry in Turkey, and rebuild the trust and confidence of potential restaurant customers. As Turkey is a well-known tourist destination and Turkish cuisine is a significant attraction of the country [27], it is also critical to build the international tourists' trust in the (post-)viral world to increase the restaurants' revenue. Fourth, previous studies have suggested that hotel employees in Turkey were not ready to work with robots [28] but the readiness of restaurant staff has not been investigated. Fifth, many restaurants in Turkey rely on food quality, human touch and hospitality in the service delivery as competitive advantages but the implementation of robots may hurt these sources of competitive advantage. In this regard, perceptions of both managers/employees and potential patrons towards robots in restaurants' service delivery systems are crucial for understanding the appropriateness of robotic service delivery systems in restaurants.

The rest of the paper is organised as follows. The next section provides a focused review of related literature on robots in restaurants. Section 3 elaborates on the methodology. Section 4 presents and discusses the results. The final section outlines the contribution of the paper, the theoretical and practical implications, addresses the limitations, provides directions to future research and concludes the paper.

## 2. Literature review

Since the paper explores the perceptions of both suppliers and potential patrons towards service robots in restaurants' service systems, the literature review includes two sections that focus on services robots in general and service robots in restaurants. The latter section analyses the literature on both the supply-side and demand-side perspectives of service robots in restaurants.

### 2.1. Service robots

A robot is an "actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks" [29]. Robots are divided into service and industrial robots based on their intended application. A service robot "performs useful tasks for humans or equipment excluding industrial automation applications" [29]. Robots are characterised by two main features – autonomy and the ability to sense and manipulate the environment. Autonomy is a robot's ability to sense the environment independently, plan its actions based on the data obtained from the environment and act accordingly to achieve a specific goal [30]. For a restaurant robot, this goal may be to deliver the food from point A to point B, flip the burger, clean the floor, etc. Obtaining data from the

environment takes place with sensors for identifying faces and objects, location and distances, temperature, sound and voice, etc. The robot influences the environment through actuators such as a motor, screen, lamp, speaker, robotic arm, etc. [31].

By the end of the 2010s, service robots had been employed in various service industries for the provision of information, cleaning, entertaining, and other tasks/activities, thus stimulating research on service robots [32–36]. Previous studies of service robots in the tourism and hospitality context, in particular, have found that people generally have positive attitudes towards robots [37], trust robots [38], and intend to use them [39]. Demographic characteristics such as gender, place of living, etc., have a significant effect on the way people perceive robots [37]. Robots are also instrumental in creating hospitality experiences [40,41]. Furthermore, research has shown that robots have a beneficial effect on the company's operations and costs, but their implementation would require significant staff training and adaptation of the company's facilities to allow for robots' navigation [42]. Furthermore, the use of robots can cause fears among employees of losing their jobs [43].

In terms of their appearance, service robots come in various shapes. They can be anthropomorphic (i.e., resemble a human), zoomorphic (look like an animal), caricatured (they have an unrealistic or cartoon-like appearance), and functional (machine appearance appropriate for the tasks the robot performs). Studies suggest that the physical appearance of service robots affects people's attitudes towards robots [33]. For example, the robot human-likeness positively influences an individual's robot acceptance [34] and boosts customers' service value expectations [32]. However, the relationship between the human-likeliness of a robot and the emotional response by the human is not linear, as confirmed by the uncanny valley concept introduced by Mori [44].

### 2.2. Service robots in restaurants

#### 2.2.1. A supply-side perspective of service robots in restaurants

From a supply-side perspective, previous studies on robots in restaurants have focused on several directions of research. Most of them have elaborated on what should robots be used for in a restaurant setting, i.e. what tasks can and/or should be robotised. Berezina et al. [9] outline that robots can be used for both back-of-house (cooking tasks) and front-of-house operations (hosts, runners, cashiers, waiters). Ivanov and Webster [45] evaluated people's perceived appropriateness of robot use for implementing various hospitality tasks, including tasks in restaurants. The authors found that tourism industry professionals consider that robots in restaurants should be used to take orders from the patrons, clean the tables, provide information about the menu, and deliver food and drinks. Cooking food was not viewed as appropriate for robotisation. Similar findings were reported by Eksiri and Kimura [46]; who found that, according to restaurant employees, robots should be used for cleaning the floor, serving food and drinks, reception, guiding customers to the tables, dancing. The perceived appropriateness of robots for implementing particular tasks is important because it is directly and positively connected to the intentions to use robots [47]. However, considering that some tasks should be robotised does not mean that they would be automated. Technical and economic (price) factors might prohibit the robotisation of some tasks [18]. For instance, Pereira et al. [14] provide a comprehensive review of the actions/tasks of foodservice workers and identify that the tasks that were rarely automated include separating solid-solid food parts, moving food between workstations or kitchen appliances, introducing food into another solid food or recipient, sewing food, etc.

The implementation of service robots in a restaurant improves productivity, ensures consistency in food quality [9], provides physical distancing during a viral outbreak [19], and decreases the staff working hours [15], hence saving on labour costs. However, robots may malfunction and create problems for the employees and the customers. This was the reason Henn na hotel officials declared when they announced

turning off half of their robots in January 2019 [48]. Nevertheless, robots are one of the solutions foodservice companies can use to mitigate the lack of employees [13].

### 2.2.2. A demand-side perspective of service robots in restaurants

From a demand-side perspective, Zemke et al. [16] found that restaurant patrons consider robots appropriate for food delivery (serving), cleaning, food preparation and inventory management, but not for order taking and security provision. Similar preferences of restaurant patrons were reported by Ivanov and Webster [45] except for order taking, which was found to be one of the most appropriate for robotisation, while cooking was perceived as inappropriate. Robots are also perceived as a more sustainable delivery mode for off-premise restaurants compared to human delivery and carry-out [10]. As a whole, restaurant robots appeal to kids and young customers [46,49]. The novelty of robotic technologies attracts customers to the restaurants, but this is not a guarantee for a repeat visit if the food quality is low, the price is high, or the overall value is poor [16]. Moreover, once robots become widespread, they would lose their novelty appeal and will not be a source of competitive advantage to restaurants.

The way restaurant patrons perceive robots influences their intentions to use them. For instance, Belanche, Casaló & Flavián [6] found that customers' perceptions of robots as service enhancement had a positive impact on intentions to use robots, while the perception of robots as a cost reduction tool had a negative impact on the intention to use. Moreover, Ivanov and Webster [50] showed that customers prefer the cost reduction achieved through the robotisation of restaurant services to be shared with them in the form of a price discount. Hence, when restaurants implement robots in their operations, they may face a situation when the labour cost savings they achieve through robotisation are offset by the price discount customers request for the robotised service. Additionally, the intentions to use robots in restaurants depend on customers' perceived trust in them, their enjoyment of interacting with robots and attitudes (positive or negative) towards (the use of) robots in restaurants [11].

Furthermore, previous studies have found that the anthropomorphism of robot chefs positively affects food quality prediction [17]. On the other hand, the anthropomorphism of service robots in a restaurant was found to negatively affects consumers' willingness to use robots in restaurants [51]. Contrarily, Lu et al. [52] show that the relationship between anthropomorphism and intentions to use service robots in a restaurant context is not linear and depends on the specific combination of human-likeness (high or low) of robot's voice, language and appearance.

Robots can create funny and memorable dining experiences [12]. In addition, they provide greater stability of the service performance [53], but they may lead to the dehumanisation of the restaurant service experience [12], and they may cause a service failure when they malfunction. When this happens, restaurant patrons are more likely to attribute the responsibility of the service failure to the firm than to the frontline employees when they are served by a robot [53].

## 3. Methodology

This paper adopted the qualitative case study method to analyse the perceptions towards service robots in restaurants because it is considered helpful for analysing complex social phenomena [54]. Besides, the qualitative approach allows researchers to obtain better insight into the participants' perceptions, feelings, and ideas [55]. Therefore, since this study aimed to explore the restaurant owners'/managers' and customers' perceptions of service robots in restaurants, the qualitative method is considered the suitable approach to gain in-depth knowledge about the subject.

Pertinent to the research aims, the study comprises two case studies related to suppliers (restaurant owners and managers) and potential restaurant patrons. Turkey is the study area of both cases. Qualitative

data were collected through semi-structured interviews from suppliers and patrons.

### 3.1. Data collection and analysis

Due to the pandemic's challenges (lockdowns and restrictions), restaurants in Turkey were closed during the data collection period. Thus, the interviews were held through different online platforms (Zoom, WhatsApp, Facetime etc.). The sample was selected by taking research objectives into account through the combination of snowball and purposive sampling. Interviews were conducted for both cases (suppliers and patrons) until saturation point was reached [56], and the data collection stopped after 26 interviews (including two pilot interviews) with suppliers (restaurant owners and managers) and 32 interviews (including three pilot interviews) with potential patrons. The sampling procedure started with reaching the known individuals from both supply and demand sides suitable for the study. Besides, a search was implemented on the internet and social media platforms to find potential participants. Accordingly, from the people contacted, individuals who wanted to be involved in the research were identified after the research aims were presented to them. Initially, appointments were arranged to carry out the online interviews through a preferred online platform, with four demand and supply-side participants. After completing the interviews with these participants, they were asked to recommend individuals suitable for the study. Furthermore, the suggested individuals were contacted (through phones and their social media account) and informed about the research objectives and details.

Following this sampling process, appointments were arranged to carry out the online interviews through a preferred online platform with those who agreed to participate. Online interviews are convenient because they remove the barriers of time and financial constraints and the challenges of locational distances that endanger face-to-face interviews [57]. They are especially useful when it is impossible to implement face-to-face interviews. Since not all participants were familiar with robotic services in a restaurant context, before their interviews, a video of robotic services in restaurants, compiled from YouTube videos about robot services in restaurants by one of the authors of this research, was sent to the participants. The aim was to provide participants with a clearer perspective towards robots in restaurant services.

The interviews were held between 18 March and May 5, 2021 with the 26 suppliers (restaurant owners and managers) and between 18 March and 1 May 2021 with 32 patrons. Tables 1 and 2 provide the respondents' profiles. Participation was voluntary, and only some basic demographic data was collected. All interviews were conducted in Turkish and later translated into English. The individual interviews ranged from 18 to 41 min for suppliers and 17–44 min for patrons. Before starting the interviews, permissions were obtained for voice recordings. After completing the interviews, they were transcribed verbatim for the analysis. The interview questions for both suppliers and patrons are presented in Appendix 1.

Data was analysed through content analysis consisting of three stages: reduction, displaying, and conclusion verification [58]. First, the raw data were filtered, and participants' statements matching the objectives of the study were determined. In the last stage, the categories, themes and sub-themes emerged independently by three human coders having qualitative research experience. After the authors' discussion related to the emerged categories, themes and sub-themes extracted independently, the findings were agreed upon and finalised. Finally, to check the reliability of the coding of this study, two other researchers (not including in this research) were asked to match the statements with the identified themes and subthemes. According to the kappa analysis, there was substantial agreement ($\kappa = 0.737$) between the two researchers [59].

**Table 1**
Profile of suppliers.

| Suppliers | Gender | Age group | Education | Position | Experience | Location |
|---|---|---|---|---|---|---|
| S1 | Male | 31–40 | Master's | Management position | over 15 years | Istanbul |
| S2 | Male | 31–40 | Bachelor | Owner | over 15 years | Istanbul |
| S3 | Male | 20–30 | Master's | Management position | 11–15 years | Istanbul |
| S4 | Male | 41–50 | Elementary | Management position | over 15 years | Istanbul |
| S5 | Male | 31–40 | Bachelor | Management position | over 15 years | Istanbul |
| S6 | Male | 31–40 | Elementary | Management position | over 15 years | Istanbul |
| S7 | Male | 31–40 | College | Management position | over 15 years | Istanbul |
| S8 | Female | 31–40 | Bachelor | Owner | 11–15 years | Çanakkale |
| S9 | Male | 20–30 | Master's | Owner | 11–15 years | Istanbul |
| S10 | Male | 41–50 | Bachelor | Management position | over 15 years | Istanbul |
| S11 | Male | 31–40 | High school | Management position | over 15 years | Istanbul |
| S12 | Female | 31–40 | Bachelor | Management position | 5–10 years | Istanbul |
| S13 | Male | 31–40 | High school | Owner | over 15 years | Istanbul |
| S14 | Male | 20–30 | High school | Management position | 5–10 years | Istanbul |
| S15 | Male | 31–40 | High school | Management position | 5–10 years | Istanbul |
| S16 | Female | 31–40 | High school | Management position | 11–15 years | Istanbul |
| S17 | Male | 31–40 | Bachelor | Owner | 5–10 years | Istanbul |
| S18 | Male | 31–40 | Bachelor | Management position | 5–10 years | Istanbul |
| S19 | Male | above 50 | Elementary | Management position | over 15 years | Balıkesir |
| S20 | Male | 31–40 | Elementary | Management position | over 15 years | Istanbul |
| S21 | Male | above 50 | Elementary | Management position | over 15 years | Istanbul |
| S22 | Male | 31–40 | Master's | Management position | over 15 years | Istanbul |
| S23 | Male | 31–40 | Master's | Management position | over 15 years | Antalya |
| S24 | Male | 31–40 | Master's | Management position | 11–15 years | Istanbul |
| S25 | Male | 31–40 | High school | Management position | over 15 years | Istanbul |
| S26 | Male | 20–30 | Bachelor | Management position | 5–10 years | Istanbul |

**Table 2**
Profile of patrons.

| Patrons | Gender | Age group | Education | Employment |
|---|---|---|---|---|
| P1 | Female | 41–50 | Bachelor | Real estate agent |
| P2 | Female | 41–50 | Master's | Language coach |
| P3 | Female | above 50 | Master's | Language coach |
| P4 | Male | 31–40 | Ph.D. | Academician |
| P5 | Female | 31–40 | Master's | Winemaker |
| P6 | Female | above 50 | Master's | Food researcher |
| P7 | Female | 41–50 | Ph.D. | Academician |
| P8 | Female | 41–50 | College | F&B manager |
| P9 | Female | above 50 | Master's | Nurse |
| P10 | Female | above 50 | College | First-aid instructor |
| P11 | Female | 31–40 | Master | Room division manager |
| P12 | Female | above 50 | Master's | Academician |
| P13 | Female | above 50 | Bachelor | Nurse |
| P14 | Male | 31–40 | Master's | Academician |
| P15 | Female | 31–40 | Master's | Sales manager |
| P16 | Male | above 50 | Bachelor | Local guide |
| P17 | Male | 20–30 | Master's | Trainer-chef |
| P18 | Female | 31–40 | Bachelor | Cook |
| P19 | Male | 31–40 | Master's | Academician |
| P20 | Male | above 50 | Ph.D. | Academician |
| P21 | Male | 31–40 | Bachelor | Consultant |
| P22 | Female | 20–30 | Bachelor | Cook |
| P23 | Female | 20–30 | Master's | Academician |
| P24 | Male | 20–30 | Master's | Business owner |
| P25 | Male | 41–50 | Master's | Consultant |
| P26 | Male | 20–30 | High school | Cook |
| P27 | Female | 31–40 | Master's | Tourism industry employee |
| P28 | Female | 31–40 | Master's | Food designer |
| P29 | Male | 31–40 | Bachelor | Consultant |
| P30 | Male | 20–30 | Bachelor | Student |
| P31 | Male | above 50 | High school | Consultant |
| P32 | Female | 31–40 | Master's | Tourism industry employee |

## 4. Results and discussion

The results demonstrate that the themes and sub-themes of both cases (supply and demand side) consist of five main categories (see Table 3): 'Attitude and readiness towards robots in restaurant services', 'suitable tasks for robots in restaurant services', 'preferred robot appearance', 'impacts of service robots in restaurant services' and 'preference towards the service delivery system'. As the cases are from suppliers and patrons' perspectives, the themes and sub-themes differ for each case (see Table 3). Thus, the findings are presented as two different perspectives (suppliers and patrons) under each category with their related discussions. For the quotations, "S" refers to a supplier, "P" means a patron.

### 4.1. Attitude and readiness towards robots in restaurant services

#### 4.1.1. Suppliers

The findings of the case of suppliers (restaurant owners and managers) show that the perceptions of suppliers related to the attitude and readiness towards robots in restaurant services include three main themes: *(i)* the readiness of employees and patrons, *(ii)* incompatibility of robots with the nature of restaurant services, and *(iii)* the future of robots in restaurant services.

*4.1.1.1. The readiness and attitudes of employees and patrons.* While some restaurant owners and managers think that employees and customers are ready and would have positive attitudes toward robots in restaurant services, others have opposite perceptions. Most of the participants hint that employees are not ready to work with robots in restaurants and that employees' attitudes would be negative due to several reasons: the concern of losing the job, antipathy towards robots, feeling useless compared to service robots, and the need for time to get used to working with robots.

The fear of losing the job is the main barrier that causes restaurant employees to not be ready and have negative attitudes (see also [60]). For instance, one of the suppliers (S26) says that "… I think that employees would be upset about working with robots … because the more they (robots) come into our lives, the fewer people will be needed in restaurants. That's why it would be a disappointment for our employees …". Moreover, S2 stresses that their employees would find robots antipathic: "… I watched the video of robotic restaurant services with three of my employees. All three are people from different age groups … from very different economic family structures … the reaction of all three was, "what is this?" … When I asked them … what you would think … if it (robotic restaurant) was ours?.. At the same time, the answer of all three is: Don't!..they found it antipathic".

**Table 3**
The findings of supply and demand sides.

| Categories | Themes and/or sub-themes | |
|---|---|---|
| | Supply Side (Restaurant owners and managers) | Demand Side (Potential Patrons) |
| **Attitude and readiness towards robots in restaurant services** | **1. The readiness and attitudes of employees and patrons**<br>**-Employees**<br>*Ready and positive attitude: robots are entertaining; they would reduce the workload.*<br>*Not ready and negative attitude: the concern of losing the job; antipathy towards robots; feeling useless comparing themselves to robots; need time to get used to working with robots.*<br>**-Patrons**<br>*Ready and positive attitude: robots are attractive; they are entertaining; patrons will be curious about it- they will be willing to experience; they will find robots exciting; patrons would prefer because robots will provide contactless service.*<br>*Not ready and negative attitude: the need of socialising and communicating in restaurants; older customers will have adaptation problems with robots.*<br>**2. Incompatibility of robots with the nature of restaurant services**<br><br>- *The needs in the restaurant businesses: communication, emotions, and socialising; skills of sales techniques; cooking skills and tacit knowledge; making consumers feel special; providing quality service; providing tasty products; preventing and fixing serving failures*<br>**3. The future of robots in restaurant services**<br><br>- Will be widespread<br>- Will harm the sector | **Readiness and attitudes of patrons**<br>*Positive attitudes and readiness to use robots: robots are advantageous because they will eliminate the unhygienic situations; they are advantageous because more viruses may appear in the future; they are more useful for supportive tasks (Mise en place: the setup tasks before cooking and serving (i.e. cutting, chopping, slicing, washing and cleaning ingredients, and set up tables); they will increase the service efficiency and quality; they will increase the speed of service; robots are safe in covid-era because they provide contactless service, and a robot is needed especially for serving tasks.*<br>*Negative attitudes and lack of readiness to use robots: robots will not address the need for communication and emotions between host-guests in restaurants; they will decrease the employment; they will damage the experience quality; they will damage the naturalness and tacit knowledge in restaurants; robots should not be used in cooking tasks because the food cooked by a human is tastier; they will decrease the hedonic experience.* |
| **Suitable tasks for robots in restaurant services** | 'Cleaning', 'washing dishes', 'hygiene, sterilization, and sanitation', 'lifting heavy things', 'hosting (Host/Hostess)', 'repetitive tasks', 'Mise en place: the setup tasks before cooking (i.e. cutting, chopping, slicing, washing and cleaning ingredients)', 'busser/commis waiter tasks (i.e. carrying equipment and food, clearing the tables, wiping cutlery, changing tablecloth)', 'serving (i.e. taking orders, serving food)', 'preparing cocktails at the bar'. | **'Cooking', 'bartending', 'calculating',** 'cleaning', 'washing dishes', 'hygiene, sterilization, and sanitation', 'lifting heavy things', 'hosting (Host/Hostess)', 'repetitive tasks', 'Mise en place: the setup tasks before cooking (i.e. cutting, chopping, slicing, washing and cleaning ingredients)', 'busser/commis waiter tasks (i.e. carrying equipment and food, clearing the tables, wiping cutlery, changing tablecloth)', 'serving (i.e. taking orders, serving food)', 'preparing cocktails at the bar'. |
| **Preferred robot appearance** | - Humanoid<br>- Neither human nor animal-a machine shape<br>- The function is more important than the shape | - Humanoid<br>- Neither human nor animal-a machine shape<br>- A cute shape (either humanoid or animal) |
| **Impacts of service robots in restaurant services** | **1. Competitiveness**<br>Pros:<br><br>- *attractive*<br>- *building confidence of patrons*<br>- *contributing to the image*<br>- *innovativeness*<br>**2. Service quality**<br>Pros:<br><br>- *not having any physical and psychological problems (such as getting tired, feeling bad or getting ill)*<br>- *standardisation in service quality*<br>- *being fast and saving time*<br>- *having higher performance*<br>- *supporting background tasks: creating more time for human employers*<br>- *decreasing the service failures*<br>- *increasing the service capacity*<br>- *implementing the task correctly and on time*<br>- *ability to work 24/7 h*<br>- *free of adaptation problem*<br>- *no need for training*<br>Cons:<br><br>- *lack of detecting service failures*<br>- *insufficiency in unpredictable and emergency situations/lack of crisis management skills*<br>- *sudden breakdowns and need of maintenance*<br>**3. Experience**<br>Pros:<br><br>- *adding value to the experience*<br>- *contactless safe experience-preventing from virus transmission*<br>Cons:<br><br>- *lack of humanoid (natural) communication skills*<br>- *eliminating socialising* | **1.Attractiveness of robotic restaurants**<br>Pros:<br><br>- *willingness to dine in a robotic restaurant*<br>- *willingness to pay more*<br>- *main motivation to travel-travelling to a destination for a robotic restaurant experience*<br>**2. Service quality**<br>Pros:<br><br>- *not having any physical and psychological problems (such as getting tired, feeling bad or getting ill)*<br>- *standardisation in service quality*<br>- *being fast and saving time*<br>- *having higher performance*<br>- *preventing the possible service failures and accidents*<br>Cons:<br><br>- *lack of detecting service failures*<br>- *insufficiency in unpredictable and emergency situations/lack of crisis management skills*<br>- *not addressing the special requirements*<br><br>**3. Experience**<br>Pros:<br><br>- *adding value to the experience*<br>- *contactless safe experience-preventing from virus transmission*<br>- *providing different types of experiences: unique, contemporary, exciting, interesting, hedonic, new, entertaining, safe*<br>Cons:<br><br>- *lack of humanoid (natural) communication skills*<br>- *eliminating socialising* |

**Table 3** (*continued*)

| Categories | Themes and/or sub-themes | |
|---|---|---|
| | Supply Side (Restaurant owners and managers) | Demand Side (Potential Patrons) |
| **Preference towards the service delivery system** | **4. Financial**<br>Pros:<br><br>- *will decrease the cost of labour*<br>- *will increase the sales*<br>- *decreasing the cost of products through using them efficiently*<br>**1. Human-based service delivery system:** human employees in all aspects of front-of-house operations, but (some of) back-of-house operations maybe with robots - (S1, S3, S4, S8, S9, S15, S16, S18, S20)<br>*Reasons: the philosophy of service is based on communication and social interactions; host-guest interactions; meet special requests; background tasks with robots will increase service quality … but food cannot be tasteful with robots.*<br>**2. Mixed service delivery system:** service robots for some front-of-house operations- (S2, S5, S7, S10, S11, S12, S13, S14, S21, S22, S23, S25, S26)<br>*Reasons: harder back-of-house and front-of-house tasks for robots; to decrease the costs and benefit from human experience; the sector needs human knowledge and experience that robots may not be able to do in some tasks (i.e. communicating with guests, guessing their special requirements, solving the service failures, the tasks that need tacit knowledge such as cooking a traditional food); initially this system is better until people get used to it; taking advantage of both sides' strengths.*<br>**3. Robotic service delivery System:** service robots for all front-of-house operations and some back-of-house operations - (S6)<br>*Reasons: provide failures-free and problem-free service.* | **1. Human-based service delivery system:** human employees in all aspects of front-of-house operations, but (some of) back-of-house operations maybe with robots - (P1, P9, P10, P12, P20, P24, P26, P31, P32)<br>*Reasons: robots are safer for back-of-house tasks; robots are not suitable for front-of-house tasks; the need for host-guest interaction and the hosts' warmth to provide valuable experience; willingness to see human employees for front-of-house tasks.*<br>**2. Mixed service delivery system:** service robots for some front-of-house operations- (P3, P4, P5, P6, P7, P8, P11, P13, P15, P17, P18, P19, P21, P22, P23, P25, P27, P29, P30)<br>*Reasons: benefit from both sides' skills; benefit from human experience; human experience is valuable; the need of human employees for the taste and communicating to guests; to increase the service quality; the need of human employees for special conditions to overcome service failures; the need of professional human chefs in restaurants.*<br>**3. Robotic service delivery System:** service robots for all front-of-house operations and some back-of-house operations - (P14, P16)<br>*Reasons: futuristic (very modern); different food flavours will emerge with robotics; willingness to see how successful the robotic system is.* |

On the other hand, several suppliers assert that employees are ready and would have a positive attitude towards robots in restaurant services due to reasons such as robots are entertaining, and they would reduce the workload of employees. For instance, S18 expresses that "Our employees would want to work with robots. Because robots will reduce their workload … robots would help them more than a human employee …". In that sense, these respondents emphasise the enhancement effect of robots related to the increased productivity of human employees due to their collaboration with service robots [18] and the decent work environment that can be created through automation [61].

Knowing the customers' perspective is important for the managers because, within the framework of the institutional theory [62], the customers are the source of the coercive pressure of the new technologies adoption. Specifically, restauranteurs may adopt robots not because they want but because customers expect them to implement robots in their operations. The perceptions of suppliers related to the readiness of restaurant patrons also consist of two opposite directions: 'ready and positive attitude' and 'not ready and negative attitude'. Initially, according to most participants, customers are ready and would have a positive attitude towards robots in restaurant services. The reasons for the readiness and positive attitudes are revealed as robots are attractive; entertaining; patrons will be curious about robots-they will be willing to experience; patrons would find robots exciting; patrons would prefer because robots will provide contactless service. For instance, one of the participants says that "… our patron profile is high level … they like the things that attract attention … which they can share in social media platforms etc … Thus, I think they would come to the robotic restaurant … They would find robots attractive …" (S8). Another supplier (S15) also mentioned that "… it can be exciting at first. It's very different … I think most of the patrons would like them (robots)".

On the flip side, some participants (S1, S3, S4, S18) consider that customers are not ready and would have a negative attitude due to two reasons: (i) the need for socialising and communicating in restaurants, and (ii) older customers would have adaptation problems with robots. For instance, S3 stated that: "I think that our restaurant patrons would have a negative attitude towards this situation (the idea of a robotic restaurant) because we have excellent communication with many of them. When some of our guests come … (with some of them), we sometimes get a coffee and chat … which both parties are happy about

… as the expectation is in this direction, it will be difficult for them (patrons) to adopt robots …".

Although studies related to employees' readiness and patrons' perspectives through the perspectives of owners and managers of restaurants do not exist in the literature, readiness and attitudes are considered significant issues in terms of intention to use or being involved in the robotic service environment [11]. For example, readiness in using service robots is linked with intrinsic motivation in hotel services [51].

*4.1.1.2. Incompatibility of robots with the nature of restaurant services.* The results show that half of the suppliers have a negative perception of robots' compatibility with the nature of restaurant services. They stressed that there are several features that restaurant service context must have: *(i)* communication, emotions, and socialising, *(ii)* skills of sales techniques (for serving tasks), *(iii)* cooking skills and tacit knowledge, *(iv)* making consumers feel special, *(v)* providing quality service, *(vi)* providing tasty products, and *(vii)* preventing and recovering service failures.

Regarding the mentioned features that shape the nature of restaurant services, S7 indicates that guest-employees interaction and communication that enables a social environment are significant in their restaurant. Thus, since robots are not compatible with such natural communication, emotions, and socialising in the restaurant environment, they are likely to harm their businesses. Additionally, S24 states that hospitality created with personal communication, positive energy, and a smiley face is possible with only human communication skills. He further explains that asking patrons about their special requests (i.e. allergic to anything, adding or removing any items) can make the guest feel special in restaurant services.

Additionally, another supplier (S1) stressed that knowledge and experience related to restaurant sales techniques are vital. He further says that " … sales techniques are essential. For example, tourists are interested in food/gastronomy … coming to your country. They want advice from you, and they want to try the special wines of the day, maybe they want to drink wine produced from the local grapes or eat a dish made with the local seasonal ingredients … In restaurant services … the human factor is crucial in these aspects … A waiter's approach to the guest is important here … ". On the other hand, S18 indicates that in the restaurant context, tacit knowledge and cooking skills that are hard to be

expected from robots are significant in terms of providing tasty products to the guests. Moreover, another participant (S23) hints that robots may not maintain the harmony of sauces or flavour balance of dishes.

The literature also supports that some components are vital for restaurants. The gastronomic aspects (i.e. taste and flavour) are crucial components of restaurant service because they are food quality indicators that can affect patrons' satisfaction and loyalty [49]. Additionally, preventing and recovering service failures is essential for the quality of restaurant services. Thus, these two features of restaurant service that suppliers indicated are inter-related issues. Besides, the interaction between service employees and patrons is considered a significant restaurant service component [63]. Finally, customer and employee interaction, which includes communication, emotions, and socialising aspects in a restaurant, can potentially influence customers' satisfaction and post-purchase behaviours [64].

*4.1.1.3. The future of robots in restaurant services.* According to the participants, two dominant perspectives are revealed about the future of robots in restaurants services: while most of the suppliers (17 participants) think that robots will be widespread, some (6 participants out of 17) state that robots will harm the restaurant industry because they will decrease employment. S1 implies that the use of robots will be widespread in the future, especially for fast-food restaurants. He further states that the use of robots will be beneficial for the delivery and takeaway services. S13 said that "… in the future, the use of robots in the service of restaurants will be widespread … One hundred per cent. We already see that … In this sense, there will be a negative effect. It will create unemployment …". His opinion was shared by S26, who further explains that the use of robots is not good as many students are studying gastronomy and will not be able to find jobs.

The effect of the current pandemic can explain why most participants think that robots will be widespread. During the pandemic, since robotics aren't affected by the virus, the robotic technology is used effectively for the tasks such as disinfection, cleaning, delivering, and providing information to people [19]. Thus, these developments and the increasing use of robotic technology may have shaped the participants' views of this study. Furthermore, the findings resonate with previous studies that robots in restaurant services could be common in the future [9], that robots can replace human cooks and chefs together with replacing many workers by doing other tasks (serving, bartending, housekeeping etc.) in the hospitality sector [11], and that robots may negatively influence employment in tourism and hospitality [28].

*4.1.2. Patrons*

The attitude of patrons towards and readiness to use robots in restaurant services include two perspectives: positive attitudes and readiness to use robots, and negative attitudes and lack of readiness to use robots.

*4.1.2.1. Positive attitudes and readiness to use robots.* The patrons who have positive attitudes towards and are ready to use robots in restaurants explain their perceptions by expressing the advantages and positive sides of service robots. While some of the patrons (P1, P20 and P21) think that robots are advantageous because they will eliminate the unhygienic situations in restaurants, one of them (P3) indicates that robots are advantageous as there might be more viruses in the future. Relatedly, three patrons (P18, P24 and P29) also have positive attitudes towards service robots in restaurants because they find robots safe as they provide contactless service. The literature also supports that robots enable a safe service environment by providing physically distant service [19].

Additionally, the patrons also pointed out the other reasons for their readiness and positive attitudes as *(i)* robots are more useful for supportive tasks (Mise en place: the setup tasks before cooking and serving, i.e. cutting, chopping, slicing, washing and cleaning ingredients, and set

up tables) (P5, P8, P12, P19 and P24), *(ii)* robots are needed for serving tasks in restaurants (P22 and P23), and *(iii)* robots will increase the speed of service (P16 and P24) together with the service efficiency and quality (P14 and P21).

It can be concluded that the readiness and positive attitudes of patrons are mostly due to the usefulness of robots and the safe environment that they enable. The reasons for acceptance and positive attitudes of customers towards robots are associated with the perceived benefit and efficiency of using robots in services [65]. Moreover, the perceived effectiveness of robots can significantly influence the preferences of customers [66].

*4.1.2.2. Negative attitudes and lack of readiness to use robots.* The patrons who are not ready and have negative attitudes towards using robots in restaurants state the negative sides of robots as reasons. The most frequently mentioned reason is that 'robots will not address the need for communication and emotions between host guests in restaurants', expressed by 11 participants. Moreover, while some participants think that robots will damage the naturalness and tacit knowledge (refers to the knowledge, skills, and abilities that an individual obtains through working experience [67] in restaurants), others are negative about using robots in cooking tasks because they believed that food made by human chefs is tastier. This supports previous studies that found that due to the lack of warmth in service robots, consumers' perceptions towards machine-made foods can be negative (Fuchs et al., 2015). Finally, two of the participants (P30 and P31) state that the use of robots in restaurant services will decrease their hedonic experience. Finally, P9 has a negative attitude and is not ready for robots because she stressed that robots would damage the experience quality and decrease employment. Some additional comments are given below:

"… I prefer to communicate with people rather than with machines … You want to see the facial expression of the person who says good morning to you. You can't see it from a robot … Having sympathetic relationships with people in the restaurant environment … People often go to restaurants to communicate … to socialise …". [P9]

"… I think that it will reduce the hedonic experience you will get from the food …. I don't think that robotisation will be suitable for a dining experience and the environment of the restaurant … I want the chef's hand to touch to food in restaurants". [P30]

These findings show that patrons having negative attitudes and not being ready for robots explain the reasons that are consistent with the suppliers' perspectives on the nature of restaurant services. As it is mentioned under the theme of "incompatibility of robots with the nature of restaurant services", some of the features (i.e. communication, emotions, and socialising; cooking skills and tacit knowledge; and providing tasty products) that suppliers stated as necessities in restaurant services are also mentioned by patrons as reasons that resulted with negative attitudes. Furthermore, patrons having negative attitudes and not ready for robots think that robotic restaurants would lack these features.

*4.2. Suitable tasks for robots in restaurant services*

*4.2.1. Suppliers and patrons*

As illustrated in Table 3, suppliers and patrons pointed almost the same tasks as suitable for robots in restaurant services. However, patrons mentioned three more tasks such as 'cooking', 'bartending', and 'calculating' suitable for robots. The other tasks that both suppliers and patrons find suitable for robots in restaurant services are 'cleaning', 'washing dishes', 'hygiene, sterilization, and sanitation', 'lifting heavy items', 'hosting (host/hostess)', 'repetitive tasks', 'Mise en place: the setup tasks before cooking (i.e. cutting, chopping, slicing, washing and cleaning ingredients)', 'busser/commis waiter tasks (i.e. carrying equipment and food, clearing the tables, wiping cutlery, changing tablecloth)', 'serving (i.e. taking orders, serving food)', 'preparing

cocktails at the bar'. Several examples from both supply and demand sides are provided below:

> "… in our restaurant services … I would look forward to the process in the preparation part. Because I would like to evaluate robots in the preparation tasks before cooking, for example cutting, chopping, slicing … and for the standardisation of these tasks". [S5]

> "… hosting task could be much better … I guess robots are working on this task now. It could work for the tasks of cleanliness … dishwashing … It could be used for serving tables. Thus, it can speed up the service … It makes human employees' jobs easier … everything can be served with a standard quality …" [S14]

> "… I think it would be appropriate for preparing food in the kitchen … Robots that can apply certain recipes would be good …" [P17]

> "… Robot could be a bartender … Robots can do a good job at cleaning … I think that robots will be very successful in cleaning. Also, in serving the tables … robots will not be bad". [P18]

The literature states that service robots are preferred in restaurants for serving and cooking tasks [12,49]. However, robots can also be used for repetitive, simple, and dangerous jobs in hospitality services [68]. Additionally, service robots have been adopted in the tourism and hospitality industry for various tasks such as cleaning, room service, delivering, serving food and beverages, entertainment, and hosting [42]. Moreover, the findings demonstrate that suppliers and consumers of restaurants find robots suitable for more tasks than those stated in the literature regarding restaurant services. Thus, service robots are likely to have a wider use and acceptance in almost all tasks in the restaurant environment in the future.

### 4.3. Preferred robot appearance

#### 4.3.1. Suppliers and patrons

The preference of suppliers and patrons towards the appearance of service robots in the restaurant context is revealed mostly as humanoid. Furthermore, there are also participants on both sides (supply and demand) who prefer service robots as machines instead of humanoid or zoomorphic. On the other hand, two suppliers (S6 and S16) stated that they would ignore the robots' appearance but pay attention to the function. Besides, three patrons (P1, P3 and P15) indicate that they would prefer a cute shape for service robots in a restaurant environment.

For example, from the supply side, S4 prefers humanoid robots. He explains that humanoid appearance would not scare customers, but animal appearance may be frightening. On the contrary, S12 finds the humanoid shape frightened and instead, she prefers a more mechanical appearance that a person could easily identify as a robot. This view can be explained by the uncanny valley theory, which suggests that a high level of anthropomorphism can evoke a negative attitude towards service robots [44,69]. Finally, S6 thinks that appearance is not a significant issue in terms of service robots, and he adds that the most important thing is the efficiency of restaurant services. Some further related statements can be presented as:

> "… I prefer a robot to have a human appearance rather than a mechanical one … I frankly have no sympathy for anything industrial … How do customers want? … I can't say anything about it but … having a human image is something that everyone may like …" [S2]

> "… not in the form of a human or animal but something that has functions, seem more technical, something easy to use … functional … more mechanical. I wouldn't prefer it to be too human or animal-shaped …" [S8]

On the flip side, P1 states that people would like the cute shape robots. Furthermore, P10 prefers machine-looking instead of humanoid or zoomorphic robots. On the other hand, another patron (P11) finds the

humanoid appearance more reliable and prefers to be served by humanoid robots. In particular, potential customers commented that:

> "… animals can also be chosen … A robot can be something that has a cute figure. That way robots would be preferable in restaurants". [P13]

> "I would like it to be simpler. I would like it to be just a machine rather than a shape of a human or animal". [P30]

Therefore, the findings provide partial support to the results of previous studies that claimed that robot human-likeness influences an individual's robot acceptance positively [34]. The reason for the mixed results might stem from the diversity of the tasks that robots in restaurants can perform that require they have different shapes. A waiter robot can be a humanoid, but it would be more efficient if it is more machine-looking (e.g. a minibar on wheels) because it may have more trays to carry the dishes. Furthermore, a robotic chef does not need to be humanoid or zoomorphic – a robotic hand or a machine-looking robot can implement the task correctly, although previous studies suggest that patrons consider that the food from anthropomorphic robotic chefs is better [17].

### 4.4. Impacts of service robots in restaurant services

#### 4.4.1. Suppliers

For the suppliers, the impacts of service robots in restaurant services consists of four themes such as competitiveness, service quality, experience, and financial aspects. The sub-themes of these themes are presented as pros or/and cons. Suppliers' perspectives show that robots have various impacts that can be evaluated in different aspects, and while there are more advantages, disadvantages exist as well.

*4.4.1.1. Competitiveness.* Fifteen suppliers express that using robots in restaurant services would be advantageous to obtain competitiveness in the market. Suppliers think that consumers would find service robots interesting and would be curious to experience them. In this regard, S1 says that "… people may wonder, may want to get service from robots, they may find robots interesting … I'm sure they would like to go to a restaurant in which robots serve …". Moreover, some participants stress that using robots in their restaurant will contribute to their restaurant image because it is innovative. For instance, one of the suppliers (S18) explains that "… using robots would affect our image positively. I also think that we will have a very good advertisement because people are always hungry for innovation, in my opinion. Moreover, service robots would be a very good advertisement and would be a good image … especially since new things are used well by today's social media networks … It would provide a competitive advantage …". Another related example is:

> "… gives a competitive advantage in the market … Innovation is always good. Of course, making this innovation in this market is an advantage … Imagine that you are the first to make this innovation. It would be a great advantage for you …" [S26]

A few suppliers (S22, S23 and S24) are optimistic about using robots in restaurant services. According to these participants, robots can help build customers' confidence in the viral world because they believe that the current pandemic has decreased consumers' trust. In this vein, S22 stresses that recently, most of the patrons of their restaurants want to see the kitchen area, and some of the patrons also ask about their safety and cleaning conditions before having reservations. Thus, according to these suppliers, robots would be advantageous to build the confidence of patrons as they would provide contactless service.

The findings are in line with previous studies. The literature also states that a competitive advantage can be gained by differentiating through novel and innovative technologies [11]. Moreover, automated

services can improve competitiveness in the market [70].

*4.4.1.2. Service quality.* Most of the participants stated that the service robots positively influence service quality. According to these suppliers, using service robots in restaurants would be advantageous and increase the service quality due to the following reasons: supporting background tasks-creating more time to human employees; standardisation in service quality; decreasing the service failures; not having any physical and psychological problems (such as getting tired, feeling bad or being ill); increasing the service capacity; implementing the task correctly and on time; being fast and saving time; ability to work 24/7 h; free of adaptation problem; having higher performance; no need for training. On the flip side, according to two of the suppliers (S1 and S4), robots may be disadvantageous and decrease the service quality in terms of: sudden breakdowns and need for maintenance (S1); lack of detecting service failures (S1 and S4); and insufficiency in unpredictable and emergency situations/lack of crisis management skills (S1).

For instance, S1 states that using robots in restaurant services will be advantageous and increase service quality because robots won't have any excuse for not working, slack off, or low performance. He further explains that "… Our industry is human-based. In other words, because it is a sector in which people work intensively, people have many problems, but there is no such situation with robots. They will not say that I am tired … and they will do the job in a standard way, so they will always continue to produce products of the same quality. Yes, these can be counted advantages … Robots may affect the service quality positively …". He (S1) also indicates some disadvantages of the use of robots in restaurant services, such as "… we have characteristics such as acting flexibly and intervening in suddenly developing situations. We cannot expect these from robots … we sometimes do tasks that are not our responsibilities. For example, a fire may break out in the restaurant, or a customer may faint. Many things like this can happen that we can't predict … after all, this is a technological tool, a device, so when it breaks, you must repair it. Sudden breakdowns of these, sudden problems, these can have a negative effect … It can reduce the quality of service … No matter how many technological devices are used, sometimes many things happen that you cannot foresee. For example, let me give an example, hair falls on the food or hair comes out of the food; this happens in every business … Sometimes you realise these kinds of failures just when you put the dish on the table … then you take the food back to the kitchen … but this cannot be possible with the robots …".

Some advantages that participants think would increase service quality are working 24/7, being fast, implementing the tasks correctly and on time, not getting bored or ill, and are also implied in the literature [42]. Furthermore, service quality, which is explained as the judgment of patrons towards the superiority of the service [71], is the significant dimension that can create memorable restaurant experiences [49]. Additionally, according to hotel employees in Turkey, service robots would improve service quality [28]. In this vein, when service quality increases, satisfaction is likely to increase too. Furthermore, satisfied customers will probably revisit the same restaurant and re-purchase the products that may also raise revenues and financial performance [72].

*4.4.1.3. Experience.* The suppliers indicate that service robots have the pros in restaurants as adding value to the customer experience and providing a contactless and safe experience to prevent virus transmission. However, a few participants (S3, S13 and S25) also indicate that robots would have some disadvantages as they would not provide natural human communication skills, which would eliminate socialising in the restaurant.

To start with negative perceptions of suppliers, S3 states that service robots would cause a lack of natural communication in the restaurant environment. As a result, the patrons would not have a natural dining experience; thus, their psychological satisfaction may decrease. Another

participant (S25) says that "Robots would not be advantageous in terms of experience. Because the characteristics of human waiters such as conversation and friendliness will not be in robots … I think socialising would be difficult with service robots …".

Conversely, most of the participants mentioned the advantages of service robots regarding customer experience in restaurants. For instance, S18 and S24 indicate that service robots would add value to the customer experience because it will be a different and unique experience that customers would like.

The current literature is also optimistic about the robotic experience. For instance, it is supported that using service robots may enable restaurants to add value to the experience of their patrons by providing memorable and entertaining experiences [49]. Furthermore, a great number of suppliers in this study think that through using service robots in restaurants, a contactless and safe experience can be provided to patrons. Thus, robots would prevent customers from virus transmission. For instance, the related words of S24 are: "Robots can prevent customers from virus transmission … they can feel safe. Considering that there will be a hygienic and disinfected service … and there will be contactless service … I think it will be very advantageous". It is also indicated in the recent literature that service robots can play a protective role against virus transmission because they provide contactless (physical distant) service to consumers [19].

*4.4.1.4. Financial aspects.* In the financial aspect, all the mentioned subjects are supportive of using robots in restaurant services. Seven suppliers state that using service robots would decrease their labour cost, which is advantageous for them. Furthermore, service robots would increase restaurant sales (S10) and reduce the cost of products if they are used efficiently (S26). According to these participants (8 of them), using service robots would financially contribute to restaurants. S10 explain the financial advantage of service robots as "… cost advantage. Robots cost less than human workers. Human employees have a salary, insurance etc … The robot is more advantageous in terms of cost, maybe you can give at once 50 thousand dollars or 30 thousand dollars, but you won't give it the second time … the restaurant would have a very good sales rate. If that's the case, restaurant sales will increase incredibly" (S10).

Besides, S26 hints that service robots would be advantageous because they won't damage the ingredients; instead, they will use them efficiently, which can decrease the costs of the products. He further explains that robots may also make minor mistakes in this aspect; however, they will still be more efficient. Another supplier (S18) stresses that cost is the crucial dimension of the restaurant business; thus, by decreasing the costs, service robots would be financially advantageous.

It is also supported in the literature that service robots can improve financial performance through decreasing costs [18]. The high cost could be a major concern for restaurant operations because it will decrease profitability. Thus, cost-reducing is an effective tool that increases profitability in the restaurant business [73]. However, efforts on reducing operational costs in restaurants should not harm the service quality [74,75] because quality is one of the crucial factors affecting restaurants' financial success [76].

*4.4.2. Patrons*

For potential patrons, the impacts of service robots in restaurant services comprise three main themes: the attractiveness of robotic restaurants, service quality, and experience. The sub-themes of these themes are provided as pros or/and cons. From the patrons' perspective, robots have different impacts that can be advantageous or disadvantageous.

*4.4.2.1. Attractiveness of robotic restaurants.* The patrons share the suppliers' perspectives on the attractiveness of service robots. Almost all participants (28 patrons) indicate that robotic restaurants are attractive;

thus, they are willing to dine in an automated restaurant. Also, they are willing to pay more to experience robotic restaurants. This goes against the results of Ivanov and Webster [50]; who found that customers request discounts if they were to be served by robots only. Finally, a significant number of patrons (14) state that robotic restaurants can be the primary motivation to travel.

Furthermore, several patrons can also travel to another destination only to experience a robotic restaurant. However, although some participants think that robotic restaurants are attractive, they won't travel to a different destination to experience a robotic restaurant for only seeing robotic service. These participants also desire delicious food (P5 and P20), authentic food (P6), and some other attractions (P7). The related statements are followed as:

"… if a robotic restaurant starts operating, I would like to go and try … I want to experience such a thing as it will be a very different experience … Would I travel to another destination to have a robotic restaurant experience … I would not travel to another destination, region or country for only a robotic experience. But if the food is also delicious … then I would want to go there to experience it …" [P5]

The attractiveness of robots and robotic restaurants is supported in the current literature. For example, service robots have the potential to raise the attractiveness of hotels [28]. Additionally, a recent study on robotic restaurant experience [68] revealed that robotic restaurants are attractive, especially for kids. Furthermore, service robots may attract individuals interested in new technologies [70].

*4.4.2.2. Service quality.* As consistent with the suppliers' opinions, a significant number of patrons also think that service robots contribute to service quality by providing some advantages. From the five advantages that patrons state, four of them were also mentioned by suppliers: robots do not have any physical and psychological problems (such as getting tired, feeling bad or getting ill); standardisation in service quality; being fast and saving time; and having high performance. The only difference extracted in this case is that one of the patrons (P15) indicates that service robots would increase service quality as they likely prevent possible service failures and accidents. On the other hand, two drawbacks (lack of detecting service failures and insufficiency in unpredictable and emergency situations/lack of crisis management skills) are also the same issues that suppliers mentioned. Besides, not addressing the special requirements (P15) is revealed as a different disadvantage that may harm the service quality in restaurants. Some of the related statements are:

"Robots can improve service quality. They can prevent possible accidents. They can prevent someone from spilling soup or water on them … they may eliminate the mistakes. But on the other hand, when you order manually, you can make special requests such as less salt … Of course, robotic restaurants may not fulfil these demands and create dissatisfaction in this sense …" [P15]

"Robots will increase the quality of service. There will be a standard in service. For example, when I go to a robotic restaurant, I will be happy if I see that the taste of the food is standard. After all, the service staff and the chefs will not always perform the same. There will be a faster service without any problem …" [P23]

As mentioned in the "suppliers" section, the literature also supports that robots can enhance service quality. Furthermore, in the restaurant dining experience context, service failures and service speed are among the main determinants of service quality [77].

*4.4.2.3. Experience.* As illustrated in Table 3, the perceptions of suppliers related to the robotic customer experience are mostly consistent with the patrons' perceptions. For example, two pros (adding value to the experience and contactless safe experience) that patrons indicated

are the same experimental advantages that suppliers stated. For instance, P18 says that "… Robotic restaurant experience … I think it will be exciting and fun …. of course, if I am satisfied and have confidence in robots, this experience will become more valuable … Since there will be no contact, robots will reduce the risk of transmission of the virus …".

On the other hand, the cons (lack of human (natural) communication skills and eliminating socialising) are the same issues that suppliers mentioned. However, patrons added some more on the pros of robots in the restaurant by stating that robots would provide different types of experiences such as unique, contemporary, exciting, interesting, hedonic, new, entertaining, and safe. The related statements are following as:

"… There is no emotion in robots … For example, I go to a restaurant, and there is a wine that I want to choose. However, is it suitable for my meal?.. If there is no waiter that I can talk to … well-trained waiter and chef who knows the job well … I want to talk to them and choose my wine … the communication part is also the emotions part … the robot will not be useful in this aspect … If I am going to socialise … I will not succeed with robots because it will be a mechanical feeling. It wouldn't be enjoyable for me …" [P7]

"… I can say that the robotic restaurant experience will be exciting … The use of robots in restaurant services will reduce the risk of virus transmission … It's a human-to-human virus. When we eliminate the human, the virus transmission will vanish." [P30]

The literature also supports that while service robots are considered a new experience and enjoyable by some of the consumers, some other consumers are seeking human employees when receiving hospitality services because they believe that robots are not compatible with the logic of hospitality [40].

*4.5. Preference towards the service delivery system*

The last part of the interviews assessed the preference towards the service delivery system. As it is clear from Table 3, three service delivery systems were explained to the participants to determine their preferences based on Seyitoğlu and Ivanov [49]: (i) human-based service delivery system, (ii) mixed service delivery system, and (iii) robotic service delivery system. According to the findings of both cases (supply and demand sides), most suppliers and patrons prefer the mixed service delivery system in which service robots are used for some front-of-house operations. Some reasons for these choices are also provided in Table 3. Additionally, the human-based service delivery system, in which human employees deliver all front-of-house operations, but robots may be used for (some of) back-of-house operations, is the second most preferred system according to both suppliers and patrons. Finally, the robotic service delivery system referring to the system in which service robots work for all front-of-house operations and some back-of-house operations is chosen by only one supplier and two of the patrons.

**5. Conclusion**

This study is the first attempt to investigate the perceptions of Turkish restaurant managers and customers towards service robots. Data were collected through semi-structured interviews with 26 managers and 32 customers. The theoretical, managerial and practical implications, limitations and future research directions are outlined below.

*5.1. Theoretical implications*

The findings of the paper lead to several theoretical implications. First, suppliers and patrons agreed that robots were appropriate for dirty, dull, dangerous and repetitive tasks in a restaurant, namely: 'cleaning', 'washing dishes', 'hygiene, sterilization, and sanitation',

'lifting heavy items', 'hosting (host/hostess)', 'repetitive tasks', 'Mise en place: the setup tasks before cooking (i.e. cutting, chopping, slicing, washing and cleaning ingredients)', 'busser/commis waiter tasks (i.e. carrying equipment and food, clearing the tables, wiping cutlery, changing tablecloth)', 'serving (i.e. taking orders, serving food)', 'preparing cocktails at the bar'. In that sense, the results confirm the previous studies [45]. However, 'cooking' was mentioned by the patrons as well, which contradicts the results of Ivanov and Webster [45] probably because of the different cultural contexts of the samples of the two studies and the different periods of data collection (before and during Covid-19 pandemic) which may influence respondents' perceptions. Moreover, bartending and calculating tasks are new tasks that patrons state as suitable tasks for robots in restaurants.

Second, suppliers and patrons share the opinion of the generally positive role of robots on the restaurant service quality and experience. Moreover, the robotic element of the restaurant experience is a reason for patrons to pay more. Therefore, the robots are perceived as service enhancers that justify paying a higher price [6]. This contradicts the findings of Ivanov and Webster [50] that robots are perceived generally as cost-saving devices by customers who request a price discount for robot-delivered services. However, in line with Seyitoğlu and Ivanov [49]; patrons and suppliers agree that robots are not the sole determinant of restaurant experience, depending on other factors such as food quality, ambience, etc.

Third, the findings confirm previous studies [45] that showed that the vested interests of people shape their perceptions of service robots. The results clearly showed that restaurant employees had a more negative attitude towards robots than patrons because they were afraid of losing their jobs. Thus, it seems that the fear of automation and losing their jobs has a significant role in shaping restaurant employees' perceptions of service robots. In this regard, the claims that waiters, waitresses, and food serving workers are among the higher risky jobs against automation in the future [78] can support these suspicions. Furthermore, according to a recent study, hotel employers also state that service robots cause fear of losing jobs [28].

Fourth, the patrons find robots useful and believe that service robots enable a safe environment in restaurants in the current pandemic. Hence, they are more positive and ready towards service robots in restaurant services. In this vein, some suppliers indicate that robots can help build their customers' confidence in the viral world because they believe that the current pandemic has decreased consumers' trust. Thus, these findings can be a clue that the current pandemic may accelerate the robotisation in the restaurant service context as people try to avoid human touch while receiving the services because of the fear of infection.

Finally, the findings showed that human-robot collaboration is the most appropriate service delivery mode in restaurants because it compensates for the disadvantages of robots with the advantages of human employees and vice versa [68]. The use of robots in a mixed service delivery mode may have a substitution effect on some employees who may lose their jobs. Still, it would positively affect the perception of the rest of the employees because their jobs would be freed from dirty, dull, dangerous and repetitive tasks and will be enriched with more tasks related to communicating with customers and operating a robot.

### 5.2. Managerial and practical implications

From a managerial perspective, the findings stress that robots can be used to enhance the service experience of customers. However, to avoid resistance by customers and employees, restaurants need to focus on the robotisation of those tasks that patrons and employees consider appropriate for robotisation. This would positively affect the human employees who would have more time to focus on interacting with customers and more revenue-generating activities. Hence, service quality and restaurants' competitiveness and revenue would be indirectly improved while unnecessary costs for robotising inappropriate tasks would be avoided.

Additionally, half of the suppliers have a negative perception of robots' suitability in the restaurant services. Moreover, they stressed that restaurant services must include the features such as the atmosphere that patrons can socialise, cooking skills and tacit knowledge of employees, high-quality service, and tasty products. Therefore, robotic technology developers should consider these features to provide suitable robots for restaurant services because they are critical as they shape restaurant customers' quality perceptions and experiences. However, the findings of a study related to the hospitality industry [79] stress that, in some cases, service robots have not successfully achieved the needed technological sufficiency to replace humans in work environments.

Furthermore, restaurants should avoid full robotisation of front-of-house processes because this would hurt patrons' perceptions of the service experience quality and fuel employees' fear of being replaced. On the contrary, a mixed serve delivery mode that combines the strengths of robots and employees would contribute to patrons' restaurant service experience and allow employees to gain additional skills (e.g. operating a robot) and enrich their jobs. Furthermore, considering robots' novelty, restaurants can use the robots in their advertisements and social media posts to create positive perceptions about the service they provide. However, they need to do this without exaggeration of the robot's capabilities or overemphasis on the robot – a more balanced approach that includes the other elements of the restaurant experience is required.

### 5.3. Limitations and future research directions

Since this study focuses on one service sector (restaurants), and respondents come from one country (Turkey), the findings are generalisable in these industrial and cultural contexts only. However, future research needs to focus on the application of robots in other service sectors and countries. For instance, studies can be based on comparative studies of different countries or sectors. Furthermore, future research may also adopt quantitative approaches to provide more generalisable findings in national or international contexts to expand these findings further. Additionally, there is a need for further research to address the economic aspects of the use of robots in service companies. For example, future research needs to evaluate whether service robots have actually delivered what their manufacturers promised the service companies, whether the financial gains/savings realised, and what were the challenges that companies faced in the implementation of service robots. Future research can also adopt a quantitative research approach and assess the role of various factors on the robotic service experience in restaurants. Finally, after the pandemic is over, future studies can be implemented to explore the perceptions of employers, employees, and customers towards using robots in restaurant services to examine whether there is a difference between the perspectives.

### Declaration of competing interest

None.

## Appendix 1. Interview questions

| Supply Side (restaurant owners and managers) | Demand Side (patrons) |
|---|---|
| - *What do you think about the use of robots in restaurants?*<br>- *What do you think about adopting robots in your restaurant's services in terms of both employees and patrons?*<br>- *What are the tasks that you think robots would be more suitable for?*<br>- *How do you want the robot to be like?*<br>- Do you think that robots would cause any problems in your restaurant?<br>- *What would be the advantages or disadvantages of robots in restaurant services?* | - *What do you think about the use of robotics in restaurant services?*<br>- What do you think about being served by robots in restaurants?<br>- *What are the tasks that you think robots would be more suitable for?*<br>- *How do you want the robot to be like?*<br>- Do you think that robots would cause any problems in a restaurant?<br>- *What would be the advantages or disadvantages of robots in restaurant services?*<br>- Would you prefer to dine in a robotic restaurant if there is one available now?<br>- Would you travel to another destination (region, city or country) to experience a robotic restaurant (to dine in a robotic restaurant)? |
| Which service system would you prefer in your restaurant? And why? | In which service system would you prefer to be served in a restaurant? And why? |
| **Robotic service delivery system** | **Robotic service delivery system** |
| **Human-based service delivery system** | **Human-based service delivery system** |
| **A mixed service delivery system** | **A mixed service delivery system** |

## Funding

None.

## Author statement

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