HUMAN CHEFS' PERCEPTIONS TOWARDS ROBOT CHEFS

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Abstract

Purpose – This research has been conducted for the purpose of exploring human chefs' perceptions on robot chefs and to identify potential challenges experienced by the use of robot chefs from a human chef perspective.
Methodology/Design/Approach – Qualitative research methods were preferred to explore the human chefs' perceptions towards the robot chefs. 30 chefs participated in semi-structured interviews. Thematic analysis method was used.
Findings – Human chefs expressed their fear that robot chefs will cause unemployment. In human chefs' opinion, the products robot chefs produce will be of poorer quality compared to the product delivery of human chefs. The chefs emphasize that it will cause guest dissatisfaction. The idea of working together will cause various problems. Human chefs have the perception that robot chefs will make the culinary profession monotonous and bring the culinary profession to an end. The positive perspectives of human chefs towards robot chefs are that robot chefs will reduce some costs, make things easier, speed up production, provide standardization and increase job safety.
Originality of the research – This study is one of the few studies examining human chefs' perceptions of changes in their roles and autonomy in restaurants by robot chefs and how human chefs respond to the use of robot chefs.
Keywords Hospitality technology, service robot, chef, human-robot interaction, robot chef, hi-tech restaurant

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INTRODUCTION

The term robot, whose most basic ideas originated in the time of Leonardo da Vinci, first appeared in the modern sense in the theatre play known as "RUR" or "Rossum's Universal Robots" by Karel Čapek in 1921. Robots, which are thought to be mechanical workers who assist humans, revolt at the end of the game and take over the world (ROMT, 2017). The term "robot", etymologically derived from the Czech word "robota", means forced labour. Robots, which are commonly viewed as machines capable of performing a complex set of actions (Singer, 2009), have the ability to make autonomous decisions, adapt to the situation, and learn from past experiences based on data received from various sensors and other sources (from the sense-think-act paradigm) (Pagallo, 2013; Allen et al., 2000). Robots have progressed from forced labor, dumb machines performing mundane and repetitive tasks, to highly intelligent, precise, and even anthropomorphic robots capable of performing potentially dangerous tasks (Lanfranco et al., 2004). Guizzo (2023) defined robots as *"an autonomous machine capable of sensing its environment, carrying out computations to make decisions, and performing actions in the real world".*

The presence of robots, which has been on the rise in various sectors for a long time, has reached the service sector (Belanche et al., 2020). Robots are frequently used in areas such as health, education, automation, manufacturing, hospitality industries, etc. (Vatan & Doğan, 2021). Robotics, artificial intelligence (AI), and machine learning technology enable industries to provide services with greater productivity, effectiveness, and efficiency (Wirtz et al., 2018). This is considered as a new reality in which humanoid service robots will replace humans in a variety of industries (Harris et al., 2018). To illustrate, Pepper, the world's first social humanoid robot that can recognise faces and basic human emotions, is built for human interaction. Pepper, which is capable of communicating with people via its touch screen, is used by over 2000 companies worldwide to welcome, inform, and guide visitors in an innovative way (SoftBank Robotics, 2019). However, according to a report by Sam Nussey from Reuters in 2021, the production of the Pepper robot appears to have been mostly halted.

The presence of robots has also begun to emerge in the hospitality industry (Murphy et al., 2017). Service robots are intended to support and serve humans through physical and social interactions (Ivanov et al., 2017). Service robots can be classified as professional service robots (used by businesses) and personal service robots (used by individuals for non-commercial tasks) (International Organization for Standardization, 2012; Ivanov et al., 2017). Considering the classification, it is possible to say that all types of robots are used for various purposes in the hospitality industry. Professional service robots, for example, are more likely to be used in background operations like food preparation in a hotel restaurant or cleaning rooms, whereas personal service robots are more likely to be used in front desk operations like concierge services, room service, and entertainment (Lukanova & Ilieva, 2019). As previously stated, service robots used in the hospitality industry have technical capabilities that allow them to perform tasks such as waitering, guest greeting, guiding, room service, cooking. As a result, it is commonly used for jobs that are repetitive, boring, dirty, and dangerous (Seyitoğlu & Ivanov, 2021).

Technological developments and applications are of great importance in the food and beverage industry as in every industry. Although technology has a cost, when used properly, it can result in significant increases in revenues and profits (Kimes, 2008). The use of technology, specifically robotics, in the food and beverage industry is critical since the sector is labor intensive, and has a particularly high staff turnover rate (Ivanov & Webster, 2023). Furthermore, such technologies can assist businesses in increasing restaurant employee efficiency and productivity, overcoming repetitive and mundane tasks, speeding up service, improving and facilitating interactions between businesses and guests, enabling guest recognition, removing language barriers, enhancing personalisation, and providing entertainment for guests (Berezina et al., 2019).

The number of studies on chefs' perceptions towards robot chefs are limited. It is obvious that the change that started in other areas of hospitality will also affect the culinary profession. The viewpoint of cooks on robot chefs is significant given the large employment rate of chefs in the hospitality industry. In this context, the question of the present research is "*What are human chefs' perceptions of chef robots?*". The current research also aimed to investigate the problems or likely problems with the use of robot chefs from the perspective of human chefs.

1. ROBOTIZATION IN FOOD AND BEVERAGE

Robots in the food and beverage industry can be used to perform tasks in both the back and front work places. Robots used in restaurants for background work are frequently used to perform repetitive tasks such as frying, grilling, rolling or slicing (like with sushi) (Berezina et al., 2019). Big Eye Japanese Cuisine & Sushi Bar in Brooklyn, for example, has implemented the use of Suzumo-developed robots to assist employees in making sushi faster and more efficiently. The production process can be accelerated to around 300 sushi and 400 rolls per hour by Suzumo-developed robots. The restaurant still uses human employees to choose ingredients and slice fish by hand. Robots mix the ingredients and form the rolls after employees have chosen and cut the ingredients. In addition to being able to adjust the rice's length, thickness, and density, the robot can also rewind the rolls to make them tighter (Neira, 2019).

Flippy, produced by Misorobotics, is one of the robotic assistants used in kitchens. Flippy, which resembles a robotic arm, can perform cooking tasks like grilling and frying with pinpoint accuracy thanks to artificial intelligence. Flippy cooks (for example, hamburger patties), while human chefs prepare the final ready-to-eat food. The robot is capable of cooking approximately 300 hamburgers per day (Graham, 2018). However, Misorobotics, stated that it attaches importance to innovation and launched Flippy 2. The Flippy 2 can fry and cook nearly any product, making it more practical than the first model. Furthermore, due to its compact, modular design, it can be used in even the most confined kitchen spaces (Miso Robotics, 2022).

On the other hand, some robots have the ability to carry out the entire food production process alone. Spyce Restaurant in Boston is a robotic kitchen. Self-described as "*the world's first restaurant with a robotic kitchen that cooks complex dishes*" Spyce uses wok pots (cooking pots) with seven different automatic cooking modes that prepare dishes simultaneously in three minutes or less. When food is ordered by customers, ingredients are selected and divided into the correct sizes by a distribution system that collects the necessary ingredients from the refrigerator. The cooked ingredients are then delivered to the robotic woks. When the process is completed, the woks are ready to be served by pouring the prepared food into bowls due to their inclination features (Holley, 2018).

Robotic Kitchen, produced by Moley Robotics, has the features like learning recipes, operating ovens and hobs, using equipment such as pots and spatulas, cooking and plating the food, and cleaning the work area after cooking. Two robotic arms mounted on ovens or hobs and outfitted with a rail system can cook these items by memorizing over 5000 recipes (Palmai & Smale, 2021). In 2015, a ramen restaurant with two robotic arms, Koya and Kona, opened in Shanghai's Hongkou District. Robotic arms cannot prepare the noodles themselves. Koya and Kona can boil and serve instant noodles and pour the appropriate amount of soup into the dish. With the assistance of a human chef, the garnishes are subsequently added to the prepared ramen bowl and presented to the customer. (Ningning, 2015).

Another robot chef is AIKE, developed by Shanghai Qi Ding Food Development Co. Ltd. in China. AIKE is capable of producing 24 different traditional Chinese dishes in three minutes and stores 751 different recipes in its memory. This robot, created with cutting-edge technology, can establish a green and low-carbon cooking environment through standardized product preparation processes, cold chain distribution, and non-polluting disposal of cooking gasses. The robot is constructed in the shape of an ATM machine and comprises basic actions that any employee may simply implement (Mathath & Fernando, 2015).

Introduced at the 2019 International Kitchen and Bathroom Exhibition, Bot Chef was produced by Samsung and designed to assist chefs with artificial intelligence support. Bot Chef, which is designed as a robotic arm, can execute duties such as cutting, whisking, pouring, and cleaning. Based on the diameter of a real human arm, access to a location, and safety, the robot may communicate with users by understanding simple voice commands (Uzan & Sevimli, 2020). When we look at the present of Bot Chef, through sophisticated grip sensors and accurate motor control, its innovative design allows it to carry out intricate operations like chopping, stirring, and seasoning using common kitchen tools and utensils. An extensible ecosystem of downloadable abilities is incorporated into the system's architecture, enabling ongoing feature improvement and adaption to different culinary conditions. The design tackles important issues in delivering industrial-grade robots to consumer settings, especially with regard to cost effectiveness, size optimization, and the creation of a user interface that is simple to use (Dawson, 2025).

In Pazzi, a pizza restaurant that opened its first branch in Paris in 2019, pizzas are prepared and cooked by a robot. The robot can roll out the dough, add the sauce, place the desired components on the dough, bake the pizza, place it in the takeout box, cut it into pieces, and deliver it. All operations can be carried out in as little as five minutes per pizza (Palmai & Smale, 2021).

The majority of robots in foreground roles in food and beverage facilities are service robots with human features. Because of these features, service robots can interact with guests in a similar way resembling human interaction (Berezina et al., 2019). If foreground service robots are assisted by artificial intelligence, they can perform tasks such as answering guest questions. As an illustration, the service robot at Tanuki restaurant in Dubai, UAE, can greet guests, sing, dance, and present food coupons and tokens (Gurur, 2019).

Service robots known as Robot Runners are among the most commonly used robots in foreground work. These robots' primary function is to deliver food to the table and return dirty plates to the kitchen. Robot Runners act in co-operation with human employees. The plates are loaded onto robot runners by the kitchen staff while the waiters are in contact with the guests in the service area. The waiters receive the prepared plates from the robot runners, who bring them to the service area and serve them to the guests. After the guests have finished their meal, robots can clean the table. Robot runners that help deliver food can save time, allowing more time for human staff to communicate with guests. This paves the way for the development of customer experience (Berezina et al., 2019).

Robots are regarded as a new and innovative factor that attracts people's attention as part of the gastronomy experience. Robots can provide service to restaurant guests before, during and after the purchase. However, service robots, which have grown in popularity in recent years, have generated some controversy in addition to the benefits they provide to businesses (Leo & Huh, 2020). Communication and interaction are two of the most basic examples of this. Food and beverage businesses, which are regarded as one of the most important elements of the hospitality industry, are regarded as places where human interaction and socialization are most prominent for tourists and customers. In this context, one of the most important concerns about the presence of robots in the sector is that they will reduce human-human interaction (Seyitoğlu et al., 2021). Since robots lack features such as personal touch or emotion, they are regarded as "merely programmed machines," lacking in terms of communication and interaction (Özgürel, 2021), and lacking common sense and empathy (Fusté-Forné, 2021). Despite the fact that the new generation of service robots can perceive customers' gestures and speech, evaluate their preferences and requests, and measure their facial expressions and feedback (Zhang et al., 2022), it is believed that the role of robots in gastronomy should be planned as an added value that aids human labor rather than replacing humans (Fusté-Forné, 2021).

Another controversial topic regarding service robots is the perception of quality and flavour of the food they prepare. Even though today's service robots can cook, take orders, and deliver food in restaurants, they remain advanced machines. For this reason, people may consider meals prepared by robots as machine-made meals. As a result, food prepared by robots may be perceived as low quality or lacking in flavour (Xiao & Zhao, 2022). It is common that people prefer handcrafted goods over machine-made goods (Abouab & Gomez, 2015). However, perceptions of the quality and flavour of food prepared by robots may vary depending on their appearance (Salvini et al., 2010). Some people may show higher trust and adoption tendency to anthropomorphic service robots due to their human-like characteristics (Van Pinxteren et al., 2019; Lin et al., 2020). Meals prepared by robots with anthropomorphic features can be perceived as if they were prepared by humans. This can increase the quality and flavour perception of the food (Xiao & Zhao, 2022). On the other hand, human chefs working in kitchens argue that the food prepared by robots cannot be as tasty as the food prepared by humans. Humans, unlike robots, can improve the flavour of a product by using small touches while preparing food (Özgürel, 2021). According to human chefs, cooking is directly related to hand taste. Therefore, meals prepared without human touch will turn into ordinary fabricated meals (Bucak & Yiğit, 2021).

Another significant distinction between robot and human chefs is the ability to taste while cooking. People can perceive or improve the flavour of food by tasting it (Sochacki et al., 2022). Since people can only notice changes in the taste and texture of food when they chew it (Massey, 2022). The most striking development regarding this difference between robot and human chefs is the robot produced by the electronic home appliances manufacturer Beko and Cambridge University. The robot, created in line with cutting-edge technology, can partially mimic human chewing and tasting. The salinity of the food can be detected by the robot, which tastes scrambled eggs and tomatoes, thanks to a conductive probe placed on the arm that sees the salinity sensor. In each repeated tasting by changing the amount of salt and tomato, it was observed that the robot gave successful feedback about the salinity of the food. The researchers also had the robot taste the egg and tomato mixture again by grinding it with a mixer to simulate the texture change caused by chewing. The product was tested at three stages of chewing (non-chewed, semi-chewed, and chewed (ready to swallow), revealing a taste map for the product (Sochacki et al., 2022).

Research shows that robots have many characteristics such as being able to work directly with people, being adaptable to the working environment, being transportable, and so on. These features and their ease of use allow them to be considered as an excellent teammate in assisting the services provided in food and beverage businesses (Grobbelaar & Verma, 2020).

The perspective on the introduction of robots in restaurants seems less optimistic. Currently, the use of robots in restaurants seems to be too high cost to be financially feasible. Despite promises to the contrary, there are reports that robots are not as fast or reliable as expected or advertised (due to frequent malfunctions and ongoing maintenance issues). However, in addition to technical and financial difficulties, psychological factors will also likely limit the adoption of robots. Some empirical studies have found that consumers attach greater value to food products made by hand. Therefore, nowadays, one of the only justifications for incorporating service robots into a restaurant environment seems to stem from the experiential value robots create (Spence, 2023). In this regard, it is still unclear how robots will benefit the gastronomy and hospitality industries (Leo & Huh, 2020).

2. METHODOLOGY

2.1. Research Method

The study aims to explore human chefs' perceptions on chef robots and to explore the problems or likely to be experienced problems to use of chef robots. In this context, qualitative research methods were preferred to explore the human chefs' perspective on the use of chef robots. Methods of qualitative research provide rich descriptions of complex phenomena, track unique and unexpected events, and illuminate the experience and interpretations of actors with diverse stakes and roles to explorations for the development of theories and hypotheses, and moving toward explanations (Sofaer, 1999). The thematic analysis method was used to identify, analyse, and report the patterns in the data set and examine the similarities and differences in their views. The sampling method of the research was determined as purposive sampling. 30 chefs who are working in various five-star hotels constituted the sample of the research.

Table 1: **Demographic Characteristics of Chefs**

No	Gender	Age	Education Status	Experience	Role
C1	Male	55 years old	High School	41 years	Executive Chef
C2	Male	42 years old	Secondry School	25 years	Head Chef
C3	Male	42 years old	High School	10 years	Sauce Chef
C4	Male	28 years old	High School	12 years	Head Chef
C5	Male	38 years old	High School	17 years	Head Chef
C6	Male	45 years old	High School	27 years	Executive Chef
C7	Male	27 years old	Primary School	12 years	Head Chef
C8	Male	30 years old	Associate	13 years	Head Chef
C9	Male	50 years old	Bachelor	30 years	Executive Chef
C10	Male	44 years old	Secondry School	26 years	Head Chef
C11	Female	40 years old	Bachelor	7 years	Pastry Chef
C12	Male	45 years old	High School	32 years	Executive Chef
C13	Male	38 years old	High School	23 years	Pastry Chef
C14	Male	55 years old	High School	41 years	Executive Chef
C15	Male	25 years old	Associate	6 years	Sauce Chef
C16	Female	40 years old	High School	10 years	Head Chef
C17	Male	42 years old	Secondry School	25 years	Executive Chef
C18	Male	32 years old	High School	18 years	Pastry Chef
C19	Male	51 years old	High School	35 years	Executive Chef
C20	Male	38 years old	Secondry School	20 years	Executive Chef
C21	Male	27 years old	High School	10 years	Head Chef
C22	Male	35 years old	High School	20 years	Executive Chef
C23	Male	41 years old	High School	20 years	Executive Chef
C24	Male	35 years old	Associate	17 years	Sauce Chef
C25	Male	22 years old	Bachelor	2 years	Sauce Chef
C26	Female	26 years old	Associate	4 years	Sauce Chef
C27	Female	29 years old	Bachelor	6 years	Sauce Chef
C28	Male	47 years old	Secondry School	27 years	Head Chef
C29	Male	34 years old	High School	15 years	Executive Chef
C30	Male	47 years old	Secondry School	30 years	Sauce Chef

According to Table 1, there are 26 male chefs and four female chefs in the study sample. The average age of the chefs is 38 years old. One of the chefs is a primary school graduate; six are secondary school graduates; 15 are high school graduates; four are associate degree graduates; and four are undergraduate graduates. The average experience of chefs is 19 years. The sample of the study includes 11 executive chefs, nine head chefs, seven sauce chefs, and three pastry chefs.

2.2. Data Collection Technique

Semi-structured interviews have been determined as the data collection technique, as it helps obtain in-depth information with a certain level of standardization and flexibility. The questions of the interview form about robotization in hospitality were created by consulting pertinent literature studies (Christou et al., 2020; Vatan & Doğan, 2021). In line with the experts' feedback who are doing research on robots, the semi-structured interview form was finalized with seven questions in total. The decision was made to incorporate five-star hotels into the study. Five-star hotels typically implement technology advancements and investments in the hospitality sector early. There are 144 5-star hotels in İstanbul. It was determined that the hotels from which data should be gathered should be located in the vital touristic districts of Istanbul—Şişli, Beşiktaş, Beyoğlu, Üsküdar, and Kadıköy. The interviews were carried out between June 11, 2023, and October 25, 2023. Interviews lasted an average of 35 minutes.

2.3. Data Analysis

The interviews were recorded for the study, and the data was moved to a computer environment. The audio was then repeatedly listened to, and a written transcript was produced. Subsequently, the transcripts were meticulously edited by listening to them again to ensure that all the errors had been caught. In the next step, the data provided by the interviewees was collected under the relevant questions, and their statements were considered as a whole. After the raw data was thoroughly examined, coding and thematization were developed. During the data analysis phase, each piece of data was coded by three different researchers. After calculating the Cohen Kappa fit values for the themes among the coders to ensure internal consistency during the data analysis process, it was found that the fit between the data codes was at a good level (77%). Furthermore, a checklist of criteria for functional thematic analysis presented by Braun & Clarke (2006) (transcription, coding, analysis, overall, written report) was used as a control once the analysis was completed.

3. FINDINGS

In this section, study presents the outcomes of the thematic analysis, with major themes being summarized in tables.

Table 2: **The connotations of the word "robot"**

Theme	***Sub-themes***	***n***
The connotations of the word "robot"	Machine	17
	Assistive device	16
	Time saving	5
	Technology	3
	Coldness	2
	Tin pile	2

As summarized in Table 2, under the theme formed with the question "What does the word Robot (Service Robot) connotate for you?", six sub-themes were formed as machine, assistive device, time saving, technology, coldness and tin pile. Robots evoke the words machine and assistive device when taking into account the frequencies that are most commonly repeated. Some of the answers supporting these sub-themes are as follows: *C1: "A production machine that moves with mechanical parts."; C12: "A mechanism planned to help us in our work is a machine."; C21: "An assistant that provides ease of work."; C30: "Electrical auxiliary machines used in the kitchen come to mind. Cutter, press, grater, vacuum machines etc."*.

Table 3: **Employing chef robots**

Theme	***Sub-themes***	***n***
Employing chef robots	Reduces human employment	7
	Destroys the art of cooking	6
	Reduces guest satisfaction	4
	Causes monotony	4
	Reduces food quality	4
	Can act an assistant	3
	Facilitates work	3
	Increases job safety	2
	Helps to ensure mass production	2

As summarized in Table 3, nine sub-themes were formed under the theme formed with the question "Considering that humanoid robots will become widespread in the coming years and we will start to see them frequently, what do you think about their employment as chefs in your business?". Reduces human employment, destroys the art of cooking, reduces guest satisfaction, causes monotony, reduces food quality, can act as an assistant, facilitates work, increases job safety, helps to ensure mass production are the sub-themes. Based on the most frequently occurring frequencies, it is predicted that robot chefs will reduce human employment while destroying the art of cooking. Some of the responses supporting these sub-themes are as follows: *C4: "I definitely do not consider this right. I think that such an initiative will increase the unemployment rate and cause psychologically bad effects on people."; C15: "I think it will decrease the employment of chefs in the sector."; C17: I think that cooking is an art and I do not consider that a robot that cannot think instantly like a human being will perform this art."; C23: "I think that if apprentices are not trained, if apprentices are not trained, craftsmanship will die, and if craftsmanship dies, the craft will disappear."*.

Table 4: **Potential Problems with Robots**

Theme	***Sub-themes***	***n***
Potential Problems With Robots	Unemployment	8
	Causing taste and odor problems in products	7
	Work slowdown	6
	Causing guest dissatisfaction	6
	Causing monotonous products	3
	Inability to implement an emergency plan	2
	Causing moving away from traditional products	2

As summarized in Table 4, seven sub-themes were formed under the theme formed with the question "What kind of problems may be caused by robots to be employed as chefs in your business?". These sub-themes included unemployment, taste and odor problems in products, work slowdown, guest dissatisfaction, monotonous products, inability to implement an emergency plan, and moving away from traditional products. Based on the frequencies that are repeated the most, robot chefs are expected to cause unemployment as well as taste and odor issues in products. Some of the answers supporting these sub-themes are as follows: *C1: "At the beginning, a taste and presentation far from traditional products and flavours are encountered. I think that it is not possible to prepare all products according to the style during the production phase in the kitchen."; C12: "The biggest problem is that people who are committed to this profession will be unemployed. I also believe that our profession will be monotonous."; C22: "People's working possibilities will be restricted."; C25: "I think it will cause problems in terms of taste."*.

Table 5: **Advantages Provided by Robots**

Theme	***Sub-themes***	***n***
Advantages Provided By Robots	Decreases various costs	10
	Provides standardization in production	9
	Accelerates production	9
	Provides continuous manufacturing	8
	Adds attractiveness to the business	4
	Facilitates work	3
	Provides job safety	3

As summarized in Table 5, under the theme formed with the question "What advantages can the robots that will be recruited as chefs in your business?", seven sub-themes were formed as follows: decreases various costs, provides standardization in production, accelerates production, provides continuous manufacturing, adds attractiveness to the business, facilitates work, and provides job safety. Based on the frequencies that are repeated the most, it is expected that robot chefs will provide benefits such as lowering various costs in businesses, providing standardization in production, and accelerating production. Some of the responses supporting these sub-themes are as follows: *C8: "Robots that are employed in the enterprise provide very useful cost savings in the products in the production phase. I believe that it will be very useful especially in the field of Fast Food."; C30: "It will cause a decrease in the cost rate and will have advantages such as a decrease in occupational accidents."; C2: "They can help to create a standardized product system."; C15: "Since there will be no human emotions, disruptions, occupational accidents, margin of error, days off, health problems, etc., production will continue without slowing down and in a standardized manner."; C28: "Fewer workers. More standard work."*.

Table 6: **Features Chef Robots Should Have**

Theme	*Sub-themes*	*n*
Features Chef Robots Should Have	Sense of taste	9
	Quick thinking	6
	Persuasion ability	4
	Hand taste (Personal touch and expertise of chef)	4
	Solution generation	4
	Creativity	4
	Sense of smell	3
	Being helpful	2
	Emotion	2

As summarized in Table 6, nine sub-themes were formed under the theme formed by the question "What kind of features do you think robot chefs should have?". Sense of taste, quick thinking, persuasion ability, hand taste (personal touch and expertise of chef), solution generation, creativity, sense of smell, being helpful, and emotion are the subthemes. Based on the frequencies that are repeated the most, the features that robot chefs should have been having a sense of taste and quick thinking. Some of the responses supporting these sub-themes are as follows: *C5: "They should produce solutions like humans and be quick when necessary."; C6: "First of all, they should have taste; you cannot present anything you have not eaten."; C21: "They must have the senses of taste and smell."; C25: "First of all, they should definitely have creativity, they must also analyse taste and sense, they should know human relations, they should know history, but I think a machine cannot do these."; C26: "They should have the ability to taste and smell."*.

Table 7: **Working together (human chefs and robot chefs)**

Theme	*Sub-themes*	*n*
Working together (human chefs and robot chefs)	Causes different problems	15
	Impossible	9
	Reduces the workload	7
	Can be harmonised	6
	It is possible if it assists human chef	4
	It is possible if it's under human control.	2
	Causes to need for engineer employment.	1

As summarized in Table 7, seven sub-themes were formed under the theme formed with the question "How do you evaluate the possibility of human chefs and robot chefs working together?". They are: it causes different problems, it is impossible, it reduces the workload, it can be harmonised, it is possible if the human assists the chef, it is possible if it is under human control, and it causes the need for engineer employment. Based on the most frequently repeated frequencies, it is predicted that human chefs and robot chefs' collaboration will result in different problems. Some of the answers supporting these sub-themes are as follows: *C4: "I think that such a situation will cause problems in the working environment and it is not possible to have a working environment together."; C13: "It will cause an environment that pushes the limits and brings anger and resignations."; C16: "I think that the possibility of working together will be weak."; C18: "This will create problems. It may cause confusion, problems and arguments."; C28: "Problems may arise. I do not think it will be an effective work."; C30: "I think working with a robot chef will have many negative effects."*.

Table 8: **Effects of robot chefs on the culinary profession**

Theme	*Sub-themes*	*n*
Effects on the culinary profession	Reduces the employment of human chefs	20
	Reduces service and product quality	5
	Makes the job easier	4
	Makes human chefs lazy	2
	Causes monotony	2
	Brings the profession to an end	2

As summarized in Table 8, six sub-themes were formed under the theme formed with the question "How do you think the use of robot chefs affects/will affect the profession of culinary?". It reduces the employment of human chefs, reduces service and product quality, makes the job easier, makes human chefs lazy, causes monotony, and brings the profession to an end are the sub-themes. Based on the most frequently repeated frequencies, robot chefs are expected to have a negative impact on the employment of human chefs. Some of the answers supporting these sub-themes are as follows: *C5: "There are subjects that will be beneficial, however, it also brings the problem of unemployment."; C6: "It will take it backwards excessively and people will be unhappy."; C10: "Since robots are a new generation technology today, they will be of interest to employers. For this reason, I think it will negatively affect the culinary profession in terms of employment."; C15: "The human chef population will decrease, but the biggest problem is that the food culture will disappear."; C22: "I think it will end the culinary profession. They will start to teach how to use robots in gastronomy departments now."*.

3.1. Discussion

As a result of the study, human chefs perceive service robots as machines. Service robots are viewed as an assistive device by human chefs. Fusté-Forné (2021) emphasizes that service robots are perceived as machines, and that service robots should be planned as an added value that aids human labor. Service robots also have negative connotations for some chefs. Some chefs regard the service robots as cold metal piles. The findings support the literature by eliciting slightly negative emotions when the term "service robot" is used (Li et al., 2019b; Lu et al., 2020, Vatan & Doğan, 2021).

In chefs' opinion, the use of robot chefs in businesses will lead to a decrease in human employment. Similar studies on the use of robots in restaurants (Harris et al., 2018; Bucak & Yiğit, 2021) have yielded the same results. Similarly, Li, Bonn, and Ye (2019a) realized that artificial intelligence and robotic awareness influence five-star hotel employees' turnover expectations. Tuomi et al. (2020) also expressed the same concern in their study. From the chefs' point of view, robot chefs will bring the end of the art of cooking. According to chefs, the use of robot chefs in businesses will decrease customer satisfaction. From chefs' perceptives, the quality of dishes prepared by robot chefs will be poor. Xiao and Zhao (2022) noticed that guests rated the quality of robot-prepared meals as poor. According to the study, the anthropomorphic features of robots can improve the quality and flavour perception of prepared food. Salvini, Laschi, and Dario (2010) realized that the appearance of the robots affects the quality and flavour perception of the meals prepared by robots. Besides, in human chefs' view, utilizing robot chefs in businesses will facilitate work, aid in mass production, and enhance job safety.

The human chefs also stated robot chefs will cause unemployment in long term. The human chefs also believe robot chefs will cause taste and odor challenges in the dishes. However, it appears that this problem may be solved by robots equipped with a taste map, as demonstrated in the study by Sochacki, Abdulali, and Lida (2022). In human chefs' estimation, robot chefs cannot implement emergency plans. It is the human chefs' contention that robot chefs will slow down manufacturing as robot chefs will require constant supervision. Contrary to what was thought, some studies (Ningning, 2015; Graham, 2018; Palmai & Smale, 2021) have shown that service robots help speed up the production process. Robot chefs, according to human chefs, will result in the production of monotonous products and the abandonment of traditional products. However, Palmai and Smale (2021) revealed that the robot they examined offered a product variety of up to 5000 distinct dishes. In addition, it is human chefs' belief that robot chefs will cause customer dissatisfaction**.** The human chefs stated that robot chefs cannot communicate like humans and that human-to-human interaction is the foundation of the service industry. A fear of decreased human-to-human interaction was also mentioned in the study conducted by Seyitoğlu et al. (2021). It has been stated that the disappearance of interaction will lead to the disappearance of one of the most fundamental features of the hospitality industry. According to the study of Sotohy (2020), digital tools will never be able to replace the depth of emotion and personal communication provided by human interaction. Similar statements were also made by the human chefs that took part in this study.

It seems to human chefs that robot chefs will decrease various costs. The chefs specifically stated that personnel costs may decrease as less human labor is used. In human chefs' opinion, robot chefs will facilitate product standardization. Zhang (2021), in his study on guide robots, concluded that robots will provide standardization in products. The human chefs also think that robot chefs will speed up production. The same conclusion was reached in similar studies (Ningning, 2015; Graham, 2018; Palmai & Smale, 2021), and it was revealed that robots accelerate the production process. The human chefs stated that because robot chefs are not subject to health issues, work accidents, or leave policies, they can produce continuously. However, it should not be ignored that robots can frequently break down and their repair/maintenance costs can be very high. The human chefs believe that robot chefs will add attractiveness to the enterprises and attract the attention of the guests. It is seen that robot chefs are thought to provide advantages such as facilitating work and providing job security.

According to some studies (Van Pinxteren et al., 2019; Lin et al., 2020), anthropomorphic robots have a higher acceptance rate. It is the human chefs' contention that robot chefs should have some humanoid characteristics. Human chefs who believe that it is impossible to serve a meal without tasting it argued that robot chefs should have a sense of taste and smell. In human

chefs' estimation, robot chefs should be able to think quickly, produce solutions, and persuade in order to successfully manage potential problems and operations. According to the human chefs, robot chefs should have hand taste. In the literature, there are studies (Özgürel, 2021; Bucak & Yiğit, 2021) stating that meals should be touched by human hands. According the studies, the food made by robots and humans will not have the same taste. Human chefs, expect robot chefs to have a sense of creativity in order to avoid the production of monotonous products.

From the chef's perspective, the idea of working together (human chefs and robot chefs) would cause various problems. They believe that collaboration is only possible if the robot chefs are under human control and only then in the position of assisting human chefs. Grobbelaar and Verma (2020) also stated that robots can be an excellent teammate as an assistant in restaurants. According to the chefs, the use of robot chefs will increase the need for engineers in businesses. Overall human chefs state that robot chefs will have a negative impact on the culinary profession. They underpin this with thoughts like decrease of employability for human chefs with the existence of robot chefs. With as a potential result loss of service and product quality. In addition, human chefs believe that robot chefs will cause human chefs to become less productive. More specifically human chefs stated that robot chefs would make the culinary profession monotonous and, in the long run, would mean the end of the culinary profession. The human chefs believe that the rise of robot cooks will cause many of them to pursue other careers. According to Ivanov and Webster (2019), the use of robots will create new job positions and cause employees' required skills to change. Similarly, robot employment will reduce the number of employees in various departments and result in zero-employee businesses. The unmanned kitchen Spyce restaurant mentioned in Holley's (2018) study can be shown as an example of this situation. Although it is called an unmanned kitchen, humans will always be needed to load food, prepare/wash some ingredients, etc.

4. CONCLUSION

In summary, this study adds to the existing literature by revealing chefs' perspectives on robot chefs. The main statement of human chefs is that robot chefs would cause unemployment. Their main believe is that since robot chefs lack a sense of taste and smell, products will be of lower quality than produced by human chefs. The human chefs emphasise that it will cause guest dissatisfaction. The human chefs' perspective on the concept of human and robot chefs collaborating is that it will lead to different challenges. To their understanding robot chefs will make the profession monotonous and, as a result, robot chefs will destroy the art of cooking. The positive perspectives of human chefs on robot chefs are that they will reduce some costs for the enterprises, facilitate the work, speed up production, provide standardization in production and help to increase occupational safety. Ultimately, although restaurant managers and restaurant chains will have the final say, how the chefs accept, perceive and react to robotization in the hospitality industry is important for the well-being, job satisfaction, efficiency of the chefs and the future of the profession. Chef's opinions are important because restaurant managers and restaurant chains can seek solutions to how chefs can adapt to this change.

4.1. Theoretical implications

The first theoretical contribution of the study is that it shares new findings supporting the negative attitudes toward robots observed in the literature. Furthermore, based on their comments, it can be concluded that older chefs frequently have a more negative perspective than younger chefs. Previous studies examining the relationship between robots and product quality approached the subject from the perspective of customers. Among the human chefs who participated in this study, the perception that the quality of food prepared by robots would be lower is a common view. This is one of the significant theoretical contributions of the study. According the human chefs, robot chefs lack the ability to taste and smell leads to a decrease in food quality, which in turn causes customer dissatisfaction. Another theoretical contribution to the field is the belief that robot chefs will lead to the disappearance of traditional dishes. Human chefs have expectations from robot chefs, such as quick thinking, problem-solving, and the ability to intervene in potential issues. Human chefs also believe that they can work peacefully with robot chefs only if the robot chefs take on an assistant role. This suggests that potential problems may arise in the near future, should there be a need for collaboration. The most important theoretical contribution of the study is that human chefs believe the employment of robot chefs will harm the profession.

4.2. Managerial implications

The study's practical contribution is that the findings show that human chefs still show hesitant hestatitation to work with robot chefs due to common prejudices. Although five-star hotels easily adapt to new technological developments, human chefs show resistance to such innovations as the culinary profession's historical journey begins in the military and the hierarchical structure in the kitchen is still preserved in many businesses. The main factor influencing human chefs' perceptions of robot chefs is the possibility of the profession disappearing. The human chefs perceive service robots as machines and their perspectives are rather negative. Based on this, managers should find some solutions to eliminate this prejudice, which will negatively affect employees' job satisfaction and well-being. The basis of the negative approach may be the belief that robots will make them

unemployed in the long term. For this reason, managers should inform them that robots will make their jobs easier and will be helpful to them, rather than taking away their jobs. The managers should raise the awareness of chefs that the use of robots can increase job safety in kitchens where occupational accidents occur frequently.

The attitude of human chefs towards robot chefs, whose roles and autonomy have changed with the employment of robot chefs, is currently negative in many ways. In the long term, it is inevitable that the culinary profession will undergo change like all professions. In this case, it is critical for hospitality managers to manage change in a way that does not harm the profession. Managers also need to think about how to integrate robotic technologies into workplaces without harming employees' business lives and remain focus on the human-to-human interactions the hospitality industry is known for. Actually, employees will have the opportunity to spend more time dealing with customers as robots speed up work and take over repetitive, tedious tasks. It should be recognized that this will have a positive impact on guest satisfaction. The positive atmosphere in businesses will also have a positive impact on employee satisfaction. Building a structure that can extract efficiency from both human and robot chefs will relieve chefs who are concerned about their future employment. It is suggested to approach the addition of robot chefs as an added value to assist human chefs, and human chefs should be shown how to effectively use robot chefs.

4.3. Limitations and Future Directions

Since this study was limited to 30 human chefs working in various five-star hotels in İstanbul, the findings cannot be generalized. During the interview, variables such as gender, age, years of experience, education level and the roles were not taken into account. Because of this, conducting research on the topic in other regions and with various kinds of hotels or restaurants may further the field.

The employment of robot chefs and the fear of future unemployment of chefs may cause chefs to turn into unhappy employees. As a result, future research on the subject can look into the relationship between chefs' subjective well-being and the use of robot chefs. A study could be conducted to compare the perceptions of chefs in kitchens where robot chefs are currently used to those of chefs who have never worked with robot chefs. In this way, the prejudices revealed by the chefs in the current study can be eliminated. In addition, how the effect of variables such as chefs' education level, gender, and work experience on chefs' perspectives on robots can be investigated. Research can be conducted on students to investigate how much new technologies are included in the curricula in hospitality schools and how to prepare students, as the employees of the future, for the future business. Additionally, studies on robots in the hospitality industry ought to be carried out, with an emphasis on the harmony between high-tech and high-touch.

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