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DIGITAL GASTRONOMY AND THE TABLES OF FUTURE

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Abstract

Digital transformation has profoundly affected all industries and reshaped the way they do business. Tourism is one of the sectors affected by the digital technologies created by the new industrial revolution. Many sub-branches of accommodation, food and beverage, entertainment and tourism have tried to keep up with this transformation and brought a different and innovative dimension to tourism. Our tables have been affected by these technological tools and new forms of food have begun to rapidly enter our lives. The effects of digital tools are felt on many issues, from the production of food to the presentation and even waste management. In the food and beverage industry, which is named as digital gastronomy or Gastronomy 4.0, alternatives to replace food and engineering applications that come to our plate await us. The use of the digital world is very important for the development of culinary arts. In gastronomy, where food is perceived not only as a meal, but also as a form of art and culture, new food forms can be produced much easier, faster and adapted to the customer with 3D printers, augmented reality and virtual reality. 3D printers, which offer the most suitable solutions for personalized customer demands, have become one of the main actors of digital gastronomy. In this study, firstly the concept of gastronomy was mentioned, and then the concept of digital gastronomy was explained. In the context of digital gastronomy, the concepts of 3D printers, virtual reality and augmented reality are also explained, and the relationship of these technologies with food has been tried to be explained with examples and pictures.

Key Words: Gastronomy, Digital Gastronomy, Digitalization, Industry 4.0

Jel Codes: *L8, L83, L86*

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DİJİTAL GASTRONOMİ VE GELECEĞİN SOFRALARI

Öz

Dijital dönüşüm tüm sektörleri derinden etkilemekte ve iş yapma biçimlerini yeniden şekillendirmektedir. Yeni sanayi devriminin yarattığı dijital teknolojilerin etkilediği sektörlerden biri de turizmdir. Konaklama, yeme-içme, eğlence ve turizm gibi birçok alt dal bu dönüşüme ayak uydurmaya çalışarak turizme farklı ve yenilikçi bir boyut kazandırmıştır. Sofralarımız da bu teknolojik araçlardan etkilenmiş ve yeni yemek formları hızla hayatımıza girmeye başlamıştır. Gıdanın üretiminden sunumuna ve hatta atık yönetimine kadar pek çok konuda dijital araçların etkisi hissedilmektedir. Dijital Gastronomi ya da Gastronomi 4.0 olarak isimlendirilen yiyecek içecek sektöründe, sofralarımıza gelen gıda ve mühendislik uygulamalarının yerini alacak alternatifler bizleri beklemektedir. Mutfak sanatlarının gelişmesi için dijital dünyanın kullanımı oldukça önemlidir. Yemeğin sadece bir yemek olarak değil, aynı zamanda bir sanat ve kültür biçimi olarak algılandığı gastronomide, 3D yazıcılar, artırılmış gerçeklik ve sanal gerçeklik ile yeni yemek formları çok daha kolay, hızlı ve müşteriye uyarlanabilmektedir. Kişiselleştirilmiş müşteri taleplerine en uygun çözümleri sunan 3 boyutlu yazıcılar, dijital gastronominin baş aktörlerinden biri haline gelmiştir. Bu çalışmada öncelikle gastronomi kavramına değinilmiş, ardından dijital gastronomi kavramı açıklanmıştır. Dijital gastronomi bağlamında 3 boyutlu yazıcılar, sanal gerçeklik ve artırılmış gerçeklik kavramları da açıklanmış, bu teknolojilerin yemekle ilişkisi örnekler ve resimlerle anlatılmaya çalışılmıştır.

Anahtar kelimeler: Gastronomi, Dijital gastronomi, Dijitalleşme, Endüstri 4.0

Jel Kodları: L8, L83, L86

INTRODUCTION

Tourism is one of the areas where digitalization is effective. The food and beverage section of tourism is positively affected by internet-based developments called industry 4.0. Thanks to Industry 4.0 technologies, a new form of food can be created, and customers are increasingly involved in the pre-cooking processes of the food. It becomes possible to shape, personalize and optionally customize the meal before it arrives at the customer's table. While this situation turns the technological developments in favor of the customers, businesses have to pay more attention to the demands of the customers in the increasing competitive environment. Although the concept of digital gastronomy is still new for Turkey, many restaurants, especially in Istanbul, have already started to implement these technological innovations. It is thought that the concept of digital gastronomy, which is thought to become widespread in the near future, can be encountered in every corner restaurant, and this concept, which is now a distinctive competitive factor for restaurants and hotels, will turn into a standard practice in the near future. When the relevant literature was examined, a limited number of studies could be found in which Industry 4.0, the tourism sector and the food and beverage sector were discussed together. In addition, due to the difficulty of creating a data set for statistical research, this study consists of a literature review on digital gastronomy. In future research, customer satisfaction,

purchase intention and tendencies to try new food forms in restaurants and cafes where digital technologies are applied can be investigated.

1. THE CONCEPT OF GASTRONOMY

The development of gastronomy shows the intensity of the work done in Turkey from the 1980s until today. The book "History of Food" written by Ömer Kılıç in 2009 is also shown as an example in the development of gastronomy. In addition, publications named "Food and Culture Magazine" and "Gastronomy Magazine" have been important indicators of gastronomy in the Turkish world (Göker, 2011: 30). Turkish cuisine is one of the most important and oldest cuisines in the world, which has the ability to offer a wide variety of products by accommodating the different flavors of seven different regions. The variation in the geographical regions inhabited also affected Turkish cuisine (Güzelşahin ve Ünver, 2015: 65).

The connection of gastronomy with different branches of science causes a large number of definitions about gastronomy (Sarıışık ve Özbay, 2015). Some of these definitions can be given as follows. Santich (2004) explains the concept of gastronomy, "Historically and etymologically, gastronomy is concerned with advice and guidance on what to eat and drink when and where. He also defined it as an 'art of living', the competence of having knowledge and skills related to food and drink and their selection that increase the pleasure of eating and drinking". Fusté-Forné (2016) explains gastronomy as "an example of both culture and nature that connects us from our roots to a particular place". Inspired by food festivals and other food-related events and themes, which were first held in the 2000s, academics introduced gastronomic tourism (Su, 2015). While the role of food in tourism has a long priority, gastronomy tourism is a relatively new form of tourism, which has been introduced as a tourism product consciously produced by those responsible for the marketing of destinations. By incorporating gastronomic principles as a subset of culinary tourism based on 'traditional' recipes in specific places, gastronomic tourism has become a subset of cultural tourism (Chaney ve Ryan, 2012). The fact that people started to continue their leisure experience related to food (Su, 2015), tourists experienced different experiences related to food (Berbel-Pineda vd., 2019) attracted much attention to gastronomy tourism. It is possible to explain gastronomy in its simplest form as a food addiction, an interest in food or a food art. Gastronomy is both an industry in itself and a valuable part of many sectors. It has an important value especially for the tourism sector. It can be said that the most important income item after accommodation activities, which is the main function of the tourism sector, is food and beverage activities. Of course, all businesses should consider such an important income item as an art.

Tourism includes a variety of areas, but with the current stage of development the tourism industry has achieved over the past decade, it has led to the development of a new form of tourism that strongly recommends food as a marketing tool for a destination, making 'gastronomic tourism' much

more important. Gastronomic tourism was no longer just attractive to tourists, but also contributed to the sustainable development of a destination (Kumar, 2019). Gastronomy tourism focuses on production rather than consumption. Farm visits and farm stays allow tourists to experience the realities of farming and livestock production (Santich, 2004).

2. DIGITAL GASTRONOMY

In the long historical journey of food, the period from the 16th century to the 21st century has witnessed extremely important developments and radical transformations. In parallel with the technological, social, political, philosophical and artistic changes that occurred during this period, cuisine and food developed continuously (Aksoy ve Üner, 2016: 3). With several recent projects, digital machines have been incorporated into the kitchen, but their impact on culinary culture has been found to be limited. Instead of replacing the chef with an autonomous machine, a culture of digital gastronomy enriching traditional cooking with new interactive capabilities was envisioned. For this reason, existing digital production tools were placed in the traditional kitchen and cooking processes were performed using hybrid recipes (Mizrahi vd., 2016: 541). The widespread use of digital technologies in almost every aspect of life has exposed the world to a rapid change process, perhaps more than ever before in human history. Recently, the effects of this process have been felt in the field of cookery and culinary arts. Today, electronic devices such as digitally controlled refrigerators, ovens and coffee machines are widely used in home and restaurant kitchens (Aksoy ve Üner, 2016).

There are some reasons behind the rapid occurrence of digital effects in gastronomy. These are possible famine and starvation dangers as a result of the increase in human life span, increase in birth rates, and the general increase in the world population. Cox (2019) states in his study that according to the report of the United Nations in 2017, the human population will increase to 9.8 billion by 2050 and 70% more food will need to be produced to feed each person. In the report of the USA-based Global Harvest Initiative, it states that global food production cannot keep up with the population growth rate (Kutup, 2016). Agriculture and food processing sectors are faced with an excessive demand in global demand and increasing competition for limited natural resources (Fırat ve Fırat, 2017).

2.1. Industry 4.0 Impact

The inclusiveness of the fourth industrial revolution and the use of 4.0 tools in almost all business lines and industry in daily life show how quickly this transformation will occur (Wang vd., 2017: 312). It is stated that the Industry 4.0 paradigm will create more sustainable industrial value in economic, social and environmental terms and will provide advantages in sustainable production (Stock ve Seliger, 2016: 536). It is emphasized that the concept of Industry 4.0 has the potential to create sustainable industrial value (Kiel vd., 2017), and there are numerous sustainable business models in the world of Industry 4.0, which is characterized by digitalization and automation (Maresova vd., 2018). In his study, Ślusarczyk (2018) accepts the concept of Industry 4.0 as a great

opportunity for development and progress in terms of competitiveness, but emphasizes that Industry 4.0 applications can vary greatly depending on the country, sector and even a company. Eleven important technological tools of the new industrial revolution (internet of things, artificial intelligence, robotic systems, dark factories, cloud computing, 3D printers, virtual reality, augmented reality, big data and data analytics, simulation, horizontal-vertical integration) It manifests itself in many areas from entertainment, retail to advertising, production to law, logistics to tourism (Yıldırım, 2019).

Circus shows performed using the simulation method, package deliveries made by Amaozon with autonomous robots, camera shots made with drones, body organs produced with three-dimensional printers, high temperature, oxygen-free and dark environment, where robots work in production places where people cannot work, Home appliances that can be controlled by a phone, and even the realization of mother-daughter meeting by creating an identical computer with virtual reality for a mother whose daughter died at a young age shows that technology enters every small area that seems impossible.

2.2. 3D Printers

Technological developments, which were primarily industrial, factory and automation, started to spread to other sectors. One of these sectors is the food and beverage sector, which is extremely important for human life (Davutoğlu ve Yıldız, 2020). Industry 4.0 has also led to changes in the transformation of the tourism sector, and its different effects are likely to emerge in the future. Developments in the service sector also cause many changes and innovations in the field of gastronomy (Mutlu Öztürk, 2020: 222).

There have been important developments in human-robot cooperation, which is one of the determining principles of Industry 4.0. In addition to having skills that humans cannot be copied by machines, it can be said that robots have life-facilitating effects. Today, human and machine work hand in hand in many new applications as well as unmanned-dark smart factories. In the simplest case, whipping a cake is used in common kitchen appliances, mixers now use technology to produce products more easily, faster and more continuously using larger mixer units (Güneş vd., 2018: 79).

The food industry also seems very excited about 3D printing technology. For example, the famous British brand Cadbury has already adapted to this technology. While a complex production process is required, the convenience of three-dimensional printing technology not only enables extraordinary designs to be produced, but also enables a more affordable production process. Another advantage of this production method is that many different products can be launched in a very short time (Feast Editorial Team, 2019).

Food can be used as a physiological need, a cultural phenomenon, a commercial product, an aesthetic value, a social expression and a communication tool in all areas of life (Güneş vd., 2018: 77). One of the most important places where food that exists in every stage of human life is consumed

outside the home is restaurants. Restaurants have become a sector where competition is a lot and speed is an important factor, where it has to be fast and sometimes very fast in understanding and meeting customer demands during service and adapting to innovations (Keeler, 2019). Today, various foods are produced by using three-dimensional printers, sugar, liquid chocolate, cheese, cream and pasta (Güneş vd., 2018: 80). In addition, many companies with three-dimensional printers; It started to produce ready-to-eat bread, pizza, cake, cookie, and hamburger baked in three dimensions (Kutup, 2016). In small-scale food production - restaurants, cafes, bakeries 3D printing technology will be particularly useful in customizing unique products and will add value to the arts in foodstuffs. Creating a gourmet style in food presentation is possible with precise 3D printing. This technology has the potential to allow restaurant, cafe or bakery operators to design different edible food models to suit individual tastes and preferences. For example, small cafes and bakeries can decorate food items such as biscuits and cakes, and also minimize labor costs (Mantihal, Kobun, & Lee, 2020).

The smart sushi restaurant named "Sushi Singularity Tokyo" opened in Tokyo in 2020 has started to analyze the nutritional needs of its visitors and prepare meals accordingly. The Japanese design studio "Open Meals" states that personalized food production will have a very important place in the food industry of the future and, thanks to DNA, urine and stool tests, each individual will have their own health identity and food identity suitable for their health identity (Onat, 2019). In addition, Food Ink offers a one-of-a-kind restaurant experience, where all food, all kitchenware and all furniture are produced in an immersive futuristic space with fully 3D printing. The pop-up restaurant, which brings together architects, artists, chefs, designers and engineers, has received the title of "the world's first 3D print restaurant" (Cecchini, 2018).

Nowadays, 3D printer technology is used in almost every field and adapts to different uses day by day. Examples of these areas are manufacturing, medicine and health, aviation and space, architecture and construction, military applications, textiles, food, education (Çallı ve Taşkın, 2015). The positive and negative aspects of 3D printers can be listed as follows (Yıldırım vd., 2018: 165):

Positive aspects:

• Having a wide range of usage

• Gaining in terms of using time more effectively and minimizing costs

• Providing geometric creativity

• Having environmentally friendly equipment

Negative aspects:

• Not widely available for individual use due to fees

• Existence of restrictions on raw materials

• Possibility to use a limited number of colors

• Possible risk of unauthorized reproduction

• Being an expensive technology

• Being able to make unwanted productions (gun, rifle production)

• Obtaining products different from original sizes

Figure 1. The first full meal that can be printed by a 3D printer

Source: Güneşli vd., 2018

Hackney Road, who invented the technology-based food category loved by both children and adults and celebrities by producing the first 3D-printed dinner in the world's first 3D-printed restaurant, food Ink: "All food, cutlery and furniture are 3D printed accurately. "It is a revolutionary and one-of-a-kind gourmet experience".

Figure 2. Food Ink Restaurant 3D meal preparation

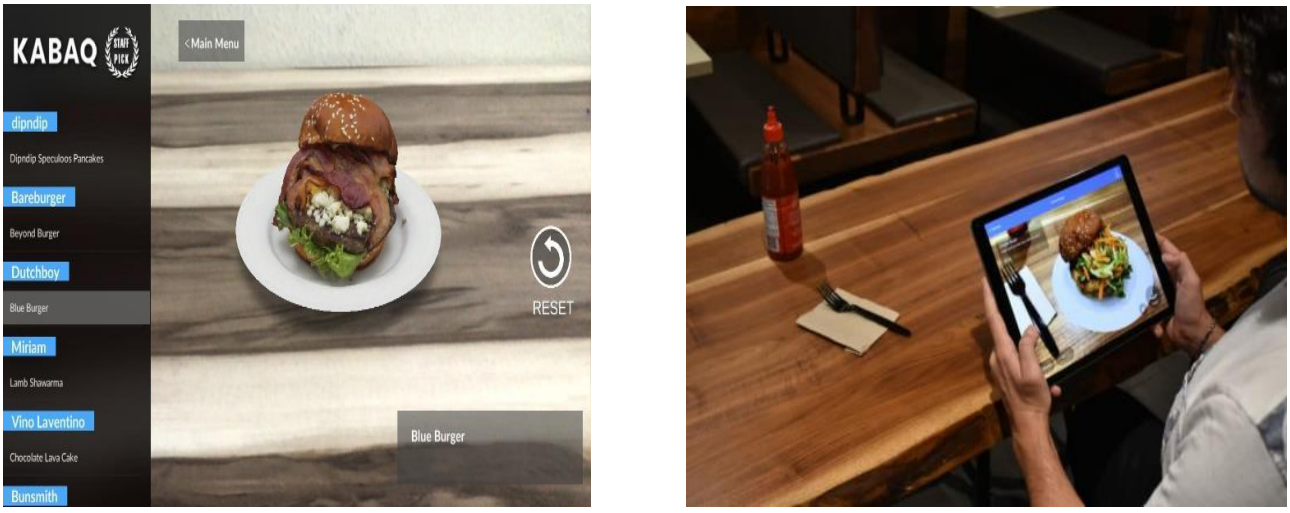
Source: Koura, 2016

2.3. Augmented Reality / Virtual Reality

Augmented reality and virtual reality applications, which are the elements of phyigital marketing, are currently used in different areas. Food and beverage sector and tourism sector are among these areas of use (Solmaz, 2020: 18). Food offers a different experience to the users in the digital world with high quality augmented reality support in three dimensions. The program reveals the real dimensions of the food selected by a smartphone or tablet on a flat area perceived by the camera without a marker. Dishes have been shown for the first time in the world with the "photorealistic" method. Photorealistic, when viewed from a distance, is a very realistic method of creating a painting, as if it is thought to be a photograph (Can, as cited in 2017, Solmaz).

Thanks to these applications, customers can see in advance what the food they order looks like and do not encounter any surprises. In this application, which is seen as the combination of physical and digital, businesses both achieve their corporate goals (Moravcikova ve Kliestikova, 2017: 148-150) and provide a personalized, exciting experience to their customers (Sorensen, 2020). The concepts of augmented reality (AR) and virtual reality (Virtual Reality-VR) can often be confused with each other. The purpose of virtual reality is to create three-dimensional and interactive virtual environments where the real world is modeled. Augmented reality aims to enrich the real world in real-time and interactively with virtual data developed in computer environment. In other words, while the first concept aims to bring reality to the virtual world as it is, the second concept focuses on enriching reality with virtual information (Somyürek, 2014: 63). Augmented reality, a type of virtual reality, allows the individual to see the real world with virtual objects that are articulated or combined with the real world. Virtual reality technologies, on the other hand, isolate the individual from the world by taking them into a synthetic or non-real environment (Azuma, 1997: 355-356).

Figure 3. Kabaq application experience



Source: Solmaz, 2020: 18

Presenting menus to customers digitally, taking customer orders digitally, sharing menus containing products with high quality photographs, prices and descriptions, on iPhone, iPad and all android-based phones and tablets. Thanks to this opportunity, people who have not been to the restaurant before can get information about the menu and the restaurant. In addition to presenting the menus digitally, it enables the availability of video, photo, information, address, telephone and location information related to the business to potential customers and to receive feedback such as customer comments and suggestions.

2.4. Robotic Systems

In many industries, manufacturers have used robots to tackle complex tasks for a long time, but robots are constantly being improved, becoming more autonomous, flexible, and able to communicate with each other to gain more benefits and increase their mobility. Developed in accordance with the interoperability theory, robots eventually reached a level that they will interact with each other, work safely side by side with humans and learn from them. These robots cost less and have a greater range of capabilities than those used in manufacturing today. For example, Kuka, a European robotic equipment manufacturer, has produced autonomous robots that interact with each other. These robots are linked together so they can work together and automatically adjust their actions to match the next unfinished product. They are high-level sensors and control units that will ensure close cooperation with people. Similarly, the industrial robot supplier ABB produced a two-arm robot called YuMi, designed specifically to assemble products such as consumer electronics with humans (Rüßmann vd., 2015).

There are two reasons for the widespread use of robots and robotic systems. First, while the cost of both hardware and software has decreased by more than 20% in the last 10 years, the performance of robotic systems has increased by 5% annually. Costs are projected to decrease by a similar amount over the next decade. As a result, robotic systems are quickly becoming a viable economic alternative to human labor in many high-wage economies. Second, many traditional robotic systems have limited technical capabilities. However, industrial robots are developed as more versatile and mobile, they can perform more complex / sensitive jobs and work in less structured environments. In addition, the most advanced robots are smart enough to provide feedback to and receive information from other parts of the production system (Strange ve Zucchella, 2017: 5).

Food and beverage businesses can make their food production as well as their services faster and more customer-focused thanks to technology-based applications. Robots meet the customers who come to the restaurant and allow them to order in their own language options, regardless of their nationality. Robots are used not only to take orders from the tables, but also during the preparation of the products. Autonomously acting robotic arms in the preparation of a beverage or a practical dessert recipe can prepare the ordered drink or dessert without the need for any human being. Especially

during pandemic times, they can both prepare the ordered products from beginning to end and serve these products to the tables without the need for human-human interaction (www.pazarlamasyon.com).

Figure 3. Smart digital dining tables that can turn into tablets

The blurring of the lines between the physical world and the digital world affects the order in restaurants. The fact that dining tables are now turning into smart tables and serving as tablets will appear as a standard in restaurants in the digital future. Fast service, personalized menus, higher customer satisfaction, reduced waiting times, entertainment and pleasure will be the advantages of digitalization on the tables of the future. It would not be wrong to say that new futuristic demands have already been created, even though it is curious what will be offered to insatiable customers who always want more.

CONCLUSION AND RECOMMENDATIONS

The fact that digital technologies are effective in all areas of life (Yıldırım ve Yıldırım, 2022) has made it inevitable that this effect is seen in the field of tourism and especially in the field of gastronomy. The emergence of new forms of food offers exciting promises to meet the world's growing food demand. While 3D printers offer personalized products to customers regardless of time and space (Yıldırım ve Yiğitbaşı, 2022), virtual reality and augmented reality applications make the customers' restaurant and dining experience more quality and give them unique moments. We know that food and the act of eating tend towards other purposes rather than the purpose of feeding and contain other meanings (Yıldırım ve Doğan, 2022). Now, gastronomy, which is matched with concepts such as art, culture and emotions such as excitement, passion and curiosity, is preparing to offer tourists the tables of the future with the developing technologies. In these times when the Covid-19 pandemic has turned into a global health and global financial crisis (Yıldırım, 2021), using technology in gastronomy reduces the risk of transmission of the virus and promises tourists more confidence and health than ever before. Services provided by robot service personnel, food and

beverages prepared with robotic arms enable the reduction of crowded environments and the preparation of products without human touch. In addition, thanks to 3D food printers, it will be possible to prepare personalized products for personalized diet meals, allergy or chronic diseases tourists in the future (Okatan ve Yıldırım, 2021; Yıldırım ve Yiğitbaşı, 2021). More conceptual and empirical studies are needed in the literature on this subject. Because it is known that some concepts are not sufficiently recognized by both tourists, local people and tourism enterprises, and most technologies are still not fully implemented. It is of great importance that some practices that remain at the level of theoretical explanations are removed from the futuristic understanding and put into practice, and awareness raising by all tourism stakeholders is the widespread use of digital gastronomy.

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