Nutrition Research and Practice

Review

Check for updates

§**Corresponding Author:**
Sunny Ham
Department of Food and Nutrition, Yonsei University, 505 Samsung Hall, 50 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea.
Tel. +82-2-2123-3176
Fax. +82-10-363-3439
E-mail. sham2@yonsei.ac.kr

ORCID iDs
Seoki Lee
https://orcid.org/0000-0003-4720-9170
Sunny Ham
https://orcid.org/0000-0001-8666-5027

Food service industry in the era of COVID-19: trends and research implications

Seoki Lee [1] **and Sunny Ham** [2§]

[1]School of Hospitality Management, The Pennsylvania State University, State College, PA 16802, USA
[2]Department of Food and Nutrition, Yonsei University, Seoul 03722, Korea

ABSTRACT

Coronavirus disease 2019 (COVID-19) is a new type of respiratory disease that has been announced as a pandemic. The COVID-19 outbreak has changed the way we live. It has also changed the food service industry. This study aimed to identify trends in the food and food service industry after the COVID-19 outbreak and suggest research themes induced by industry trends. This study investigated the industry and academic information on the food and food service industry and societal trends resulting from the COVID-19 outbreak. The most noticeable changes in the food industry include the explosive increase in home meal replacement, meal-kit consumption, online orders, take-out, and drive-through. The adoption of technologies, including robots and artificial intelligence, has also been noted. Such industry trends are discussed in this paper from a research perspective, including consumer, employee, and organizational strategy perspectives. This study reviews the changes in the food service industry after COVID-19 and the implications that these changes have rendered to academia. The paper concludes with future expectations that would come in the era of COVID-19.

Keywords: COVID-19; Pandemics; Food services; Technology

INTRODUCTION

Coronavirus disease 2019 (COVID-19) captured public attention as a new type of respiratory disease. The World Health Organization (WHO) announced it as a pandemic on March 11, 2020 [1]. Although most people heard "corona virus" for the first time, humans have experienced seven types of coronaviruses, including severe acute respiratory syndrome (SARS) in 2003 and Middle East respiratory syndrome (MERS) in 2015. COVID-19, like SARS and MERS, is a respiratory disease with similar symptoms. Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the virus that causes COVID-19, is genetically 80% similar to SARS-CoV, the virus that causes SARS [2]. The viruses for COVID-19, SARS, and MERS are stable and active at 4 °C [3]; they become inactive as the temperature increases to 65–70°C [4]. As COVID-19 is transmitted via droplets, aerosols, and direct contact, wearing masks and washing hands with disinfectants are the foremost defensive methods. The COVID-19 virus also come out of human activities like breathing, speaking, coughing, and sneezing [5].

As a major route of COVID-19 transmission is droplets, human contact should be avoided to prevent infection. Furthermore, eating food together, such as Korean soup and side dishes, should be avoided, because the droplets can transmit the COVID-19 virus [6]. Therefore, foodservice operations have been one of the primary sources of COVID-19 transmission. During the COVID-19 era, people look for healthy foods and adopt behaviors to prevent virus transmission. The COVID-19 outbreak has resulted in novel trends in the foodservice industry.

FOOD SERVICE INDUSTRY TRENDS

Emergence of COVID-19 new normal era

The COVID-19 outbreak brought a situation that people have never experienced. A new word, "a new normal era after COVID-19," was coined. The era of Before Corona (B.C.) was separated from that of After Corona (A.C.) because people can never get back the days before the pandemic struck. The word "new normal" was used at the time of the global economic crises initiated by the US sub-prime mortgage during 2007–2008 [7]. A new normal indicates a new norm for the economic standards. The new normal After Corona described the situation as H (healthcare), O (Online), M (manless), and E (economy at home): healthcare as heightened public interest in health and safety; online as a core essence of digital economies with the advantages of artificial intelligence, big data, and 5G; manless as a proven safety and efficiency during the course of prevention from coronavirus transmission; economic activities at home while staying long hours at home [7]. Such "new normal" also took place in the food service industry.

Non-human contact (untact) purchasing

Most of all, an explosive increase has been observed in the foodservice purchasing using untact methods. Contrary to the dramatic decrease in the sales of restaurants and institutional foodservices, Starbucks Korea experienced a sales increase of 32% from January to February 2020, compared to the same months in 2019 [8]. In fact, the orders made via Siren contributed to a 25% increase in terms of the purchase number, compared to the previous year [9]. The outcome explains consumers' intention to use untact services to minimize human contact, which will be expanded in the future. Since the order could be made online, the drive-through pick-up of the ordered products increased, from café, bakery, and fast foods to all kinds of restaurants, including even Sish-shop [10]. McDonalds expanded drive-through stores in the US and China, which resulted in a double-digit increase in sales in September 2020, compared to the same month of 2019 [11].

Explosive increase in home meal replacement (HMR) and meal-kit

One of the segments that has benefitted most from the COVID-19 outbreak is the meal-kit and HMR products [12]. While people stay at home, they care more about health and have time to cook. In the US, the sales of meal-kit products in 2020 became 2 times higher than in the previous year [13]. The major players in the meal-kit industry, Blue Apron, HelloFresh, and Home Chef, experienced a 49% increase in the number of customers. The meal-kit products satisfy the needs of a variety of customers, including vegan, gluten-free, children, and patients with diabetes [14]. In Korea, since the COVID-19 outbreak, the sales of meal-kit brands have rapidly increased, while offline retail brands rushed into the meal-kit segments with the names of Simply Cook (GS Retail), ChefBox (Hyundai Department Store), Yorihada (Lotte Mart), Gourmet 494 (Galleria), and Peacock Meal Kit (E-mart) [14]. The delivery of online order food and HMR food services increased by 77.5% in 2020, compared to the

previous year [15]. Further, people are more concerned about health and look for healthy foods. Consumers purchased more high-protein salads with low calories, health-protection HMR, and fresh ingredient meal-kit [16].

Acceleration of food tech

COVID-19 resulted in the acceleration of food technology. Robotics in foodservice operations has been expanded significantly. Manless cafés, such as Briggo in USA, Lounge X in Korea, and Chowbotics in California, are its good examples [17-19]. Chowbotics is the first manless café to purchase fresh produce. Cooking robots work at various positions, such as making hamburgers in a fast-food chain (Miso Robotics in White Castle Burger in California), working at a pasta kitchen (DaVinci Kitchen, Germany), and serving in chicken restaurants (Robert Chicken, Korea) [20-22]. Moley is the first robot to cook gourmet cuisines using artificial intelligence techniques [23]. Robotics has also been applied to serving (Royal Palace, Netherlands) and deliveries (PepsiCo's, USA) [24,25]. TUG, as a delivery robot for patient meals at the Reading HealthPlex in Pennsylvania, reduced labor costs by 80% [26]. The UVD Robotics Techniques have been utilized to prevent COVID-19 transmission, while Blue Ocean Robotics played a role in disinfection at the Heathrow International Airport, UK [27].

New government project

In Korea, the Ministry of Agriculture, Food and Rural Affairs (MAFRA) launched a new project called "Korean Eating Culture Improvement" in May 2020 [6]. The project aimed to change Koreans' eating behavior of sharing cuisines, which can cause diseases that are transmitted via droplets [28]. Thus, COVID-19 can be transmitted through such food-sharing behavior. To accomplish this change, MAFRA proposed three activities: one-person portion meal setting, sanitary management of spoons and chopsticks, and employees wearing masks. The project spread all over the country. Authorities of respective provinces supported the restaurants that abided by the above-mentioned activities by rendering certification to the restaurants. The project is expected to construct a safe eating culture with a high level of safety among Koreans.

RESEARCH IMPLICATIONS

COVID-19 has drastically changed the world, and many believe that some of those changes may last even after the pandemic is over [29,30]. This reality and future expectations certainly apply to the food service industry as well. This study discusses the kinds of research implications that can be drawn from these changes and future expectations. Such changes can be related to the behaviors and perceptions of consumers and employees, as well as the strategic responses of food service businesses. Considering these primary constituencies of the food service industry, this study attempts to provide meaningful research implications related to COVID-19.

Consumer perspectives

Consumer confidence in dining-in

Consumers of food service businesses have been through and will continue to undergo tremendous changes due to COVID-19. First, due to lockdown or heavy restrictions on in-dining food services during the pandemic, consumers have been unable to enjoy in-dining experiences, either in a complete or at least a partial manner [31,32]. Even in the absence of government restrictions on the in-dining food service, many consumers were and are

reluctant to dine out in a confined food service setting, because of the possibility of COVID-19 transmission [33]. Moreover, although the vaccination rate is significantly increasing, some consumers either refuse inoculation, thus avoiding dining out, or do not feel safe to dine out in a confined place even after getting vaccinated [34,35]. This lingering concern is understandable because of the high level of uncertainty regarding COVID-19 and its vaccines, especially among the general public [36]. Accordingly, it is important to understand the real consumer confidence in dining in food service establishments as the COVID-19 development continues and how such confidence can be boosted from the perspective of food service management.

Therefore, food service researchers should pay close attention to the status of consumers' confidence in dining at food service establishments. An important aspect of this examination would be a constant or timely update because since everyone is experiencing this type of pandemic for the first time, how people psychologically recover from and respond to this event is unknown. In particular, as vaccination rate accelerates globally, consumer confidence may recover quickly in a non-linear fashion, or it may first recover quickly but later possibly stall at a certain level due to a particular group of consumers who are either too concerned about the possibility of full recovery or skeptical of vaccination programs, which raise legitimate empirical questions for the food service industry.

Next, the food service business should have a better understanding of how they can improve consumer confidence in in-dining food services. There are various ways that can be implemented to boost consumer confidence in this matter, such as cleaning and sanitizing, restructuring the dining table layout to ensure social distancing, requiring employees and customers to wear face masks, installing transparent plastic panels at the counter and/or between tables, and minimizing human interactions (e.g., use of an electronic tablet for menu ordering or even robots to take orders). Restaurant businesses need to understand which practices to prioritize or emphasize because they do not have unlimited resources to implement them all. An efficient allocation of resources is essential for the food service industry to achieve a more desirable level of profitability because they have a tight profit margin. Furthermore, even when all or most of the possible implementations are feasible and can be done, proper prioritization of these implementations can go a long way to enhance consumer confidence in in-dining services more effectively, which can directly or indirectly impact the establishment's or brand's image, and consumer loyalty and revisit intention eventually.

Accordingly, researchers in the food service literature are recommended to explore, first, the practices that restaurant businesses should consider implementing to improve consumer confidence in in-dining services. In addition, it would be interesting to investigate differing degrees of consumers' perceptions of the importance of such practices to assist the food service business to prioritize relevant practices more efficiently and effectively, especially in terms of resource allocation. It would also be critical to study how to disseminate the information of those practices to the target markets (i.e., a marketing strategy). Some potential questions to answer in this matter may include which marketing media should be used, which practices or messages should be emphasized, and how these messages should be delivered (e.g., with more detailed information in an educational format or with more visual representations of actual practices). To accomplish these research goals, researchers should seek responses from consumers as primary data by utilizing a survey method in an observational or experimental manner. Laboratory experiments and follow-up field studies are desirable. In addition to examining the main effects of the aforementioned factors, researchers would be encouraged to test potential moderating factors such as gender,

Nutrition Research and Practice

age, perceptions of COVID-19, having children, pre-existing health conditions, tendency to general risks, and so on in relation to some characteristics of consumers, but also food service types (e.g., fast food, full-service, etc.), franchised vs. independent, size of the food service establishment, managerial abilities, location of the business, and so on in relation to the business characteristics. Understanding these contingent boundaries will help untangle the proposed main relationships among the mentioned factors in a more detailed and comprehensive way.

Untact service

Another interesting topic is the contact-free service, which can be represented by the marketing term "untact service" in the recent literature (from 2017 to be precise) [37]. The untact service for the food service business includes drive-through, curbside pickup, and delivery. All these forms of untact services have become a norm in the food service industry during the current pandemic and they have helped many businesses in the industry survive the global health and economic crisis [38,39]. It would be important to reveal, first, how untact services have been helped the industry, for example, its impact on sales and profits, and second, how such positive impacts have been heterogeneous contingent on various factors from both consumer (e.g., gender and age) and business perspectives (e.g., location and type of food service).

Post-pandemic change

Lastly, food service researchers should pay attention to which mentioned factors would stick around even after the pandemic is over. Many believe that these new norms during the pandemic, such as the popularity of untact services, fewer interactions with service providers (e.g., service by robotics), and some cleaning and sanitization practices will continue even after the pandemic. However, it is clearly an empirical question that needs to be examined and verified with actual data and rigorous analyses. Even when consumers may anticipate that these practices will still be important and influence their decisions even after the pandemic, their perceptions can certainly change once the pandemic is over. Although we strongly believe that some of these practices will still be important even after the pandemic, which practices will be significant remains to be answered empirically. Understanding the matter will help the food service business to develop more appropriate and timely strategies.

Employee perspectives

Employee turnover

Similar to consumers of the food service business, employees of the food service business have been experiencing tremendous changes and hardships. For example, the current pandemic has revealed a high level of risk embedded in the food service industry regarding job security from an employee's perspective. Due to the lockdowns and rigid restrictions on food service operations due to COVID-19, countless food service employees have been laid off or furloughed or have experienced a reduced number of working hours. In fact, the food service industry has been one of the hardest hits in the economy by the pandemic [33]. Since the food service industry is known for a high turnover rate of employees, the added hardship on employees in the industry has been devastating for both employees and employers. Some employees are considering switching to a new career in a different industry because of this hardship, which requires the business to decide what it needs to do to retain and recruit talented employees during and after the pandemic. This is a critical issue even for those employees who stay with their company because they have witnessed a high level of risk and uncertainty in the food service business, which is volatile to external forces such as the

pandemic. The industry needs to convince its employees that the industry is still viable and has great potential to grow in the future, especially after the crisis.

Employee attitudes

Understanding the factors during the pandemic that significantly influence employees' various perceptions, such as satisfaction, commitment, and loyalty, is critical for food service management. Employee perceptions play an important role in shaping employees' intention to remain with the company at the end [40,41]. Despite the extreme operational hardships faced by food service employers during the pandemic, they still need to ensure that they show their employees that they care for them and are trying their best to provide them with job security during the pandemic. Such practices can go a long way, possibly making significantly positive impacts on employees' satisfaction with and commitment to their organization because employees also understand how challenging those practices can be during the current pandemic. This kind of positive impact may eventually have an aftereffect on organizational culture and its long-term success. Accordingly, it is suggested that researchers may explore how employers' caring and transparency in their communication influence employees' perceptions and behaviors during the pandemic.

Human resources allocation

Another important issue that needs to be considered regarding employees in the food service business during the pandemic is human resource allocation. As discussed earlier, the food service business had to adapt to a new business environment during the pandemic by extensively implementing untact services, such as drive-through, curbside pickup, and delivery. In doing so, many food service businesses had to deviate from their traditional in-dining services. Such a dramatic transition requires reallocation of human resources to different tasks and related new training. It would be interesting to research how this reallocation impacted the food service business and, in particular, employees' various perceptions about their job and productivity. Additionally, an extension of this research to the post-pandemic period should be encouraged because such investigations may reveal possible lasting benefits (e.g., improved human capital with multiple capabilities) and/or drawbacks (e.g., dissatisfied employees with too many or less focused job responsibilities) in a long-term manner.

Organizational strategy perspectives

Corporate social responsibility strategy and more

In addition to the customer and employee perspectives, there are potential research topics from an organizational strategy perspective that need attention. Food service businesses can implement or might have implemented certain organizational strategies to cope with the pandemic. Accordingly, it is important for researchers to investigate which business strategies (e.g., corporate social responsibility [CSR], franchising, internationalization, and diversification) generate positive benefits during the pandemic. For example, previous studies found that a firm's engagement in CSR activities can enhance employees' commitment to and satisfaction with their organization, improve their productivity, and reduce turnover intention [42,43]. Furthermore, many previous studies have found that CSR positively impacts consumers [44] and firm performance [45]. Hence, it can be interesting to see whether the food service business's CSR investment during the pandemic has the same positive impact (e.g., on customers, employees, and/or business performance). Interestingly, some may argue that an investment in CSR activities during the pandemic has an opposite impact (i.e., a negative impact) on employees, customers, and performance because such

investments will cause the cash flow of the business to become even tighter in an extremely difficult time, thus making the probability of its survival slimmer.

It would also be interesting to explore whether a company's pre-existing reputation of being socially responsible can generate business benefits during the pandemic. The pre-existing reputation is not about the company's investment in CSR during the pandemic, but rather the reputation that had already been built before the pandemic, which does not put any burden on the company during the pandemic. In such a case, the pre-existing reputation of CSR may be more likely to provide benefits because it does not cost the company anything during the pandemic, and CSR investment has been found to provide insurance-like protection during a crisis [46]. All these CSR issues can be viewed as part of or equivalent to environmental, social, and governance (ESG) issues, which have gained considerable attention from the corporate world and public. Although the ESG concept was created and has been used more in the investment context, due to its extensive popularity in the contemporary corporate world, the term is now used more interchangeably with a broader concept, such as CSR. Accordingly, the suggested research topics are timely, even in the context of ESG. However, since all these suggested research issues are empirical questions, they require empirical verification.

Furthermore, similar research studies apply to other business strategies, such as franchising, internationalization, and various diversification strategies. In particular, since the food service industry employs the franchising strategy the most in the U.S. economy [47], significant implications of implementing the strategy may exist in relation to the pandemic. Researchers are encouraged to find such implications.

Unit-level analysis
The organizational strategies mentioned above are mainly at the firm level and not at the individual unit level. A majority of the food service business consists of independent and small businesses. Hence, inspecting the effects of the characteristics of the food service business at an individual unit level during the pandemic can provide meaningful and practical implications for food service business owners and operators. An example of such characteristics can be the type of financing. In contrast with large corporations, small food service businesses rely heavily on personal connections to finance (e.g., raising capital from family members and friends) in addition to formal financing (i.e., loans from financial institutions). These different types of financing may imply certain capabilities or lack of them in owners and consequently suggest some anticipatory outcomes during the pandemic, such as a high likelihood of suffering from poor performance and business failure. Thus, these issues should be researched to gain a better understanding of the food service business during the COVID-19 pandemic.

CONCLUSION

The COVID-19 pandemic has resulted in tremendous changes in the overall economy and society. In the food service industry, the ways people order has shifted mostly to non-human contact or untact methods, such as online orders and drive-through orders. The consumption of particular products, such as HMR and meal-kit, has also increased explosively. Cooking and serving robots have been extensively adopted to prevent human contact and reduce labor costs. The COVID-19 situation has also caused serious issues in environmental protection. In terms of research implications, COVID-19 poses great challenges and provides opportunities.

This study discusses these challenges and opportunities from three perspectives: consumer, employee, and organizational strategy perspectives.

REFERENCES

1. World Health Organization. WHO Director-General's opening remarks at the media briefing on COVID-19 [Internet]. 2020 March 11 [cited 2021 June 15]. Available from: https://www.who.int/.

2. Paraskevis D, Kostaki EG, Magiorkinis G, Panayiotakopoulos G, Sourvinos G, Tsiodras S. Full-genome evolutionary analysis of the novel corona virus (2019-nCoV) rejects the hypothesis of emergence as a result of a recent recombination event. Infect Genet Evol 2020;79:104212.
   PUBMED | CROSSREF

3. World Health Organization (WHO). COVID-19 and food safety: Guidance for food businesses. Geneva: WHO; 2020.

4. Chin AW, Chu JT, Perera MR, Hui KP, Yen HL, Chan MC, Peiris M, Poon LL. Stability of SARS-CoV-2 in different environmental conditions. Lancet Microbe 2020;1:e10.
   PUBMED | CROSSREF

5. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, Liu L, Shan H, Lei CL, Hui DSC, et al. Clinical characteristics of coronavirus disease 2019 in China. N Engl J Med 2020;382:1708-20.
   PUBMED | CROSSREF

6. An KM. Less eating out and extended school starting... Food supplies and Food service Company 'Depressed First Quarter'. Etoday [Internet]. 2020 March 22 [cited 2021 March 22]. Available from: https://www.etoday.co.kr/news/view/1873379.

7. Korea Trade-Investment Promotion Agency (KOTRA). Post-corona 19 China promising products, promising services [Internet]. Seoul: KOTRA; 2020 [cited 2021 March 10]. Available from: https://news.kotra.or.kr.

8. Kim HW. Due to Covid-19, Starbucks untact orders increased. IT Chosun [Internet]. 2020 Marh 5 [cited 2021 March 22]. Available from: http://it.chosun.com/site/data/html_dir/2020/03/05/2020030501964.html.

9. Rectors K. Rotting food. Hungry masses. Chaotic supply chains. Coronavirus upends the U.S. food system. Los Angeles Times [Internet]. 2020 May 5 [cited 2021 May 5]. Available from: https://www.latimes.com/california/story/2020-05-05/coronavirus-food-supply-chain-makers-distributors-retailers.

10. Bae JW. It was comfortable to try. Convenience stores and sushi restaurants are also hot in the drive-through ordering system. JoongAng Ilbo [Internet]. 2020 September 14 [cited 2021 May 5]. Available from: https://news.joins.com/Article/23871179.

11. Jeong MH. Starbucks recovered 2/3 of its sales in the wake of the U.S. economic revival. ChosunBiz [Internet]. 2020 May 22 [cited 2021 May 5]. Available from: https://biz.chosun.com/site/data/html_dir/2020/05/22/2020052201373.html.

12. Lee SM. CJ CheilJedang "HMR trends this year is save time, enjoy late night snacks and snacks". ChosunBiz [Internet]. 2020 March 22 [cited 2020 March 22]. Available from: https://biz.chosun.com/site/data/html_dir/2020/03/22/2020032200376.html.

13. Bae KH. Food trends noted by the US Food industry in 2021. The Food & Beverage News [Internet]. 2020 November 10 [cited 2021 May 6]. Available from: http://www.thinkfood.co.kr/news/articleView.html?idxno=89075.

14. Lee JE. "Meal-kit in untact time" Distributor's table war. Money Today [Internet]. 2020 May 10 [cited 2021 May 10]. Available from: https://news.mt.co.kr/mtview.php?no=2020050809312818267.

15. Pyun EJ. Due to COVID-19 online shopping rose 13% in May... Delivery food, HMR, and healthy food increased. Today Korea [Internet]. 2020 July 3 [cited 2021 May 6]. Available from: https://www.todaykorea.co.kr/news/articleView.html?idxno=273348.

16. Kim BR. Five meals at home, increased meal kit and healthy food. Hankyung [Internet]. 2020 March 16 [cited 2021 May 16]. Available from: https://www.hankyung.com/economy/article/202003130254i.

17. Briggo Coffee [Internet]. Briggo coffee, powered by dell technologies [Internet]. Briggo Coffee; 2021 [cited 2021 May 6]. Available from: https://briggo.com/briggo-powered-by-dell-technologies/.

18. Stern M. Can robots keep the salad bar safe? RetailWire [Internet]. 2020 June 30 [cited 2021 May 10]. Available from: https://www.retailwire.com/discussion/can-robots-keep-the-salad-bar-safe/.

19. Lee J. Food Tech. Following by Lounge X cafe and hand-drip bar, a drive-through store, a 'cafe on the road' is appearing. Food News [Internet]. 2020 July 15 [cited 2021 May 15]. Available from: https://www.foodnews.news/mobile/article.html?no=123357.

20. Linder C. A robot might cook your next White Castle burger. Popular Mechanics [Internet]. 2020 July 26 [cited 2021 May 15]. Available from: https://www.popularmechanics.com/technology/robots/a33314615/white-castle-fry-cook-robot-flippy-miso-robotics/.

21. Heater B. DaVinci Kitchen is building a robotic pasta-making kiosk. Verizon Media [Internet]. 2020 September 15 [cited 2021 May 15]. Available from: https://techcrunch.com/2020/09/14/davinci-kitchen-is-building-a-robotic-pasta-making-kiosk/.

22. Cheung L. Fried chicken made by robots! Robert Chicken. KoreabyMe [Internet]. 2020 November 9 [cited 2021 May 15]. Available from: https://koreabyme.com/fried-chicken-made-by-robots-robert-chicken/.

23. Hood B. The world's first robot chef is finally here, and it even cleans up after itself: the Moley Robotic Kitchen will come pre-programmed with over 5,000 recipes. Robb Report [Internet]. 2021 January 11 [cited 2021 May 15]. Available from: https://robbreport.com/gear/electronics/moley-robotics-robot-kitchen-uk-for-sale-1234590791/.

24. Restaurant in the Netherlands to use robots to help out waiters. Euronews [Internet]. 2020 October 6 [cited 2021 May 15]. Available from: https://www.euronews.com/2020/06/10/restaurant-in-the-netherlands-to-use-robots-instead-of-waiters.

25. FSD Staff. Technology & Equipment. 3 New robots shaking up foodservice. Foodservice Director [Internet]. 2019 February 1 [cited 2021 May 15]. Available from: https://www.foodservicedirector.com/technology-equipment/3-new-robots-shaking-foodservice#page=1.

26. AETHON [Internet]. One platform, multi-purpose. Pittsburgh (PA): Aethon; 2018 [cited 2021 May 15]. Available from: https://aethon.com/.

27. UVD robots makes a quantum leap for disinfection robots. I Connect 007 [Internet]. 2020 September 10 [cited 2021 May 15]. Available from: http://ein.iconnect007.com/index.php/article/124413/uvd-robots-makes-a-quantum-leap-for-disinfection-robots/124416/?skin=ein.

28. Ham S. Looking forward to establishing a decent food culture that can protect the health of the people. Korea Policy Briefing [Internet]. 2020 August 7 [cited 2021 May 15]. Available from: https://www.korea.kr/news/contributePolicyView.do?newsId=148875462.

29. Ramelli S, Wagner AF. Feverish stock price reactions to COVID-19. Rev Corp Financ Stud 2020;9:622-55.
    CROSSREF

30. Song HJ, Yeon J, Lee S. Impact of the COVID-19 pandemic: Evidence from the U.S. restaurant industry. Int J Hosp Manag 2021;92:102702.
    PUBMED | **CROSSREF**

31. Gössling S, Scott D, Hall CM. Pandemics, tourism and global change: a rapid assessment of COVID-19. J Sustain Tour 2020;29:1-20.
    CROSSREF

32. Kim K, Bonn MA, Cho M. Clean safety message framing as survival strategies for small independent restaurants during the COVID-19 pandemic. J Hosp Tour Manage 2021;46:423-31.
    CROSSREF

33. Gursoy D, Chi CG. Effects of COVID-19 pandemic on hospitality industry: review of the current situations and a research agenda. J Hosp Mark Manag 2020;29:527-9.
    CROSSREF

34. Tuzovic S, Kabadayi S, Paluch S. To dine or not to dine? Collective wellbeing in hospitality in the COVID-19 era. Int J Hosp Manag 2021;95:102892.
    CROSSREF

35. Yost E, Cheng Y. Customers' risk perception and dine-out motivation during a pandemic: Insight for the restaurant industry. Int J Hosp Manag 2021;95:102889.
    CROSSREF

36. Kim J, Kim J, Wang Y. Uncertainty risks and strategic reaction of restaurant firms amid COVID-19: evidence from China. Int J Hosp Manag 2021;92:102752.
    PUBMED | **CROSSREF**

37. Lee JY. Digital technology has helped South Koreans cope with the pandemic. But the elderly have been left behind in the new contact-free era. BBC [Internet]. 2020 August 6 [cited 2021 May 17]. Available from: https://www.bbc.com/worklife/article/20200803-south-korea-contact-free-untact-society-after-coronavirus.

38. Gavilan D, Balderas-Cejudo A, Fernández-Lores S, Martinez-Navarro G. Innovation in online food delivery: learnings from COVID-19. Int J Gastron Food Sci 2021;24:100330.
    CROSSREF

39. Heinonen K, Strandvik T. Reframing service innovation: COVID-19 as a catalyst for imposed service innovation. J Serv Manag 2020;32:101-12.
    CROSSREF

40. Bufquin D, Park JY, Back RM, de Souza Meira JV, Hight SK. Employee work status, mental health, substance use, and career turnover intentions: an examination of restaurant employees during COVID-19. Int J Hosp Manag 2021;93:102764.
   CROSSREF

41. Chen H, Eyoun K. Do mindfulness and perceived organizational support work? Fear of COVID-19 on restaurant frontline employees' job insecurity and emotional exhaustion. Int J Hosp Manag 2021;94:102850.
   CROSSREF

42. Lee S, Lee K, Gao X, Xiao Q, Conklin M. Do a company's sincere intentions with CSR initiatives matter to employees?: a comparison of customer-related and employee-related CSR initiatives. J Glob Responsib 2018;9:355-71.
   CROSSREF

43. Youn H, Lee K, Lee S. Effects of corporate social responsibility on employees in the casino industry. Tour Manage 2018;68:328-35.
   CROSSREF

44. Ham S, Lee S, Yoon H, Kim C. Linking creating shared value to customer behaviors. J Hosp Tour Manage 2020;43:199-208.
   CROSSREF

45. Kim B, Lee S. The impact of material and immaterial sustainability on firm performance: the moderating role of franchising strategy. Tour Manage 2020;77:103999.
   CROSSREF

46. Yeon J, Song HJ, Yu HC, Vaughan Y, Lee S. Are socially responsible firms in the U.S. tourism and hospitality industry better off during COVID-19? Tour Manage 2021;85:104321.
   CROSSREF

47. Sun KA, Lee S. Competitive advantages of franchising firms and the moderating role of organizational characteristics: Evidence from the restaurant industry. Int J Hosp Manag 2019;77:281-9.
   CROSSREF